UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MASIMO CORPORATION,

Petitioner,

v.

APPLE INC.,

Patent Owner.

Case No. TBD
U.S. Patent No. 10,627,783

DECLARATION OF R. JAMES DUCKWORTH, PH.D

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

I reserve the right to supplement my opinions in the future to respond to any arguments or positions Apple may raise, taking account of new information as it becomes available to me.

Dated: 2/23/2023



R. James Duckworth, Ph.D

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I. INTRODUCTION

1. I, R. James Duckworth, Ph.D have been retained by Knobbe, Martens, Olson & Bear, LLP, counsel for Petitioner Masimo Corporation ("Masimo"). I am making this declaration at the request of Masimo in the matters of *Inter Partes* for claims 1–20 of U.S. Patent No. 10,627,783 ("the '783 Patent"). I understand that Apple has asserted the '783 patent against Petitioner in *Apple Inc. v. Masimo Corporation and Sound United, LLC*, U.S. District Court for the District of Delaware, Case No. 1:22-cv-01378-MN ("the Delaware Litigation"). I understand that this Declaration is being submitted as EX1003.

2. I am being compensated for my work in this matter at my standard hourly rate for expert consulting services. My compensation in no way depends on the outcome of this proceeding. I have no financial interest in any of the parties to these matters.

II. INFORMATION AND MATERIALS CONSIDERED

3. I have been asked to provide technical expert opinions relating to the validity of the claims of the '783 Patent. In conducting the analyses and forming the opinions set forth in this Declaration, I have reviewed and considered the '783 Patent's claims, specification, and file history. I have also reviewed the prior art references relied upon in this Declaration. I have reviewed and considered at least the following materials in preparing this Declaration:

- The ’783 Patent, including its claims, specification, and file history;
- The references relied upon or referred to in this Declaration, including but not limited to Kotanagi, Honda, Kateraas, Park, and Jabori;
- Any materials referenced directly or indirectly in my Declaration; and
- The information and materials identified in the following table:

Exhibit No.	Description
1001	U.S. Patent No. 10,627,783 (’783 Patent)
1002	File History of the ’783 Patent
1003	Declaration of Professor R. James Duckworth, Ph.D.
1004	*Curriculum Vitae* of Professor R. James Duckworth, Ph.D.
1005	PCT Publication No. WO 2005/092182 A1 (“Kotanagi”)
1006	U.S. Patent No. 6,265,789 (“Honda”)
1007	U.S. Publication No. 2001/0056234 A1 (“Ohsaki”)
1008	PCT Publication No. WO 2012/140559 Al (“Shmueli”)
1009	European Patent App. No. EP14163114 (“Coppola”)
1010	U.S. Provisional Patent App. No. 61/976,388 (“Fei”)
1012	U.S. Publication No. US 2015/0214749 A1 (“Park”)
1014	U.S. Publication No. 20120221254 A1 (“Kateraas”)

Exhibit No.	Description
1015	U.S. Provisional Patent Application No. 61/932258 ("Park Provisional")
1016	U.S. Publication No. 20140135594 A1 ("Yuen")
1017	PCT Patent Pub. WO2015116111 A1 ("Jabori")
1020	PCT Patent Pub. WO 2015150199 A1 ("Coppola PCT")
1022	U.S. Patent No. 4,129,124 ("Thalmann")
1025	U.S. Patent No. 4,163,447 ("Orr")
1026	U.S. Patent No. 4,224,948 ("Cramer")
1027	U.S. Patent No. 4,248,244 ("Charnitski")
1028	PCT Publication No. WO 1982000088 A1 ("Steuer")
1029	U.S. Patent No. 4,375,219 ("Schmid")
1030	U.S. Patent No. 5,316,008 ("Suga")
1031	U.S. Patent No. 5,738,104 ("Lo")
1033	U.S. Publication No. 20050116820 A1 ("Goldreich")
1034	U.S. Publication No. 20070276270 A1 ("Tran")
1035	U.S. Publication No. 20080208009 A1 ("Shklarski")
1036	U.S. Patent No. 6,091,530 ("Duckworth")
1037	U.S. Patent 6,075,755 ("Zarchan")
1038	Y. Mendelson, "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE (2006)

Exhibit No.	Description
1039	Y. Mendelson, "Wearable Wireless Pulse Oximetry for Physiological Monitoring," PPL Workshop (2008).
1041	U.S. Publication No. 20150355604 A1 ("Fraser")
1042	J. Shackelford and R. Doremus, "Ceramic and Glass Materials Structure, Properties and Processing" (2008) – Excerpt
1043	F. Shi, "Ceramic Materials – Progress In Modern Ceramics" (2012) – Excerpt
1044	R. Loehman, "Characterization of Ceramics" (1993) – Excerpt
1045	F. Aldinger and V. Weberruss, "Advanced Ceramics and Future Materials: An Introduction to Structures, Properties, Technologies, Methods" (2010) – Excerpt
1046	W.D. Kingery et al., "Introduction to Ceramics: Second Edition" (1960) – Excerpt
1047	USPTO Memo of April 5, 2018 regarding *Dynamic Drinkware* and *Amgen* cases
1048	District of Delaware Statistics, downloaded on February 21, 2023 from https://www.uscourts.gov/sites/default/files/data_tables/fcms_na_distprofile0930.2022.pdf

4. In preparing this Declaration, I have considered my own knowledge and experience, including my work in the fields of electrical and computer engineering; my experience teaching within those subjects; my experience working with others involved in those fields; and the materials identified herein. I understand my analyses and opinions, including my review of any materials cited herein, should

be made from the perspective of a person of ordinary skill in the art at the relevant time (i.e., a "POSITA"). I define my opinion on what constitutes a POSITA in Section V of this declaration. I understand the relevant time is September 2, 2014. Accordingly, my analyses and opinions are made from that relevant perspective. My testimony herein refers to the knowledge of a POSITA as of September 2, 2014, unless indicated otherwise.

5. Any figures appearing in this Declaration were prepared with the assistance of counsel and reflect my understanding of the '783 Patent and the materials discussed herein.

6. EX1042 is a copy of an excerpt of a 2008 book by J. Shackelford and R. Doremus, titled *Ceramic and Glass Materials Structure, Properties and Processing*. I believe EX1042 to be an authentic copy of the relevant portions of the book, as it was provided and certified by librarian Sylvia D. Hall-Ellis. *See* EX1049. I am familiar with scientific reference texts such as this. This book indicates a copyright date of 2008. EX1042 at 4. I understand that it is the regular practice of scientific publications to include the copyright date as an indication of when the book was published, and this book is consistent with this practice. Further, the information included in this book is credible and consistent with my own understanding of what was known to a POSITA at least as early as 2008.

Accordingly, I relied on this book to inform my understanding of what was known to a POSITA at the relevant time for this declaration.

7. EX1043 is a copy of an excerpt of a 2012 book edited by Feng Shi and titled *Ceramic Materials – Progress In Modern Ceramics*. This book is available online at http://www.issp.ac.ru/ebooks/books/open/Ceramic_Materials_-_Progress_in_Modern_Ceramics.pdf. I believe EX1043 to be an authentic copy of the relevant portions of the book, as it was provided and certified by librarian Sylvia D. Hall-Ellis. *See* EX1049. I am familiar with scientific reference texts such as this. This book indicates a copyright date of 2012 and a first publication of April 2012. EX1043 at 2. I understand that it is the regular practice of scientific publications to include such dates of when the book was published, and this book is consistent with this practice. Further, the information included in this book is credible and consistent with my own understanding of what was known to a POSITA at least as early as 2012. Accordingly, I relied on this book to inform my understanding of what was known to a POSITA at the relevant time for this declaration.

8. EX1044 is a copy of an excerpt of a 1993 book edited by Ronald E. Loehman and titled *Characterization of Ceramics*. I believe EX1044 to be an authentic copy of the relevant portions of the book, as it was provided and certified by librarian Sylvia D. Hall-Ellis. *See* EX1049. I am familiar with scientific reference texts such as this. This book indicates a copyright date of 1993. EX1044 at 3. I

understand that it is the regular practice of scientific publications to include the copyright date as an indication of when the book was published, and this book is consistent with this practice. Further, the information included in this book is credible and consistent with my own understanding of what was known to a POSITA at least as early as 1993. Accordingly, I relied on this book to inform my understanding of what was known to a POSITA at the relevant time for this declaration.

9. EX1045 is a copy of an excerpt of a 2010 book by Dr. Fritz Aldinger et al. titled *Advanced Ceramics and Future Materials: An Introduction to Structures, Properties, Technologies, Methods*. I believe EX1045 to be an authentic copy of the relevant portions of the book, as it was provided and certified by librarian Sylvia D. Hall-Ellis. *See* EX1049. I am familiar with scientific reference texts such as this. This book indicates a copyright date of 2010. EX1045 at 2. I understand that it is the regular practice of scientific publications to include the copyright date as an indication of when the book was published, and this book is consistent with this practice. Further, the information included in this book is credible and consistent with my own understanding of what was known to a POSITA at least as early as 2010. Accordingly, I relied on this book to inform my understanding of what was known to a POSITA at the relevant time for this declaration.

10. EX1046 is a copy of an excerpt of a 1960 book by W.D. Kingery et al. titled *Introduction to Ceramics: Second Edition*. I believe EX1046 to be an authentic copy of the relevant portions of the book, as it was provided and certified by librarian Sylvia D. Hall-Ellis. *See* EX1049. I am familiar with scientific reference texts such as this. This book indicates a copyright date of 1960. EX1046 at 2. I understand that it is the regular practice of scientific publications to include the copyright date as an indication of when the book was published, and this book is consistent with this practice. Further, the information included in this book is credible and consistent with my own understanding of what was known to a POSITA at least as early as 1960. Accordingly, I relied on this book to inform my understanding of what was known to a POSITA at the relevant time for this declaration.

III. EXPERIENCE AND QUALIFICATIONS

12. My academic and professional background is in electrical and computer engineering. I obtained a Bachelor of Engineering degree in Electrical and Electronic Engineering from the University of Bradford, England and a Ph.D. Degree in Electrical and Electronic Engineering from the University of Nottingham, England. My Ph.D. thesis work concerned increasing the speed of data processing using multiple processing elements to complete computations in parallel and triggering computations based on the availability of data. After completing my Ph.D., I was a lecturer in the university's Computer Science Department for two years.

13. For more than 40 years, I have studied, designed, and worked in these fields. My experience includes over 35 years of teaching and research, including in the fields of pulse oximetry and other physiological monitoring technologies, low powered wireless sensor design, embedded system design, wearable technology, and indoor location tracking for first responders, among others.

14. I have been a professor of electrical and computer engineering at Worcester Polytechnic Institute ("WPI") for over 35 years. I joined WPI in January 1987 as an Assistant Professor of Electrical Engineering and was an Associate Professor of Electrical and Computer Engineering from July 1991 to June 2021. Presently, I am a Professor Emeritus of Electrical and Computer Engineering at WPI.

15. More recently, my research work has centered on Precision Personnel Location (PPL) for First Responders. This project started as a result of a tragic incident in Worcester in 1999, when six firefighters lost their lives in a warehouse fire. The overall goal of the PPL project is to protect the lives of emergency responders and to enhance their ability to accomplish their missions through research and development of systems for personnel location and tracking, movements, physiological and environment status monitoring, and command and control. The PPL project brought together diverse technical capabilities from other centers and laboratories at WPI to address important problems for emergency responders, the most critical of which is precise location and path tracking for each person in a building.

16. For over 30 years, I developed and taught courses at WPI relevant to the technology disclosed in the '783 Patent. The classes I developed and taught included associated laboratory exercises and projects, which I also developed. As reflected in my curriculum vitae (EX1004), I developed and taught at least the following relevant courses: (1) Microprocessor System Design; (2) Modeling and synthesis of digital system using Verilog and VHDL; (3) VHDL for Modeling and Synthesis; (4) Computer System Design; (5) Multi-processor and Distributed Systems; (6) Advanced Computer System Design; and (7) Advanced Digital System Design with FPGAs. All of these courses pertain to the technology disclosed in the

'783 Patent. For example, the "Advanced Digital System Design with FPGAs" course required students to interface peripheral sensors such as a light sensor with an analog-to-digital converter to read information from the sensors and a digital-to-analog converter to convert sensed data into waveforms for processing.

17. In the course of my work at WPI, I have advised hundreds of engineering students in B.S. and M.S. programs and advised or co-advised approximately ten Ph.D. students that have completed Ph.D. degrees.

18. Additionally, I have authored or co-authored dozens of technical papers in refereed journals and conference proceedings and given many conference presentations in the fields I have taught, researched, and worked.

19. Aside from my work at WPI, I have years of experience working with portable, battery powered sensors. During leave in approximately 2000 from WPI, I was the Vice President of Engineering for Adaptive Instruments. At Adaptive Instruments, I was responsible for designing and manufacturing a line of wireless industrial sensors for use in industrial process control. As a consultant, I helped program a small, battery powered device that included a microcontroller and custom LCD and was used to count the number of times an inhaler had been used. Also as a consultant in approximately the year 1997, I helped design and program a wrist-worn device that reminded the user throughout the day of the medications that needed to be taken. My work on the wrist-worn device led to the patent I obtained

on a "Low Power Infrared Communication System," U.S. Patent No. 6,091,530, included as EX1036. This wearable electronic device had some similar functionality to the consumer product described in the '783 patent. It was worn like a watch, provided watch functionality on a display, was battery powered, contained a microcontroller to calculate and display messages, employed an optical data communication system, and incorporated buttons for user control. EX1036 at Abstract, col. 2:7–17.[1] The system included a cradle shaped complimentary to the watch for data communication: "The cradle housing 104 is preferably shaped configured to receive and align the case of the watch 102 so that, when the watch 102 is placed in the shaped nest provided by 104, the watch IR emitter 110 is thereby aligned in close proximity with the cradle IR detector 112." EX1036 at col. 4:38–42. This device, described in U.S. Patent No. 6,091,530, is shown in Figure 1 reproduced below:

[1] Citations herein containing a colon (":") are to columns and lines, where available, or to pages and lines, where lines are numbered.

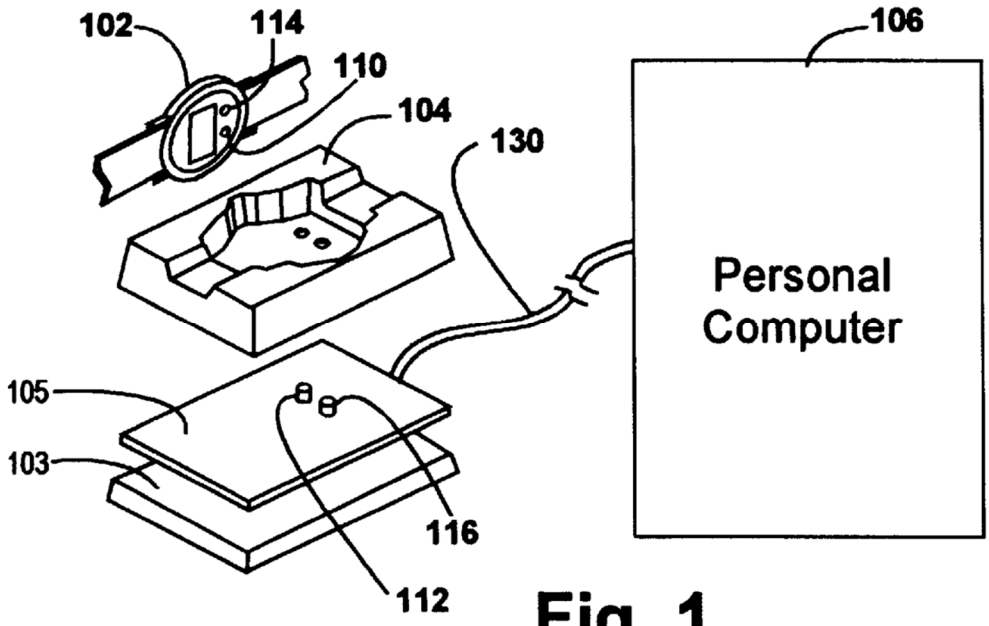


Fig. 1

EX1036, Fig. 1.

20. My technical work also contributed to features in the same device shown in U.S. Patent 6,075,755 titled "Medical Reminder System and Messaging Watch," included as EX1037. As in my '530 patent above, the device incorporated a display with watch functionality (LCD display 110), was battery powered, contained a microcontroller to calculate and display medication reminder messages, employed an optical data communication system (infrared emitter and detector 116), and incorporated buttons (120, 122, 124, 126) for user control. EX1037 at col. 6:28–65. Figure 1 and Figure 4 of the '755 patent are shown below.

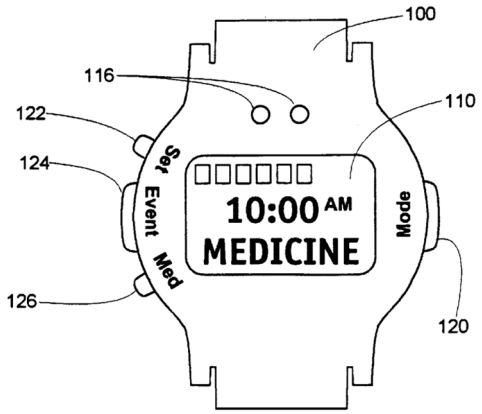


Fig. 1

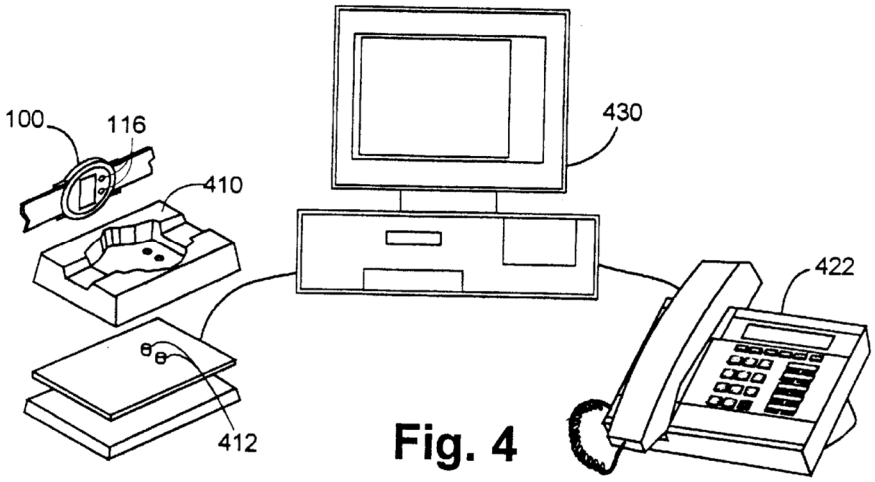
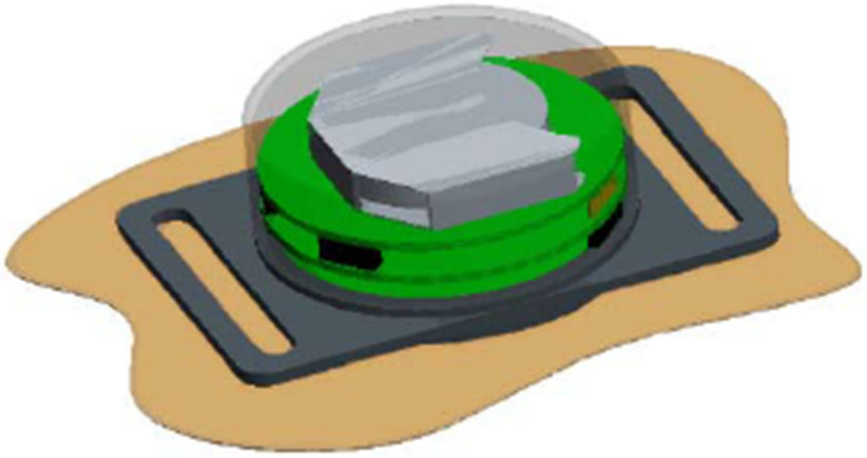


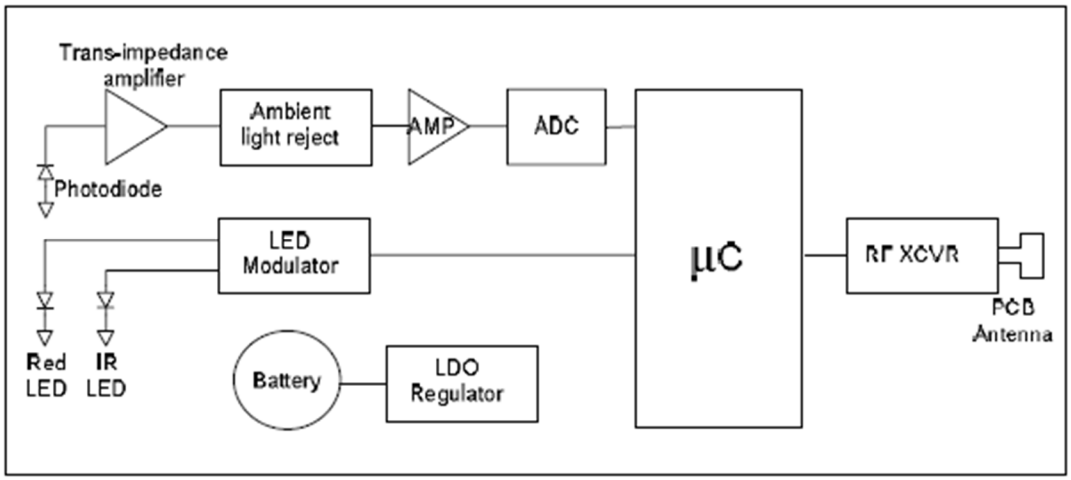
Fig. 4

EX1037, Figs. 1, 4.

21. From 2005 through 2008, I worked extensively with my colleague at WPI, Professor Yitzhak Mendelson, Ph.D., to research, publish papers about, design, and make, wearable pulse oximetry devices. One publication stemming from this work is titled "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," which is included as EX1038. As stated in the paper, our wearable Pulse Oximeter measured arterial oxygen saturation (SpO_2) and utilized the principle

of photoplethysmography: "Pulse oximetry also relies on the detection of photoplethysmographic (PPG) signals produced by variations in the quantity of arterial blood that is associated with periodic contractions and relaxations of the heart." EX1038 at 1. As shown below, our Pulse Oximeter incorporated a photodiode, a red LED, and an infrared LED.





EX1038 at 2.

22. Subsequently, in July 2007, Professor Mendelson and I formed a company together called Advanced Body Sensing to design, develop, and build a new, wireless, battery powered, forehead-mounted reflectance pulse oximetry device. To meet these design goals, we had to develop a completely new device, as our prior work concerned prototype devices that required an external power supply and additional instrumentation to operate. Together, Professor Mendelson and I developed, along with a small team of engineers, a new housing, optical sensor, and associated electronics, including the design and programming of microprocessor and wireless transmission components. Our design and development process led us to the final forehead-mounted pulse oximetry device shown below.



EX1039 at 24 (annotated).

23. Our device included an optical biosensor with two LED's and a photodetector, as highlighted above. Over the course of 2007 and 2008, Advanced

Body Sensing received over $1,000,000 to develop and build the above pulse oximetry devices for the United States Air Force. The device above was designed to be "integrated into a headband or a helmet" (EX1038 at 2), such as for army use, but the basic principle allows measurements on various skin surfaces of the body. On August 4, 2008, Professor Mendelson presented on our Advanced Body Sensing work, including the above device, at an annual international technology conference held at WPI called the PPL Workshop. His presentation, titled "Wearable Wireless Pulse Oximetry for Physiological Monitoring," is included as EX1039.

24. In addition to those listed above, I am a named co-inventor on several patents, including:

a. U.S. Patent No. 7,292,189, issued in 2007, titled "Methods and Apparatus for High Resolution Positioning"
b. U.S. Patent No. 9,476,963, issued in 2016, titled "Search and Rescue Method and System"
c. U.S. Patent No. 9,658,309, issued in 2017, titled "Precision Location Method and System"; and
d. U.S. Patent No. 9,846,042, issued in 2017, titled "Gyroscope Assisted Scalable Visual Simultaneous Localization and Mapping."

25. Above, I have provided a short summary of my education and experience that I believe is most relevant to the analyses and opinions I have expressed in this Declaration. A copy of my curriculum vitae, which describes in further detail my qualifications, responsibilities, employment history, honors, awards, professional associations, presentations, publications, and patents is included as EX1004.

IV. APPLICABLE LEGAL STANDARDS

26. I am an electrical and computer engineer by training and profession. The opinions I express in this Declaration involve the application of my knowledge and experience to the evaluation of the ’783 Patent and certain prior art to the ’783 Patent.

27. Although I have been involved as a technical expert in patent matters before, I am not an expert in patent law. Therefore, I have been advised of certain principles of patent law applicable in this matter, which I have used in arriving at my determinations and opinions. The paragraphs below express my understanding of the legal requirements I have used in forming my opinions.

A. Claim Construction

28. I understand that, in assessing the patentability of a patent claim, the Patent Office generally construes claim terms by giving them their ordinary and customary meaning, as they would have been understood by a POSITA at the time

of the invention in view of the intrinsic record (patent specification and file history). However, I understand that the inventors may, in the patent specification, expressly define a claim term to have a meaning that differs from the term's ordinary and customary meaning. I also understand that the inventors may disavow or disclaim certain claim scope, thereby departing from the ordinary and customary meaning, when the intrinsic record demonstrates that a clear and unambiguous disavowal or disclaimer has occurred. I understand that extrinsic evidence, such as relevant technical literature and dictionaries, may be useful in ascertaining how a POSITA would have understood a claim term, but the intrinsic record is the primary source for determining the meaning of claim terms. For the purposes of this review, and to the extent necessary, I have interpreted each claim term in accordance with the principles set forth in this paragraph.

29. I understand that the preamble of a claim is limiting where it supplies antecedent basis for a subsequent claim limitation.

B. Anticipation

30. It is my understanding that a claim is unpatentable as "anticipated" under 35 U.S.C. § 102 if a single prior art reference discloses every limitation of the claim, arranged as in the claim. I understand that a prior art reference does not anticipate a claim, however, when it discloses multiple, distinct teachings that a POSITA might have somehow combined to achieve the claimed invention. I

understand that anticipation has not been alleged in the petition, and, thus, is not at issue.

C. Obviousness

31. I understand that a claim is unpatentable as "obvious" under 35 U.S.C. § 103 if the claimed subject matter as a whole would have been obvious to a POSITA at the time of the invention. I also understand that an obviousness analysis takes into account the following factors, which are sometimes referred to as the *Graham* factors: (1) the scope and content of the prior art, (2) the differences between the claimed subject matter and the prior art, (3) the level of ordinary skill in the art at the time of the invention, and (4) "objective indicia of non-obviousness," also referred to as secondary considerations of non-obviousness. I understand that these objective indicia include considerations such as whether there was: (i) any unexpected result(s); (ii) skepticism of the invention; (iii) a teaching away from the invention; (iv) failure of others to find the solution(s) provided by the claimed invention; (v) copying by other companies; (vi) commercial success due to the merits of the claimed invention; (vii) praise by others for the invention; and (viii) a long-felt need in the industry for the claimed invention.

32. In determining the scope and content of the prior art, it is my understanding that a reference is considered appropriate prior art if it falls within the field of the inventor's endeavor. In addition, a reference is appropriate prior art if it

is reasonably pertinent to the particular problem with which the inventor was involved. A reference is reasonably pertinent if it logically would have commended itself to an inventor's attention in considering his or her problem. If a reference relates to the same problem as the claimed invention, that supports use of the reference as prior art in an obviousness analysis.

33. To assess the differences between prior art and the claimed subject matter, it is my understanding that 35 U.S.C. § 103 requires the claimed invention to be considered as a whole. This "as a whole" assessment requires showing that a POSITA at the time of invention, confronted by the same problems as the inventor and with no knowledge of the claimed invention, would have selected the elements from the prior art and combined them in the claimed manner.

34. It is my further understanding that the Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; a predictable use of prior art elements according to their established functions; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and some

teaching, suggestion, or motivation that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

35. I understand that the obviousness analysis must be performed from the perspective of a POSITA at the time of the alleged invention. I understand this requirement is to help avoid using impermissible hindsight in the analysis. I further understand that the claims of the patent-at-issue must not be used to provide a road map for obviousness; instead, the claims would have been obvious only if a POSITA, without knowledge of the patent-at-issue, would have been motivated to combine the teachings of the prior art to arrive at the claimed invention and had a reasonable expectation of success in doing so.

36. I understand that an assessment of what a reference discloses or teaches—for purposes of an anticipation analysis or an obviousness analysis—must be conducted from the perspective of a POSITA at the time of the invention. In other words, a reference discloses or teaches a claim limitation if a POSITA would, at the relevant time, interpret the reference as expressly, implicitly, or inherently disclosing the claim limitation. I further understand that a reference does not need to use the exact language of the claim to disclose a claim limitation. I also understand that something is only "inherent in," and therefore taught by the prior art if it necessarily flows from the explicit disclosure of the prior art. I understand the

fact that a certain result or characteristic may be present in the prior art is not sufficient to establish inherency.

37. I understand that the obviousness analysis also must show that the prior art, taken as a whole, enables a POSITA to make and use the claimed invention.

38. Applying these legal standards to Claims 1–20 of the ’783 Patent, I believe Claims 1–20 would have been obvious to a POSITA based on the grounds discussed below.

V. LEVEL OF ORDINARY SKILL IN THE RELEVANT ART

39. The field of art relevant to the ’783 Patent is watches and wearable electronic devices, and the problems addressed were for wireless charging of biosensing versions of such devices and watches.

40. I understand that the level of ordinary skill in the art for the ’783 Patent is determined as of September 2, 2014, which is the earliest effective filing date of the ’783 Patent. I also understand that Apple has not alleged that the ’783 Patent is entitled to an effective filing date other than September 2, 2014.

41. A POSITA of the ’783 patent would have had at least a bachelor’s degree in a discipline related to electrical engineering, mechanical engineering, physics, industrial design, or equivalent, and at least three years of experience working with or developing electronic medical or consumer devices.

42. I understand the capabilities of a POSITA as of September 2014. Indeed, I possessed at least those capabilities myself before, during, and after that time. As a professor of electrical and computer engineering for over three decades, I have taught many such persons and understand the level of knowledge and skill that persons with such academic experience would have possessed in September 2014. Through my education and decades of experience, such as teaching relevant engineering courses, I am familiar with what a POSITA would have understood in September 2014 and qualified to provide opinions from the perspective of a POSITA at the relevant time.

VI. CLAIM CONSTRUCTION

43. I have interpreted claim terms in accordance with the claim construction principles set forth above.

44. Numerous claim terms are construed based on their ordinary meanings or otherwise in the context of the invalidity analysis in this Declaration, consistent with *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005). Constructions of a few example terms and phrases are also discussed here for convenience.

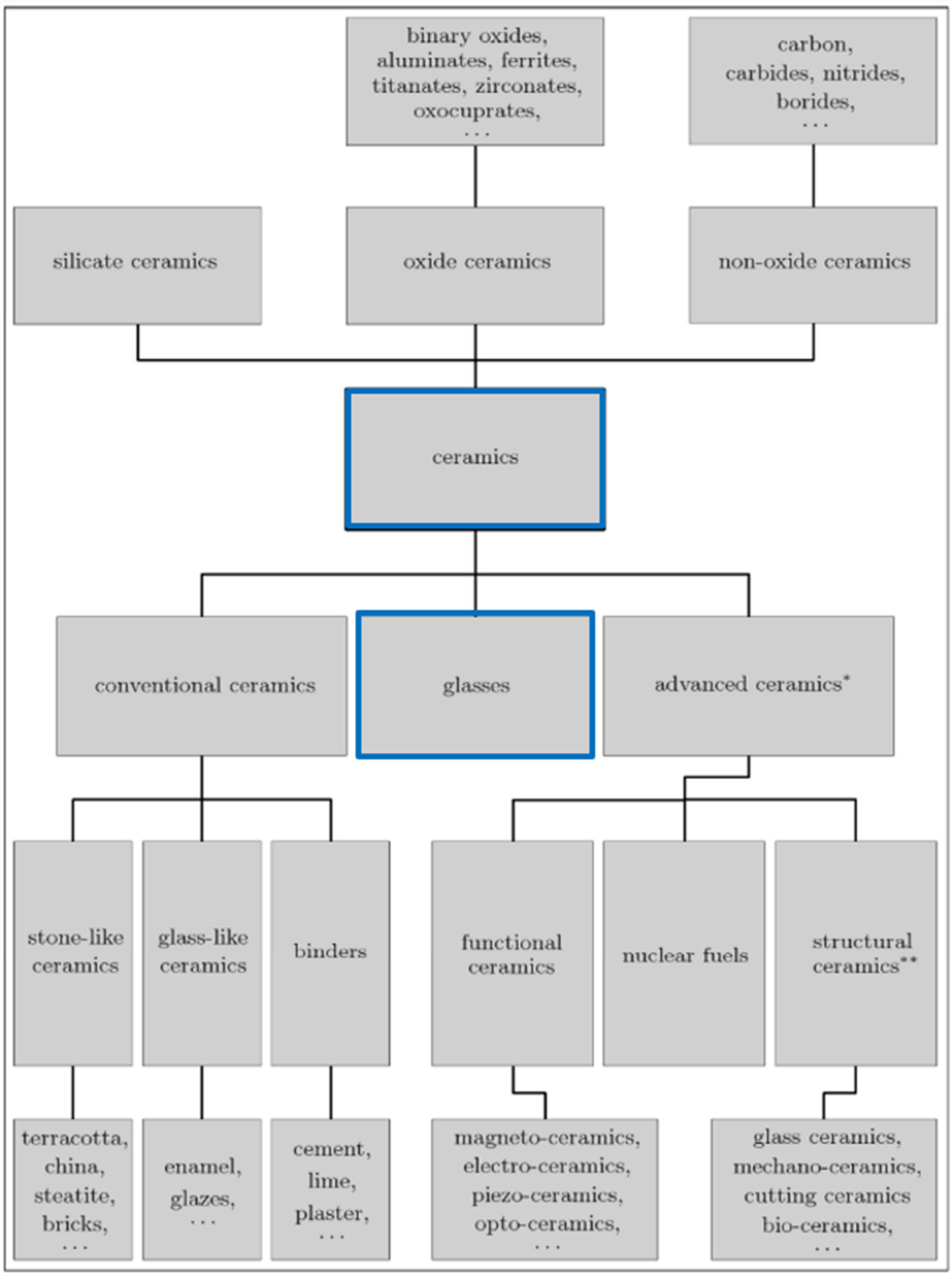
A. "a ceramic cover"

45. Claim 1 recites "a ceramic cover disposed over the second opening and forming a portion of an exterior surface of the electronic device." Although claim context shows that the second opening is in the rear, the '783 patent specification

fails to specifically label its rear cover 608 "ceramic." The '783 patent description specifies that this rear cover may be a sapphire sheet, zirconia, or alumina material. *See* EX1001 at col. 26:16–19. Based on my experience and analysis in this case, in my opinion a POSITA would have understood "ceramic" in this context to mean a solid, nonmetallic, inorganic material such as glass or sapphire.

46. I reviewed some literature regarding the definition of "ceramic," including EX1042–EX1046. Ceramic is consistently used to refer to solid, inorganic (e.g., mineral) materials that are not metal that can be formed or densified with heat. EX1043 at 9 ("As we all know, ceramic materials are inorganic, non-metallic, solid, and inert materials."); EX1045 at 7 ("ceramics is defined as a name for products made out of non-metallic inorganic substances"); EX1044 at 13 ("In a broad sense, a ceramic is any manmade, inorganic, nonmetallic, solid material. Glass, usually considered a subset of ceramics, is any solid that lacks crystalline order."). This describes not only pottery, but also modern man-made substances. EX1046 at 8 ("We define ceramics as the art and science of making and using solid articles which have as their essential component, and are composed in large part of, inorganic non-metallic materials. This definition includes not only materials such as pottery, porcelain, … and glass but also … manufactured single crystals, glass-ceramics and a variety of other products which were not in existence until a few years ago"). Alumina is "the quintessential structural ceramic material" and "one of the most

important ceramic materials." EX1042 at 5, 13. The "stable phase of alumina is … corundum," and "[i]n single-crystal form, corundum is called sapphire." *Id*. at 15. Therefore, alumina and sapphire are examples of ceramic materials. The ordinary meaning of "ceramic" is thus "a solid, nonmetallic, inorganic material." Glass is often classified as a ceramic. EX1044 at 13 ("Glass, usually considered a subset of ceramics, is any solid that lacks crystalline order."); EX1046 at 8 ("This definition includes … glass"), 14 ("We can define traditional ceramics as those comprising the silicate industries–primarily clay products, cement, and silicate glasses"). The figure below shows a family tree of ceramics and identifies glasses as subset of ceramics, as annotated with the highlighted boxes:



EX1045 at 8.

47. The ’783 patent fails to specifically refer to a “ceramic” rear cover in the specification. However the ’783 patent specification discloses that the rear cover

608 may be a sapphire sheet, zirconia, or alumina material. *See* EX1001 at col. 26:16–19. The '783 patent specification lists ceramics as potential housing and surface treatment or coating materials. EX1001 at col. 24:2–12.

48. The '783 patent explains that the term "cover glass" is not limited to glass, and that such covers can be formed from "sapphire":

> [T]he display includes or is integrated with a cover 609 that helps to protect the display from physical impact or scratches. **In the field of wearable devices, the cover 609 may also be referred to generically as a crystal or cover glass, *regardless of the material that is used* to form the cover 609**. In some cases, the cover 609 is formed from a sheet or block of **sapphire** material. Sapphire may provide superior optical and surface hardness properties as compared to other materials.

Id. at col. 21:54–62 (emphasis added). The '783 patent further explains that sapphire is a particularly advantageous material for the rear cover:

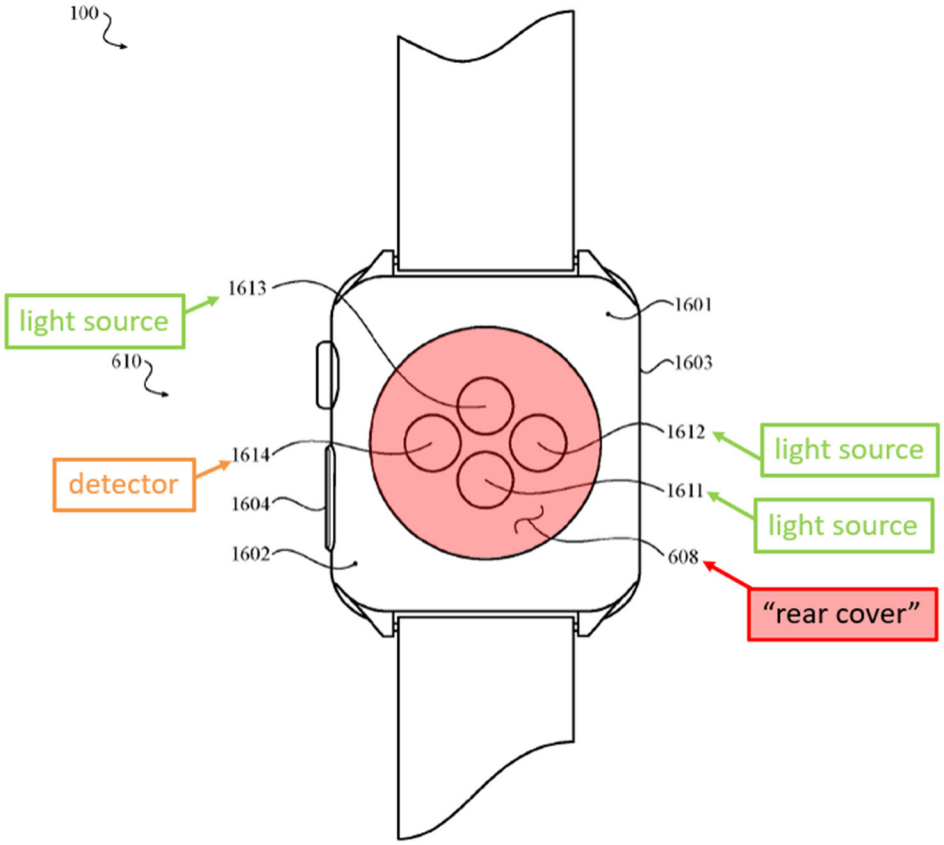
> For example, in some embodiments, the **rear cover 608 may be formed from a sapphire sheet**, zirconia, or alumina material having superior scratch resistance and surface finish qualities. . . . Due to the superior strength of the sapphire material, a **cover glass** formed from a **sapphire sheet** may be very thin.

Id. at col. 26:15–23 (emphasis added).

49. Based on the ordinary meaning of "ceramic" and how it is used in the '783 patent, the construction for "ceramic cover" I have applied in this matter is "a cover formed from a solid, nonmetallic, inorganic material." Prior art having a rear cover of glass or sapphire or any other ceramic material satisfies this limitation.

B. <u>"biosensor module"</u>

50. Claims 1, 9, 11, 13–15, and 19 refer to a "biosensor module," a portion of the device that includes one or more sensors (e.g., the lights and detector of Fig. 16). EX1001 at cols. 58-60.



See EX1001 at 22.

51. The '783 patent describes its "biosensor module" as follows:

> In the example depicted in FIG. 7, a biosensor module 710 is disposed in an opening formed in the rear surface of the housing 601. In some embodiments, the biosensor module 710 includes the rear cover 608 and may also include a chassis or plate that facilitates attachment of the biosensor module 710 to the housing 601.

EX1001 at col. 28:7–12.

52. The ’783 patent further explains: “in some embodiments, the biosensors are disposed relative to or attached to a rear cover 608 that is formed from an optically transparent material and is configured to be positioned with the opening of the housing 601.” *Id* col. 40:46–48.

53. Based on the use of “biosensor module” in the ’783 patent, the construction I have applied to this term in this matter is a portion of the device that includes one or more sensors and optionally includes a cover.

C. “ceramic cover defines a [first/second] opening to [transmit/receive] the light”

54. Claim 1 recites a first opening in the housing, where the display is positioned, and a second opening opposite to the first. EX1001 at 58:3. These openings should not be confused with the additional openings of Claim 3. Claim 1 states that a ceramic cover is disposed over “the second opening” (making it a rear cover), and Claim 3 states that this rear, ceramic cover “defines” its own separate “first opening” and “second opening.” EX1001 at 58:29–31. Accordingly, the “first opening” in Claim 3 is not the same as the “first opening” of Claim 1 where the display is positioned. *Id*. at ¶58:3–31.

55. The ’783 patent describes the rear cover this way:

> The device 100 may also include a **rear cover 608** located on the rear-facing surface of the housing 601 of the device body 610. . . . [T]he rear cover 608 may be formed from **a sapphire sheet**, zirconia, or alumina material . . . . The convex curved area of the rear cover 608 may include one or more windows or apertures that provide operational access to one or more internal components located within the housing. For example, the rear cover 608 may include an array of windows, each window including an aperture or opening for a respective light source 1611–1613 and/or the detector 1614.

EX1001 at 26:12–19; 40:46–67(emphasis added).

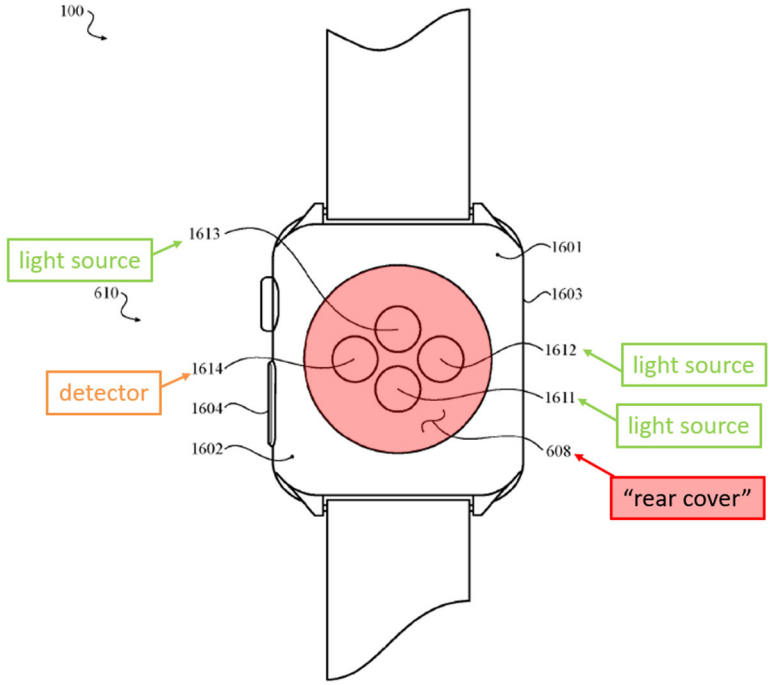


FIG. 16

EX1001, Fig. 16.

56. Accordingly, the '783 patent describes a single sheet of material positioned within a single opening in a housing. This sheet defines one or more windows or apertures, where sensors are positioned behind that sheet. EX1001, Fig. 16 (above). Thus, the rear cover defines these openings by allowing light to pass

through for operational access to the internal optical components, and the term should receive this construction. A single transparent cover can define multiple openings by allowing passage of light through the cover at the locations labeled 1611–1614 in Fig. 16 (e.g., for the light sources and detector of the '783 patent's Fig. 16). EX1001, Fig. 16. Thus, the "ceramic cover defines a [first/second] opening to [transmit/receive] the light" should be construed as the "ceramic cover that includes" [first/second] locations that "allow the passage of light."

VII. SUMMARY OF OPINIONS

57. I have conducted analyses leading to the opinions expressed in this Declaration. To summarize those opinions, it is my conclusion, from a technical point of view, that Claims 1–20 of the '783 Patent would have been obvious to a POSITA based on the teachings of the prior art at the time of invention.

58. It is my opinion that:

- Ground 1: Claims 9–11, 15, 19, and 20 are unpatentable because they would have been obvious in view of Kotanagi and Honda.
- Ground 2: Claim 16 is unpatentable because it would have been obvious in view of Kotanagi and Honda, and optionally in further combination with Park.

- Ground 3: Claims 1–7 and 14 are unpatentable because they would have been obvious in view of Kotanagi and Honda, and optionally in further combination with Kateraas.
- Ground 4: Claims 12–13 and 17–18 are unpatentable because they would have been obvious in view of Kotanagi, Honda, and Jabori and optionally in further combination with Park.
- Ground 5: Claims 3 and14 are unpatentable because they would have been obvious in view of Kotanagi, Honda, and Fraser and optionally in view of Kateraas.
- Ground 6: Claim 8 is unpatentable because it would have been obvious in view of Kotanagi, Honda, and Jabori and optionally in further combination with Kateraas and/or Park.

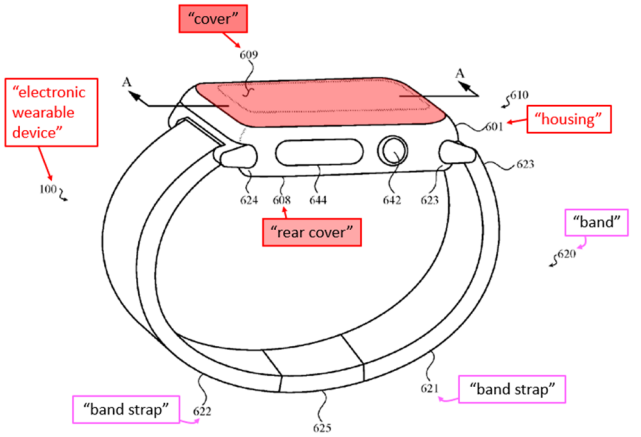
59. Below, I provide a detailed analyses supporting my opinions.

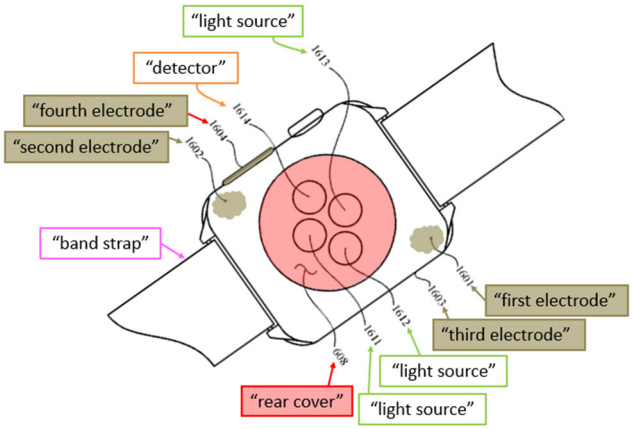
VIII. THE '783 PATENT

A. Overview of the '783 Patent

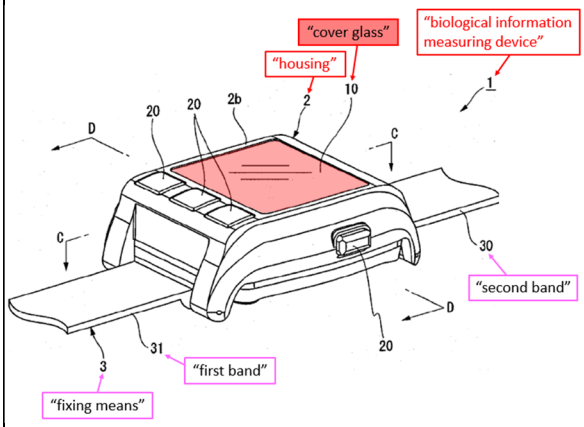
60. Apple's '783 patent purports to claim novel improvements to health-monitoring smart watches. However, in my opinion the Challenged Claims recite features that were well known prior to the '783 Patent. Their combinations in the claims provided no results or benefits that would have been unexpected to a POSITA. Some of those features are shown in the annotated figures below comparing the '783 Patent to figures from a 2005 patent to Kotanagi:

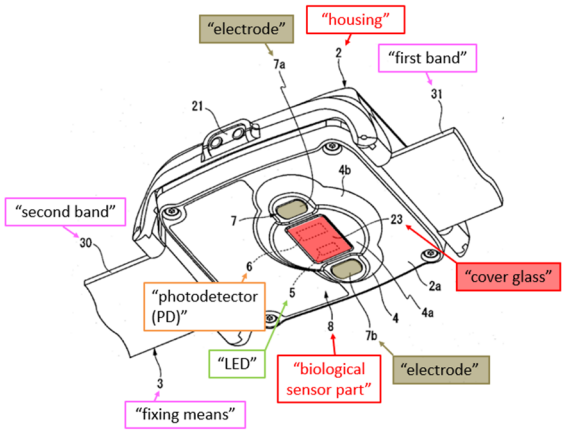
'783 Patent





Prior Art - Kotanagi





EX1001, Figs. 6, 16 (labels added[2]); EX1005, Figs. 4, 5.

61. Even some of more specific aspects of Apple's claims have been part of smartwatch technology for many years. As explained in further detail below, Kotanagi and Honda teach wireless charging for these devices. EX1005 at ¶53; EX1006, Fig. 16a, 16b. Kateraas teaches that glass and sapphire are known transmissive cover materials (EX1014 at [0059][3]), and therefore can be substituted for each other, and Jabori teaches using convex / concave shapes to promote alignment for wireless power transmission. EX1017 at [0017].

B. Prosecution History of the '783 Patent

62. I have reviewed EX1002, the prosecution history of the '783 patent, to help form my opinion in this matter. The following only highlights some portions of that file history.

63. The Examiner rejected Claims 1–34 on June 15, 2018. Thereafter Applicant and Examiner held an interview, which Applicant summarized as follows:

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[2] In this declaration color feature labels and color shadings have been added for convenience and do not come from the cited patent drawings themselves.

[3] In this declaration citations to documents having square brackets "[]" for paragraph numbering use brackets instead of paragraph symbols "¶".

> Applicant proposed adding structural features to the claim including features that facilitate wireless charging, such as a ceramic cover configured to allow transmission of biosensor signals and wireless charging signals. Such amendment was considered to overcome the prior art of record.

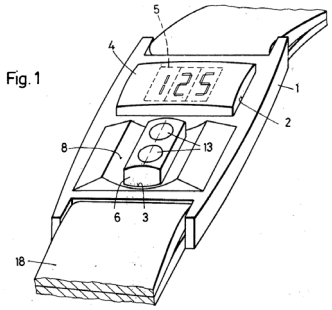
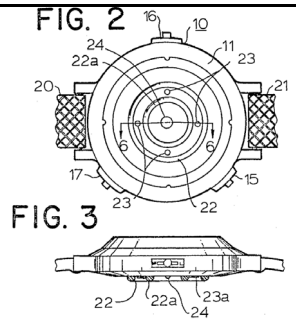
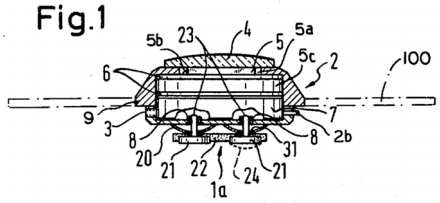
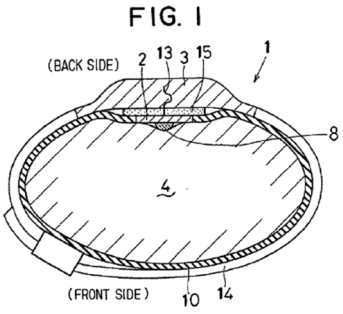
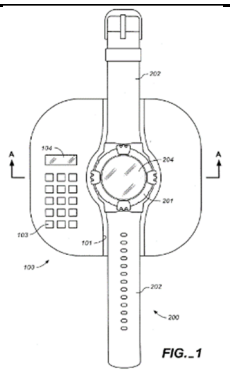
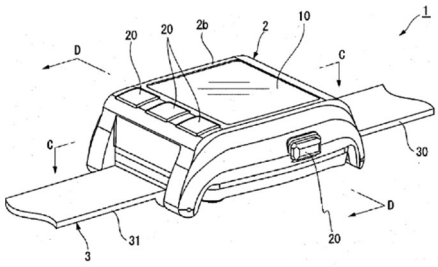
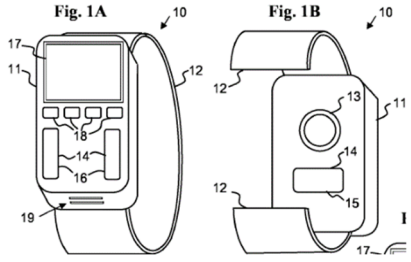
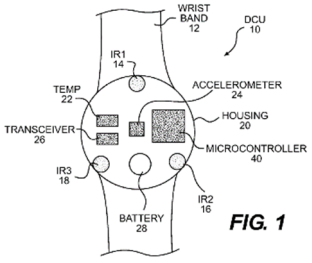
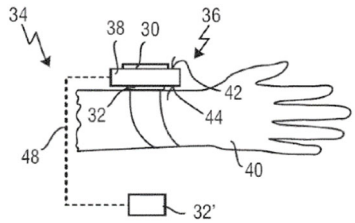
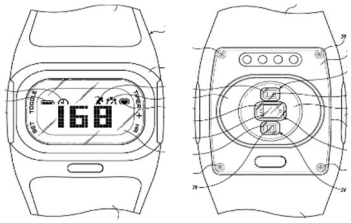
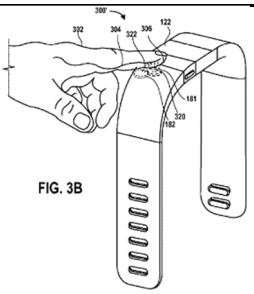
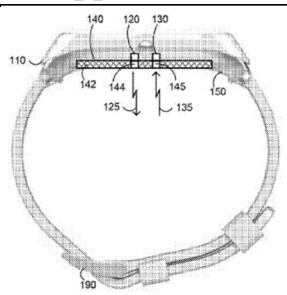
EX1002 at 1269. The Patent Owner cancelled all original claims and submitted new Claims 35–54. *Id*. at 1275–78. Without further discussion, on December 19, 2018, the Examiner allowed Claims 35–54. *Id*. at 1005–1010. These issued in the '783 patent, each including a wireless charging coil and/or a ceramic cover. EX1001 at col. 58–60. After one of multiple requests for continued examination ("RCE"s) (each for information disclosure statements, or "IDS"s), the Examiner provided a reason for allowance: "the prior art fails to teach or suggest the specific arrangement and configuration of the claimed cover, opening in the housing, and wireless charging coil." EX1002 at 387. However, the applicant did not submit, and the examiner did not consider, any of the prior art references that Petitioner relies on in this Declaration. *See generally Id*.

C. Priority of the '783 Patent

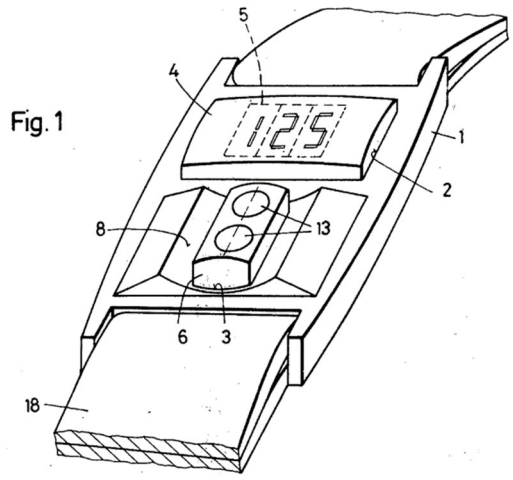
64. I understand the '783 patent was filed September 10, 2016 and is a continuation of U.S. Application No. 14/842,617, filed September 1, 2015, which claims priority to provisional application 62/044,974, filed September 2, 2014. Thus, the earliest alleged priority date of the '783 Patent is September 2, 2014. EX1002 at 186, 1965.

IX. BIOSENSING WATCHES THROUGH THE DECADES

65. Biosensing wristwatches were known for decades prior to the earliest September 2014 filing of Apple's patent. A graphical overview of some of these devices is shown in the table below.

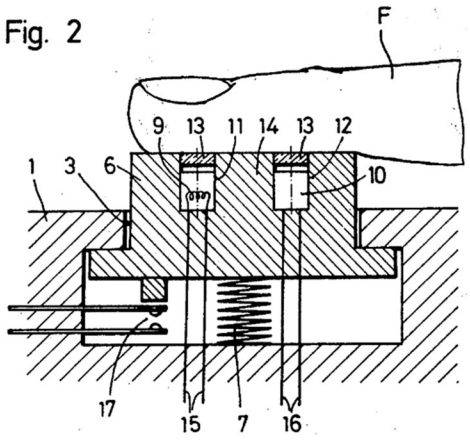
 Thalmann (EX1022) - **1978** US Pat. 4,129,124	 Cramer (EX1026)-**1980** US Pat. 4,224,948	 Schmid (EX1029) - **1983** US Pat. 4,375,219
 Ohsaki (EX1007) - **2001** PCT Pub. 2001/0056243	 Honda (EX1006) - **2001** US Pat. 6,265,789	 Kotanagi (EX1005) - **2005** PCT Pub. WO2005/092182
 Shmueli (EX1008) - **2012** PCT Pub. 2012/140559	 Kateraas(EX1014)-**2012** US Pub 2012/0221254	 Coppola (EX1020) - **2014** EP App. 141631147
 Fei (EX1010) - **2014** US Prov. App. 61/976388	 Yuen (EX1016) - **2014** US Pub 2014/0135594	 Fraser (EX1041)-Filed **2014** US Pub 2015/0355604

66. One of the earliest patents showing an optical pulse-rate sensor incorporated into a wristwatch device was U.S. Patent 4,129,124 in 1978 to Thalmann ("Thalmann," EX1022). Thalmann constructed a wristwatch device having an optical pulse-rate sensor incorporated on the upper surface of the device, as shown below:



EX1022, Fig. 1.

67. In Thalmann's device a user would place their finger on the upper surface of pushbutton 6, which contains translucent plugs 13. *Id.* at col. 1:35–44. Below translucent plugs 13 are light source 9 and photosensitive element 10, as shown below:



Id., Fig. 2.

68. Thalmann describes that "light source 9 emits light upon being supplied with electric current over connecting wires 15, and finger F is placed upon pushbutton 6, light penetrates into finger F" as a result of the reflected light "[t]he intensity of the light incident upon element 10 is dependent upon the perfusion of blood in finger F placed upon pushbutton 6. The perfusion of blood in finger F is influenced by the pulse." *Id.* at col. 2:17–25. Thus, Thalmann teaches a wristwatch device for pulse detection.

69. Following Thalmann, inventors experimented with placing light emitting components and photodetecting sensors on the back side of a wristwatch. Orr, U.S. Patent 4,163,447 ("Orr," EX1025) granted in 1979, is one early example of this. As shown below, Orr demonstrated a configuration with "light emitting diode 1 and the photodiodes 3 disposed on the rear surface of a wristwatch casing 6" in

order to detect a pulse signal. EX1025 at col. 3:34–36. This particular configuration is shown below:

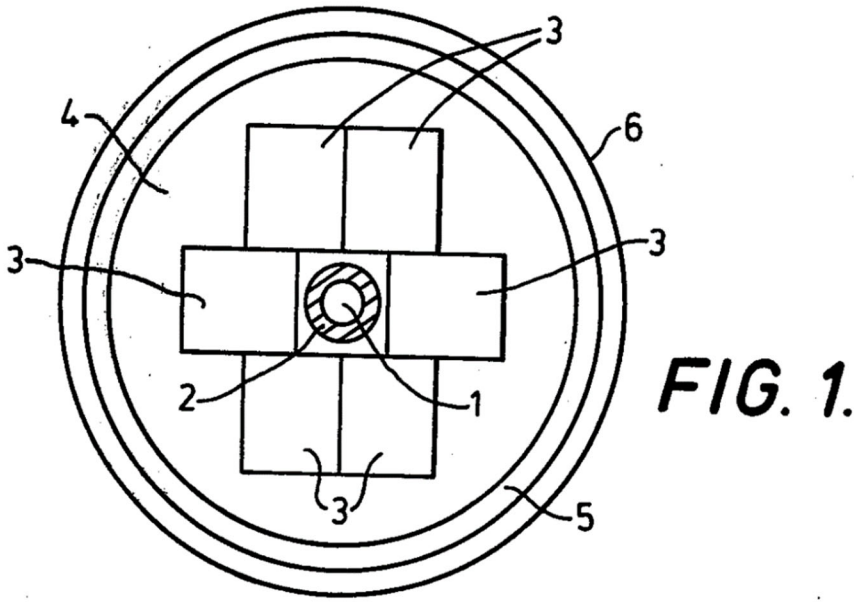


FIG. 1.

Id., Fig. 1.

70. Orr teaches in other embodiments that the placement of the photodiodes and LED's on the back of a biosensing watch could vary. This is shown below in Figures 4 and 5:

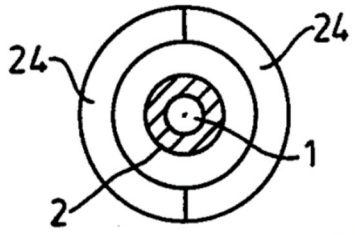


FIG. 4.

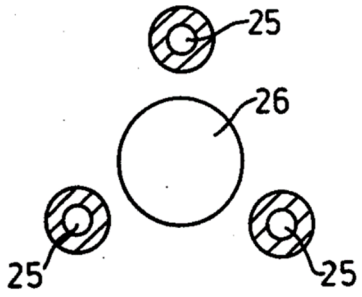


FIG. 5.

Id., Figs. 4, 5.

71. Orr additionally teaches that its wristwatch may be provided with a rechargeable battery and that the "battery is recharged with current derived from a semiconductor detector which is also alternatively used to produce a signal in dependence on the heartbeat rate." *Id*. at EX1025 at col. 1:36–39. Thus, Orr teaches a wristwatch with a form of "wireless" charging via light incident on the photodetector on the rear side of Orr's watch .

72. Orr was followed by further innovations in biosensing watches. In 1980 Cramer was granted U.S. Patent 4,224,948 ("Cramer," EX1026) titled "Wrist borne pulse meter/chronometer." EX1026 at 1. Like Orr, Cramer placed optical elements for pulse detection on the back side of a wristwatch. In the picture below, "infra-red source 24" is surrounded by a "detector array 23" as an optical biosensor. EX1026 at col. 5:41–42.

FIG. 1

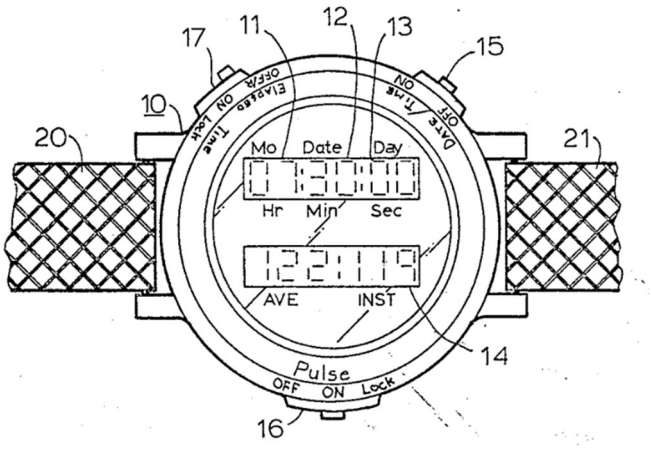


FIG. 2

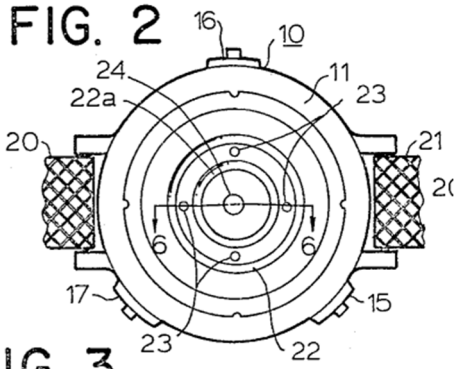
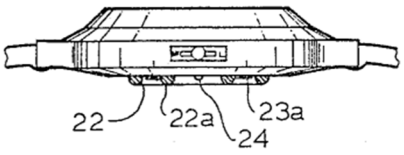


FIG. 3



*Id., Fig*s. 1,2.

73. Instead of the opaque regions in Orr, Cramer placed ridges or "boss 22" and "boss 22a" between the light and the detectors in order to "prevent[] direct transmission of light between source 24 and detectors 23." EX1026 at col. 5:45–48. Thus, from Orr and Cramer a POSITA would have known that additional light source and detector configurations on the back of a wristwatch are possible.

74. In the following year, 1981, U.S. Patent 4,248,244 was granted to Charnitski ("Charnitski," EX1027) which incorporated an "electrode section 11" comprising "capacitive plate" 13 and 17 on the top and bottom of the watch with "insulating surfaces 15 and 19" over the capacitive plates and an "electrode 21" in the form of the wrist band of the watch, shown below. EX1027 at col. 5:10–15; col. 2:52.

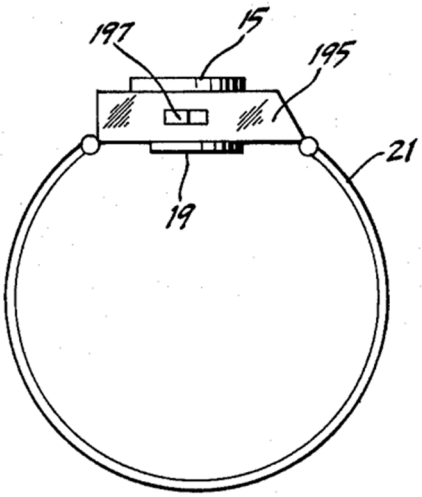


Fig. 2

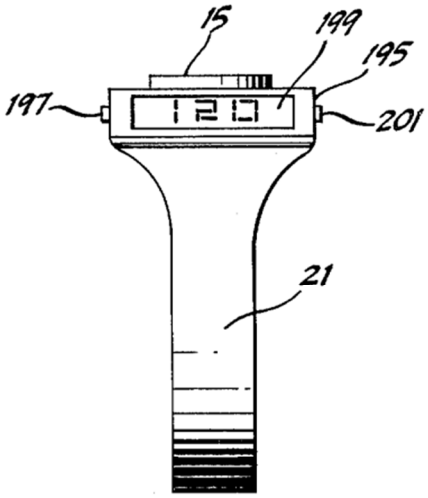
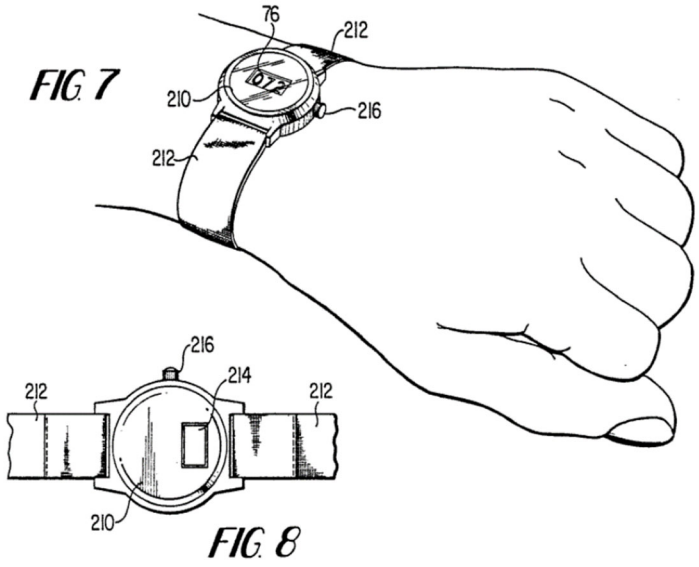


Fig. 3

*Id., Fig*s. 2,3.

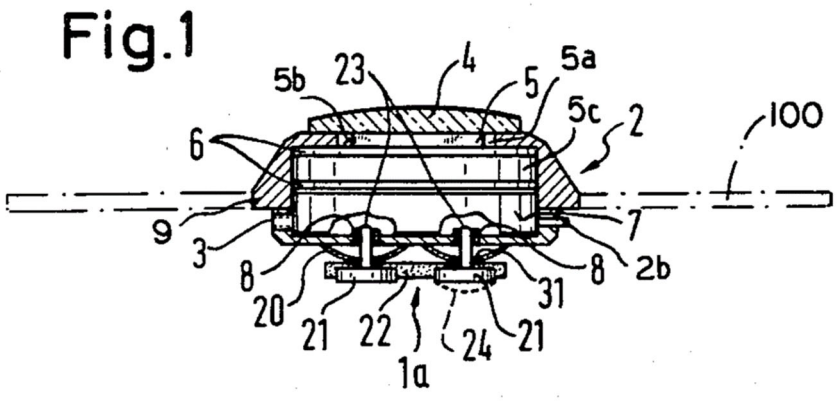
75. Charnitski notes that its watch is superior to the prior art because "electrodes of electrode section 11 have the ability to produce an ECG signal without the necessity of preparing the skin of a living subject with a material such as a conductive gel to accept the electrodes." EX1027 at col. 7:5–8.

76. In the following year of 1982, WO 1982000088 A1 was published by Steuer ("Steuer," EX1028). Steuer teaches "A sensor 12, which may be a conventional pressure transducer or a light emitting diode/photocell combination, [which] measures the systolic beats of the user. In the case of the wrist watch embodiment, the beats are sensed at the wrist of the user in a conventional manner." EX1028 at 6:15–20. These sensors function as a cardiotachometer by measuring systolic heartbeats. EX1028 at 1. Steuer's system is shown below:



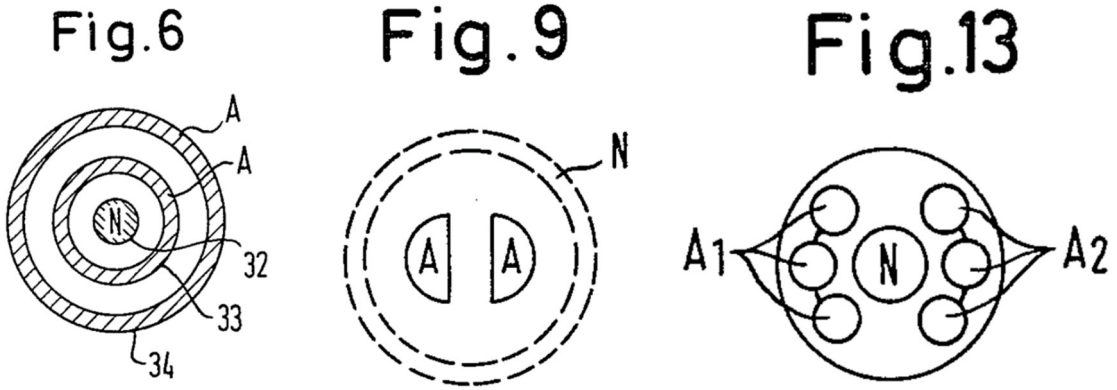
Id., Fig. 8.

77. In the following year, U.S. Patent 4,375,219 was granted to Schmid ("Schmid," EX1029) relating to ECG/EKG measurements with a biosensing watch. In particular, Schmid modified the design of Charnitski to show that multiple "electrodes 21" may be placed on the rear side of a watch, and the "armband 100 and/or the housing 2 can form the neutral or reference electrode." EX1029 at col. 5:20–22. Schmid's general watch structure is shown below with "watch-face window 4" in the front side and "electrodes 21" on the rear side. EX1029 at col. 5: 35, 48.



Id., Fig. 1.

78. Schmid further showed that an ECG electrode structure is not particularly limited and that active electrodes ("A") and a reference electrode ("N") may be arranged in "various configurations" (EX1029 at col. 6:36), some of which are shown below:



Id., Figs. 6, 9, 13.

79. Like Charnitski, Schmid explains that its biosensing watch is advantageous because it "provide[s] an electrode assembly for EKG and other bioelectrical purposes, which can operate without an electrode gel or other contact

element." EX1029 at col. 1:52–54. Schmid also teaches that its configuration allows the EKG sensors to be in "close proximity" and are "at least as precise as the electrodes heretofore used for EKG measurements inspite [sic] of the many times greater spacing employed with the conventional electrodes." EX1029 at col. 4:17–22.

80. In 1991, Suga (U.S. Patent 5,316,008, "Suga," EX1030) showed that a biosensing watch could combine the ECG and optical sensors of the prior art into a single watch. As described by Suga, "In the present embodiment, both the detection of ECG waves and the detection of changes in blood flow in a fingertip are used for detection of sphygmus." EX1030 at col. 6:5–7. As stated in Suga, this configuration is advantageous over the prior art because "the invention allows sphygmus and electrocardiographic R waves to be precisely sensed and further generates accurate cardiac data such as sphygmus data, blood pressure data, blood flow rate data and the like for promotion of health." EX1030 at col. 2:33–38.

81. Suga's watch shows "ECG wave detecting electrodes 4a, 4b" with one electrode on the front of the watch and one on the rear surface of the watch. EX1030 at col. 5:46. Embedded within the front electrode 4a is the optical sensor composed of "LED 7" and "photo-transistor 5." EX1030 at col. 3:46–47. These are shown below:

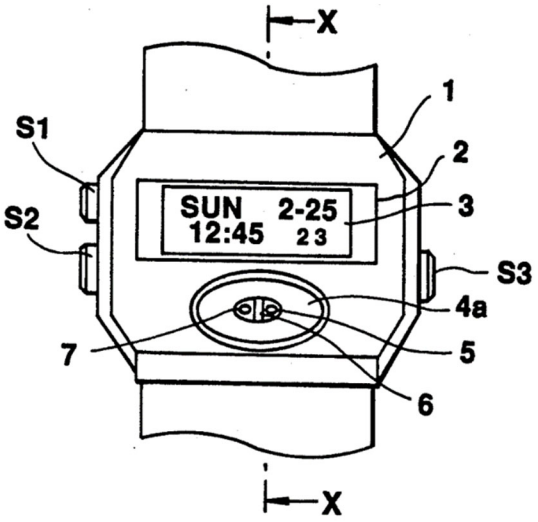


FIG.1

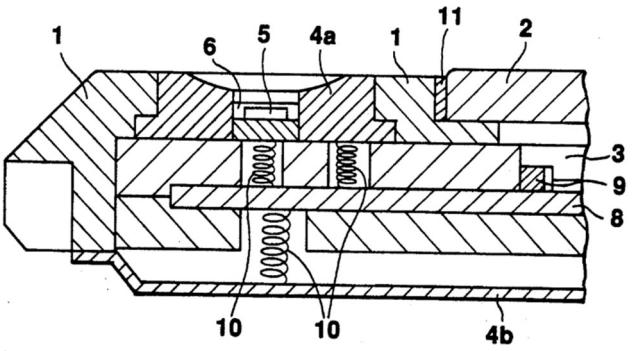


FIG.2

Id., Figs. 1, 2.

82. Thus, in Suga's device an ECG is calculated with a user's "right fingertip being in contact with the ECG wave detecting electrode 4a while his left wrist being in contact with the ECG wave detecting electrode 4b." EX1030 at col. 4:31–33. At the same time "[t]he sphygmus detecting section 15b is connected with the photo transistor 5 and LED 7 of FIG. 1, and senses pulsating flow of blood in a blood vessel in his right fingertip, detecting sphygmus and supplies the sphygmus data to the control section 14." EX1030 at col. 4:35–40. Therefore, it was known from the disclosure in Suga in 1991 to incorporate ECG and pulse detection into a single biosensing watch.

83. Several years later in 1998 a patent to Lo (U.S. Patent No. 5,738,104, "Lo," EX1031) disclosed a "digital wrist watch for the EKG type heart rate monitor."

EX1031 at col. 7:26–27. The watch has "Two electrical contacts 14 and 16 [] placed on the front of the watch for the user to place his or her fingers on when the pulse mode is entered. A third electrical contact is located on the back side of the watch and is indicated in phantom at 18." EX1031 at col. 7:34–38. This is shown below:

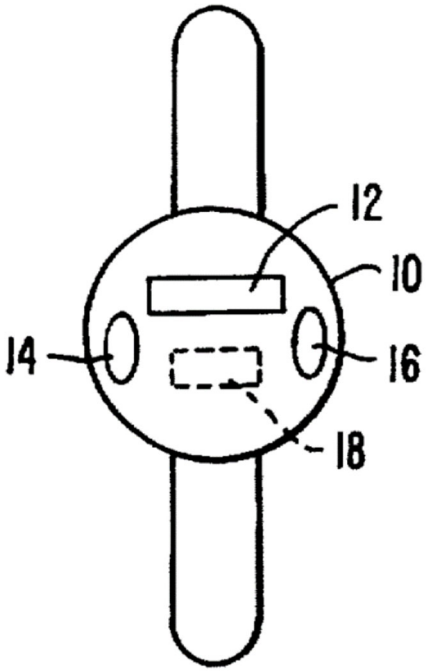


FIG. 1.

Id., Fig. 1.

84. Lo teaches that "[t]he digital watch embodiment uses a three contact approach to help eliminate noise." EX1031 at col. 7:33–34. Thus, a person having ordinary skill in the art would have known in 1995 that three or more electrodes on a watch would have reduced noise in an ECG measurement.

85. In the year 2001, Honda was granted patent 6,265,789 ("Honda," EX1006). Honda describes and illustrates a portable electronic device in the form of a wristwatch and teaches wireless charging of such devices using a wireless charging "station." EX1006 at col. 6:7. The watch gathers "biological information of the body, such as the pulse rate or heart rate," which it can transmit to the station. EX1006 at col. 8:40–42.

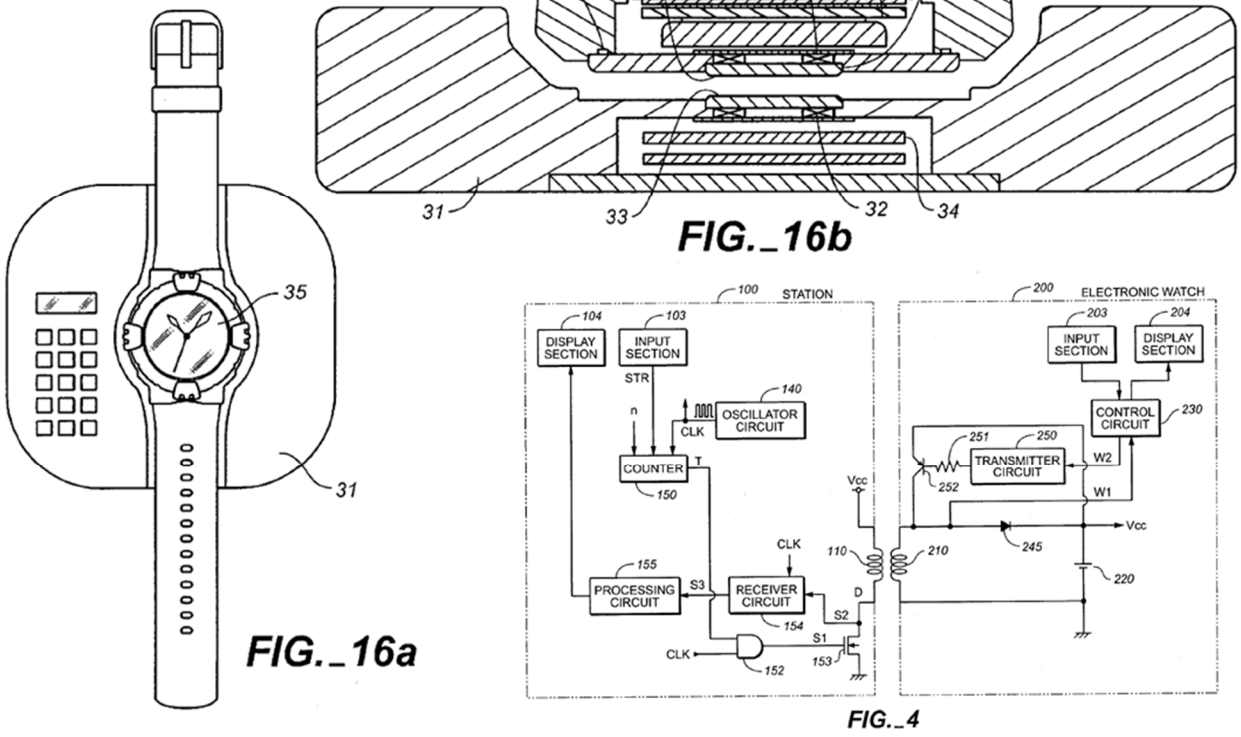


FIG._16b

FIG._16a

FIG._4

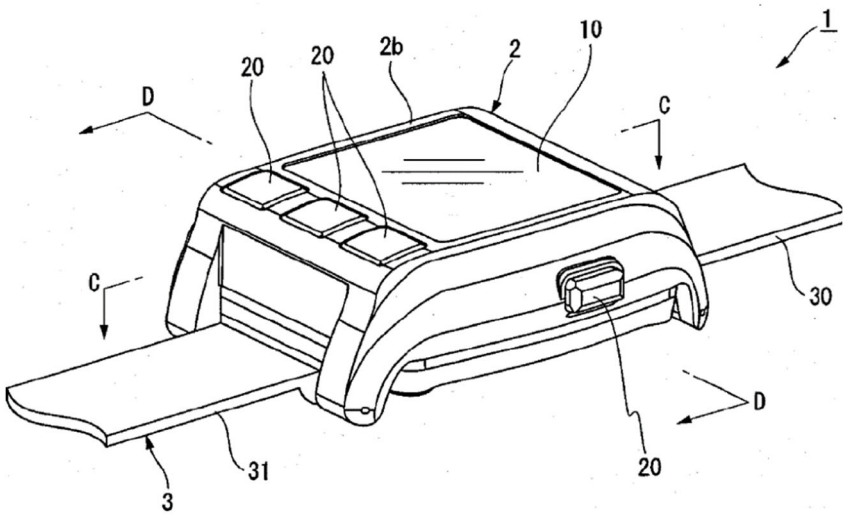
*Id., Fig*s. 4, 16a, 16b.

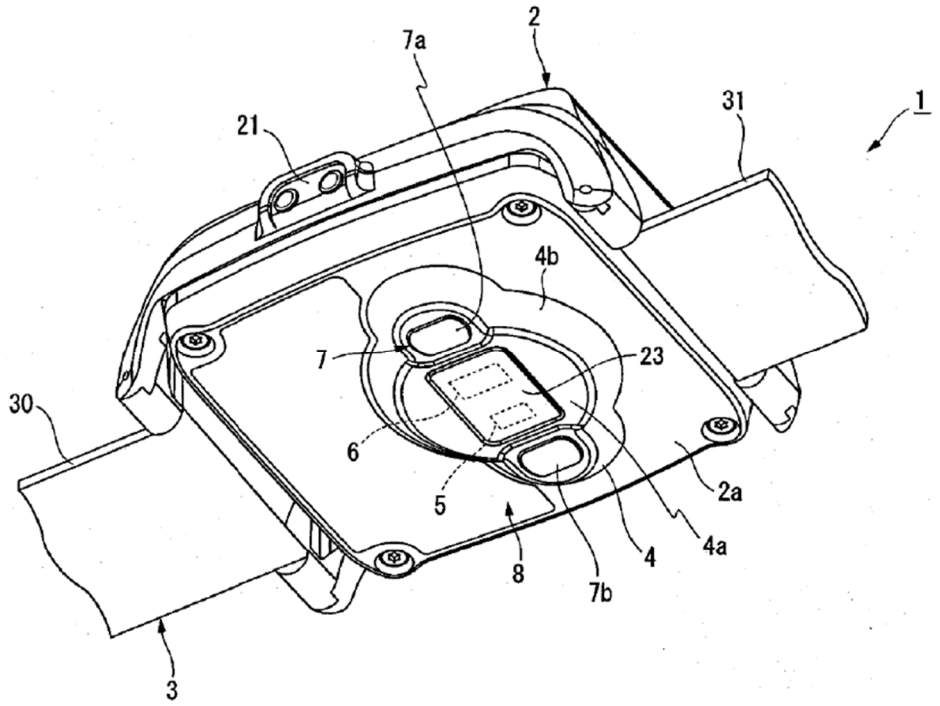
86. Therefore, a POSITA would have known from Honda's disclosure that a biosensing watch may be wirelessly charged via magnetic coupling through a rear cover in a charging station.

87. In the year 2005 Kotanagi was published as WO 2005092182 ("Kotanagi," EX1007). Kotanagi describes and illustrates a wristwatch as a "biological information measuring device." EX1005 at Abstract. Kotanagi describes its biological sensor, at least in part, as:

> A biological sensor part 8, which includes an LED (Light Emitting Diode) (light-emitting part) 5 for emitting light toward the living body while in contact with the living body surface B side, a PD (Photodetector) (light-receiving part) 6 for receiving reflected light from the living body out of the light emitted by the LED 5 and generating a pulse signal (biological information signal) corresponding to the amount of received light, and a contact detection means 7 for detecting whether the LED 5 and the PD 6 are in contact with the living body surface B, is disposed on the lower surface 4a of the protruding part 4.
>
> EX1005 at ¶0046.

88. Kotanagi's device is shown in Figures 4 and 5 below:





EX1005, Figs. 4, 5.

89. In the same year, 2005, Goldreich was published as US 20050116820 A1 ("Goldreich," EX1033). Goldreich disclosed a wristwatch device which may display "medical information to the user on a local LCD display, such that the user is optionally and preferably able to read the result locally." EX1033 at [0015]. Goldreich provides a list of medical information that the watch may extract and provide:

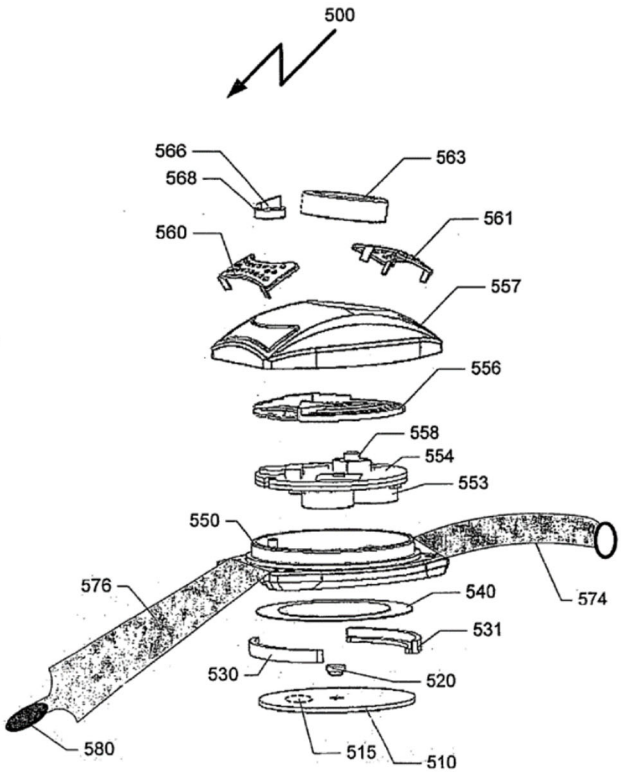
> Examples of medical information which may be extracted from the measured physiological parameter or parameters include, but are not limited to: heart rate; regularity in heart rate; breathing rate; arrhythmia of the heart (if any), as well as the general rhythm and functioning of the heart; blood pressure; presence of abnormal body movements such

> as convulsions for example; body position; general body movements; body temperature; presence and level of sweat; oxygen saturation in the blood; and glucose levels in the blood.

EX1033 at [0015].

90. In one embodiment, Goldreich's device shows "conductive areas 560 and 561" on the upper sides the watch, and "conductive area 515" on the lower side of the watch such that 515 would be in contact with the wrist. EX1033 at [0118]. Goldreich also teaches a "temperature sensor 580" in the wrist of the watch, and an "SpO2 sensor 566" which "preferably has two light sources, optionally by two LEDs (light Emitting Diode) and a photoelectric detector." EX1033 at [0124]. Goldreich's device is shown below:

FIG. 5



Id., Fig. 5.

91. From Goldreich's disclosure a POSITA would have known that a watch could measure a variety of physiological parameters with an optical sensor, a temperature sensor, or three or more electrodes.

92. In the year 2007 a biosensing watch was published in US 20070276270 A1 ("Tran," EX1034), which also included optical sensors and ECG electrodes like Goldreich. Tran teaches that the "back of the device is a conductive metal electrode 1381 that in conjunction with a second electrode 1383 mounted on the wrist band 1374, enables differential EKG or ECG to be measured." EX1034 at [0237]. Tran

also teaches an optical sensor embedded in the wrist band and that a "light source and the photo-detector are slidably adjustable and can be moved along the wrist band to optimize beam transmission and pick up. 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." EX1034 at [0244]. Tran's watch, showing electrode 1381, electrode 1383, and wrist band 1374, is below.

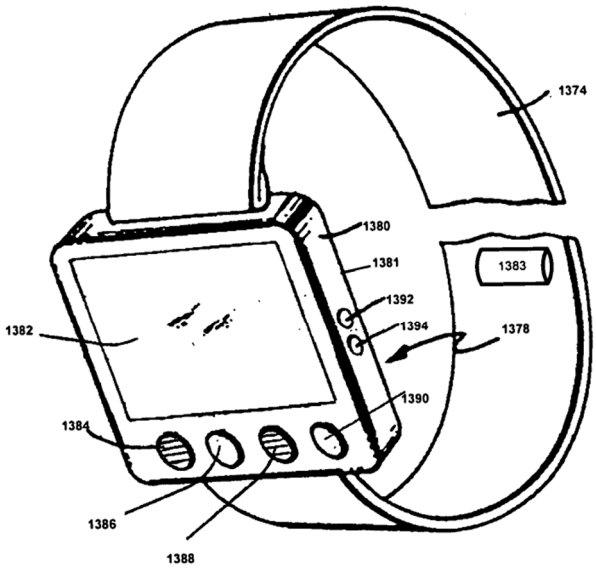


FIG. 6A

Id., Fig. 6A.

93. Tran also teaches that the various sensors do not have to be in the wrist band as "[i]n one embodiment, the sensors for monitoring vital signs are enclosed in a wrist-watch sized case supported on a wrist band. The sensors can be attached to the back of the case." EX1034 at [0336]. Thus, a POSITA would have known from

Tran's disclosure that a watch may have ECG and pulse sensors in the wristband or the watch casing.

94. In the year 2008, US 20080208009 A1 was published by Shklarski ("Shklarski," EX1035). Shklarski teaches an electronic watch including "one or more electrodes, for example, an ECG RA (Right Arm) finger electrode 122, an ECG LA (Left Arm) wrist electrode 124 (FIG. 2B), and an ECG REF[.] (Reference) wrist electrode 126." EX1035 at [0028]. Shklarski additionally teaches that the "wearable device 105 may include at least one blood oxygen level (SpO_2) transceiver 128 to measure the level of the oxygen in the patient's blood, and at least one pulse transceiver 130 (shown in FIG. 2B) to measure the patient's pulse." EX1035 at [0029]. The blood oxygen, pulse, and ECG sensors on the front and back of the watch are shown below:

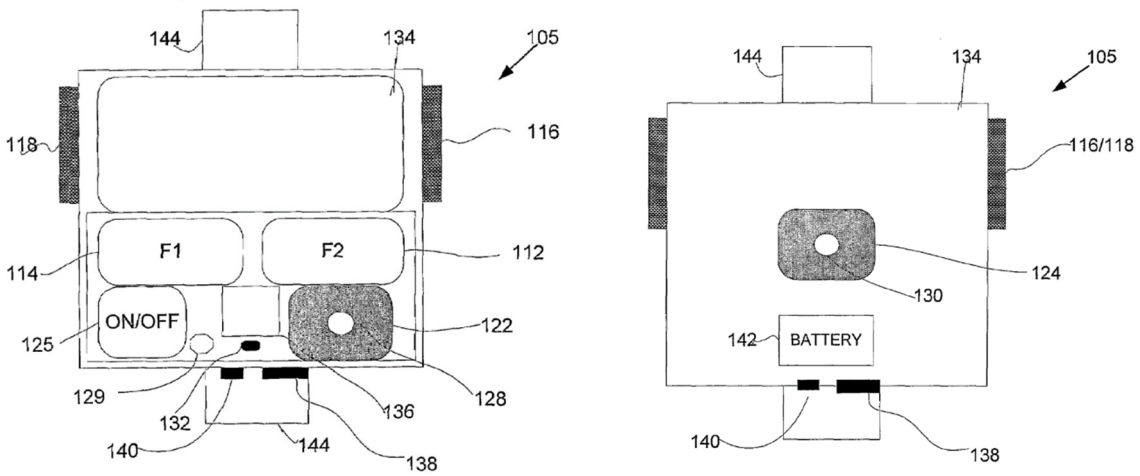
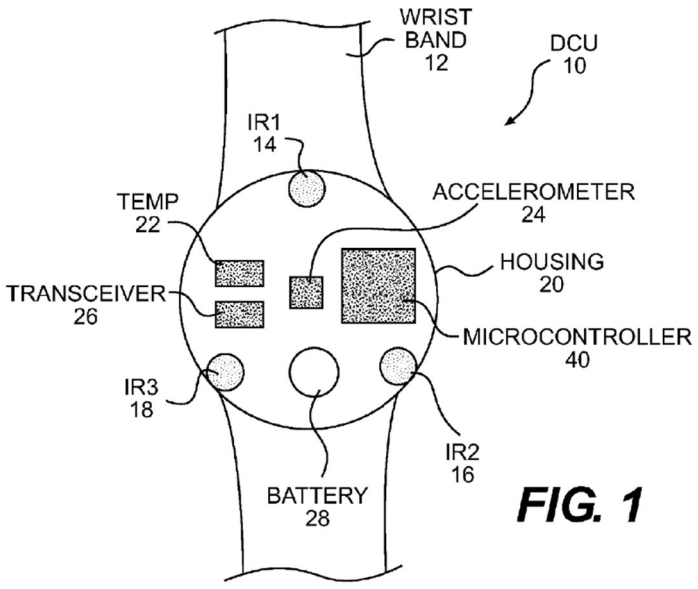


FIG. 2A FIG. 2B

EX1035, Figs. 2A, 2B.

95. In August 2012, US20120221254A1 was published by Kateraas ("Kateraas," EX1014). Kateraas, like many other references before it, teaches a "sensor array" that may be "located at any position along wrist band 12" but that "the sensor array is located in housing 101" in a position "adjacent to the underside of the wrist of a user." EX1014 at [0058]. The sensor array may comprise "accelerometer 24; infrared sensors 14, 16, and 18; and/or temperature sensor 22." EX1014 at [0058]. Kateraas Figure 1 is shown below:



EX1014, Fig. 1.

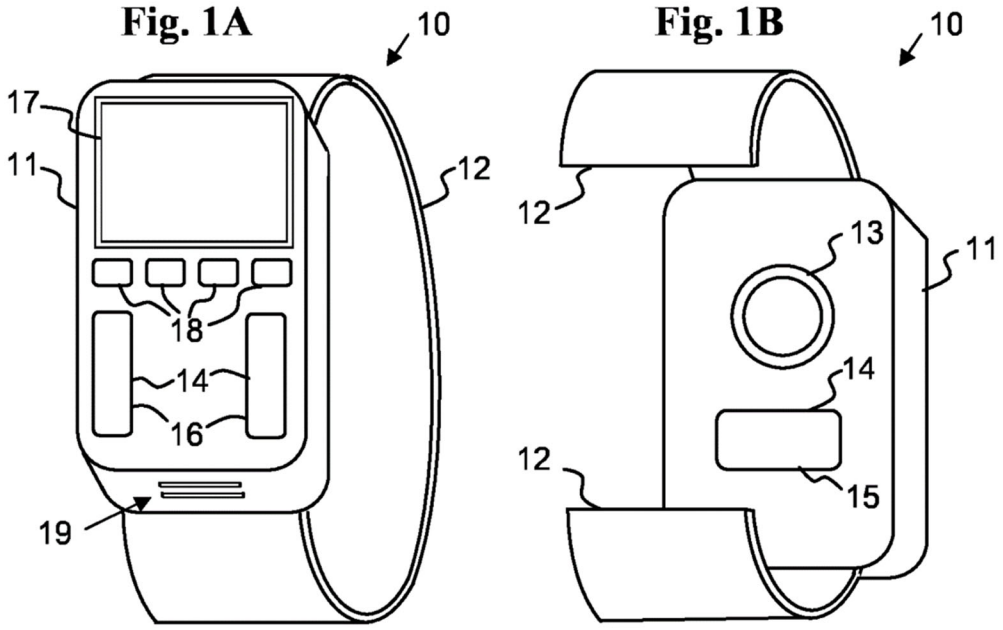
96. Kateraas teaches that its sensor array may "monitor only a single biological marker. Alternatively, an individual sensor in the array may be configured to monitor multiple biological markers." EX1014 at [0014]. Some of these biological

markers are "pulse rate, body temperature, blood oxygen content, or any other suitable marker." EX1014 at [0014].

97. Kateraas specifies that its sensor array may be covered by a transparent "window 103" that may be comprised of "germanium, zinc selenide, sapphire, IR glass, IR polymer, barium fluoride, calcium fluoride, and combinations thereof." EX1014 at [0059].

98. Thus, a POSITA would have known from the disclosure in Kateraas that the underside of a biosensing watch may have an "array" of sensors covered by a transparent, sapphire window.

99. In October 2012, WO 2012140559 A1 was published by Shmueli ("Shmeuli," EX1008) teaching a "heart monitoring device 20" with an oximetry (SpO_2) sensor and ECG electrodes where "The oximetry sensor 13 (not shown) preferably faces the back side of the hand. Two electrical contacts (not shown) mounted on the back side of the heart monitoring device 10 touch the skin of the subject at the wrist, and one of the fingers of the second hand of the subject touches the electrical contact 14 on the front side of the heart monitoring device 10." EX1008 at 11. Shmeuli's device is shown in Fig. 1A and 1B below.



EX1008, Fig. 1A, 1B.

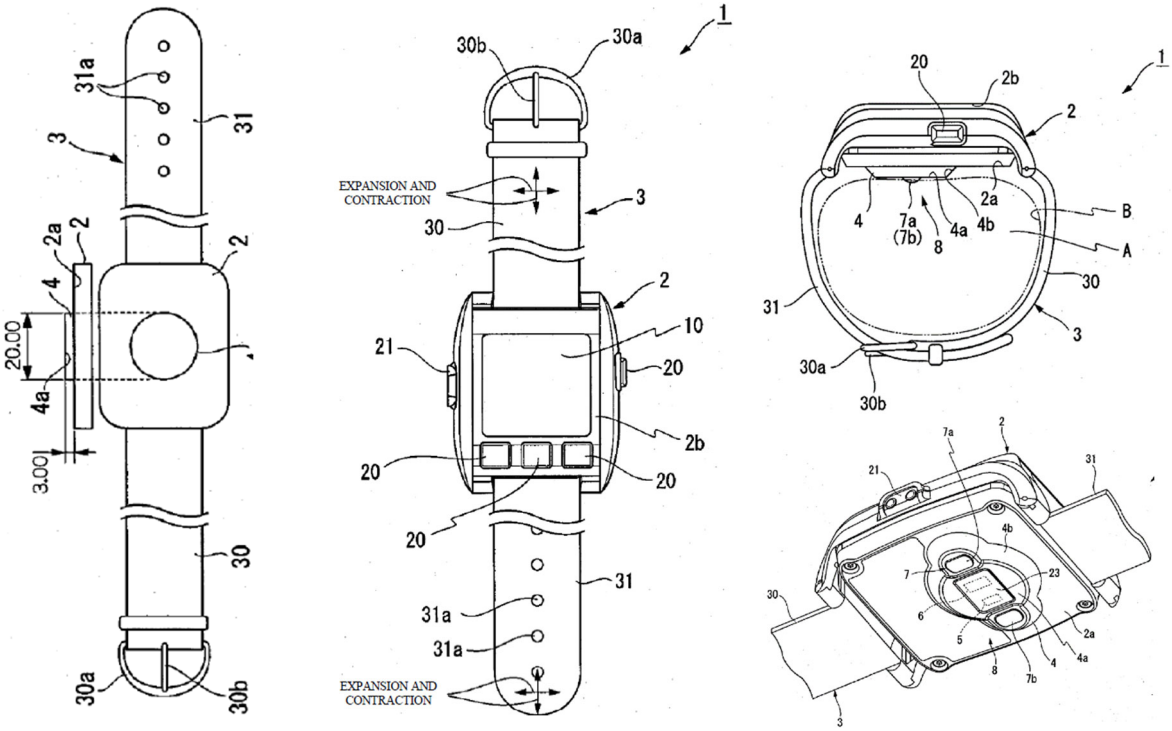
100. In the years following, other advancements were made in the field of biosensing watches. This overview is not meant to be exhaustive. However, an explanation of the decades of technology relating to biosensing watches prior to September 2014 may be helpful in understanding the general knowledge of a POSITA as it relates to the challenged patent. Further, it is important to note that none of these references were cited by or considered by the Examiner during the prosecution of the '783 patent. *See* EX1002 generally.

X. Introduction to Selected Prior Art References

A. Kotanagi (EX1005)

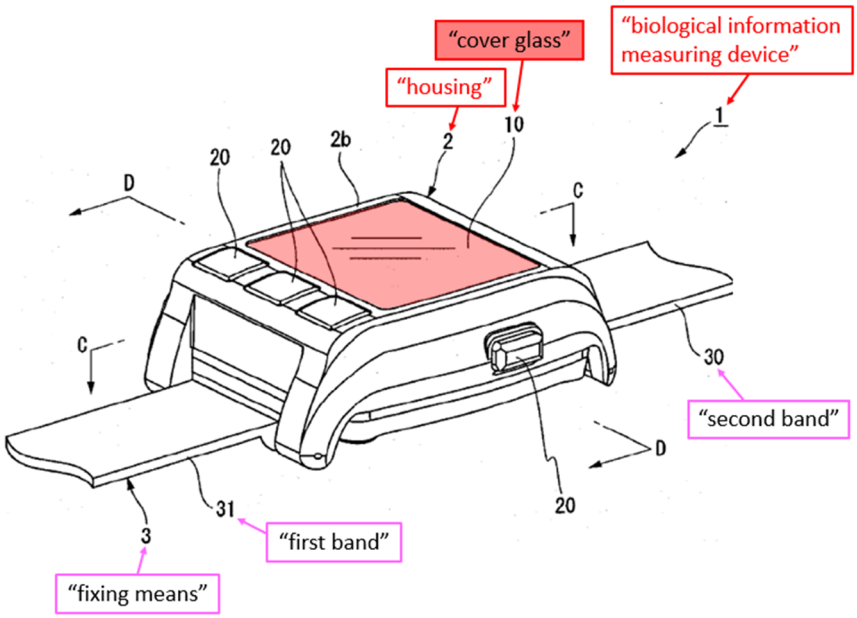
101. As noted above, the '783 patent was believed to be distinguishable from the prior art based in part on the "opening in the housing." EX1002 at 387. Kotanagi teaches this and many of the other limitations.

102. PCT Patent Publication WO 2005092182 ("Kotanagi," EX1005) claims an earliest priority date of March 26, 2004, more than a decade before Apple's '783 patent application was filed. EX1005 at 1. Kotanagi was not cited or reviewed in the '783 patent's prosecution history and is not listed on the face of the '783 patent. EX1002 generally; EX1005 at 1. Kotanagi describes and illustrates a "biological information measuring device" in the form of a wristwatch:



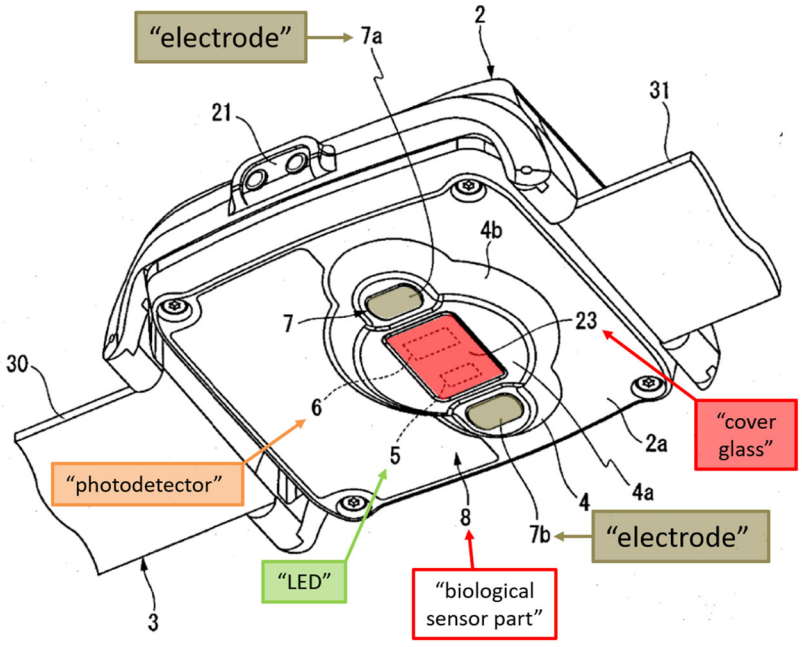
EX1005, Figs 1, 2, 5, 8.

103. The watch has touch electrodes and sensors (behind a window in a protruding bulge at its base) for directing optical signals to and, receiving optical reflection from, a user's skin. Kotanagi teaches that the device can be charged wirelessly. EX1005 at ¶53. The upper surface contains a glass electronic display, and it has a wristband:



See id., Fig. 4.

104. The lower (skin-facing) surface of Kotanagi's wristwatch contains biological sensors. It has two electrodes and at least one optical biosensor, shown below:



See id., Fig. 5.

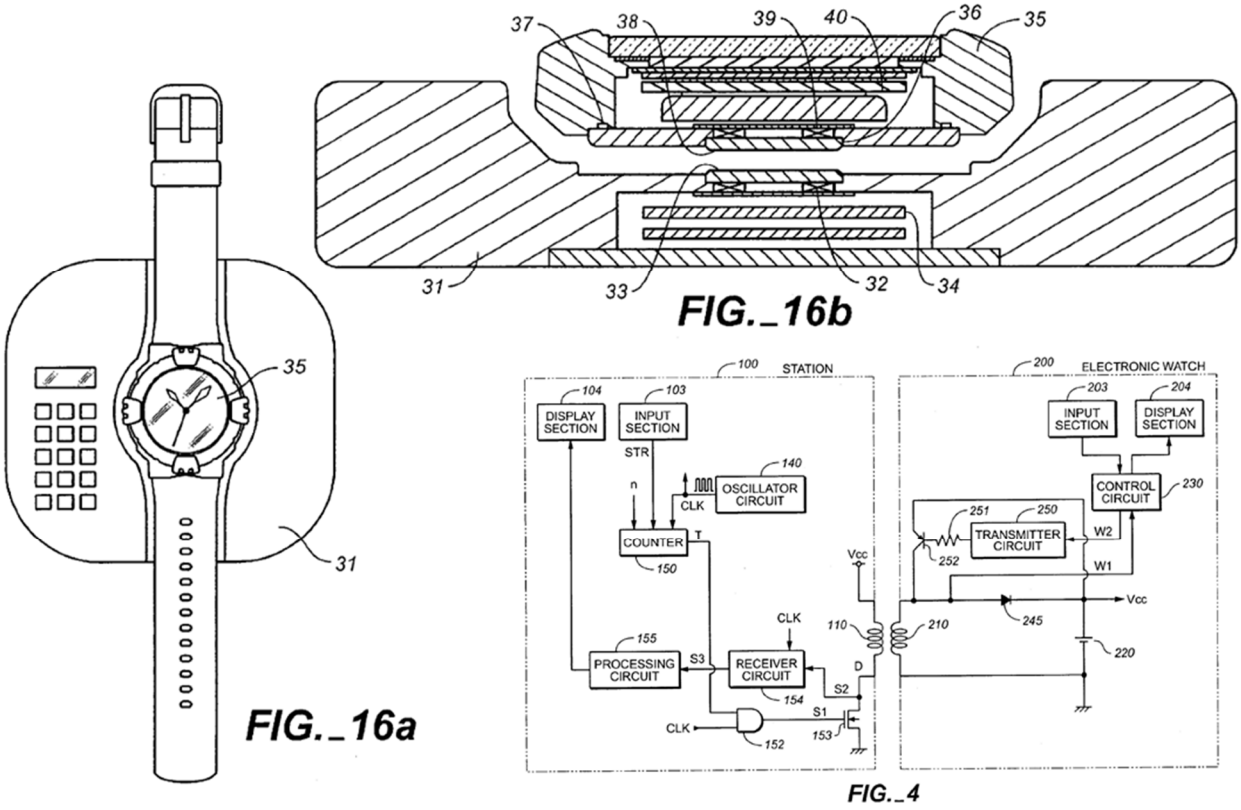
Kotanagi's LED and photodetector measure a user's heart pulse rate via light emitted and reflected from skin back to the biosensor. EX1005 at ¶46.

B. <u>Honda (EX1006)</u>

105. The '783 patent was believed to be distinguishable from the cited prior art based, in part, on the "opening in the housing, and wireless charging coil." EX1002 at 387. Honda teaches this and many of the other limitations.

106. U.S. Patent No. 6,265,789 to Honda ("Honda," EX1006) issued July 24, 2001, more than a decade before Apple's '783 patent application was filed. EX1006 at 1. Honda was issued to a subsidiary of the same parent company (Seiko) as Kotanagi. *Id.* Honda was not cited or reviewed in the '783 patent's prosecution history and is not listed on the face of the '783 patent. *Id.* Honda describes and

illustrates a "portable electronic device" in the form of a wristwatch, and provides details about wireless charging of such devices using a "station." *Id.* at col. 4:21–28. The watch also gathers "biological information of the body, such as the pulse rate or heart rate," which it can transmit to the station. EX1006 at col. 8:40–42.



EX1006, Figs. 4, 16a, 16b.

C. Status of References as Prior Art

107. The references relied upon in the grounds herein are prior art for the following reasons:

Exhibit No.	Description	Prior Art Basis
1001	'783 patent (background section)	Admitted Prior Art
1005	Kotanagi	Post-AIA 35 U.S.C. §102(a)(1) – published October 6, 2005
1006	Honda	Post-AIA 35 U.S.C. §102(a)(1) – issued July 24, 2001
1012	Park	Post-AIA 35 U.S.C. §102(a)(2) – effectively filed January 28, 2014 (see EX1015)
1014	Kateraas	Post-AIA 35 U.S.C. §102(a)(1) – published August 30, 2012
1016	Yuen	Post-AIA 35 U.S.C. §102(a)(1) – published May 15, 2014
1017	Jabori	Post-AIA 35 U.S.C. §102(a)(2) –filed January 30, 2014
1041	Fraser	Post-AIA 35 U.S.C. §102(a)(2) –filed August 19, 2014

108. In my opinion, these references constitute analogous art because they are from the same field of endeavor as the '783 patent, e.g., watches and wearable electronic devices. They are also reasonably pertinent to a particular problem with which the inventor was involved, e.g., wireless charging of biosensing watches. The volume and character of the overlapping features between the references listed above and the subject patent provides further evidence that these references are analogous

art and highly relevant for a POSITA. For example, the side-by-side figures in the section above titled "Overview of the '783 Patent" show many similarities between the patent and the Kotanagi reference. These figures and similar figures throughout this document support the obviousness combinations generally and also support the conclusion that these references are analogous art. For at least these reasons, I understand that under U.S. patent law, a POSITA is presumed to have been aware of these references. *In re Nilssen*, 851 F.2d 1401, 1403 (Fed. Cir. 1988). As set forth in detail below in the context of the invalidity analysis, a POSITA would have been motivated to combine these references at the relevant time for many additional reasons.

a. Jabori 35 U.S.C. § 102(a)(2) Analysis

109. As I understand, Jabori (EX1017) is a PCT publication that designates the United States (35 U.S.C. § 374), does not claim priority to a prior-filed application (35 U.S.C. § 102(d)(1)) and was filed January 30, 2014, predating the earliest priority of the '783 patent. EX1017 at 1. Thus, Jabori is prior art as of January 30, 2014.

b. Fraser 35 U.S.C. § 102(a)(2) Analysis

I understand Fraser (EX1041) is a U.S. patent publication. Filed August 19, 2014, it predates the earliest priority of the '783 patent and is therefore prior art. 35 U.S.C. § 102(d)(1).

c. Park 35 U.S.C. § 102(a)(2) Analysis

110. As I understand, U.S. Patent Pub. No. 20150214749 A1 ("Park" EX1012) was published July 30, 2015 and is prior art under post-AIA 35 U.S.C. § 102(a)(2) because it is a U.S. publication and claims an effective filing date that predates the earliest effective filing date of the '783 patent. EX1012 at 1. I understand that Park has a predating effective filing date because it claims priority to U.S. provisional 61/932,258 ("Park Provisional" EX1015) filed January 28, 2014. EX1012 at 1.

111. As I understand, Park is literally supported by the provisional filing of January 28, 2014. Park Provisional provides support for every limitation relied upon in this Declaration, as each pincite relied upon in this Declaration cites to both Park and Park Provisional. Additionally, Park and Park Provisional's figures 1-17 are identical. Compare EX1012 at 2–14 and EX1015 at 41–52.

112. I believe that Park Provisional provides support[4] for at least one claim in Park. To demonstrate this Claim 1 of Park is reproduced below:

[4] It is my understanding that a showing that the Park Provisional supports one of Park's claims is not necessary under USPTO guidance indicating that *Dynamic Drinkware* does not apply to post-AIA cases. *See* EX1047 at 3 (stating "The requirement that one of the claims in the patent, patent application publication, or international application publication be supported by the written description of the

1. A wireless power transmitting apparatus for wirelessly transmitting power to a wireless power receiving apparatus, the wireless power transmitting apparatus comprising:

a transmitting coil for transmitting the power;

a hall sensor for sensing a change width of flux density caused by the wireless power receiving apparatus; and

a controller for comparing the sensed change width of the flux density with a predetermined critical value determine whether to transmit the power, wherein

magnets provided in the wireless power transmitting apparatus and the wireless power receiving apparatus are disposed such that polarities of the magnets are different from each other at opposite faces thereof.

EX1012 at 25.

113. Under my analysis this claim is supported by at least by Park's disclosure below:

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provisional application in compliance with pre-AIA 35 U.S.C. § 112, first paragraph (or AIA 35 U.S.C. § 112(a)), is not applicable when examining an application subject to the first inventor to file provisions of the AIA"). Nevertheless, it is my understanding that some Board cases apply *Dynamic Drinkware* to certain post-AIA cases. *See, e.g.*, *Mueller Sys., LLC v. Rein Tech, Inc.*, Case No. IPR2020-00100, 2020 WL 2478524, at *10 (PTAB May 12, 2020);*Epizyme, Inc. v. GlaxoSmithKline LLC*, Case No. IPR2020-01577, 2021 WL 841118, at *10–11 (PTAB Mar. 5, 2021).

> In another embodiment of the present invention, a wireless power transmitting apparatus for wirelessly transmitting power to a wireless power receiving apparatus comprises a transmitting coil for transmitting the power, a Hall sensor for sensing a change of magnetic flux density caused by the wireless power receiving apparatus, and a controller for comparing the sensed change of magnetic flux density to a certain critical value to determine whether to transmit the power, wherein magnets provided in the wireless power transmitting apparatus and the wireless power receiving apparatus respectively are arranged such that the polarities of the magnets on the surfaces facing each other are different.

EX1015 at 7.

114. A chart comparison of the published claim and the provisional support (EX1015) are shown below:

Published Claim 1 (EX1012 at 25)	Provisional Support (EX1015 at 7)
A wireless power transmitting apparatus for wirelessly transmitting power to a wireless power receiving apparatus, the wireless power transmitting apparatus comprising:	In another embodiment of the present invention, a wireless power transmitting apparatus for wirelessly transmitting power to a wireless power receiving apparatus comprises
a transmitting coil for transmitting the power;	a transmitting coil for transmitting the power,

Published Claim 1 (EX1012 at 25)	Provisional Support (EX1015 at 7)
a hall sensor for sensing a change width of flux density caused by the wireless power receiving apparatus; and	a Hall sensor for sensing a change of magnetic flux density caused by the wireless power receiving apparatus,
a controller for comparing the sensed change width of the flux density with a predetermined critical value determine whether to transmit the power, wherein	and a controller for comparing the sensed change of magnetic flux density to a certain critical value to determine whether to transmit the power, wherein
magnets provided in the wireless power transmitting apparatus and the wireless power receiving apparatus are disposed such that polarities of the magnets are different from each other at opposite faces thereof.	magnets provided in the wireless power transmitting apparatus and the wireless power receiving apparatus respectively are arranged such that the polarities of the magnets on the surfaces facing each other are different.

Thus, Park Provisional supports at least one claim in the Park, and Park is entitled to the earliest priority date of January 28, 2014.

XI. ANALYSIS OF SPECIFIC GROUNDS

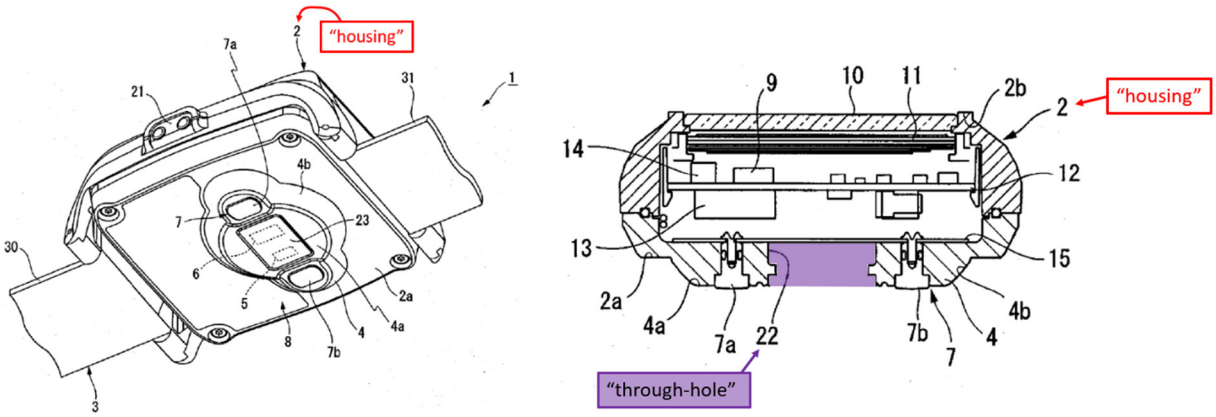
115. In my opinion, claims 1–20 of the '783 patent would have been obvious in view of the prior art to a POSITA at the relevant time. My reasoning is further set forth below.

A. Ground 1: Claims 9–11, 15, 19, and 20 are unpatentable because they would have been obvious in view of Kotanagi and Honda.

1. Independent Claim 9

a. "A wearable electronic device, comprising: a housing comprising a bottom portion defining an opening;"

116. Kotanagi teaches a housing with an opening in the bottom:

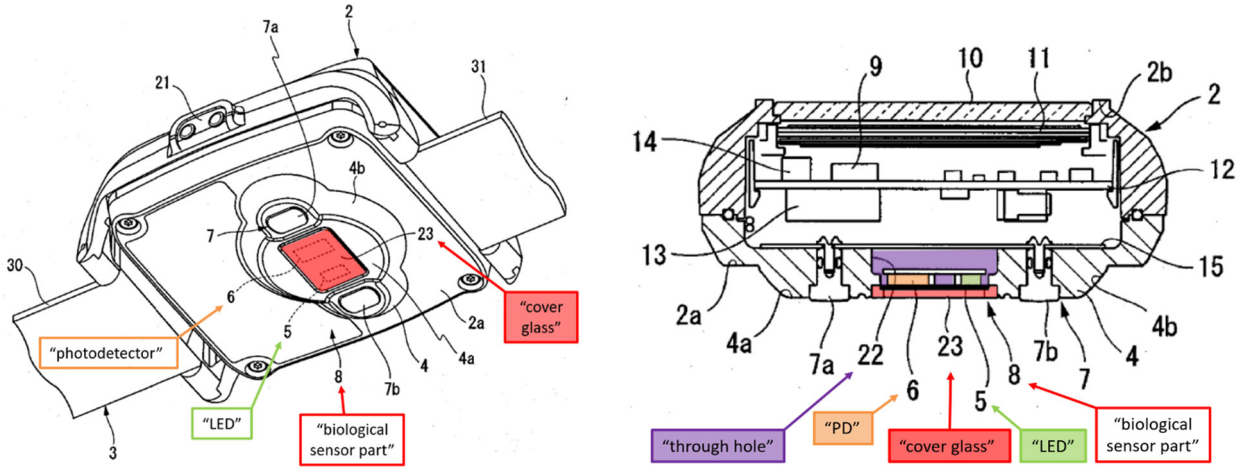


> This biological information measuring device 1 includes a housing (main body) 2 . . . . [A] through-hole 22 passing through the outside and the inside of the housing 2 is formed in the center of the lower surface 4a of the protruding part 4 . . . .

See EX1005, Figs. 4, 5 (biosensor module removed); *id*. at ¶¶45, 55.

b. "a biosensor module aligned with the opening;"

117. Consistent with the construction of "biosensor module" above, Kotanagi teaches a biosensor aligned with the opening, with figure labels below showing terms Kotanagi uses for the labeled features.



> [A]s illustrated in FIG. 7, a through-hole 22 passing through the outside and the inside of the housing 2 is formed in the center of the lower surface 4a of the protruding part 4, and a cover glass 23 is fixed to the housing 2 so as to block the through-hole 22. The LED 5 and the PD 6 are disposed adjacent to one another in a direction orthogonal to the longitudinal direction of the housing so as to touch the inside of the glass cover 23.

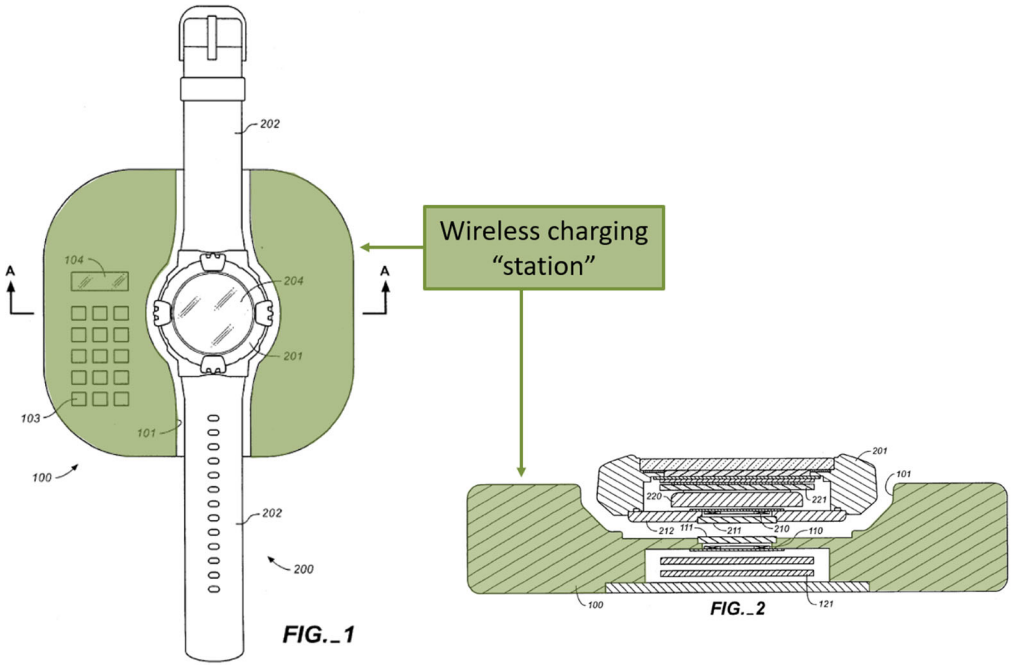
See EX1005, Figs. 5, 7; ¶55.

c. "a wireless charging receive coil positioned within the housing and aligned with the opening;"

118. Kotanagi teaches that "a transformer or the like for supplying power to a recharger and to the inside of the housing 2 may be provided ***so as to recharge the rechargeable battery 13 in a contactless state***." EX1005 at ¶53 (emphasis added).

A POSITA would have known at the time of the '783 Patent's invention that transformers utilize coils and that such contactless charging involves a wireless charging receiving coil, which is shown with regard to Honda below.

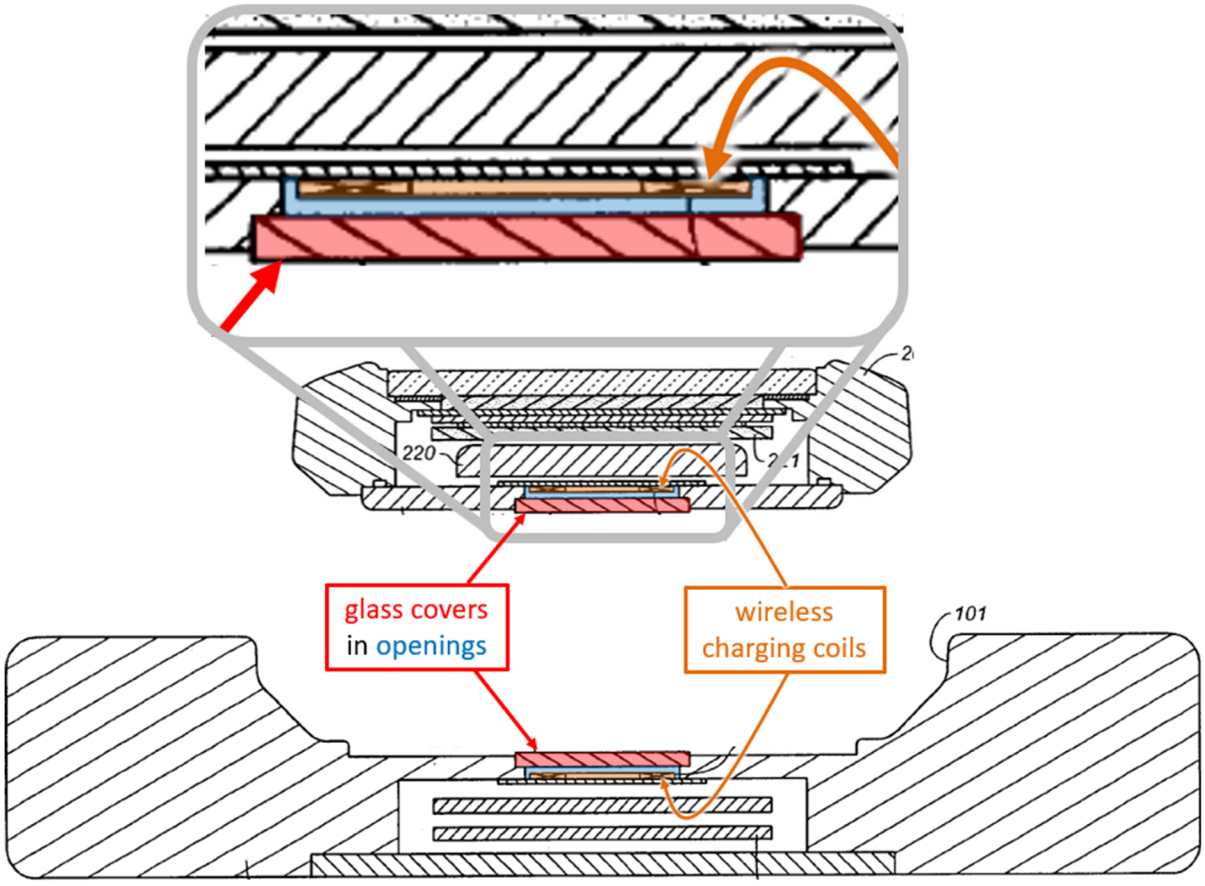
119. **Honda**, issued in 2001 and assigned to a subsidiary of the same parent company as Kotanagi, discloses such a contactless charging system for a biosensing wristwatch. EX1006 at 1. Honda's Figure 1 shows a plan view of a watch in a charging station, with Figure 2 showing a cross-section of this arrangement:



See EX1006, Figs. 1, 2.

120. Like Kotanagi, Honda teaches a biosensor: "the electronic watch 200 detects biological information including the pulse rate or the heart rate of the body." EX1006 at col. 6:17–19. Like Kotanagi, the Honda watch has a cover glass that

spans an opening in the bottom face of the watch. *Id., Fig*. 2. Within its housing and behind its cover glass, Honda illustrates a "wireless charging receive coil" "aligned with the opening," as claimed:



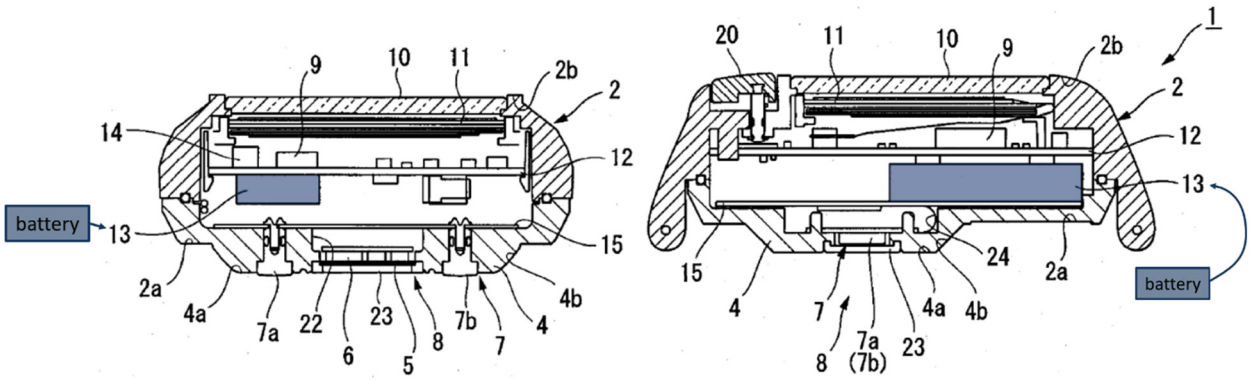
See EX1006, Fig. 2 (modified and labels added).

121. A POSITA would have been motivated to combine Honda and Kotanagi (e.g., to apply Honda's wireless charging teachings and structure to the Kotanagi device) based at least on Kotanagi's own statement that its rechargeable battery can be recharged "in a contactless state." EX1005 at ¶53. A POSITA seeking to implement Kotanagi would have looked to Honda—assigned to another

subsidiary of the same parent company as Kotanagi and providing compatible disclosure—to implement Kotanagi. Honda's watch structure is similar in size and purpose to the watch of Kotanagi and Honda teaches the incorporation of a sensor for "pulse rate" or "heart rate". EX1006 at col. 6:17–19. Thus, a POSITA would have had a reasonable expectation of success in fitting Honda's wireless charging receive coil within the housing of Kotanagi to accomplish Kotanagi's expressed purpose of "contactless recharging." *See* EX1005 at ¶53.

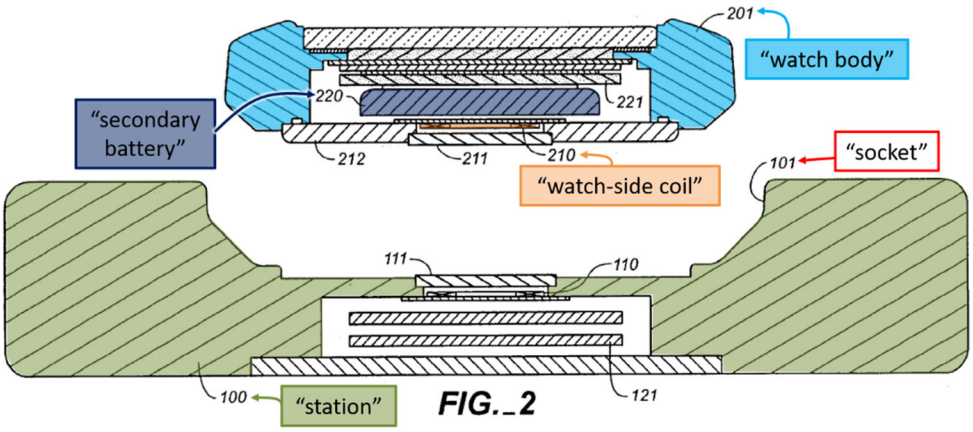
d. "a battery operably coupled to the wireless charging receive coil; and"

122. Kotanagi teaches a "rechargeable battery 13," which can be connected for wireless charging: "[R]ather than the external connection terminal 21, a transformer or the like for supplying power to a recharger and to the inside of the housing 2 may be provided so as to recharge the rechargeable battery 13 in a contactless state." EX1005 at ¶53. The battery is illustrated in the cross-section of Kotanagi's Figure 6.



EX1005, Figs. 6, 7.

123. Honda specifically teaches a rechargeable battery coupled to a wireless charging coil: "The watch body 201 includes a circuit board 221, connected to a secondary battery 220 and a watch-side coil 210." EX1006 at col. 6:25–27.

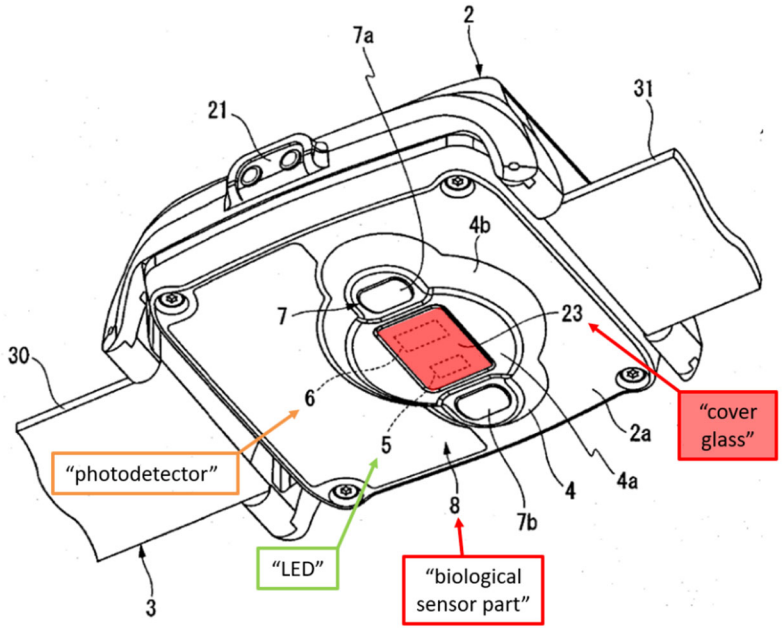


See EX1006, Fig. 2.

124. To obtain power, a POSITA would have been motivated to include a coil in the Kotanagi device and connect it to Kotanagi's battery, just as with the battery to coil connection in Honda.

e. "a cover disposed over the biosensor module; wherein: the cover is configured to pass optical signals to and from the biosensor module; and"

125. Kotanagi illustrates its photodetector 6 and LED 5 with dashed lines to indicate they lie behind the cover glass 23, forming a "biological sensor part" 8:



See EX1005, Fig. 5, ¶46. Kotanagi further explains:

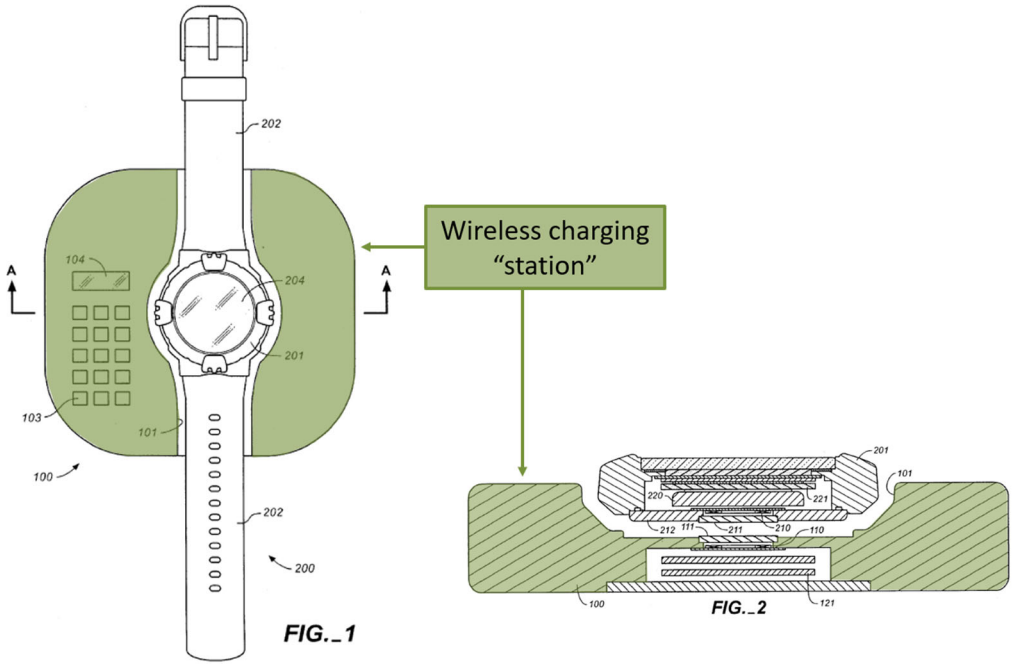
> [T]he data processing part 9 **emits light from the LED 5** toward the living body. A portion of the emitted light is absorbed, for example, by hemoglobin in blood vessels, and another portion of the light is reflected by biological tissue. **The PD 6 receives this reflected light**, generates a pulse signal (biological information signal) corresponding to the amount of received light, and outputs the signal to the data processing part 9.

Id. at ¶65 (emphasis added).

126. A POSITA would have understood from this context that because Kotanagi's "cover glass 23 is fixed to the housing 2 so as to block the through-hole 22" (EX1005 at ¶55), its LED and photodetector work by passing optical signals *through* the cover glass. Thus, Kotanagi's cover glass already passes optical signals to and from the LED and photodetector, satisfying this limitation.

f. "the cover is configured to pass wireless power to the wireless charging receive coil."

127. As noted above, Kotanagi teaches recharging its battery "in a contactless state" (EX1005 at ¶53) and Honda teaches wireless charging of wrist-watch biosensor devices using wireless charging receive coils (*see* EX1006 *passim*). Honda also shows an external wireless charging device, which it terms a "station":



See EX1006, Figs. 1, 2.

Honda explains that this station passes wireless power to the wireless charging receiving coil through a rear cover glass (similar to that of Kotanagi), using the physics of induced currents and magnetic flux. Honda illustrates the physics in detail as follows:

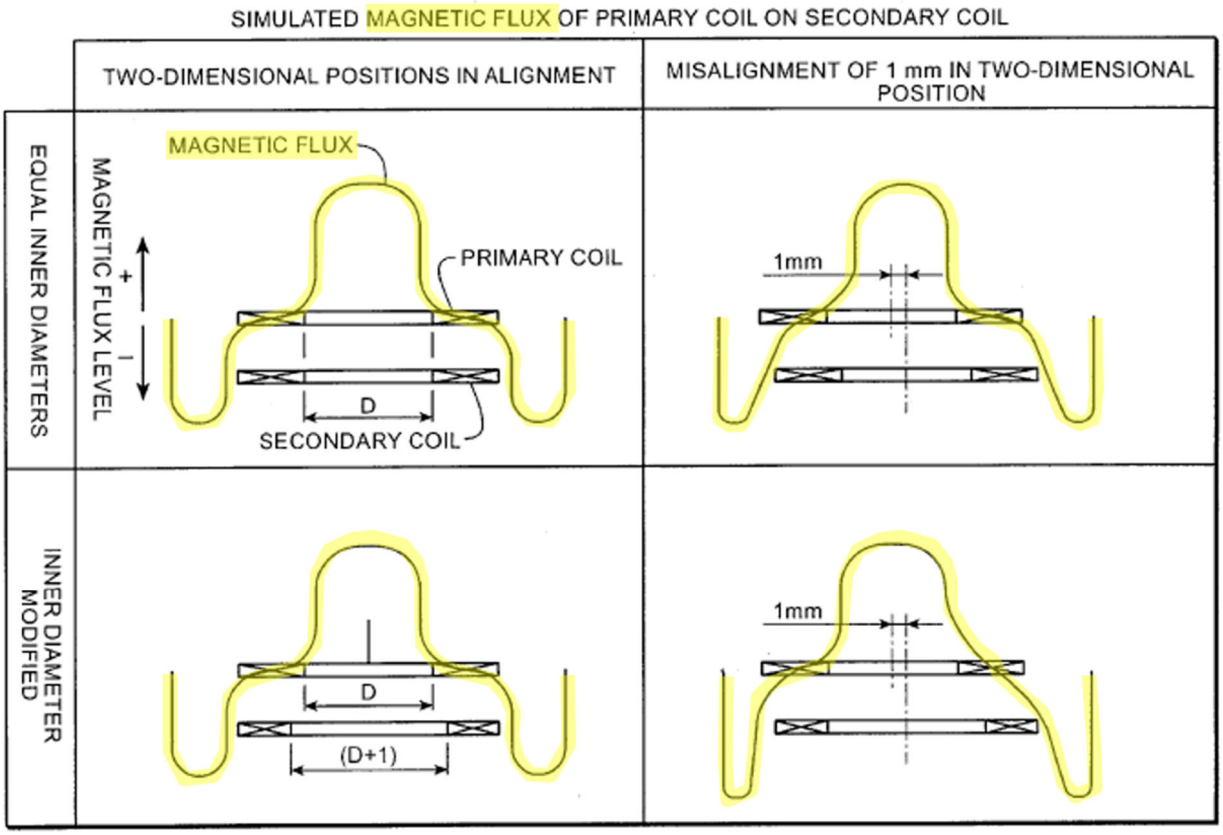
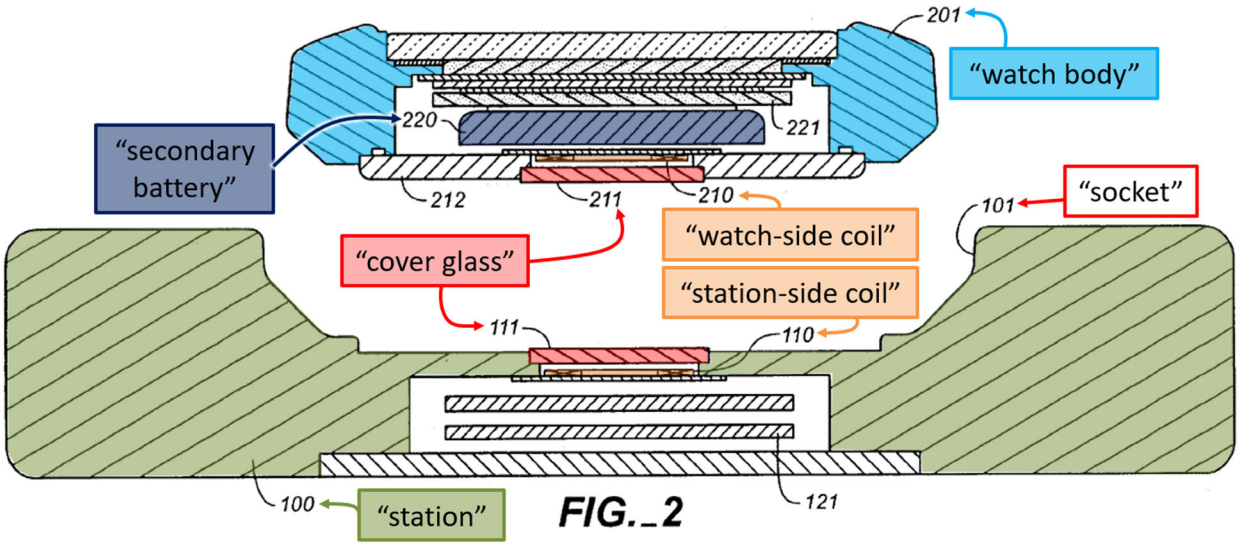


FIG._10

See id., Fig. 10. This charging effect occurs as wireless power traverses a cover glass:

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally in parallel to each other.

Id. at col. 6:28–35.



See id. at 1006, Fig 2. Thus, a person of skill would understand that charging coils in both the charging station and the watch body must be aligned and at an acceptable distance.

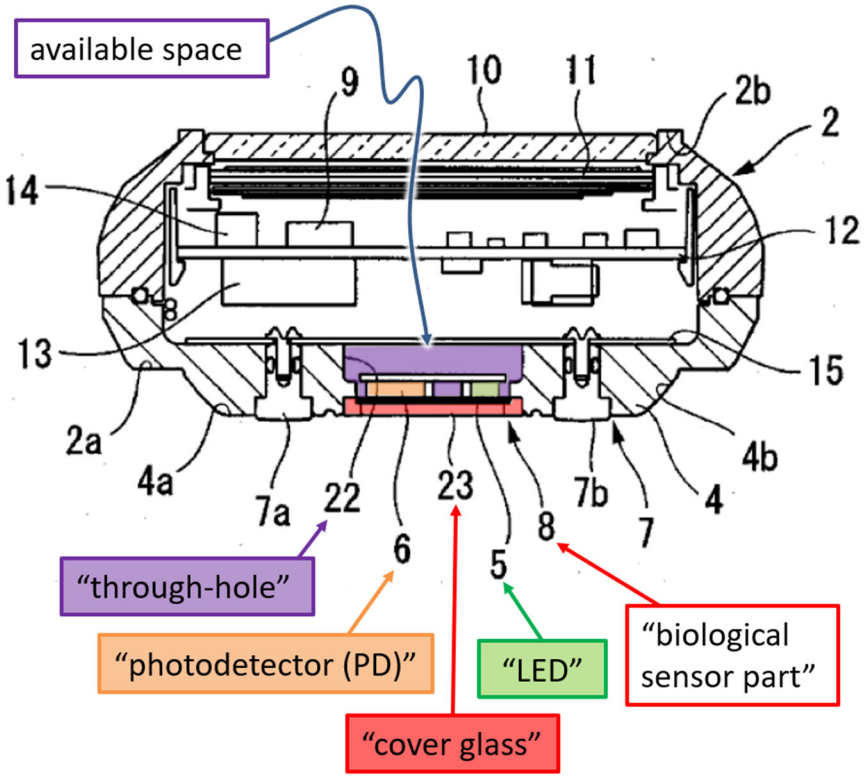
128. Kotanagi's cover glass is already centrally located at the base of the device consistent with Honda's wireless charging design. A POSITA would have known to modify Kotanagi's device based on Honda's teachings to include a charging receive coil behind this cover glass (in a similar position and with a comparable size to that taught in Honda). With this straightforward modification (motivated, for example, by Kotanagi's own reference to "contactless" charging and Honda's teaching of how to do so in a watch-style device) the cover would be "configured to pass wireless power" in the claimed manner. Accordingly, Kotanagi and Honda teach the claimed cover "configured to pass wireless power from an external wireless charging device to the wireless charging receive coil."

129. Based on the above, Claim 9 would have been obvious over Kotanagi and Honda prior to the '783 priority date.

g. Motivation to Combine and Reasonable Expectation of Success

130. A POSITA at the time of the invention would have been motivated to make the modifications based on teachings of both Kotanagi and Honda and had a reasonable expectation of success in doing so. Kotanagi teaches a pulse rate biosensor watch that may be charged in a "contactless state," which would have motivated a POSITA to look to Honda. EX1005 at ¶53. Honda teaches wireless watch charging, but also refers to watch sensors for pulse/heart rate or heart rate of the body, which would have motivated a POSITA to look to Kotanagi. EX1006 at col. 6:14–20; col. 8:40–42. Moreover, these two references are assigned to subsidiaries of the same Seiko parent company.

131. Given Honda's teaching of a wireless receive coil near a rear opening similar to that taught in Kotanagi (where both Honda's and Kotanagi's openings have a cover glass), a POSITA would have noticed the available space near Kotanagi's opening and been motivated to use that space for such a coil. The purple shading in the figure below shows this available space:



See EX1005 at 27.

132. Moreover, Honda's Figure 15 and related text teach metal covers are inferior for power transmission due to, e.g., eddy currents. EX1006 at 14, col. 2:48–50 ("eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling.") A POSITA would thus have aligned Honda's coil with Kotanagi's opening such that power could pass through the cover.

133. As stated above in § IX regarding biosensing watches from the 1970's to the 2010's, a POSITA would have had a reasonable expectation of success in the combining the features of the two references as a natural combination of the features

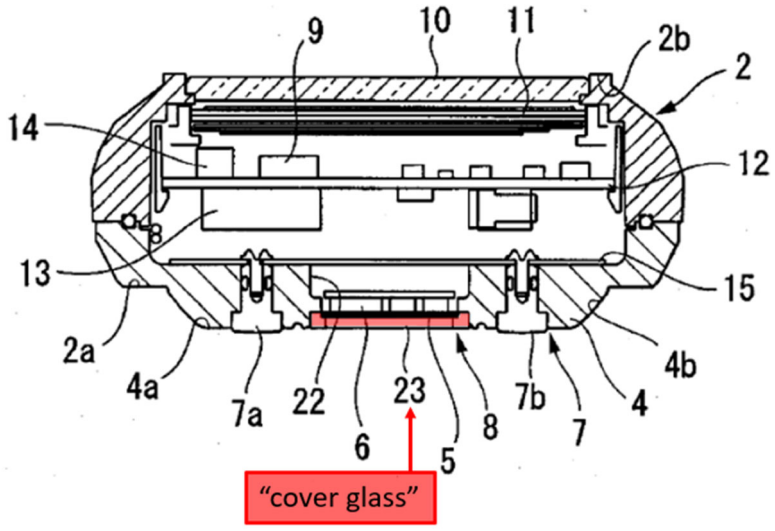
in the prior art. For at least the above reasons, a POSITA would have been motivated to substitute Honda's charging components for those of Kotanagi in order to implement the express teachings of Kotanagi to implement a contactless or wireless charging system.

134. This motivation to combine also applies to the other Ground 1 combinations and dependents from Claim 9. Further motivations to combine are provided throughout this Declaration.

2. Dependent Claim 10

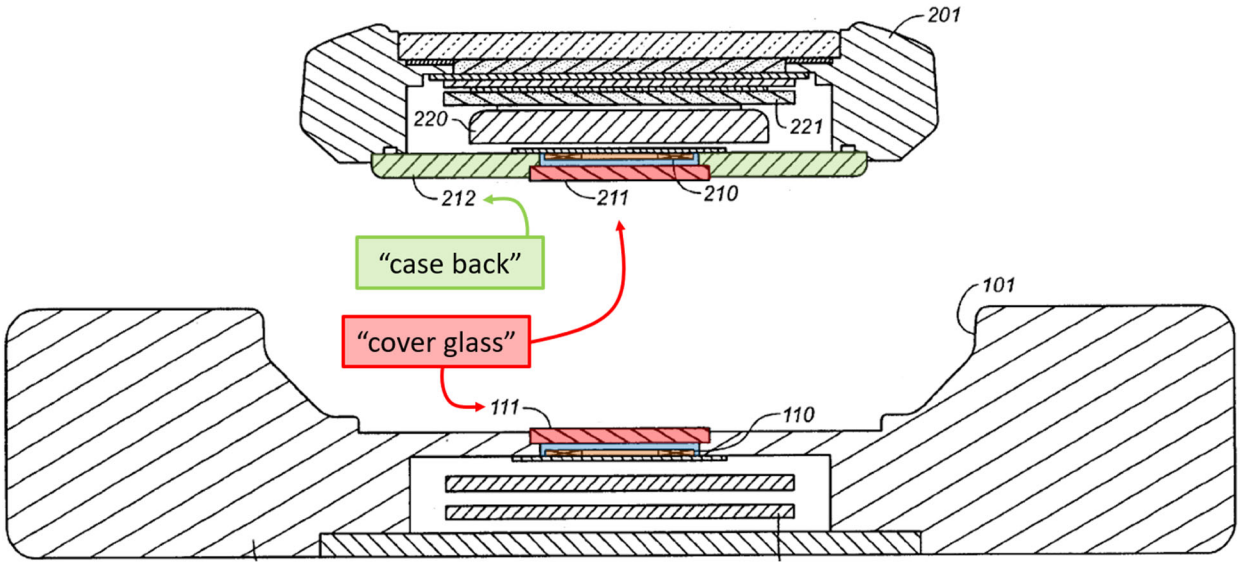
135. Claim 10 depends from Claim 9 and adds "**the housing is formed from a metal material; and the cover is formed from a non-metal material**."

136. Kotanagi teaches metal for the housing: "The housing 2 described above is made of plastic **or a metal material** such as aluminum . . . ." EX1005 at ¶48 (emphasis supplied). Kotanagi also teaches at least two different "cover glass" features, on the top and bottom of the device. *Id*. at ¶¶48, 55. The cover most relevant to Claims 9 and 10 is Kotanagi's cover glass 23:



See Id., Fig. 7. Based on this figure and the related descriptions, Kotanagi teaches using a different, non-metal material (such as ceramic, glass, etc.) for the cover glass.

137. Similarly, Honda teaches a metal case and a non-metal (glass) cover:



See EX1006, Fig. 2. "In the first embodiment, the case back 212 (typically made of a metal) and the cover glass 211 are arranged as shown in FIG. 2." EX1006 at col. 15:47–49.

138. Honda also explains that non-metal covers are good for transmitting power, using its Figure 15 to contrast poor transmission efficiency for different thicknesses of stainless steel with much higher transmission efficiencies of glass and glass combinations:

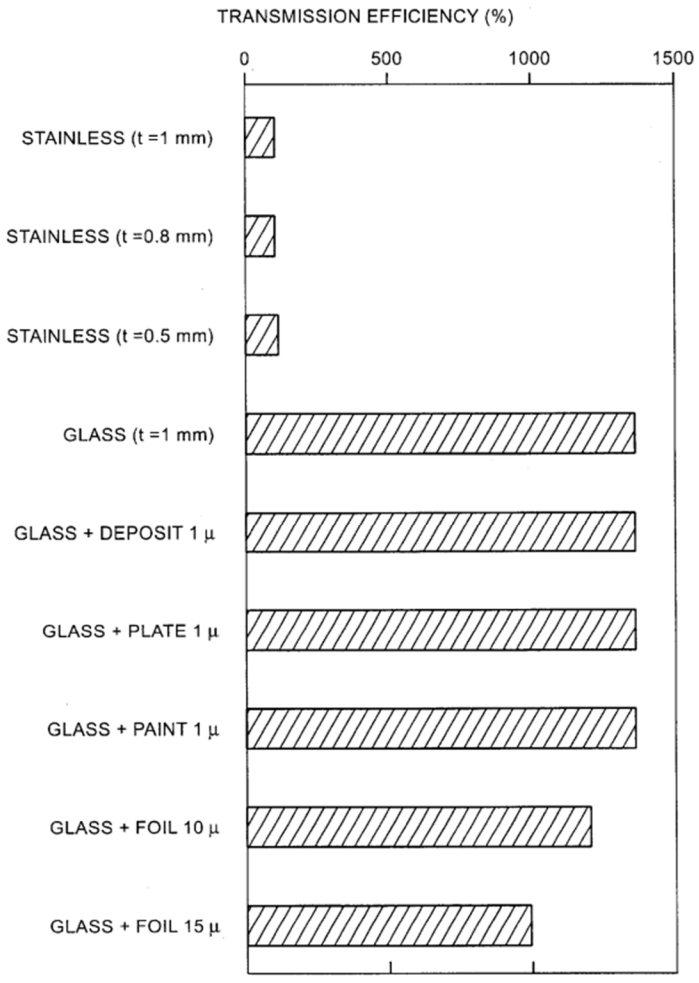


FIG._15

Id., Fig. 15; *see id*. 2:48–50.

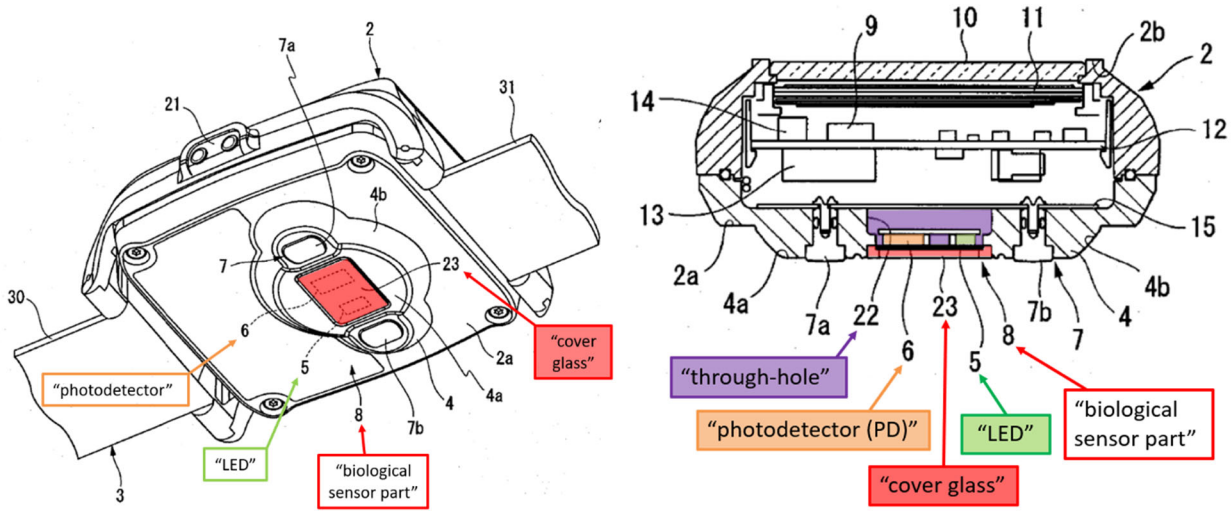
139. A POSITA would have been motivated to use the non-metal cover teachings of Kotanagi and Honda because the POSITA would have known from basic principles of electrical shielding that complete metal enclosures prevent electromagnetic radiation from penetrating. This is confirmed by Honda's experiments in this setting. *Id*. at col. 13:33–63. Thus, to achieve the wireless charging goal expressed in Kotanagi, a POSITA would have naturally used a non-metal material as a cover for a wireless charging coil.

140. Based on the above, Claim 10 would have been obvious over Kotanagi and Honda.

3. Dependent Claim 11

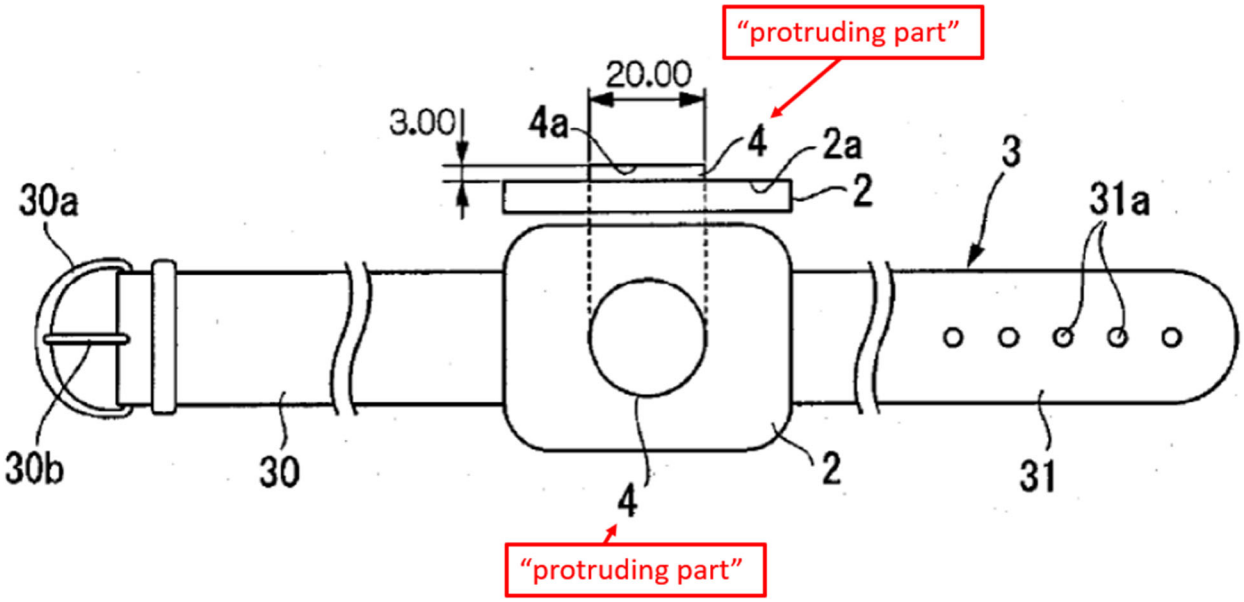
141. Claim 11 depends from Claim 9 and adds "**the wireless charging receive coil has a coil diameter that is less than a diameter of the biosensor module; and the wireless charging receive coil is configured to receive the wireless power through the biosensor module**."

142. Consistent with the construction of "biosensor module" above, Kotanagi teaches a biological sensor part: "[t]he LED 5 and the PD 6 are disposed adjacent to one another . . . so as to touch the inside of the glass cover 23." EX1005 at ¶55.



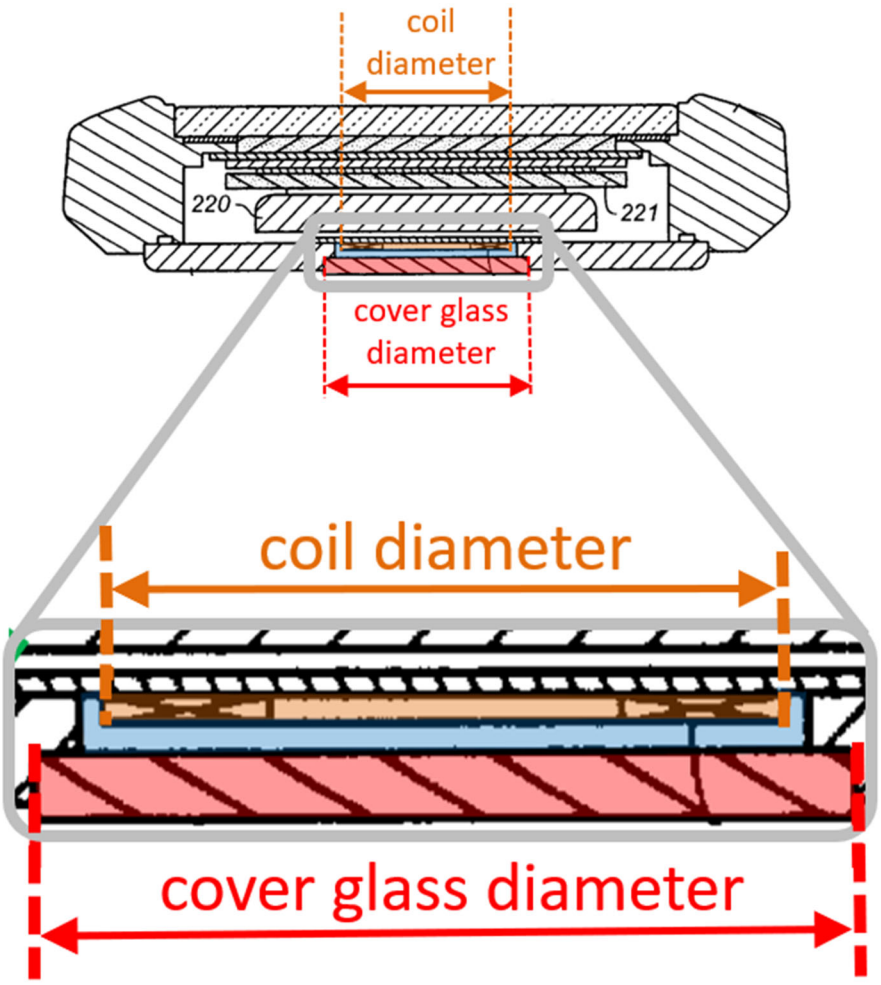
See id., Figs. 5, 7. Because in the '783 patent the "biosensor module" includes both biosensors and a cover glass, Kotanagi's cover glass, LED 5 and PD 6 teach the claimed biosensor module.

143. Although the "cover glass" in the Kotanagi Figure 5 above is not circular, Kotanagi also teaches a protruding disk in its Figure 8: "the protruding part 4 may be formed so that the outer periphery is circular" and Kotanagi describes its diameter: "the diameter of the protruding part 4 illustrated in FIG. 8 is set to 20 mm." EX1005 at ¶76.



See id., Fig. 8. Accordingly, a POSITA would have understood that Kotanagi's biosensor module could be similarly round and therefore have a "diameter."

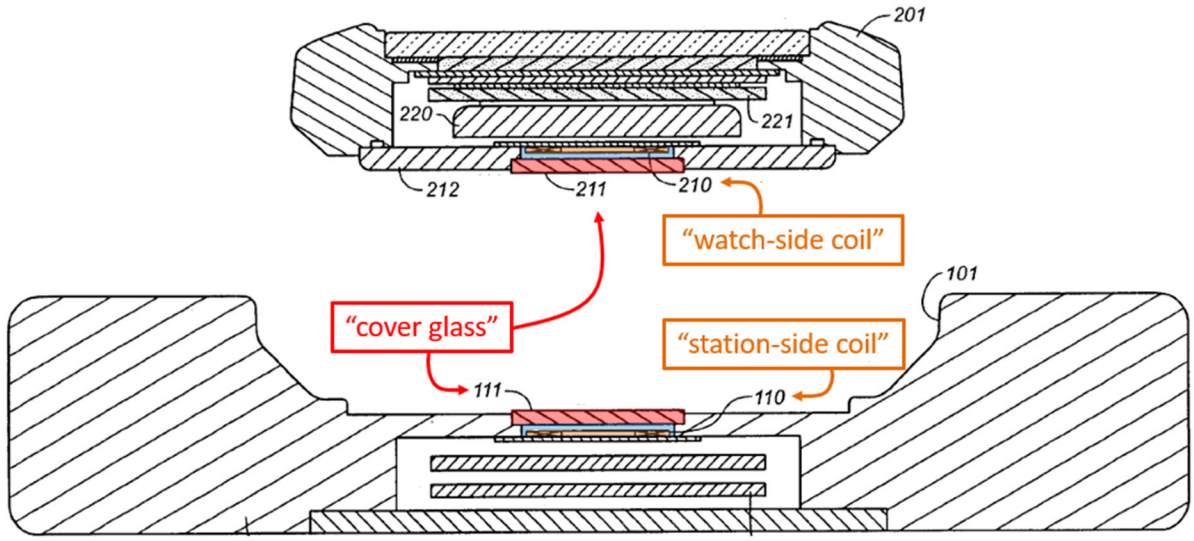
144. In the same field of endeavor (*e.g.*, biosensing watches), Honda teaches a wireless charging receive coil, located within a rear opening spanned by a cover glass with a diameter smaller than that of its cover glass:



See EX1006, Fig. 2 (modified and labels added).

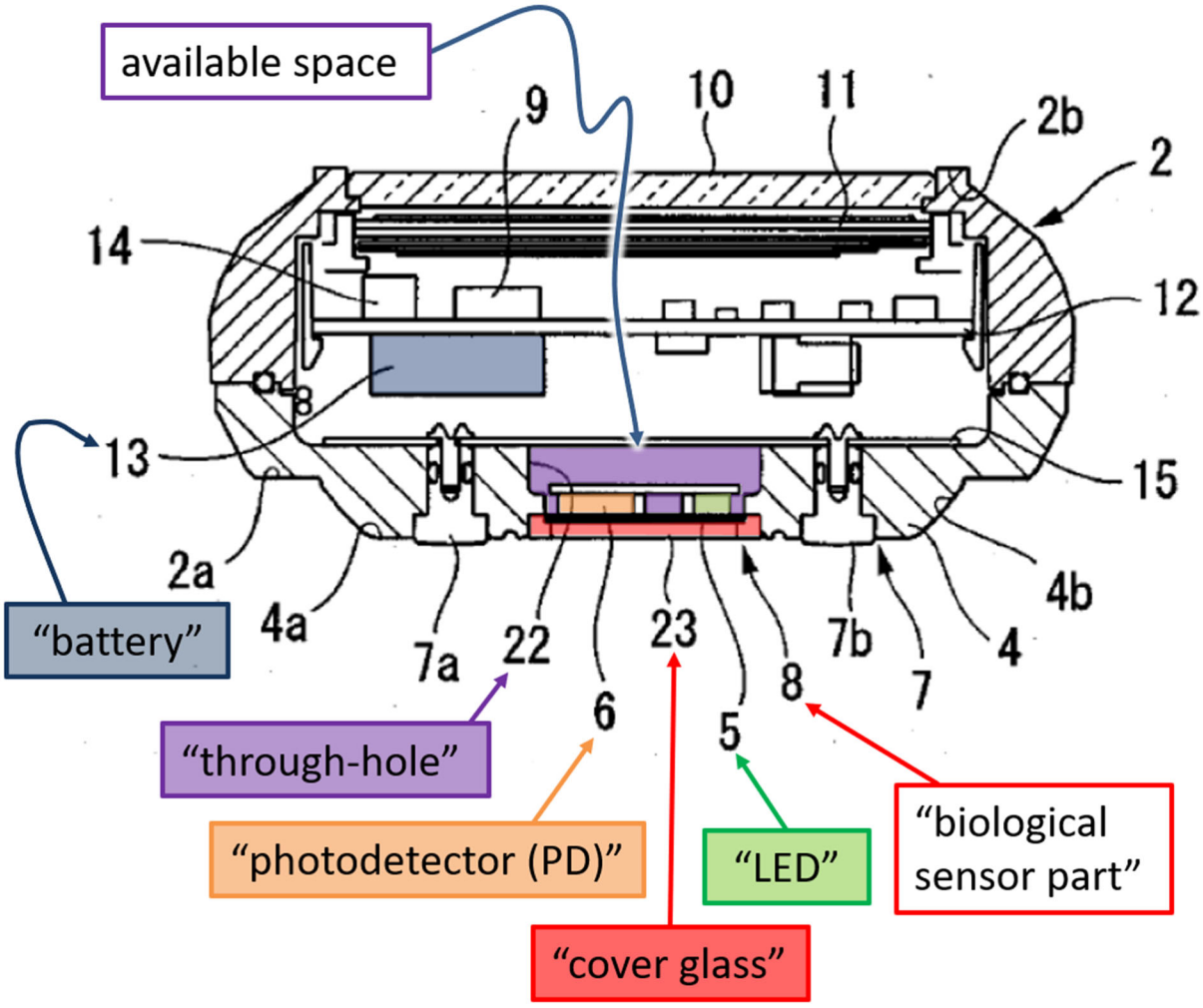
Honda teaches that the wireless charging receive coil is configured to receive the wireless power through the cover glass:

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally in parallel to each other.



See id. at col. 6:36–40; *see id*., Fig. 2.

145. Given this and Kotanagi's teaching of a "biological sensor part" with an LED and photodetector "disposed adjacent to one another . . . so as to touch the inside of the glass cover 23" (*see* EX1005 at ¶55), a POSITA would have used Honda's teachings to either: 1) modify Kotanagi to position a wireless charging coil behind Kotanagi's cover glass, LED, and PD; or 2) enlarge Kotanagi's opening and cover glass to make room for a coil behind the cover glass, surrounding the LED and PD. In either case, the resulting magnetic flux would pass through the biosensor module, including the cover glass, as taught by Honda. The purple shading in the figure below shows that space was already available in Kotanagi's "through-hole" behind and around the outside of the other listed components, making the modification from Honda simple and feasible with a high expectation of success:



See EX1005, Fig. 7.

146. Moreover, in view of teachings such as that of Honda's Figure 15 (metal covers are inferior for power transmission due to, e.g., eddy currents) (EX1006, Fig. 15, col. 2:48–50 "eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling"), a POSITA would have known that wireless charging occurs more effectively when a charging coil is exposed through a large enough opening, so that any metal housing does not

create an electrical shielding effect that tends to prevent electromagnetic transmission. *Id.* at col. 13:23–32. A POSITA would have also known (e.g., from the experiments summarized in Honda's Fig. 15, EX1006, Fig. 15) that charging occurs most efficiently through an opening in any metal cover.

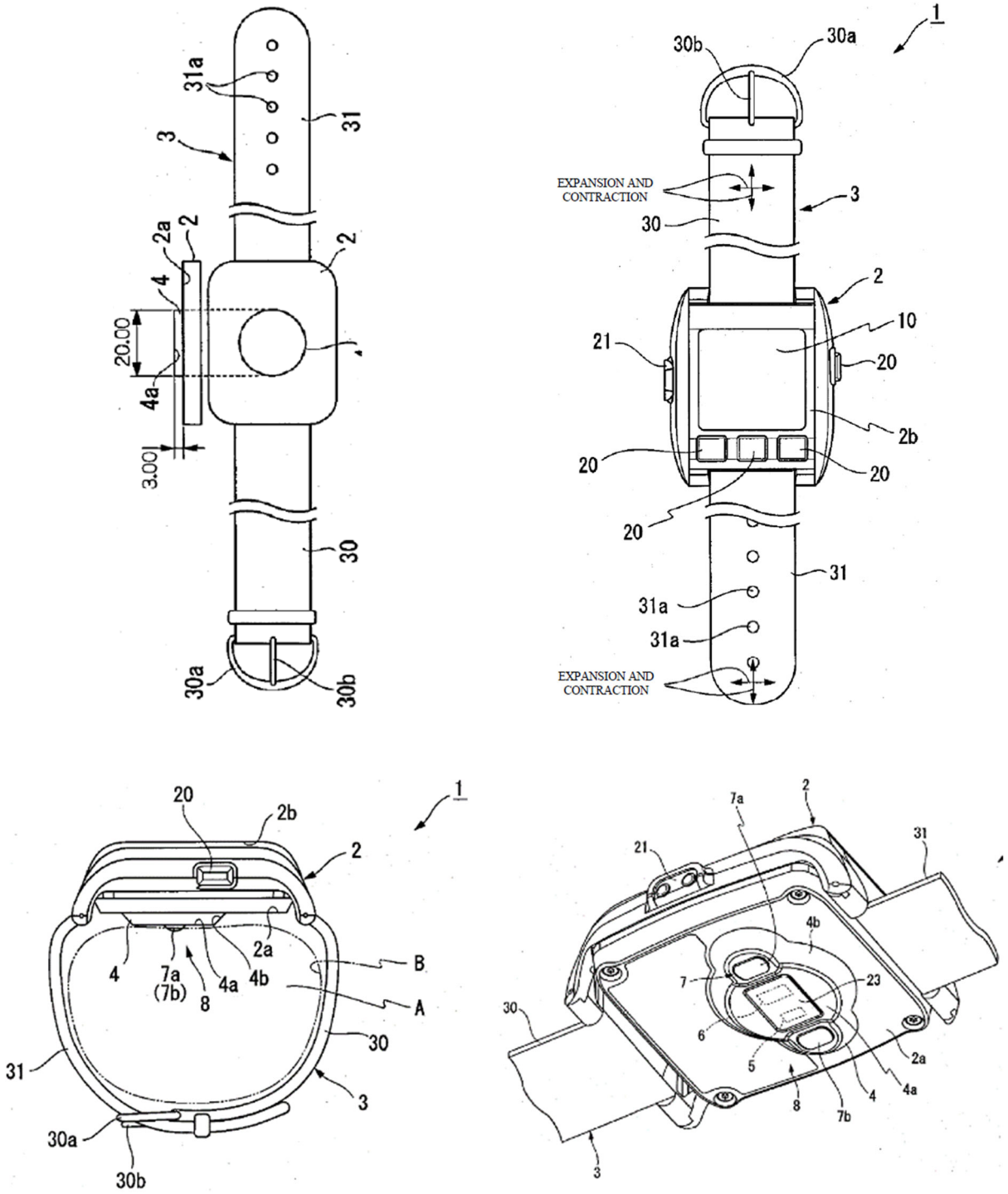
147. Accordingly, a POSITA would have had a reasonable expectation of success in modifying Kotanagi in view of Honda. This combination teaches the claimed "coil diameter that is less than a diameter of the biosensor module," where the coil would be "configured to receive the wireless power through the biosensor module." That is, power would be received through at least the cover glass that forms part of that biosensor module.

148. In view of the knowledge and teachings above, a POSITA would have been motivated to configure the coil diameter to receive wireless power through an opening in Kotanagi's metal cover to achieve the wireless charging goal expressed in Kotanagi. Based on the above, Claim 11 would have been obvious in view of Kotanagi and Honda.

4. Independent Claim 15

a. "An electronic watch, comprising:

149. Kotanagi describes a "wristwatch-type device which detects pulse rate as a type of biological information while mounted to the wrist." EX1005 at ¶44.


31a
31
3
2a
2
4
20.00
4a
3.00
30
30a
30b
1
EXPANSION AND CONTRACTION
10
21
20
2b
EXPANSION AND CONTRACTION
20
4b
7a
(7b)
8
B
A
7
23
6
5
7b

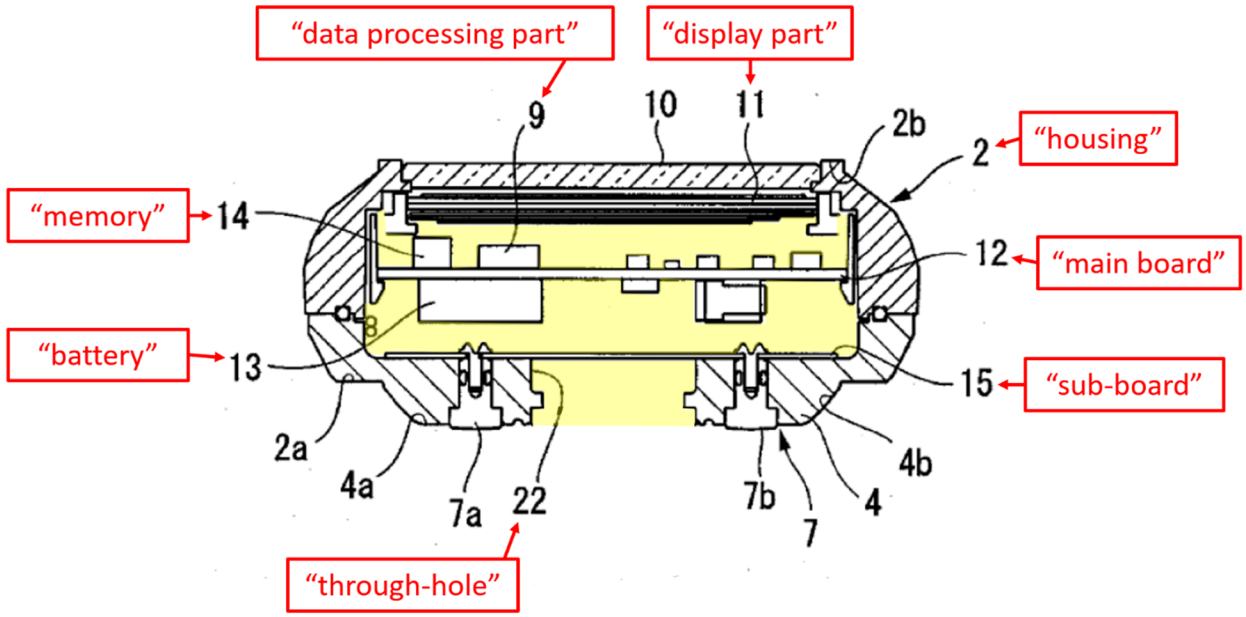
Id., Figs. 1, 2, 5, 9.

b. a housing defining an interior cavity and a bottom portion having an opening;

150. This wristwatch-type device described by Kotanagi has a "housing" with several components "inside," demonstrating that it teaches the claimed "interior cavity":

> [A]s illustrated in FIGS. 6 and 7, a main board 12 is provided **inside the housing** 2, and the data processing part 9, the display part 11, a rechargeable battery 13 that can be recharged, a memory 14 for recording the pulse rate, a sub-board 15, and various other electronic parts are mounted on or electrically connected to the main board 12.

EX1005 at ¶49.



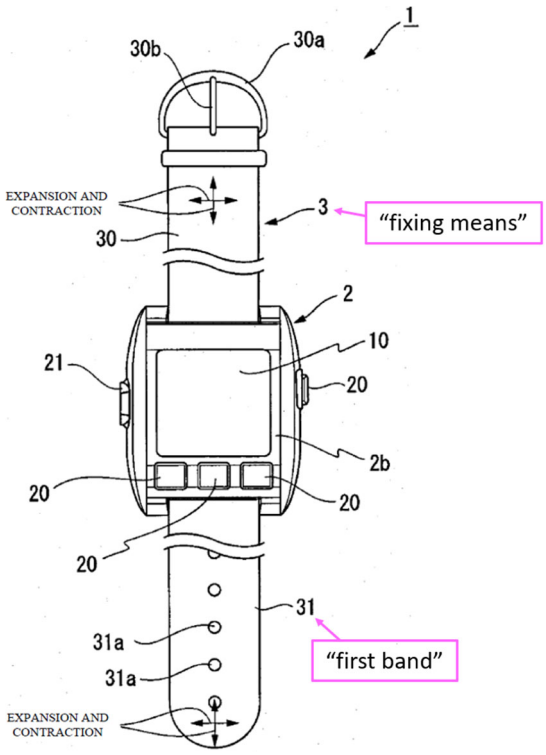
See id., Fig. 7 (biosensor module removed).

Kotanagi also describes a "through-hole 22 passing through the outside and the inside of the housing 2" and "formed in the center of the lower surface 4a of the protruding part 4." *Id.* at ¶55. In the cross-section above, the interior cavity and a

visible portion of the through-hole 22 are shaded in yellow.

c. a band attached to the housing and configured to secure the electronic watch to a user;

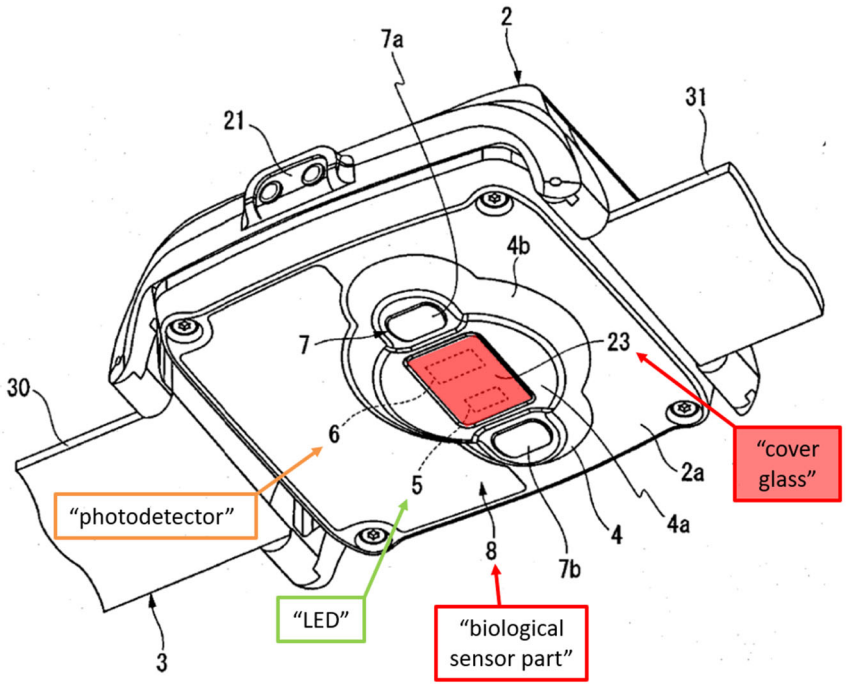
151. Kotanagi has a "means for fixing" the device "to an arm" (*id.*, Abstract) and explains: "The fixing means 3 has a first band 30 and a second band 31 having base end sides that are attached to the housing 2 to enable mounting to the wrist." (EX1005 at ¶60; *See id.* Fig. 1).



d. a biosensor module positioned along the bottom portion of the housing and configured to transmit optical signals and

receive reflected optical signals through the opening of the housing; and

152. Consistent with the construction of "biosensor module" above, Kotanagi teaches a biosensor module with a cover glass, as illustrated here.



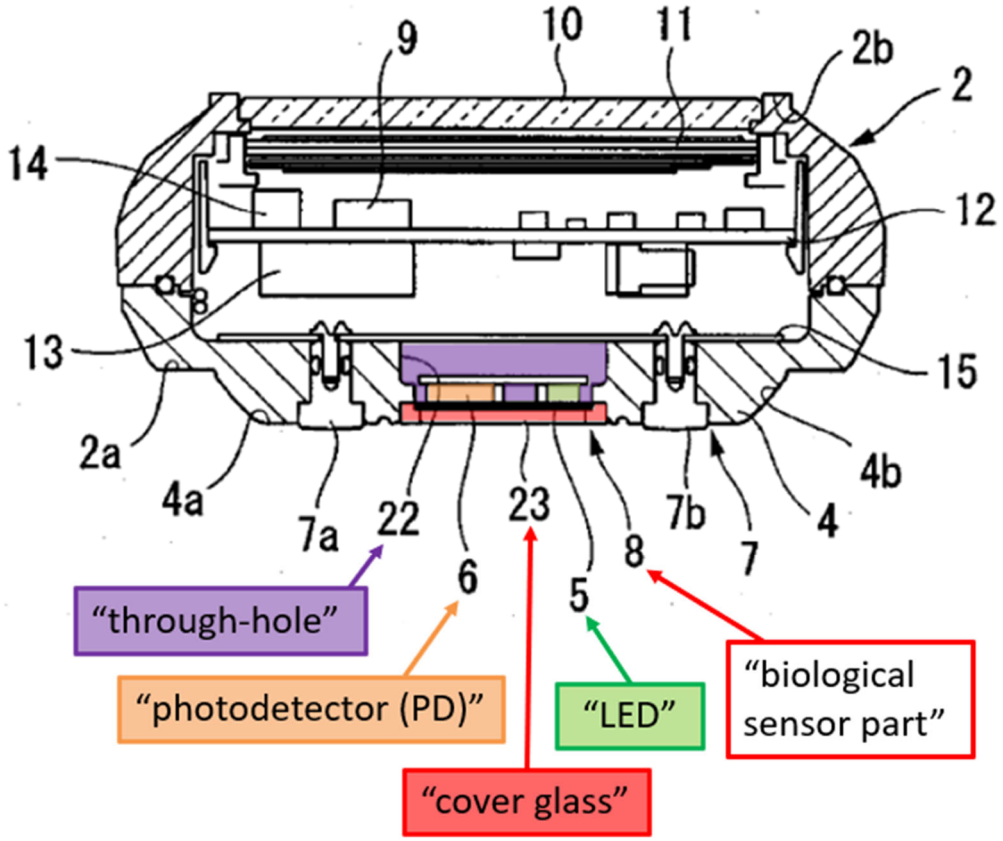
See EX1005, Fig. 5

153. Kotanagi further explains where the biosensor module is positioned, and how optical signals are transmitted through an opening in the bottom of its housing, in the context of Figure 7:

> [A]s illustrated in FIG. 7, a through-hole 22 passing through the outside and the inside of the housing 2 is formed in the center of the lower surface 4a of the protruding part 4, and a cover glass 23 is fixed to the housing 2 so as to block the through-hole 22. The LED 5 and the PD 6 are disposed adjacent to one another in a direction orthogonal to the longitudinal direction of the housing so as to touch the inside of the glass cover 23. That is, the LED 5 and the PD 6 are configured so as to

> be dropped into the protruding part 4. As a result, the LED 5 and the PD 6 are as close to the living body surface B as possible.

EX1005 at ¶55.



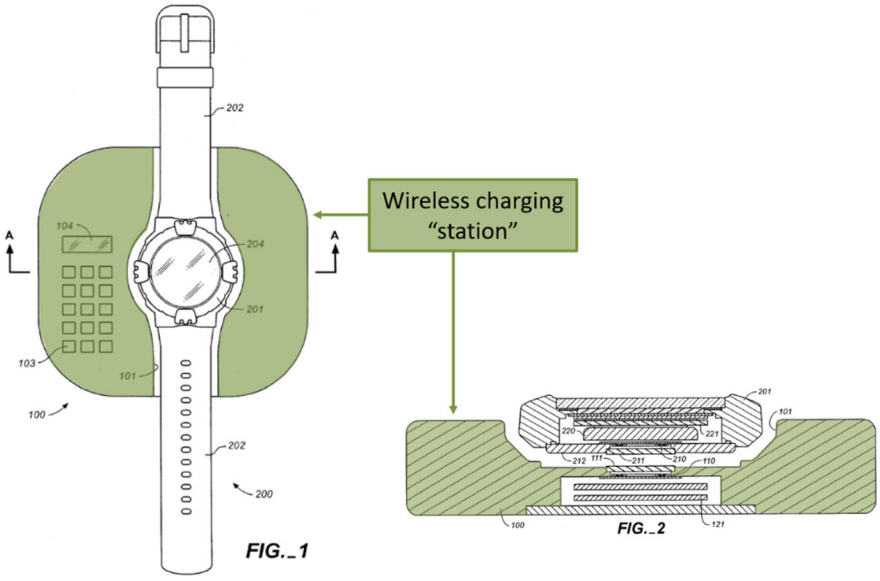
See Id., Fig. 7.

e. a wireless charging receive coil positioned within the interior cavity and configured to receive wireless power through the opening of the housing.

154. Kotanagi teaches that "a transformer or the like for supplying power to a recharger and to the inside of the housing 2 may be provided ***so as to recharge the rechargeable battery 13 in a contactless state***." EX1005 at ¶53 (emphasis added). A POSITA would have known at the time of the '783 Patent's invention that

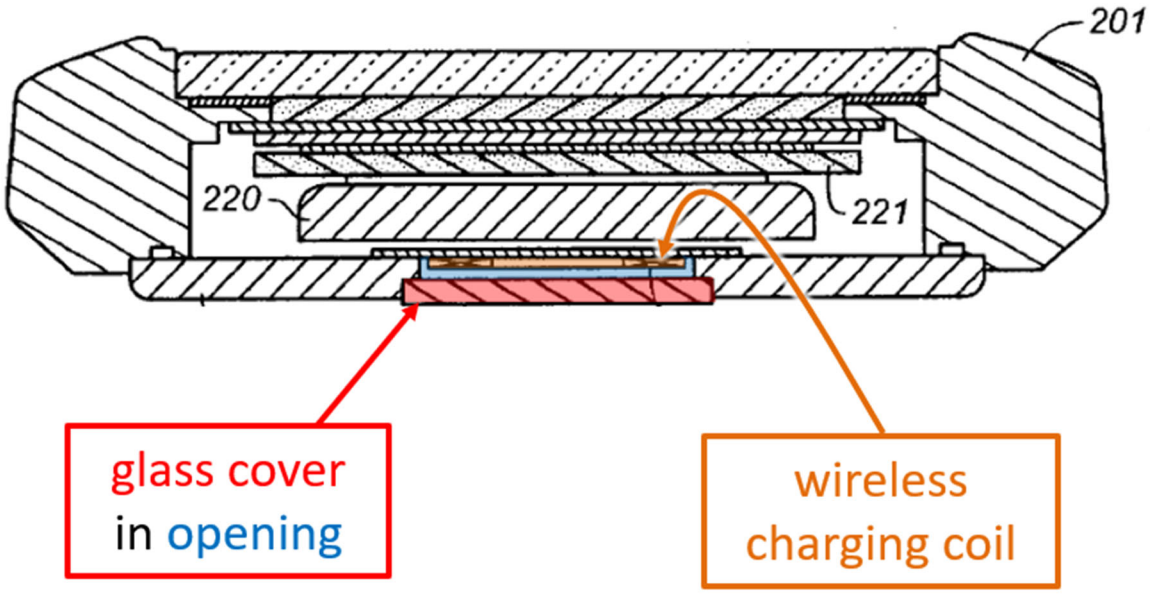
transformers utilize coils and that such contactless charging involves a wireless charging receive coil, and that this coil would be positioned within the interior of the cavity (like the rechargeable battery 13). Kotanagi teaches its watch housing can be metal and a person of skill would have understood that wireless charging coils need to be positioned to allow charging through an opening in metal housing because the metal housing would otherwise significantly reduce the ability of the coils to charge if metal. EX1006 at 14, col. 2:48–50 ("eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling.") Accordingly, Kotanagi teaches every limitation of this claim. However, to further support that this claim would have been obvious, Honda is discussed below.

155. **Honda**, which issued in 2001, discloses such a contactless charging system for a biosensing wristwatch. Honda's Figure 1 shows a plan view of the watch in a charging station, with Figure 2 showing a cross-section of this arrangement:



See EX1006, Figs. 1, 2.

156. Like Kotanagi, Honda teaches a biosensor: "the electronic watch 200 detects biological information including the pulse rate or the heart rate of the body." EX1006 at col. 6:17–19. Like Kotanagi, the Honda watch has a cover glass that spans an opening in the bottom face of the watch. *Id*., Fig. 2. Behind this cover, Honda illustrates a "wireless charging receive coil" "positioned within the interior cavity," as claimed:



See id., Fig. 2.

Moreover, Honda's coil is "configured to receive wireless power through the opening" and its cover glass through the physics of induced currents and magnetic flux:

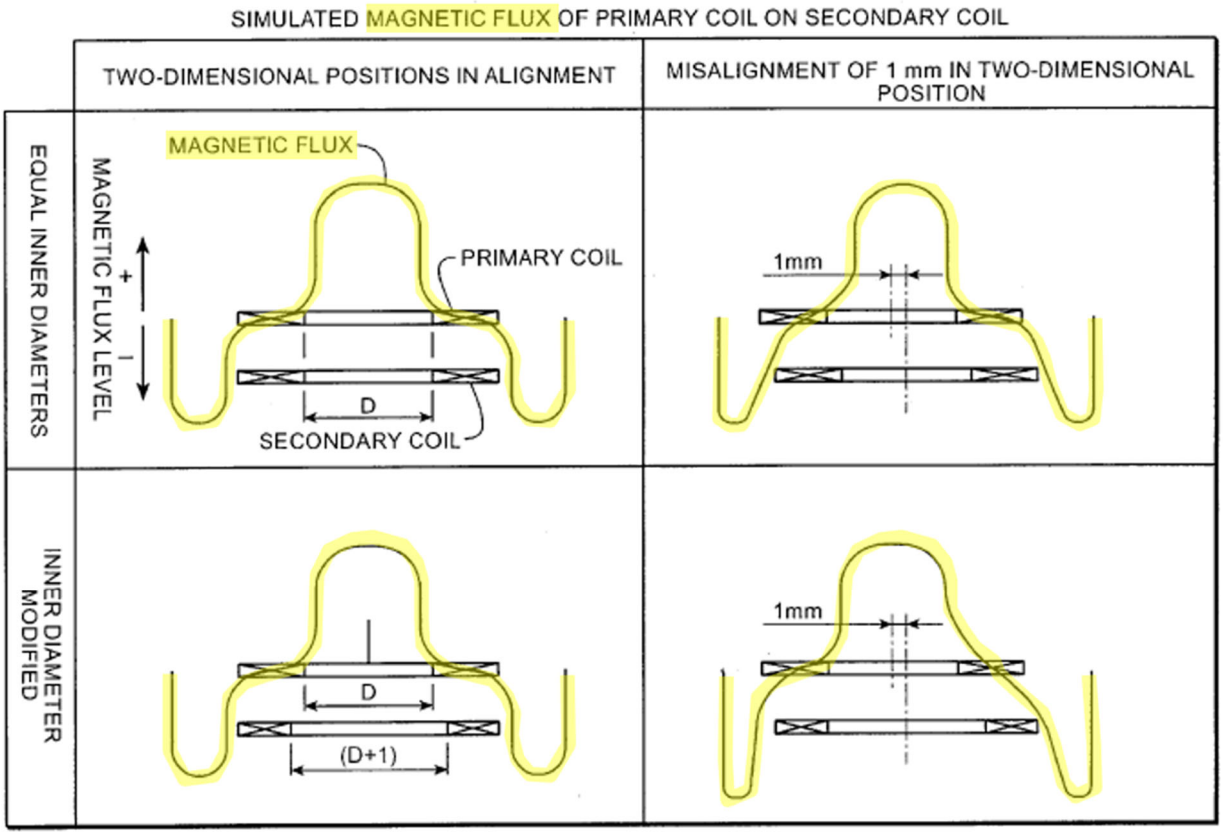


FIG._10

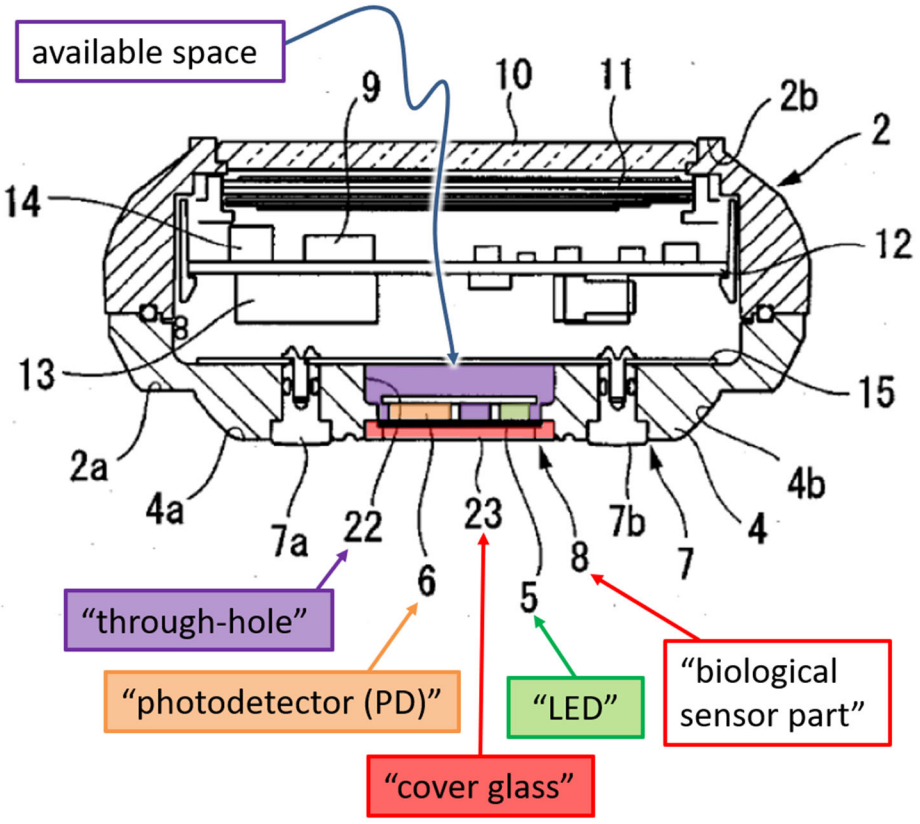
See id., Fig. 15.

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally in parallel to each other.

Id. at col. 6:28–35.

157. Accordingly, a POSITA would have used the wireless charging disclosure and goal of "contactless" charging expressed by Kotanagi (EX1005 at ¶53) as a motivation to combine with the teachings of Honda. Honda's teachings

further enable the wireless charging Kotanagi briefly mentions as desirable. To do this, a POSITA would have (after adjusting for any potential scale differences) positioned a wireless charge coil in the available space of Kotanagi's through-hole 22:



See EX1005, Fig. 7. Thus, Kotanagi, modified by Honda, would include the claimed "wireless charging receive coil positioned within the interior cavity."

158. Kotanagi's cover glass is already centrally located at the rear, so a POSITA would have readily modified this device based on Honda's teachings to include a charging receive coil behind the cover glass—which is a portion of the biosensor module (in a similar position and with a comparable size to that taught in

Honda). With this straightforward modification, (motivated, for example, by Kotanagi's own reference to "contactless" charging and Honda's teaching of how to do so in a watch-style device), the coil would be "configured to receive wireless power through the opening of the housing" as claimed. Accordingly, Kotanagi and Honda teach the claimed "wireless charging receive coil positioned within the interior cavity and configured to receive wireless power through the opening of the housing." Thus, Claim 15 would have been obvious in view of Kotanagi and Honda.

159. A POSITA would have been motivated to combine and had a reasonable expectation of success in combining Kotanagi and Honda at least for the reasons provided above and in § XI(A)(1)(g). This motivation likewise applies to other Ground 1 combinations and dependents from Claim 15, and further motivations are found herein.

5. Dependent Claim 19

160. Claim 19 depends from Claim 15 and adds "**the electronic watch is configured to compute a health metric using the biosensor module; and the health metric is one or more of: a heart rate, a respiration rate, a blood oxygenation level, a blood volume estimate, or blood pressure**."

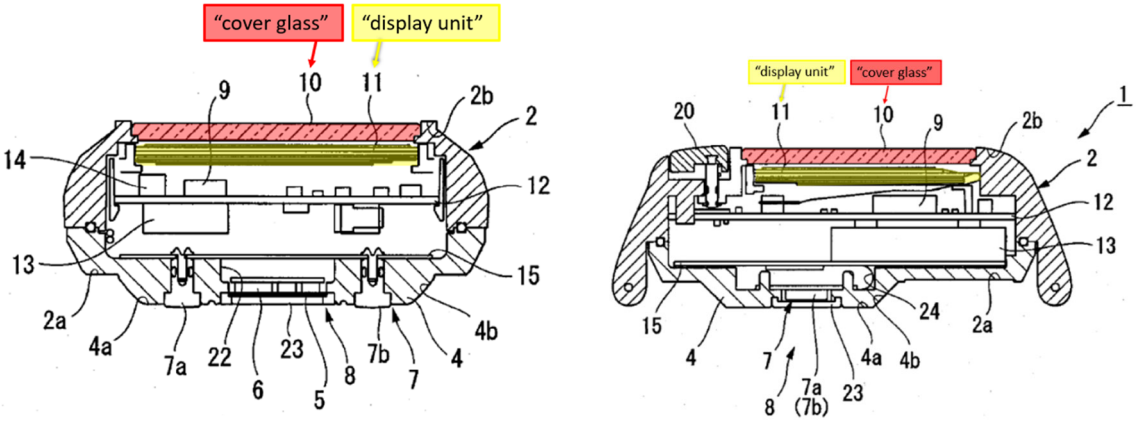
161. Kotanagi's watch uses its LED and photodetector to generate a "pulse signal (biological information signal)" (EX1005 at ¶46), satisfying the claimed computation of a "health metric" and "heart rate." Likewise, Honda's watch "detects

biological information including the pulse rate or the heart rate of the body." EX1006 at col. 6:17–19. Accordingly, the claimed combination of Kotanagi, as modified by Honda, would also satisfy these limitations without further modifications. Thus, Claim 19 would have been obvious in view of Kotanagi and Honda.

6. Dependent Claim 20

162. Claim 20 depends from Claim 19 and adds "**the electronic watch includes a display; and the display is configured to display information associated with the health metric.**"

163. Kotanagi teaches a watch with a display:



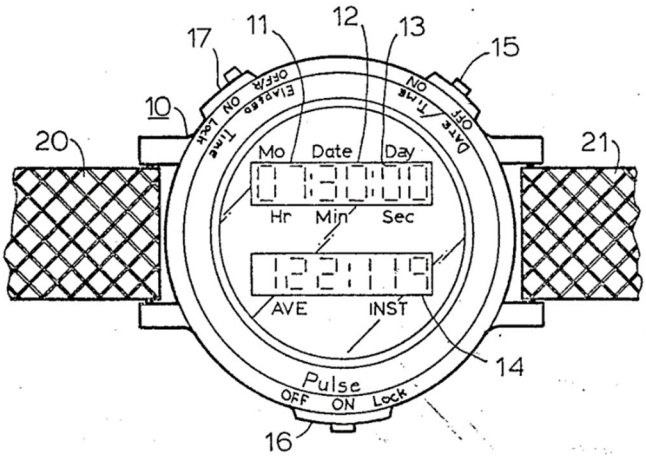
See EX1005, Figs. 6 and 7.

164. After Kotanagi's "data processing part" "analyzes the signal to detect the pulse rate," it "displays the signal on the display part 11." EX1005 at ¶66 . Its

"display part 11" is "for displaying the aforementioned pulse rate." *Id*. at ¶48. Moreover, it was common at the time to, if a health metric was calculated, at least display information "associated with" that metric. For example, Kateraas also teaches displaying the health metric (EX1014 at [0043]), and many other relevant references teach this.

165. In another U.S. patent (4,224,948 to Cramer, EX1026), pulse rate is displayed in a "wrist-borne pulse rate meter":

FIG. 1



> … to simultaneously calculate and **display** the average pulse rate over a period of time equal to "N" pulses. Thus employing our invention the wearer is able to simultaneously observe his average pulse rate and the last pulse rate . . . . A simultaneous **display** of average and instantaneous pulse rate may show a difference between the two which is of no significance . . . .

EX1026 at 1, Fig. 1, col. 1:56–col. 2:3.

166. In another U.S. patent (4,248,244 to Charnitski, EX2017), heartbeat is displayed:

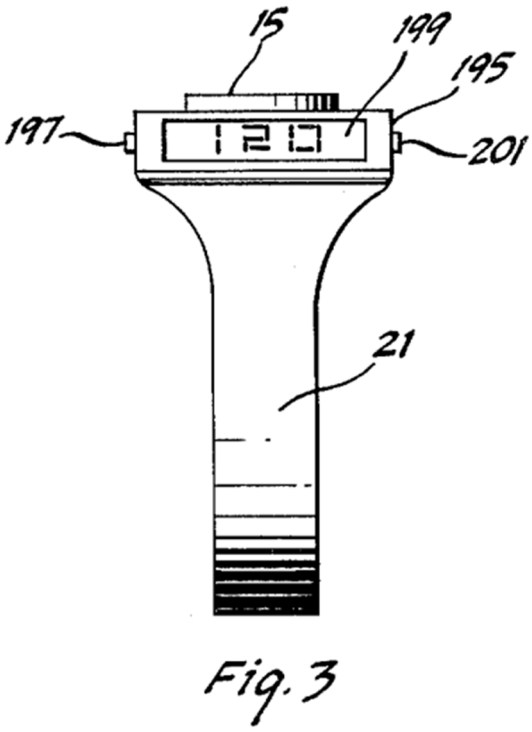
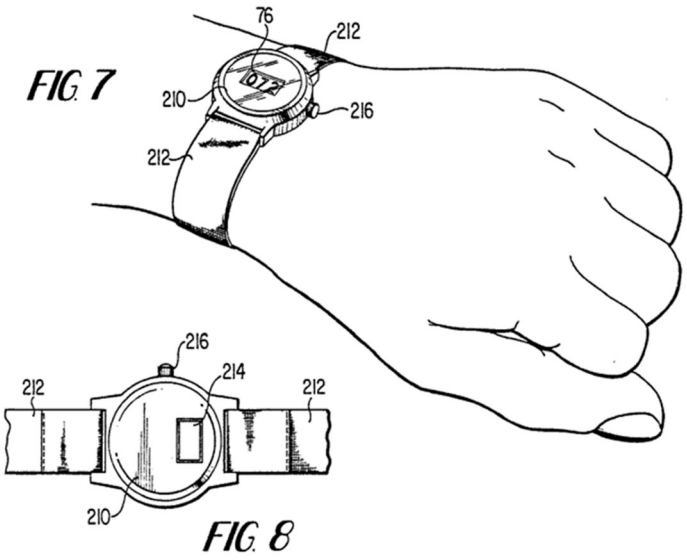


Fig. 3

> Once the beats per minute number is derived, it is converted into a format to activate digital **display** 193. . . . The **display** may be an alpha-numeric liquid crystal display (LCD) which may be driven directly from ROM 191. A typical LCD **display** which may be utilized is a two-and-a-half digit, 7-bar, bipolar **display**. ROM 191 is further programmed to cause the **display to indicate the detection of each heartbeat impulse** by flashing all or a portion of the digits in response to each impulse. . . .
> Although only heartbeat detection and **display** is described herein, it is anticipated that any one or more of the well known time functions of a digital wristwatch may be incorporated into the monitoring device. Further, a preset low heart rate and preset high heart rate visual or audible alarm may be incorporated to alert the wearer when the heart rate is outside of desired preset limits. . . .

EX1027, Fig. 3; col. 10:9–19; col. 11:9–16.

167. In a PCT publication from 1982, (WO1982000088 to Steuer, EX1028), heart rate is displayed:



> [M]eans for selecting between three functions for **display**, namely, time of day, elapsed time, or **heart rate**. . . . a conventional display 76 to display in eye readable form the **heart rate** of the user in beats per minute.
>
> EX1028 at 8, Figs. 7,8.

168. In another U.S. patent (5,316,008, "Suga," EX1030), blood pressure and related parameters are displayed:

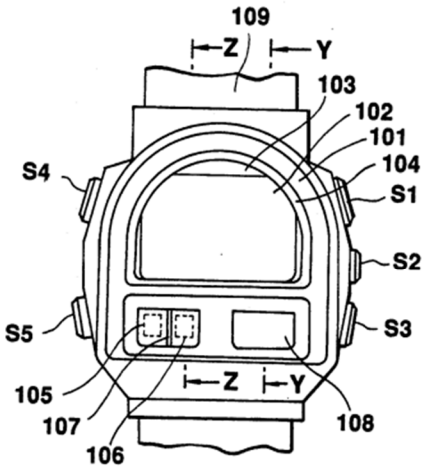


FIG. 8

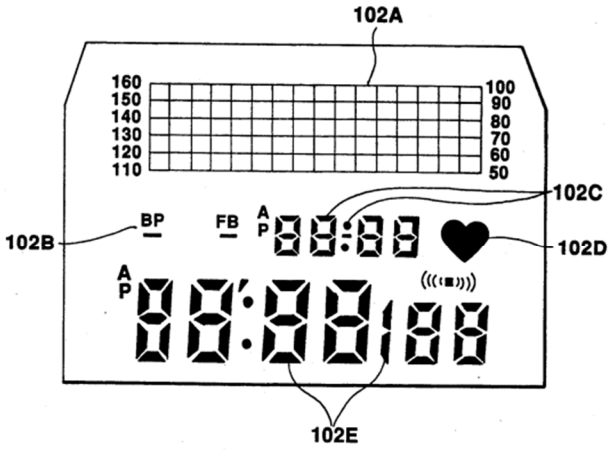


FIG. 9

A detailed construction of display electrodes of LCD 102 is shown in FIG. 9. . . . Six numerals 160, 150 . . . 110 indicating the highest **blood pressure** are printed on the portion left to the dot-matrix display section 102A and six numerals 100, 90, . . . , 50 for indicating the lowest **blood pressure** are printed on the portion right to the dot-matrix display section 102A. On the medium portion of LCD 102 are provided a mode display section 102B for indicating a current display mode, a small segment display member 102C for indicating sphygmus and a heart shaped display member 102D for indicating "under measurement" in a blinking manner. On the lower portion of LCD 102 are provided a large segment display member 102E for indicating a present time in a watch mode and indicating the highest blood pressure (or the lowest blood pressure) in a haemadynamometer mode. . . .

EX1030, Fig. 8,9; col. 9:38–57

169. The above evidence further demonstrates it was commonly known to, if a health metric was calculated, at least display information "associated with" that metric.

170. Accordingly, the claimed combination of Kotanagi, as modified by Honda, would also satisfy these limitations without further modifications. A POSITA would have understood Kotanagi as modified by Honda to teach these limitations prior to the filing of the '783 patent (especially in view of the general knowledge at the time about displaying health metric information), rendering Claim 20 invalid.

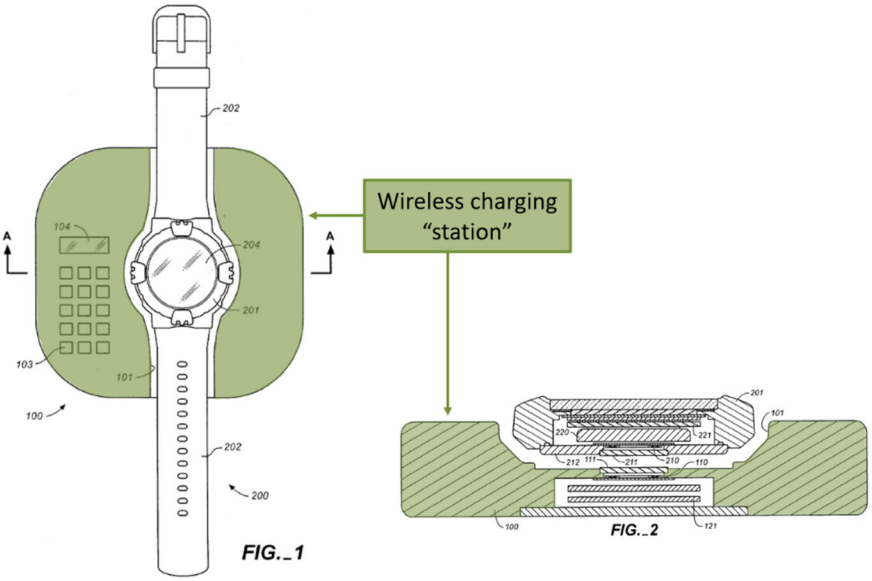
B. Ground 2: Claim 16 is unpatentable because it would have been obvious in view of Kotanagi and Honda, and optionally in further combination with Park.

1. Dependent Claim 16

171. Claim 16 depends from Claim 15 and adds "**the wireless charging receive coil is configured to receive power from an external inductive power transmitter dock; and the electronic watch is configured to magnetically couple with the external inductive power transmitter dock**."

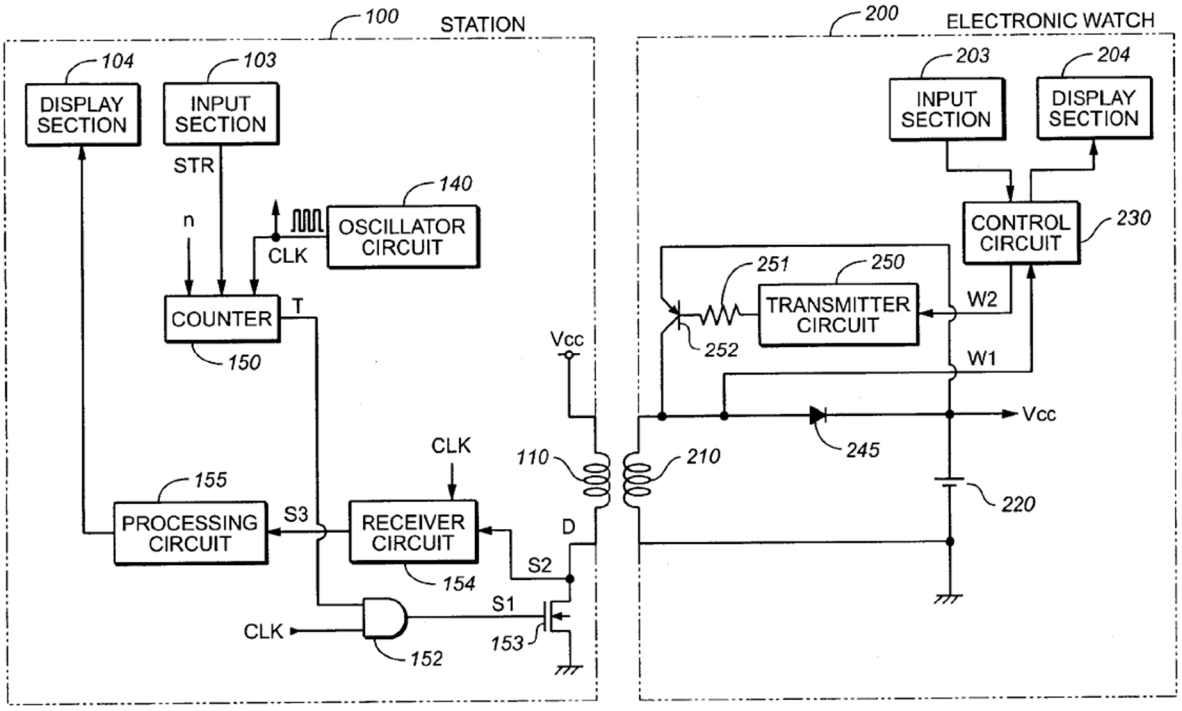
172. Kotanagi's teaching of a "transformer or the like for supplying power to a recharger and to the inside of the housing" to "recharge the battery in a contactless state" (EX1005 at ¶53) would have been understood by a POSITA to teach the receive coil was configured to receive power from an external inductive power transmitter dock because transformers utilize coils and contactless charging is known to use induction, and this always occurs from an external transmitter for contactless charging.

173. **Honda**, which issued in 2001, discloses an external transmitter, which it describes as a charging station. EX1006 at col. 6:28–35. Figure 2 shows a cross-section of this arrangement:



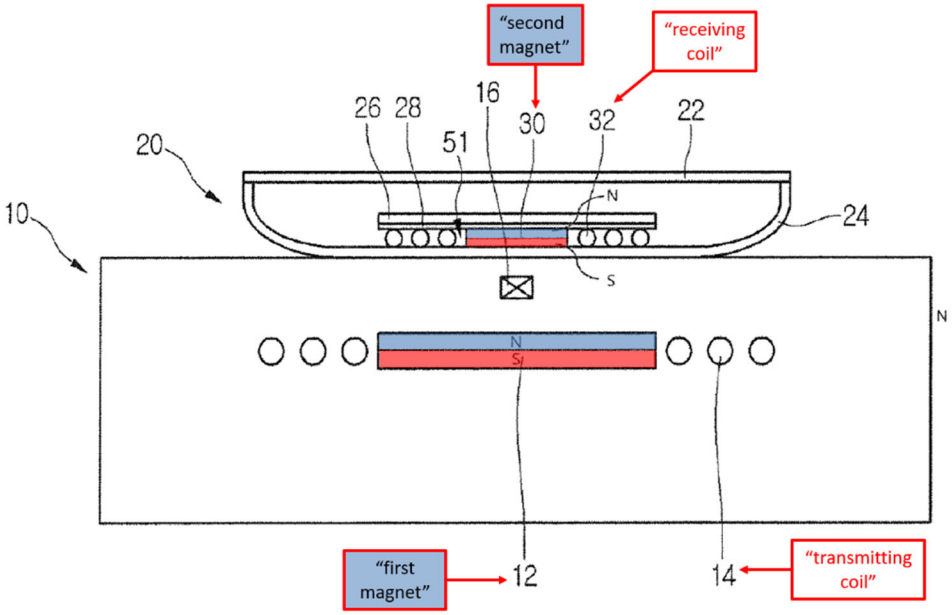
See EX1006, Figs. 1–2.

174. Honda teaches that external and internal coils are "physically out of contact with each other, but magnetically coupled . . . ." EX1006 at 9; *id*. at col. 6:38–39 (teaching "magnetically coupled with each other"). Honda schematically illustrates how its dock aligns coils (110, 210) for magnetic coupling in this Figure:



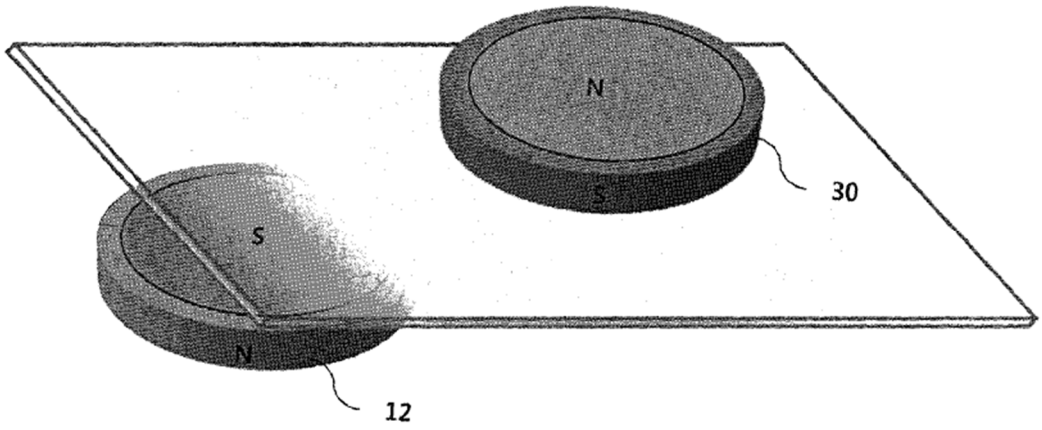
EX1006, Fig. 4. Thus, Claim 16 is obvious in view of Kotanagi and Honda.

175. In addition to the magnetic coupling discussed above, the '783 specification also refers to magnetic alignment. EX1001 at col. 5:37–40; 43:36–41; 45:29–51 (e.g. discussing Fig. 19); *id.* at 25. Although Claim 16 does not refer to alignment, if "configured to magnetically couple" is construed to require, in addition to the magnetic coupling of induction, magnetic coupling for alignment a POSITA would have been motivated by Honda (EX1006 at col 1:48–59) to look to Park, which teaches using magnets 12 and 30 to align devices in wireless charging stations. EX1015 at 36; EX1012 at [0213].



See EX1015, Fig. 14; EX1012, Fig. 14.

176. Park explains that "attractive force may be generated between the first magnet 12 and the second magnet 30" to optimize "wireless power transfer efficiency." EX1015 at 34; EX1012 at [0204].



EX1015, Fig. 16; EX1012, Fig. 16.

177. A POSITA would have been motivated to combine Park's teachings with those of Kotanagi and Honda based at least on Honda's description of a "socket" where the watch body is "seated in alignment" in Honda's station. EX1006 at col. 6:11, Fig. 1. Understanding the value and feasibility of alignment from both Honda and Park, a POSITA would have expected success in modifying Honda to include Park's permanent magnets.

178. A POSITA would have also been motivated by Park, which teaches disadvantages of existing wireless charging schemes: "the electromagnetic resonance scheme is utilized within a limited distance and space and energy transfer efficiency is somewhat low." EX1012 at [0008]; EX1015 at 5. A POSITA would have known that such inefficiencies can apply to all wireless charging systems, but Park teaches permanent magnets can reduce the distance, "thereby improving wireless power transfer efficiency." EX1012 at [0192]; EX1015 at 32.

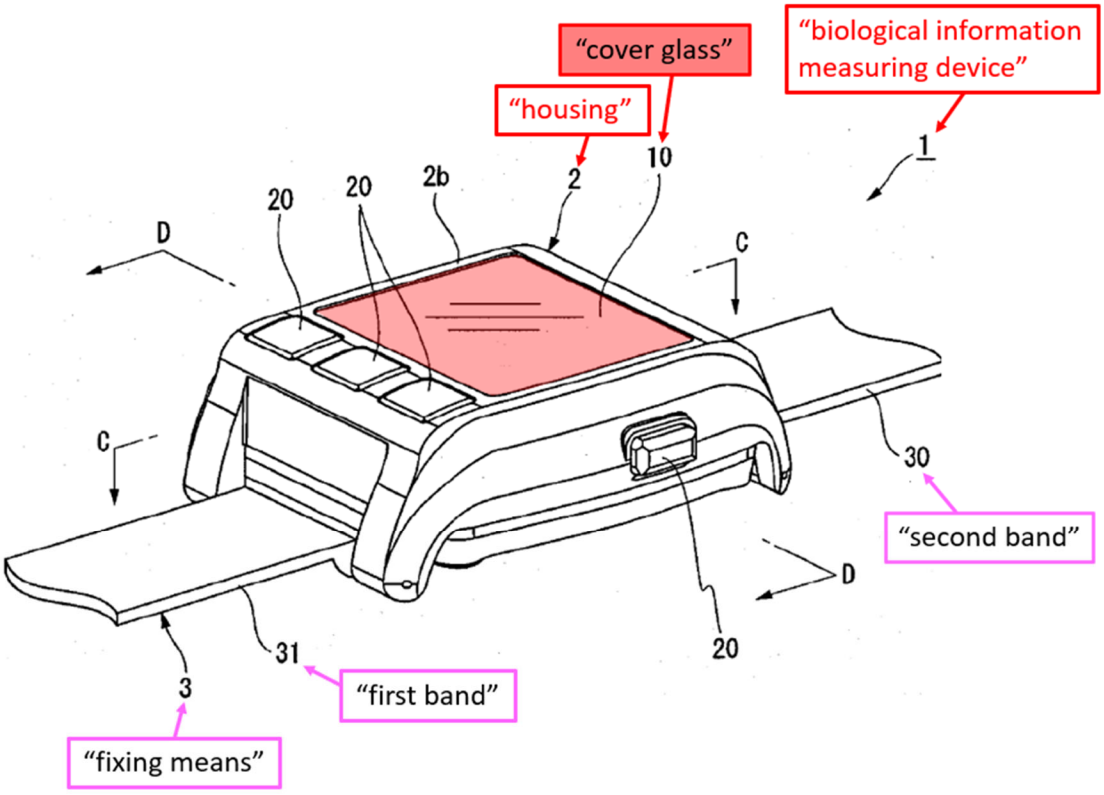
179. Based on the above, Claim 16 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 16 would have been obvious in view of Kotanagi and Honda, combined with Park.

C. Ground 3: Claims 1–7 and 14 are unpatentable because they would have been obvious in view of Kotanagi and Honda, and optionally in further combination with Kateraas.

1. Independent Claim 1

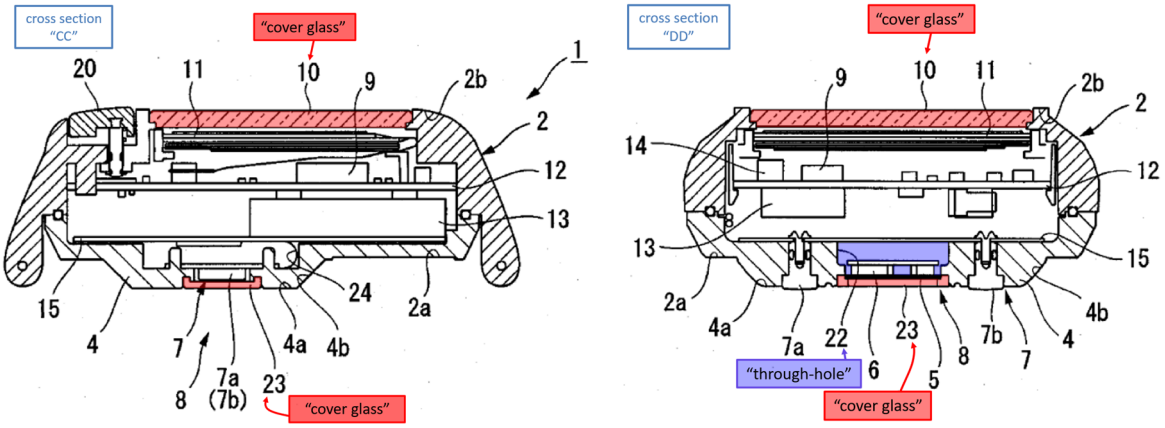
a. "An electronic device, comprising: a housing defining a first opening opposite to a second opening; a band attached to the housing and configured to secure the electronic device to a user;"

180. Kotanagi teaches these limitations, as shown below:



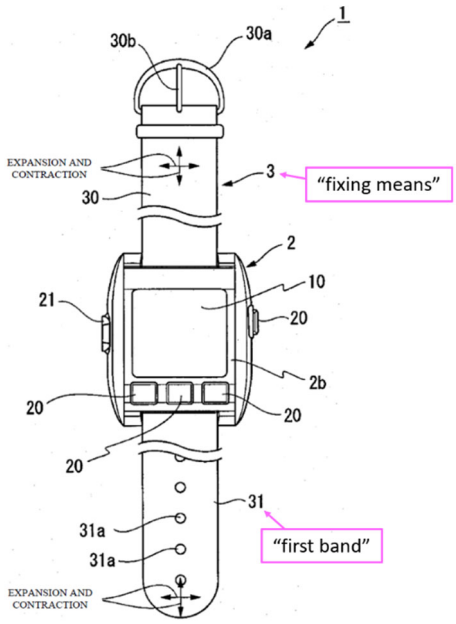
See EX1005,, Figs. 1, 4.

181. The "first opening" in Kotanagi's housing can be seen in the cross-sections of figures 6 and 7 (below). The cover glass 10 that fills this opening has been shaded here, along with the second opening ("through-hole 22") and its cover glass 23:



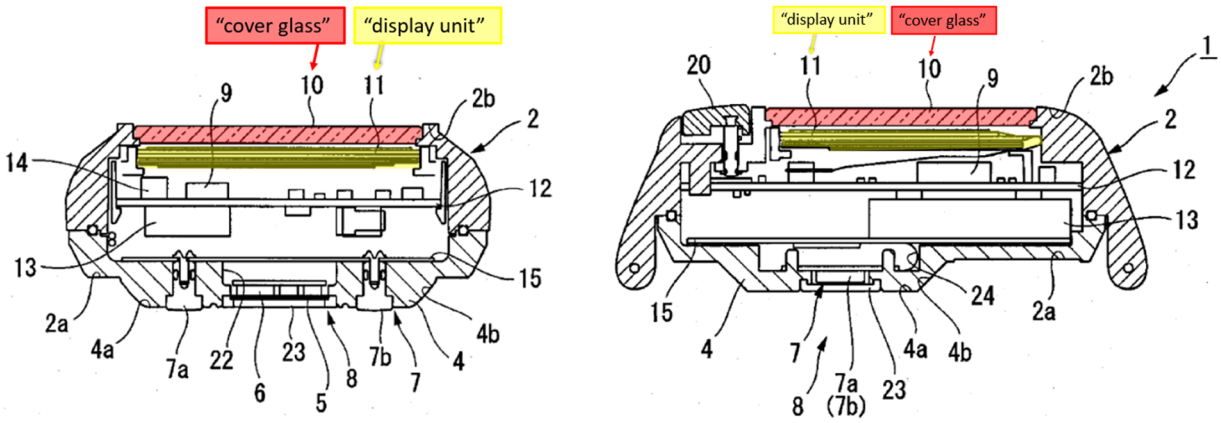
See id., Fig. 6, 7.

182. Kotanagi has a "means for fixing" the device "to an arm" (*id.*, Abstract) and explains: "The fixing means 3 has a first band 30 and a second band 31 having base end sides that are attached to the housing 2 to enable mounting to the wrist A." (*Id.* at ¶60; *See id.*, Fig. 1).



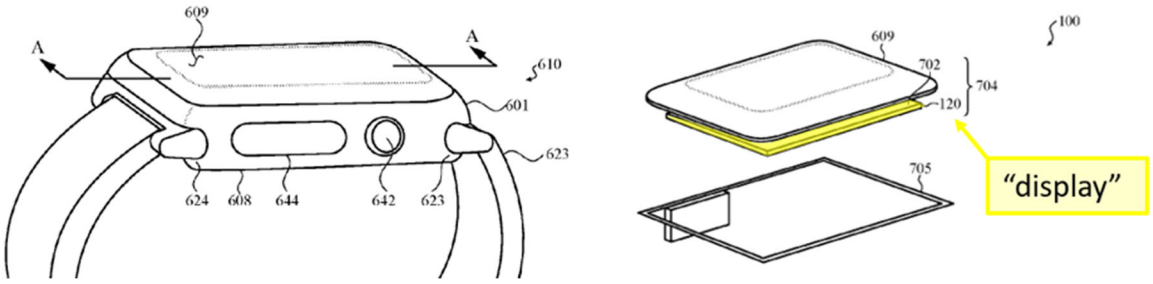
b. "a display positioned in the first opening;"

183. Kotanagi teaches "A cover glass 10 with a substantially square shape is fitted into the central portion of the upper surface 2b of the housing 2, and a display part 11 for displaying the aforementioned pulse rate that is detected and various other information is disposed inside the cover glass 10." EX1005 ¶48.



See EX1005,, Fig. 6, 7.

184. This is consistent with the '783 patent's display, which is also under a cover glass in the opening.

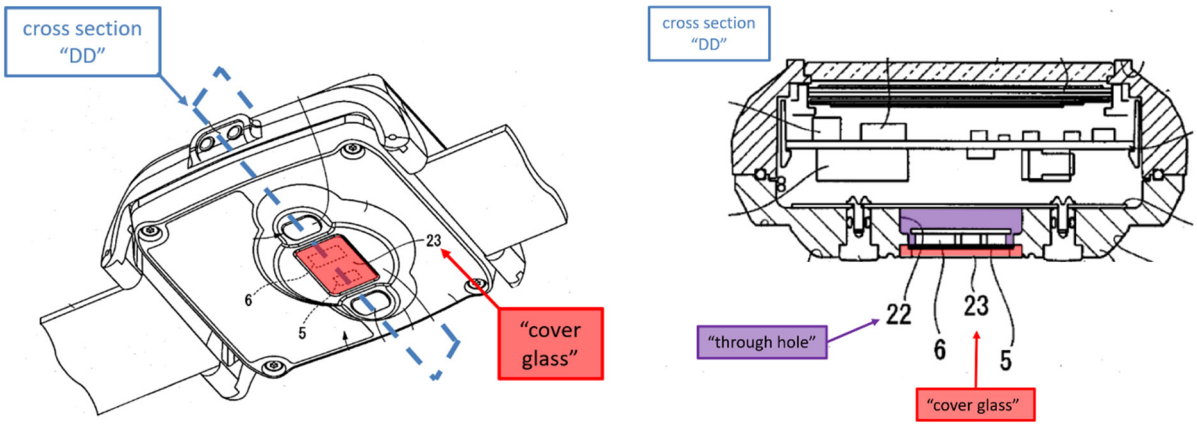


See EX1001 at 12–13.

185. Accordingly, Kotanagi teaches this limitation.

c. "a ceramic cover disposed over the second opening and forming a portion of an exterior surface of the electronic device;"

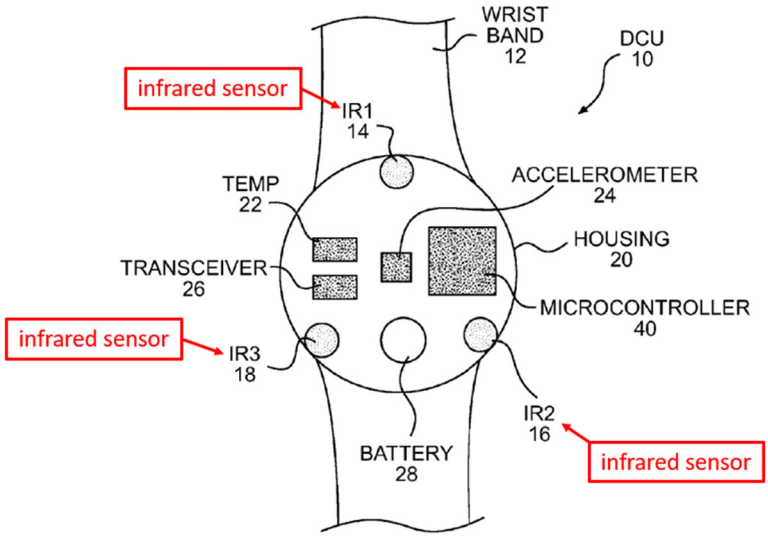
186. Kotanagi teaches "cover glass" forming a portion of its bottom surface and covering through-hole 22:



See EX1005,, Figs. 5, 7.

187. Based on the construction and evidence provided above in § VI(A) (e.g., glass is "usually considered a subset of ceramics." EX1044 at 13; *see* EX1045 at 8), a POSITA would have understood the Kotanagi "cover glass 23" to satisfy this limitation.

188. Moreover, the evidence shows a POSITA would have considered glass and ceramic interchangeable. Like Kotanagi, **Kateraas** (EX1014), which published in 2012, describes a biosensing wristwatch.



See EX1014, Fig. 1.

189. Kateraas teaches that ceramics (which includes sapphire), can form a "window" of "infrared transmissive or transparent material":

> [0059] **Housing** 101 **may include a window** 103, fabricated from an infrared transmissive or transparent material, for example, to allow radiation emitted from infrared sensors 14, 16, and 18 to pass out of housing 101 and impinge upon the underside of the user's wrist. In turn, window 103 also allows infrared radiation reflected or emitted

> from the user's skin to pass into housing 101 via window 103. Such infrared transmissive or transparent materials for **window** 103 may include, e.g., germanium, zinc selenide, **sapphire**, IR glass, IR polymer, barium fluoride, calcium fluoride, and combinations thereof . . . .

EX1014 at [0059] (emphasis added).

190. Like Kotanagi and Kateraas, **Yuen**[5] (EX1016), which published in May 2014, describes a biosensing wristwatch ("a heart rate measuring system in the form of a wearable wrist attachable device," *id*. at [0068]). It teaches continuous "deadfront" covers formed from glass or ceramic for optical sensing:

[5] It is not necessary to include Yuen in this combination to render obvious the present limitations. Rather, Yuen is cited here to confirm that a POSITA would have understood that ceramic and glass are interchangeable, and that ceramic covers can form a portion of an exterior surface of a device. In view of this, a POSITA would have understood that Kotanagi's and Honda's cover glass material would have readily formed part of an exterior surface, rendering Claim 1 obvious.

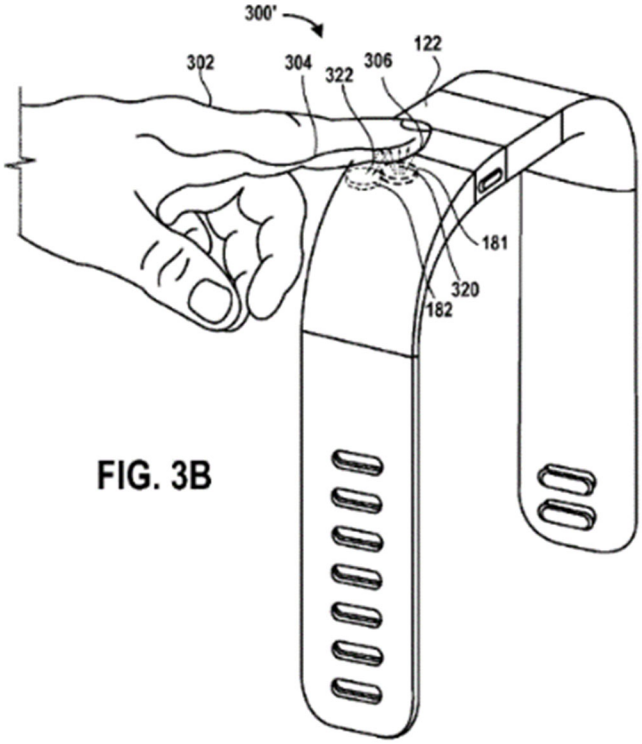


FIG. 3B

> [0070] The heart rate measuring system includes a light source 181 and a reflected light detector 182. . . . **The heart rate monitor location 183 can include a cover that enables light of the light source to pass while blocking substantially all light in a human visible spectrum**. The **cover** can be a smoked filter or other suitable filter color or shaded plastic or **glass** or shaded glass, transparent or translucent glass or plastic or **ceramic** or any other suitable material capable of allowing the desired wavelengths of light to pass through the cover. In one embodiment, the light source 181 uses an infrared (IR) light and the IR light produces a deadfront at the heart rate monitor location 183. Where a deadfront is defined as a continuous surface such that the cover is not easily discernable from the remaining surface of the housing. A deadfront cover is substantially hidden from the user however a light source 181 or the display screen 122 can emits sufficient light to pass through the cover. . . .

Id., Fig. 3B, [0070] (emphasis added).

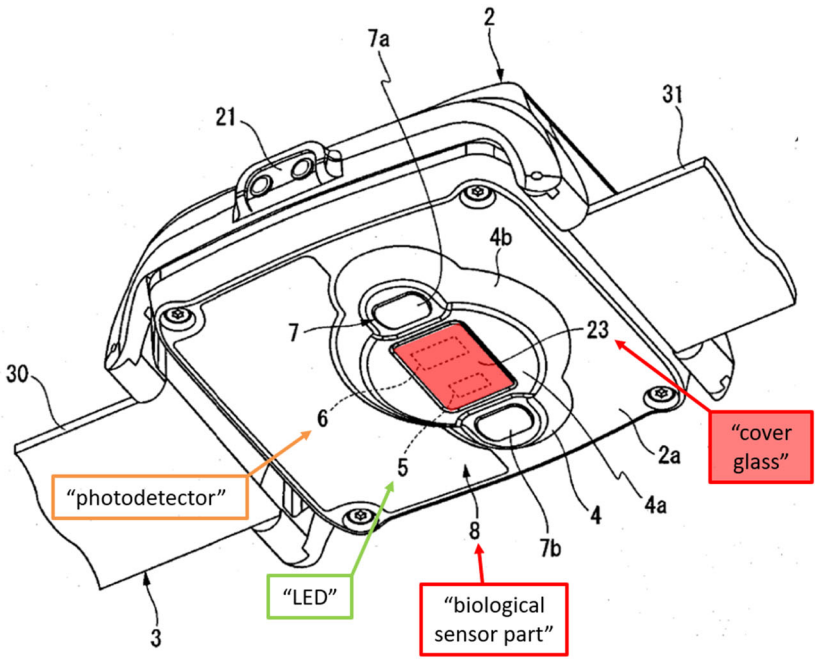
191. Ceramics literature teaches that ceramics are inorganic, non-metallic, solid materials. EX1043 at 9; EX1045 at 7; EX1044 at 13. Sapphire is a ceramic

(EX1042 at 13, 15), and glass is "usually considered a subset of ceramics." EX1044 at 13; *see* EX1045 at 8. Thus, a POSITA would have known that glass is substitutable for another ceramic material, as they are closely related.

192. Thus, Kotanagi's teaching of "cover glass" would have rendered obvious the "ceramic" cover of Claim 1, in view of the teachings above and the knowledge of a POSITA.

d. "a biosensor module disposed within the second opening below the ceramic cover; and"

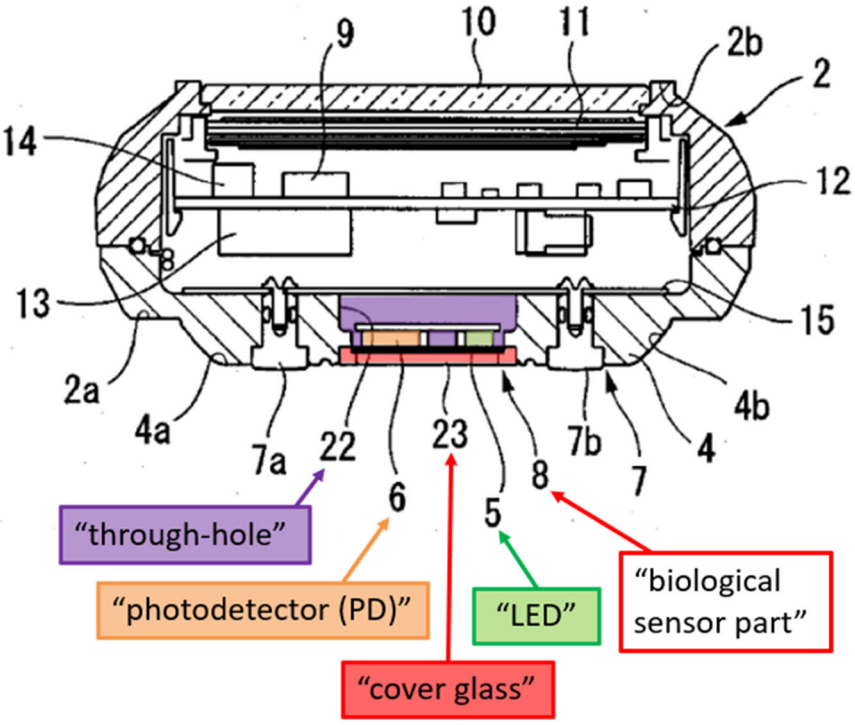
193. Kotanagi teaches a biosensor, as illustrated in its Figure 5:



See EX1005, Fig. 5.

194. Kotanagi further explains its "cover glass 23" in the context of Figure 7:

> [A]s illustrated in FIG. 7, a through-hole 22 passing through the outside and the inside of the housing 2 is formed in the center of the lower surface 4a of the protruding part 4, and a cover glass 23 is fixed to the housing 2 so as to block the through-hole 22. The LED 5 and the PD 6 are disposed adjacent to one another . . . so as to touch the ***inside*** of the glass cover 23.



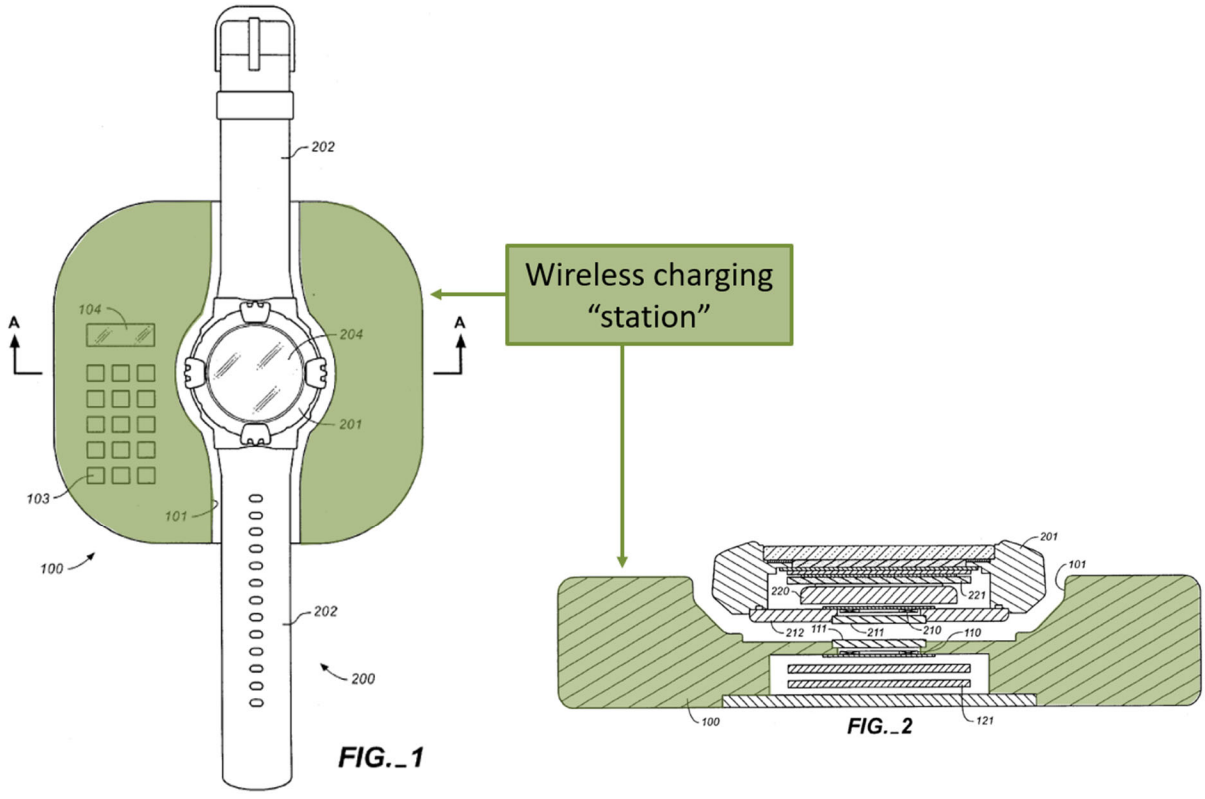
See *Id.* at ¶55 (emphasis added), Fig. 7. From this, a POSITA would have understood that Kotanagi teaches these claim limitations.

e. "a wireless charging receive coil aligned with the second opening and below the ceramic cover;"

195. Kotanagi teaches that "a transformer or the like for supplying power to a recharger and to the inside of the housing 2 may be provided ***so as to recharge the rechargeable battery 13 in a contactless state***." EX1005 at ¶53 (emphasis added). A POSITA would have known at the time of the '783 Patent's invention that

transformers utilize coils and such contactless charging involves a wireless charging receiving coil.

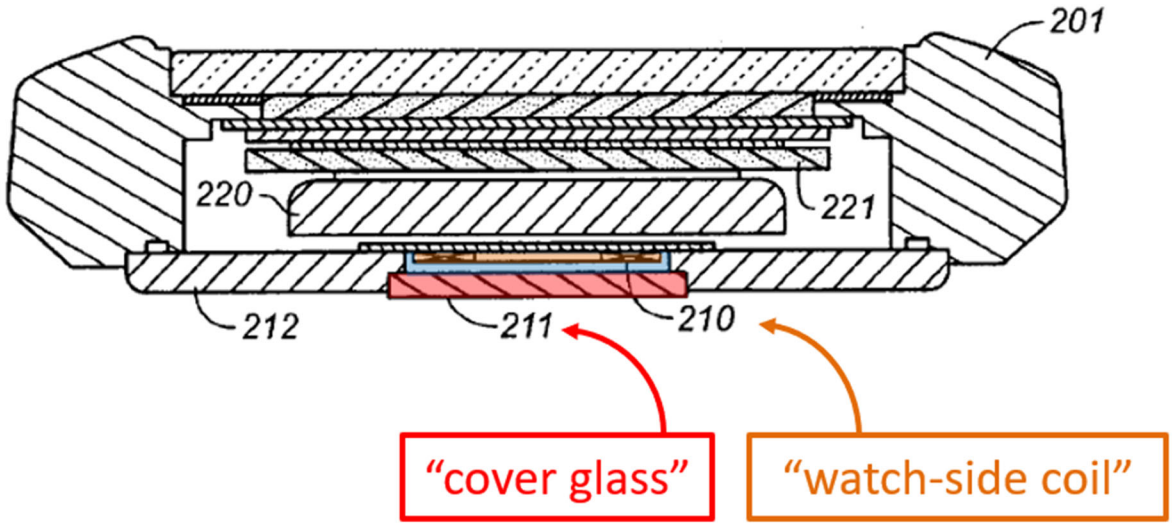
196. **Honda**, which issued in 2001, discloses such a contactless charging system for a biosensing wristwatch. EX1006, Fig. 1. Honda's Figure 1 shows a plan view of the watch in a charging station, with Figure 2 showing a cross-section of this arrangement:



See EX1006, Fig. 1, 2.

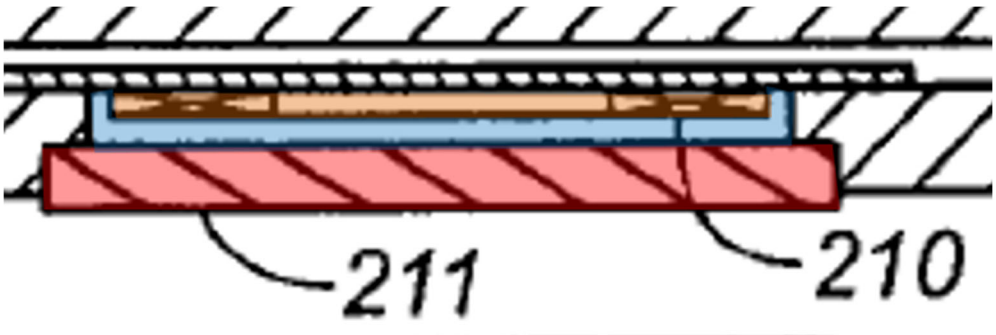
197. Like Kotanagi, Honda teaches a biosensor: "the electronic watch 200 detects biological information including the pulse rate or the heart rate of the body." EX1006 at col. 6:17–20. Like Kotanagi, the Honda watch has a "cover glass" over

an opening in the bottom face of the watch. EX1006 at col. 6:24–25. Behind this is a charging coil: "[A] watch-side coil 210 for the data transmission and the battery charging is arranged in a case back 212 of the watch body 201 and is covered with a cover glass 211." *Id* col. 6:22–25.



See EX1006, Fig. 2.

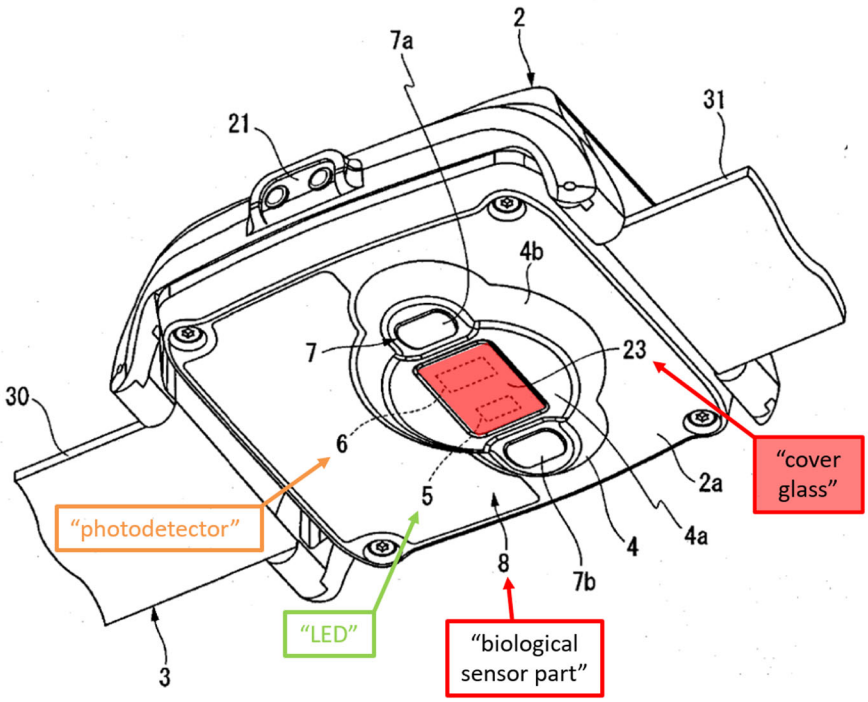
The following shows a close-up view confirming that Honda's watch-side coil is "aligned with the opening," as claimed:



Id.

f. "wherein: the ceramic cover is configured to pass optical signals generated by the biosensor module; and

198. Kotanagi illustrates its photodetector 6 and LED 5 with dashed lines to indicate they lie behind the cover glass 23, forming a "biological sensor part" 8:



See EX1005,, Fig. 5. Kotanagi further explains:

> [T]he data processing part 9 **emits light from the LED 5** toward the living body. A portion of the emitted light is absorbed, for example, by hemoglobin in blood vessels, and another portion of the light is reflected by biological tissue. **The PD 6 receives this reflected light**, generates a pulse signal (biological information signal) corresponding to the amount of received light, and outputs the signal to the data processing part 9.

Id. at ¶65 (emphasis added). A POSITA would have understood from this context that because Kotanagi's "cover glass 23 is fixed to the housing 2 so as to block the through-hole 22" (EX1005 at ¶55), its LED and photodetector work by passing

optical signals *through* the cover glass.

199. Moreover, Kateraas' ceramic cover is configured to pass optical signals: "Such **infrared transmissive or transparent** materials for window 103 may include, e.g., germanium, zinc selenide, sapphire, IR glass, . . ."[6] EX1014 at [0059]. Accordingly, Kotanagi alone, or Kotanagi as modified by Kateraas, teaches the "ceramic cover" "configured to pass optical signals generated by the biosensor module" as claimed.

g. "the ceramic cover is configured to pass wireless power from an external wireless charging device to the wireless charging receive coil."

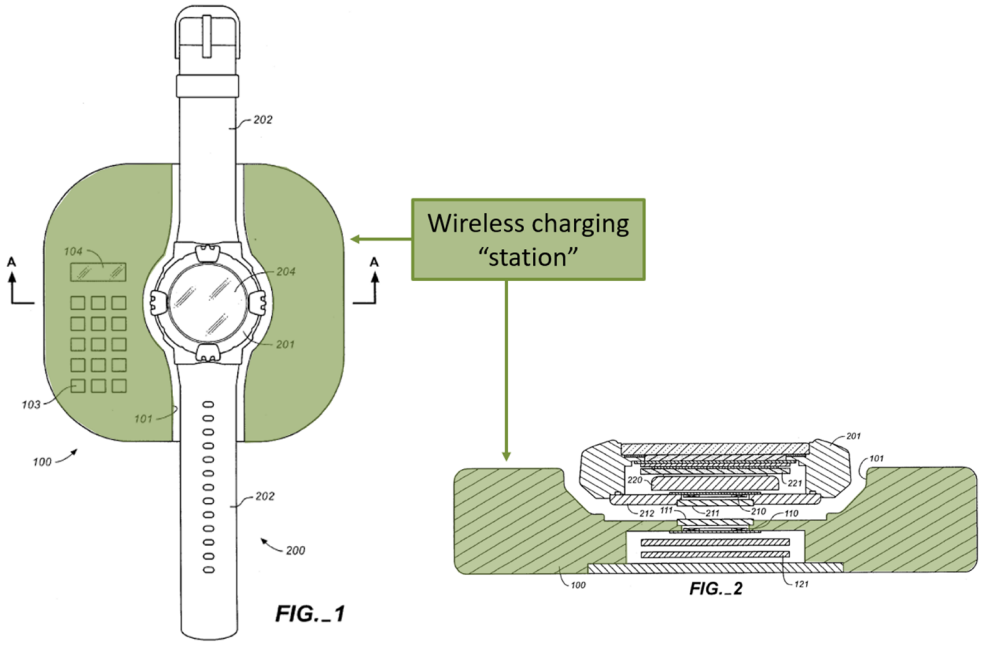
200. As noted above, Kotanagi teaches recharging its battery "in a contactless state" (EX1005 at ¶53) and Honda teaches wireless charging of wrist-watch biosensor devices using wireless charging "coils" (EX1006 *passim*). Honda also shows the claimed "external wireless charging device," which it terms a "station." EX1006 at col. 5:20–21.

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[6] Yuen also teaches an optical transmissive cover, showing this was common in the art at the relevant time:

> The . . . monitor . . . can include **a cover that enables light of the light source to pass** . . . . The cover can be a smoked filter or other suitable filter color or shaded plastic or glass or shaded glass, **transparent or translucent glass** or plastic **or ceramic** or any other suitable material **capable of allowing the desired wavelengths of light to pass through the cover**.

EX1016 at [0070] (emphasis added).



See EX1006, Fig. 1, 2.

201. Honda explains that this station passes wireless power to the wireless charging receiving coil through the physics of induced currents and magnetic flux:

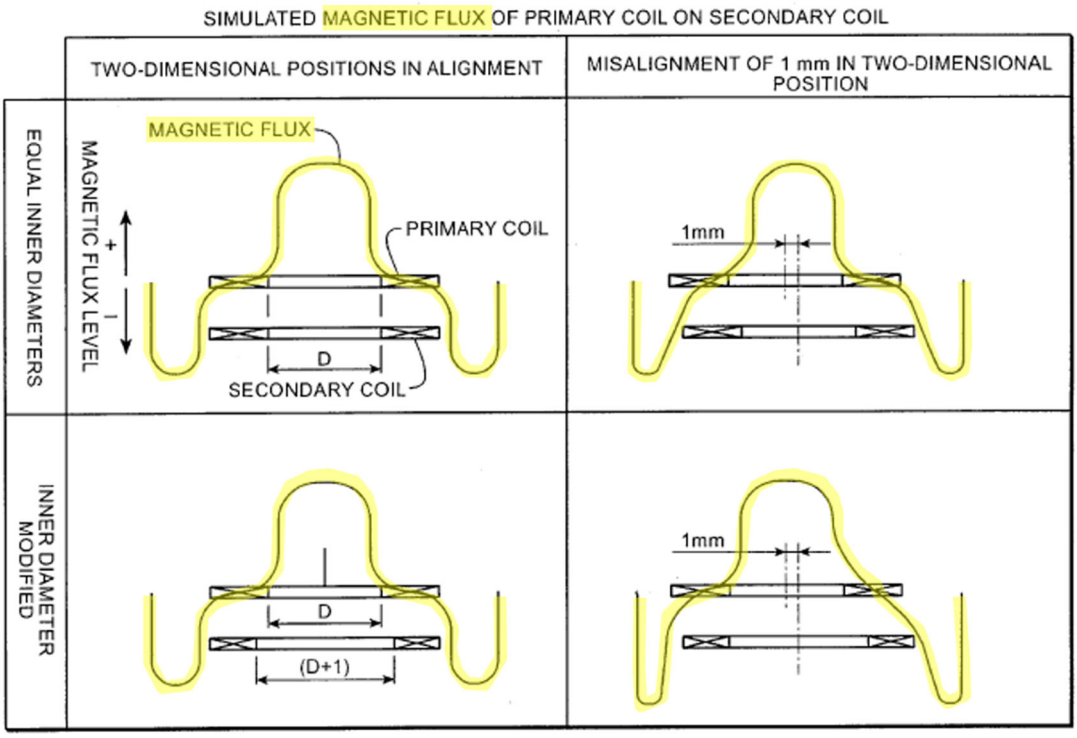
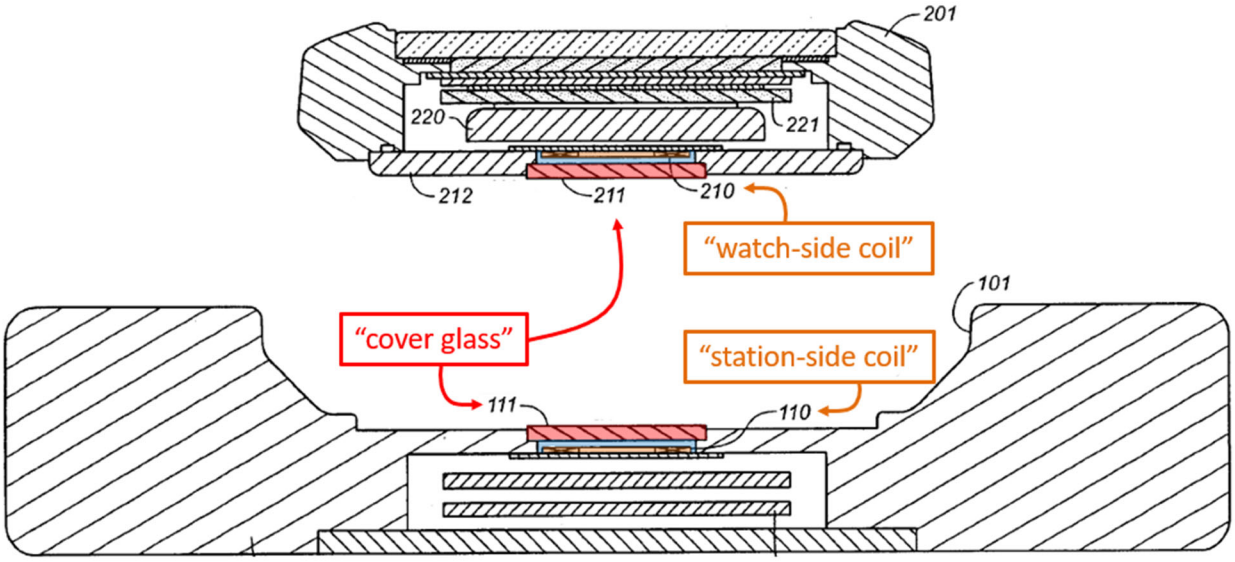


FIG._10

See id., Fig. 10 . This charging effect occurs as wireless power traverses a cover glass:

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally in parallel to each other.



See id. at col. 6:28–40; *see id*., Fig. 2.

202. Both Kotanagi and Honda refer to "cover glass," a term of art inclusive of ceramic materials as explained above. *See supra* § VI(A); EX1001 21:56–59. Accordingly, Kotanagi and Honda—or Kotanagi and Honda as modified by Kateraas—teach the claimed "ceramic cover" "configured to pass wireless power from an external wireless charging device to the wireless charging receive coil."

203. Based on the above, Claim 1 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 1 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

h. Motivation to Combine and Reasonable Expectation of Success

204. As discussed above with respect to Ground 1, a POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi

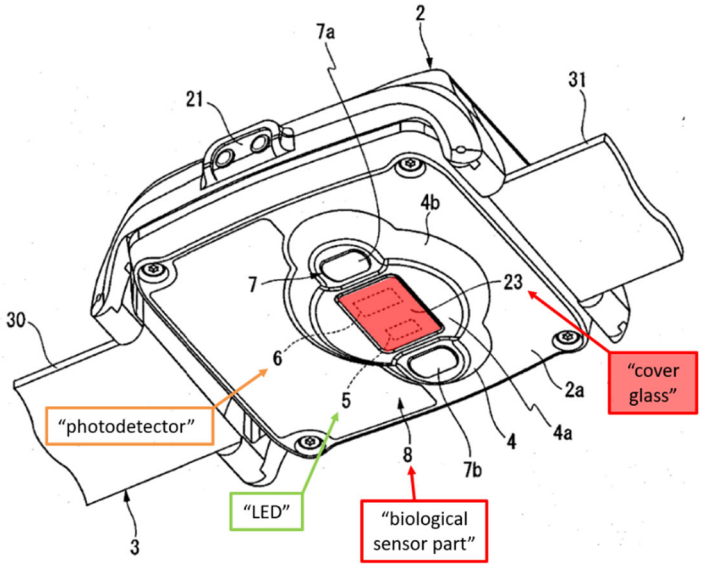
and Honda. A POSITA would have been further motivated to combine Kateraas (in the same field of biosensing watches) because Kotanagi explains its goal that "light can be emitted and received efficiently, and biological information can be detected with high precision." EX1005 at ¶89. Kateraas helps fulfill this goal by teaching specific window materials that are "infrared transmissive or transparent . . . to allow radiation emitted from infrared sensors 14, 16, and 18 to pass out of housing 101" and allow "infrared radiation reflected or emitted from the user's skin to pass into housing 101 via window 103." EX1014 at [0059]. Thus, a POSITA would have found it obvious to substitute those specific window materials (e.g., sapphire, zinc selenide, germanium, barium fluoride, or calcium fluoride) for Kotanagi's or Honda's cover glass. A POSITA would have had a reasonable expectation of success in combining these two references as a POSITA would have been equipped with the knowledge from the extensive prior art documents relating to biosensing watches, discussed in § IX above.

205. This motivation to combine applies equally to the other claims in Ground 3 and dependents from Claim 1. Further motivations to combine are provided throughout this Declaration.

2. Dependent Claim 2

206. Claim 2 depends from Claim 1 and adds "**wherein the biosensor module comprises: a light source configured to emit light toward a region of**

skin of the user; and a detector configured to receive light reflected from the region of skin." Kotanagi teaches the limitations of claim 2, as summarized in the following annotated figure:



See EX1005, Fig. 5.

207. These features are "configured" in the claimed manner because both are positioned in a protrusion at the base of the device, for contacting a user's wrist:

> A biological sensor part 8, which includes an LED (Light Emitting Diode) (light-emitting part) 5 for emitting light toward the living body while in contact with the living body surface B side, a PD (Photodetector) (light-receiving part) 6 for receiving reflected light from the living body out of the light emitted by the LED 5 and generating a pulse signal (biological information signal) corresponding to the amount of received light, and a contact detection means 7 for detecting whether the LED 5 and the PD 6 are in contact with the living body surface B, is disposed on the lower surface 4a of the protruding part 4.

EX1005 at ¶46.

Kotanagi further explains that after light is emitted:

> A portion of the emitted light is absorbed, for example, by hemoglobin in blood vessels, and another portion of the light is reflected by biological tissue. The light-receiving part receives this reflected light and generates a biological information signal such as a pulse signal corresponding to the amount of received light.

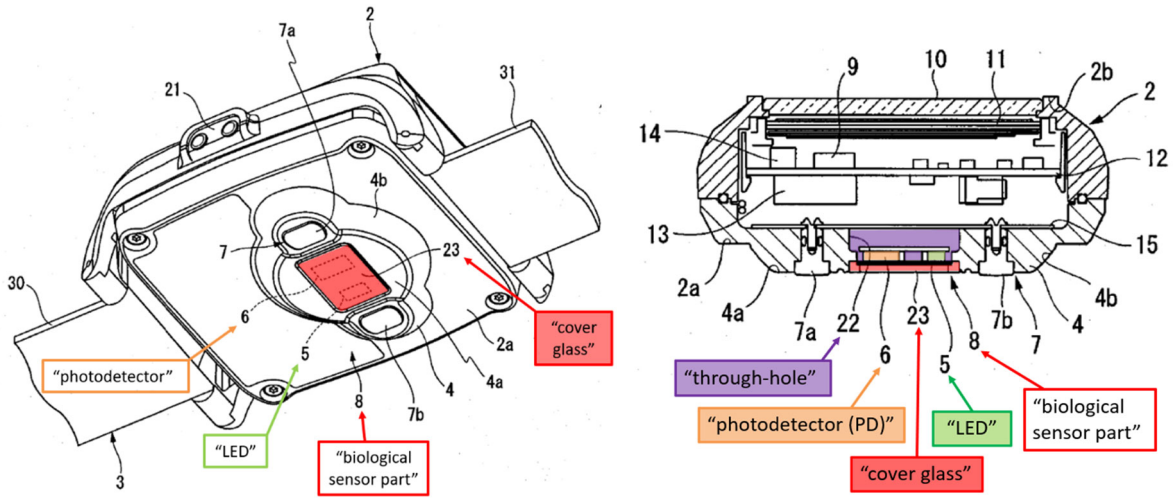
Id. at ¶8.

208. Based on the above, Claim 2 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 2 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

3. Dependent Claim 3

209. Claim 3 depends from Claim 1 and adds "**the ceramic cover defines a first opening to transmit the light from the light source; and the ceramic cover defines a second opening to receive the light reflected from the region of skin**."

210. Similar to the '783 patent and consistent with the claim construction of provided in § VI(C) above, Kotanagi teaches a single opening in its base spanned by a single cover glass, with an LED and a photodetector both positioned in that opening immediately behind the cover glass such that light can travel through the cover glass to and from these features:



See EX1005, Fig. 5.

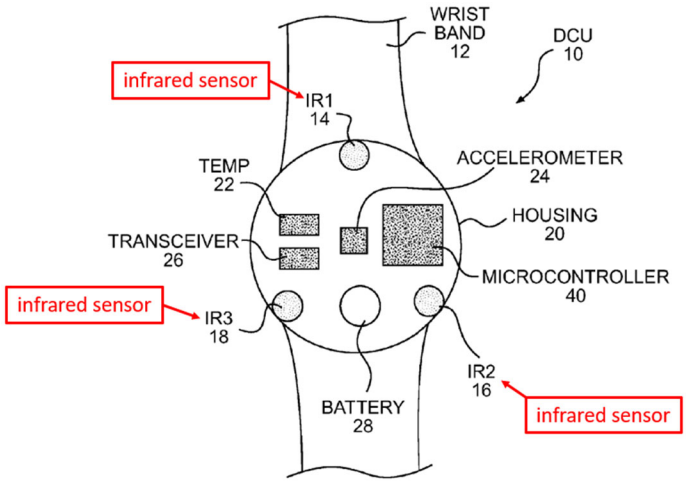
Kotanagi's cover glass covers the rear opening, thereby spanning more than the surface areas shown for both the LED and photodetector and providing operational access to them. It therefore defines both the transmission ("to transmit the light from the light source") and reception ("to receive the light reflected from the region of skin") openings by allowing light to pass through. Accordingly, Kotanagi's cover glass therefore defines the openings as claimed, consistent with the '783 patent.

211. If this claim is interpreted to be more specific and cover only "an array of windows, each window including an aperture or opening for a respective light source 1611–1613 and/or the detector 1614" (EX1001 at col. 40:64–66) such that there must be two *separate* apertures, a POSITA would have also understood this as obvious from Kotanagi alone. Kotanagi's single opening would suggest the claimed

openings to a POSITA. The two areas surrounded by dashed lines in Kotanagi's Figure 5 would suggest to such a person that two separate windows could be used in those areas. Kotanagi's larger opening is functionally equivalent to the claimed two openings, because it is large enough to accommodate both the transmission and reception of light; creation of two openings instead of one would create no new and unexpected result.[7]

212. Moreover, Kateraas teaches an "array" of separate sensors. EX1014 at [0012] (infrared sensors 14, 16, and 18; and/or temperature sensor 22 (and any combinations thereof) may be integrated together to form a sensor array**)**.

[7] *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960) (Claims at issue were directed to a water-tight masonry structure wherein a water seal of flexible material fills the joints which form between adjacent pours of concrete. The claimed water seal has a "web" which lies in the joint, and a plurality of "ribs" projecting outwardly from each side of the web into one of the adjacent concrete slabs. The prior art disclosed a flexible water stop for preventing passage of water between masses of concrete in the shape of a plus sign (+). Although the reference did not disclose a plurality of ribs, the court held that mere duplication of parts has no patentable significance unless a new and unexpected result is produced.).



See EX1014, Fig. 1.

213. These sensors in the array can be "embedded directly into" the material of a window, thus establishing a specific opening or window for each sensor. EX1014 at [0059] ("In certain embodiments, one or more of infrared sensors 14, 16, and/or 18 may be embedded directly into the material of window 103."). Thus, a POSITA would have understood, either from Kotanagi alone or from Kotanagi and Kateraas, the limitations of Claim 3.

214. Based on the above, Claim 3 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 3 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

4. Dependent Claim 4

215. Claim 4 depends from Claim 2 and adds "**the light source and the detector are configured to measure changes in light absorption by the region of**

skin; the electronic device is configured to compute a health metric using the measured change in light absorption; and the display is configured to display information associated with the health metric."

216. Kotanagi teaches this. The watch of Kotanagi:

> emits light from the LED 5 toward the living body. A portion of the emitted light is absorbed, for example, by hemoglobin in blood vessels, and another portion of the light is reflected by biological tissue. The PD 6 receives this reflected light, generates a pulse signal (biological information signal) corresponding to the amount of received light, and outputs the signal to the data processing part 9.

EX1005 at ¶65.

217. A POSITA would have understood from Kotanagi that reduction of local hemoglobin increases relative amounts of reflection (because other biological tissue does not absorb as much). This teaches the claimed measurement of "changes in light absorption by the region of skin." Kotanagi expressly teaches that this generates a "pulse signal (biological information signal)," satisfying the claimed computation of a "health metric." EX1005 at ¶46. After Kotanagi's "data processing part" "analyzes the signal to detect the pulse rate," it "displays the signal on the display part 11." EX1005 at ¶66.

> A cover glass 10 with a substantially square shape is fitted into the central portion of the upper surface 2b of the housing 2, and a display part 11 **for displaying the aforementioned pulse rate** that is detected and various other information is disposed inside the cover glass 10.

EX1005 at ¶48 (emphasis added). This teaches the claimed "display" that is

"configured to display information associated with the health metric."

218. Kateraas also teaches the limitations of dependent Claim 4, while expressly disclosing the ceramic cover of independent Claim 1. It teaches the light source and detector for health metric computation:

> In the exemplary embodiment shown in FIG.1, data collection unit 10 includes three infrared sensors 14, 16, 18. . . . Each infrared sensor may be configured as a transmitter/receiver capable of monitoring the oxygen content of blood passing through nearby blood vessels.

EX1014 at [0014]–[0015]. It also teaches displaying the health metric:

> Data collection unit 10 may also include a feedback element, including, for example, a display . . . . During periods when the user's physical activity exceeds the exercise threshold and qualifies for rewards accrual, microcontroller 40 may activate the feedback element to indicate to the user that the exercise threshold has been exceeded and rewards are being accrued. For example, an LED may be included that blinks during periods of qualifying exercise. . . . Such an embodiment would be especially useful where data collection unit 10 was incorporated into a watch or other type of device including a display.

EX1014 at [0043].

219. Based on the above, Claim 4 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 4 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

5. Dependent Claim 5

220. Claim 5 depends from Claim 2 and adds "**wherein the light source and the detectors are configured to operate as a photoplethysmogram (PPG) sensor**."

221. The term "detectors" (plural) appears to be a typo in Claim 5 because Claims 1 and 2 both refer to a single "detector." Accordingly, I have analyzed this claim as if it refers to "the detector." Moreover, adding more than one detector would not affect patentability because multi-detector devices are well known (*see*, *e.g.*, the three infrared sensors 14, 16, and 18 in Kateraas, EX1014 [0014], Fig. 1).

222. A plethysmograph[8] measures changes in volume within an organ or body, typically from air or blood fluctuations. A photoplethysmogram (PPG) sensor uses a light source and a photodetector at the surface of skin to measure the volumetric variations of blood circulation. Thus, a PPG sensor measures changes in light absorption by a skin region that are specifically caused by volumetric variations of blood circulation. A typical PPG relies on this same biological principle: hemoglobin in blood absorbs light wavelengths, and that is how the Kotanagi and Kateraas optical sensors operate to determine pulse rate, etc. EX1005 at ¶65

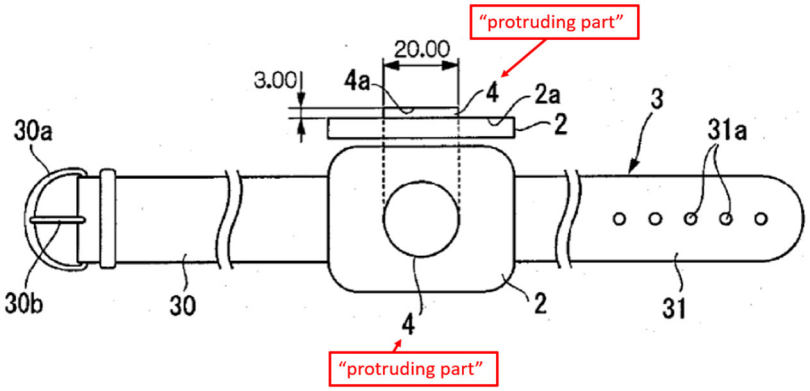
[8] The Greek word "plethysmos" means increasing, enlarging, or becoming full, and "graph" refers to writing or recording.

(teaching "the amount of reflected light out of the light emitted from the LED 5 varies depending on fluctuations in blood flow within arteries and arterioles in the wrist"); EX1014 at [0016] ("[T]he infrared absorption level may be affected by the expansion and contraction of nearby blood vessels and the oxygen content of blood passing through nearby vessels, which are both physical characteristics that vary together with heart rate."). Accordingly, the evidence provided above for dependent Claim 4 also applies to Claim 5.

223. Based on the above, Claim 5 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 5 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

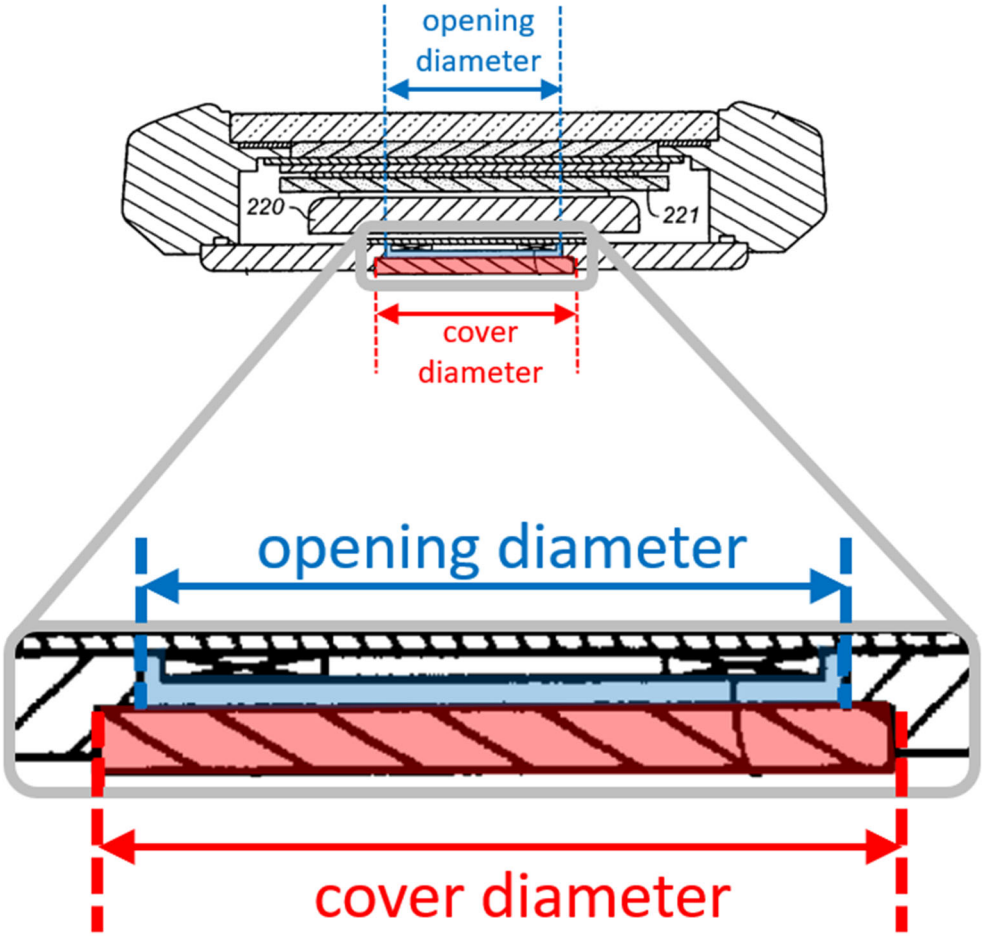
6. Dependent Claim 6.

224. Claim 6 depends from Claim 1 and adds "**wherein: the ceramic cover is a disk having a disk diameter that is greater than an opening diameter of the second opening; and the ceramic cover forms a water-tight seal with the housing along a perimeter of the ceramic cover**." Kotanagi teaches a protruding disk in its Figure 8, for example: "For example, as illustrated in FIG. 8, the protruding part 4 may be formed so that the outer periphery is circular." EX1005 at ¶76.



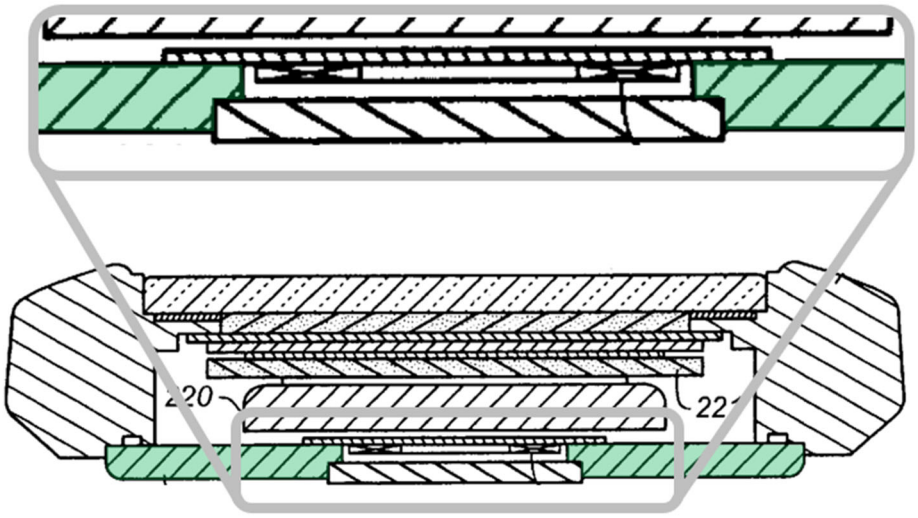
See EX1005,, Fig. 8. This disk covers the opening and therefore has at least the same diameter, if not a larger diameter, than the opening. However, Kotanagi does not specifically state that this disk is a ceramic cover forming a water-tight seal.

225. In the same field of endeavor Honda teaches "By arranging a high-rigidity glass on the surface to which the primary coil and the secondary coil face, a compact and waterproof electronic apparatus is provided." EX1006 at col. 15:36–38. Honda shows a cover with a diameter that is "greater than an opening diameter of the second opening":



See EX1006, Fig. 2 (labels added).

The claimed diameter differences are also demonstrated by the notch in the housing for seating the window, as highlighted here:



See EX1006, Fig. 2.

226. One of the reasons motivating Honda's wireless charging invention is a need for stronger "waterproofness":

> If the charging and the signal transmission are performed through electrical contacts in such a system, the contacts are exposed and the apparatus is **weak in terms of waterproofness**. **For this reason**, the charging and the signal transmission are preferably performed in a non-contact fashion, through the electromagnetic coupling between coils respectively arranged in the station and the portable electronic apparatus.

EX1006 at col. 1:24–31.

227. Honda additionally teaches, "By arranging a high-rigidity glass on the surface to which the primary coil and the secondary coil face, a compact and waterproof electronic apparatus is provided." EX1006 at col. 15:36–38. Honda teaches the watch is waterproof up to five atmospheres. EX1006 at col. 13:22–25.

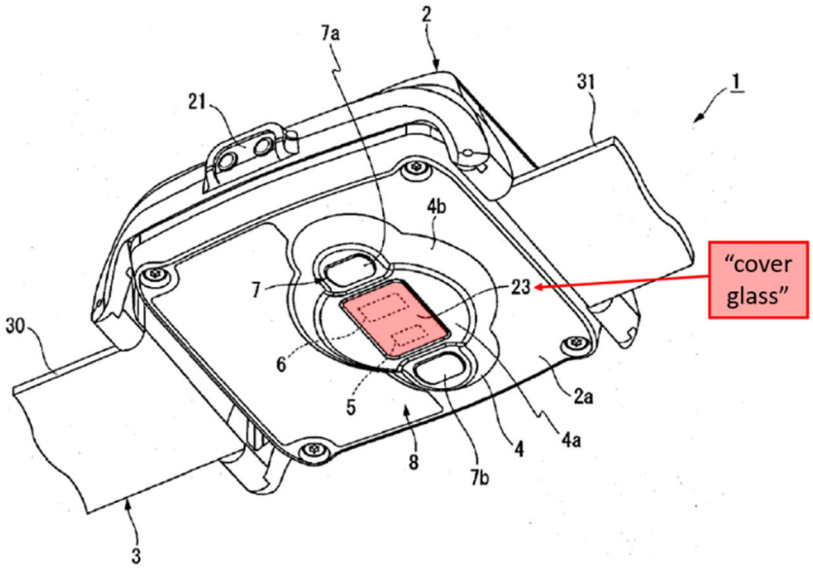
228. From the above, the relative sizes of the opening and disk, and the notched arrangement shown above, a POSITA would have understood that the Honda cover forms "a water-tight seal with the housing along a perimeter of the ceramic cover" as claimed.

229. Based on the above, Claim 6 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 6 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

7. Dependent Claim 7

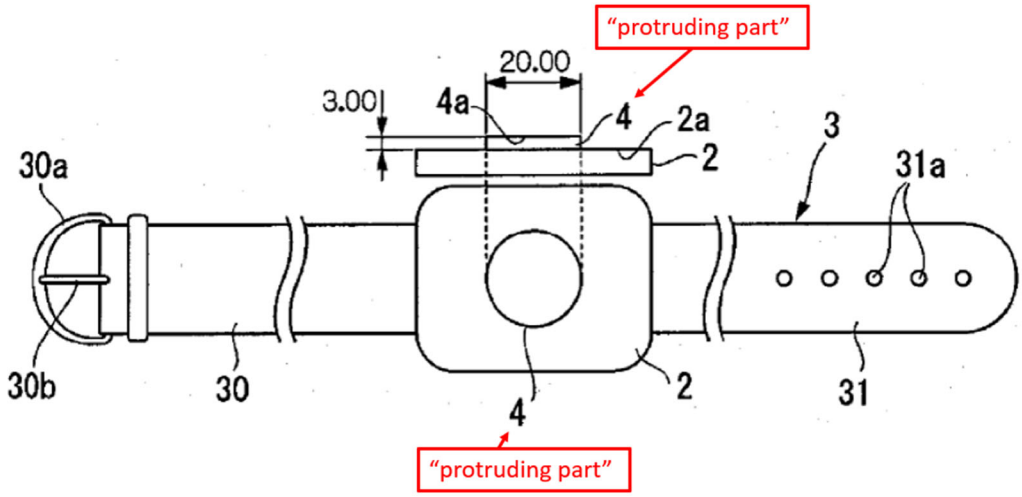
230. Claim 7 depends from Claim 1 and adds "**wherein: the second opening has an opening diameter; the wireless charging receive coil has a coil diameter that is less than the opening diameter; and the wireless charging receive coil is configured to receive the wireless power through the second opening**."

231. As noted above, Kotanagi teaches a second opening with a cover glass. In some figures, Kotanagi illustrates the opening and cover with a roughly rectangular shape, with rounded corners:



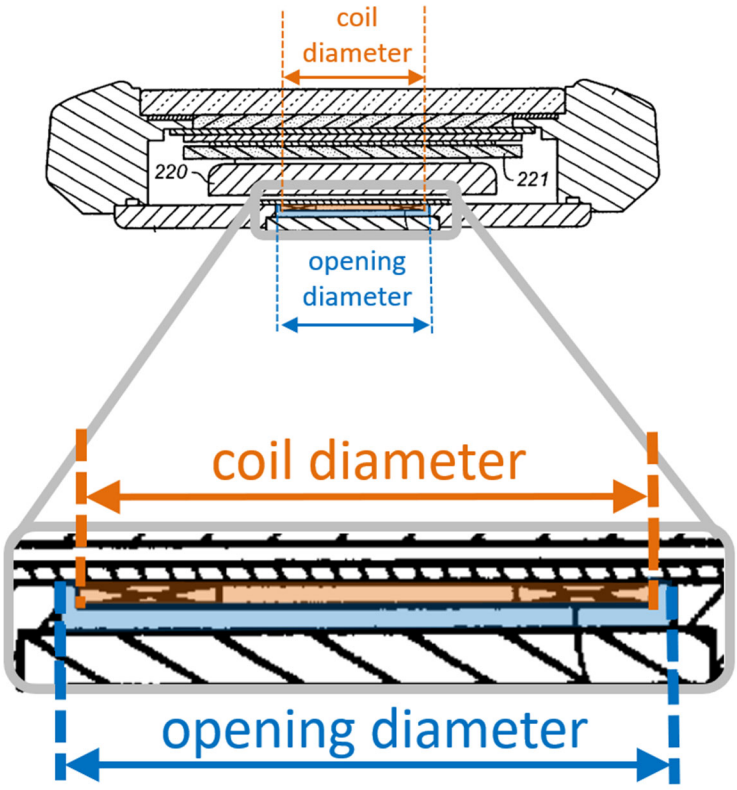
See EX1005, Fig. 5.

232. Although the "cover glass" in the Kotanagi figures above is not circular, Kotanagi also teaches a protruding disk in its Figure 8: "the protruding part 4 may be formed so that the outer periphery is circular" and Kotanagi describes its diameter: "the diameter of the protruding part 4 illustrated in FIG. 8 is set to 20 mm." EX1005 at ¶76.



See id., Fig. 8. A POSITA would have understood from the figure above that the underlying opening also has an "opening diameter."

233. In the same field of endeavor Honda teaches a wireless charging coil that is aligned with and fits within (thus having a smaller diameter than) a second opening:



See EX1006, Fig. 2.

234. Honda thus teaches that the wireless charging receive coil is configured to receive wireless power through the second opening. In Honda, this power comes from a station coil:

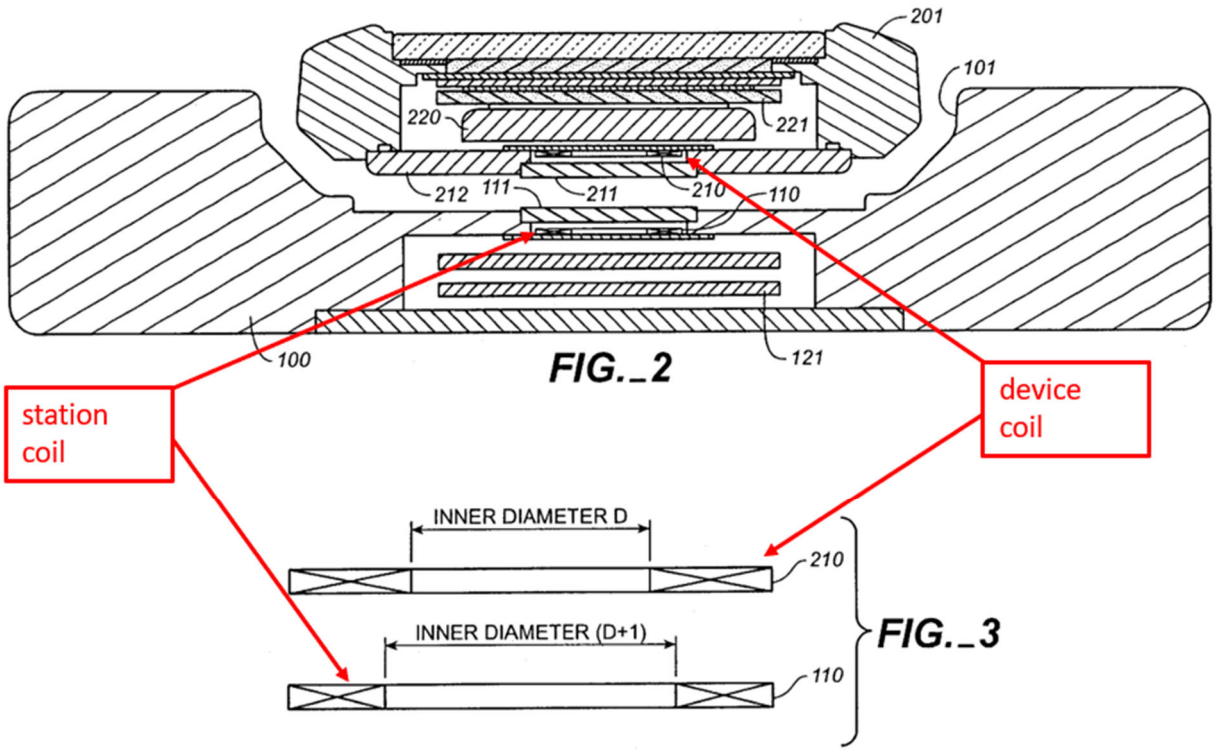
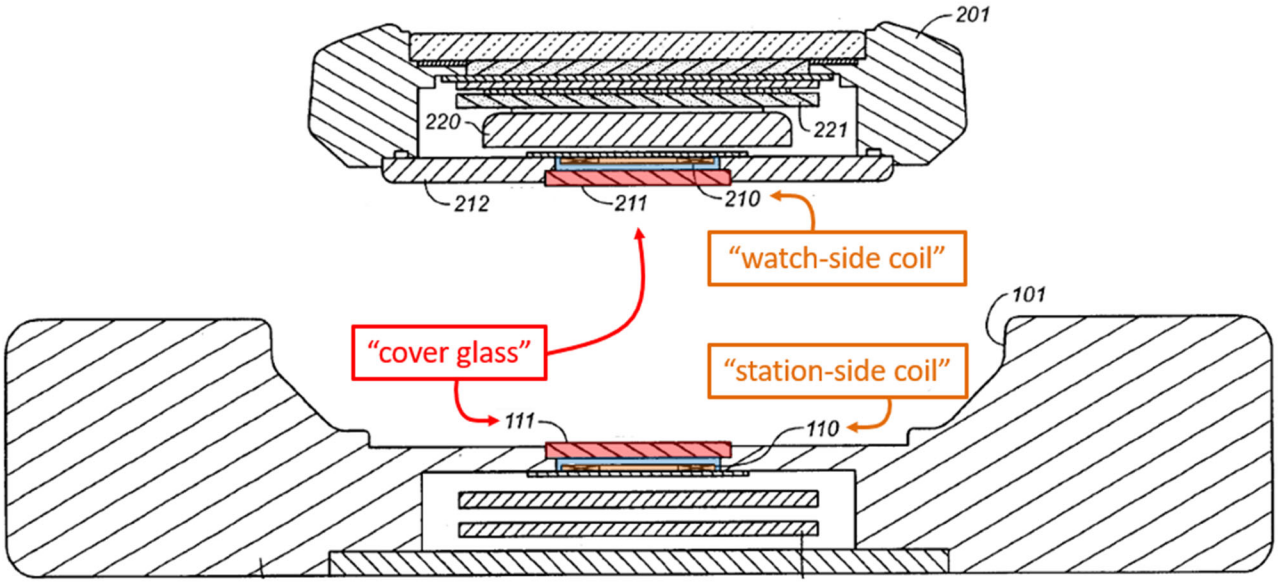


FIG._2

FIG._3

See id., Fig. 2.

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but magnetically coupled with each other because the surfaces of coil winding of both coils are generally in parallel to each other.



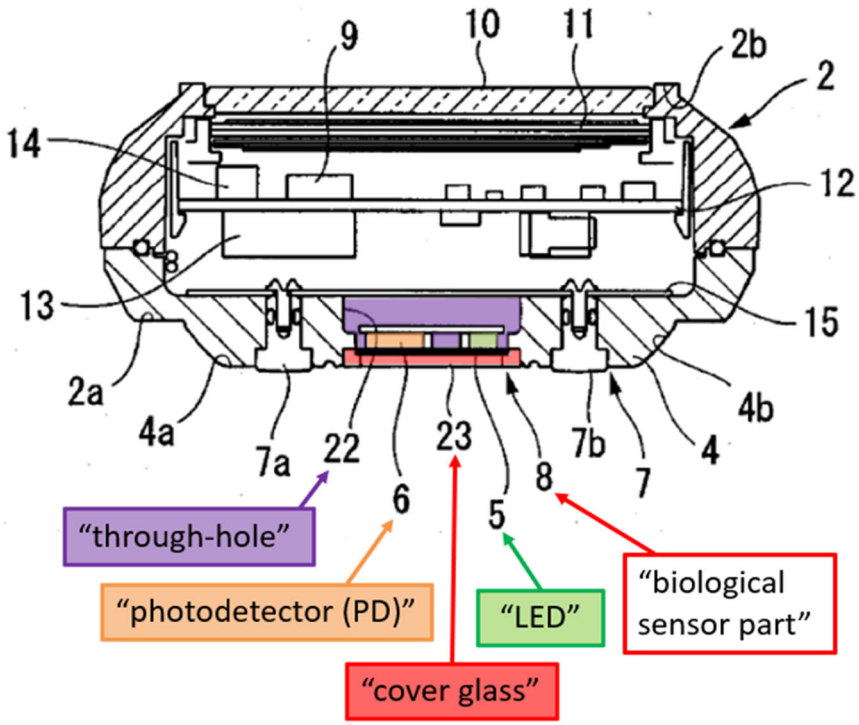
Id. at col. 6:28–40; *see id*., Fig. 2.

235. Based on the above, Claim 7 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 7 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

8. Dependent Claim 14

236. Claim 14 depends from Claim 9 and adds "**the biosensor module includes an array of optical components; and the cover includes an array of windows, each window aligned with a corresponding optical component of the array of optical components.**"

237. As discussed herein with respect to Claim 3, Kotanagi teaches a single opening in its base, with a single cover glass, and an LED and a photodetector both positioned in that opening immediately behind the cover glass:

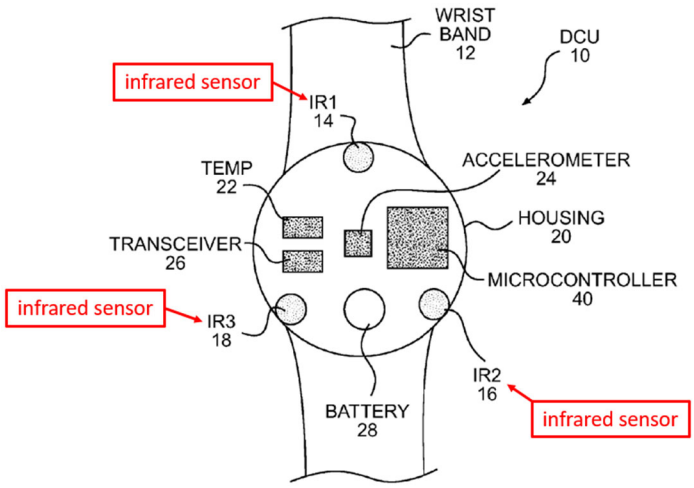


See EX1005, Fig. 5.

238. Kotanagi's cover glass fills the single large opening, thereby spanning more than the surface areas shown for both the LED and photodetector and providing operational access to them. Thus, Kotanagi teaches an "array" of two optical components, and a single window "aligned with" the corresponding optical components in the array. It does not teach separate windows, one for the LED and one for the photodetector. However, a POSITA would have understood two smaller windows as obvious from Kotanagi's single larger window. The two areas surrounded by dashed lines in Kotanagi's Figure 5 would suggest to such a person that two separate windows could be used in those areas. Kotanagi's larger opening is functionally equivalent to the claimed two openings, because it is large enough to

accommodate both the transmission and reception of light to the two optical components; creation of two openings instead of one would create no new and unexpected result.[9]

239. Moreover, as discussed above with respect to Claim 3, Kateraas teaches an "array" of separate sensors. EX1014 at [0012] (infrared sensors 14, 16, and 18; and/or temperature sensor 22 (and any combinations thereof) may be integrated together to form a **sensor array)**.



See EX1014, Figs. 1, 3. These sensors in the array can be "embedded directly into" the material of a window, thus effectively establishing a specific opening or window for each sensor having their own opening. EX1014 at [0059] ("In certain embodiments, one or more of infrared sensors 14, 16, and/or 18 may be embedded

[9] *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960), *see supra* footnote 7.

directly into the material of window 103."). Based on the figure above showing three different sensors, embedding these directly into a window material, as taught by Kateraas, specifically aligns each of the sensors with its separate, corresponding specific opening or window of the window material.

240. This would not affect charging because, just as in the '783 patent (which states "the outer surface of the rear cover defines one or more windows" for "operational access to . . . optical components", EX1001 at col. 2:65–67), the windows of Kotanagi and Kateraas are likewise defined by a rear cover; for these references, the individual openings are each surrounded by the same transmissive material as the opening itself. EX1005, Fig. 5 (dashed lines within cover 23); EX1014 at [0059] ("one or more of infrared sensors 14, 16, and/or 18 may be embedded directly into the material of window 103.").

241. Thus, a POSITA would have understood, either from Kotanagi alone or from Kotanagi and Kateraas, the limitations of Claim 14.

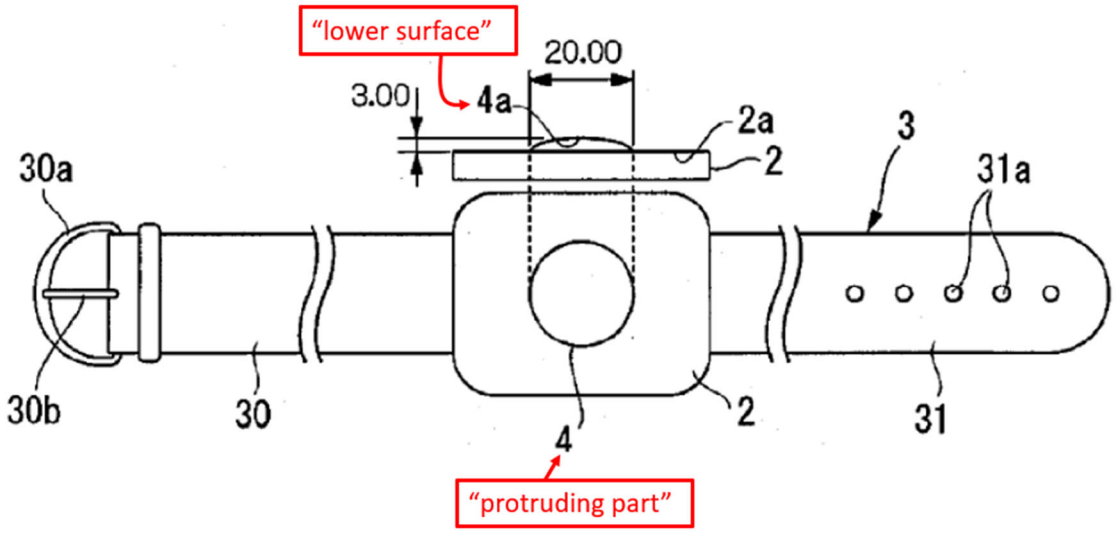
242. Based on the above, Claim 14 would have been obvious in view of Kotanagi and Honda. Alternatively, Claim 14 would have been obvious in view of Kotanagi and Honda, combined with Kateraas.

D. Ground 4: Claims 12–13 and 17–18 are unpatentable because they would have been obvious in view of Kotanagi, Honda, and Jabori and optionally in further combination with Park.

1. Dependent Claim 12

243. Claim 12 depends from Claim 9 and adds "**the cover is a disk having a convex shape that protrudes away from the housing; and the convex shape is configured to facilitate alignment with a concave surface of an external inductive power transmitter dock**." Claim 9 recites that the cover is "disposed over the biosensor module" and passes optical signals.

244. Kotanagi's Figure 10 shows a disk-shaped protruding part with a convex shape that protrudes away from the housing: "Further, a curved surface may be formed from the center toward the outer edge of the lower surface 4a of the protruding part 4, as illustrated in FIG. 10." EX1005 at ¶80.

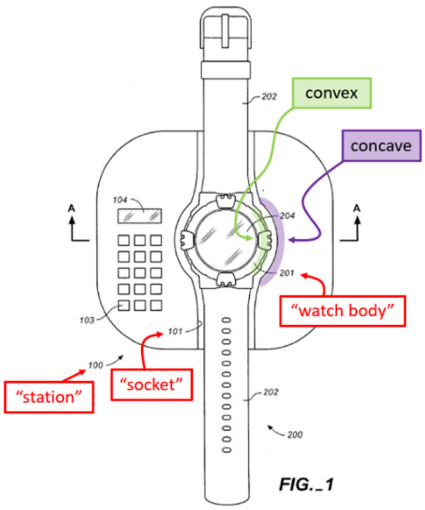


See Id., Fig. 10.

Kotanagi elsewhere includes a cover glass within a "protruding part 4." EX1005 at ¶55. A POSITA would have understood from Kotanagi's Figure 10 that the entire protruding part can form a convex "cover glass" that spans the through-hole 22. *Id.*, Fig. 10. As noted above, Kotanagi also teaches wireless charging, or charging "in a contactless state" (EX1005 at ¶53). This would have motivated a POSITA to look to Honda for modifications to make for such wireless charging.

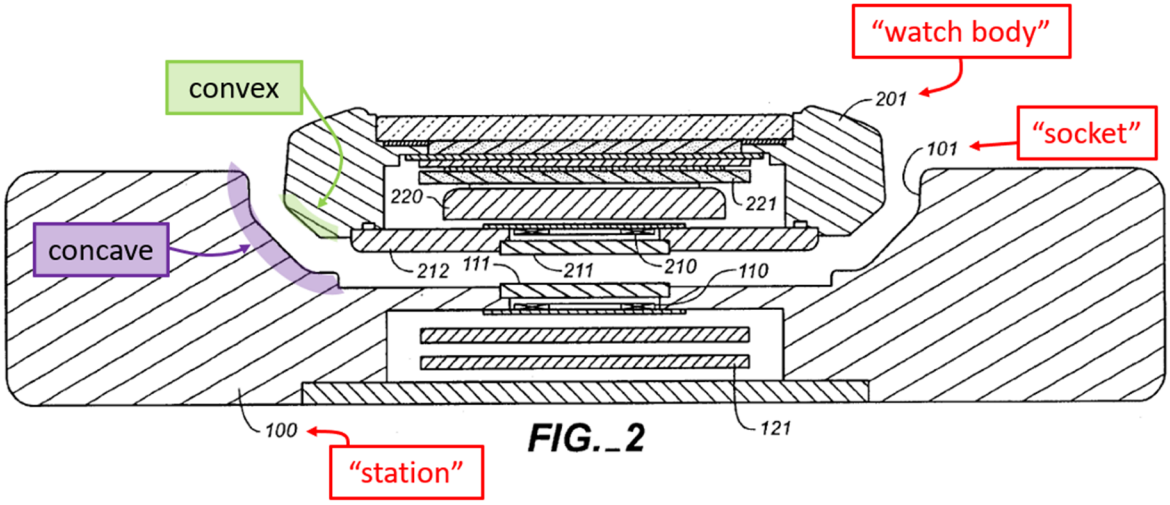
245. Honda teaches an external inductive power transmitter dock which it terms a "station." EX1006 *passim*. Honda also teaches using complementary shapes (including convex and concave shapes) to facilitate alignment for charging. EX1006, Figs. 1, 2. Thus, a POSITA would have known from Honda to accommodate Kotanagi's convex protrusion in a slightly modified version of Honda's wireless charging station. This modification would have been relatively simple, since Honda's station already demonstrates the concept of using concave surfaces to accommodate convex surfaces of a device to be charged. Honda explains how socket shape can be "slightly larger" to assist with alignment for charging:

> FIG. 1 is a plan view showing the construction of the station and the electronic watch according to this embodiment. As shown, an electronic watch 200 is seated in a socket 101 of a station 100 when a charging operation or a data transmission operation is performed. Since the socket 101 is shaped to be slightly larger than a body 201 of and a band 202 of the electronic watch 200, the watch body 201 is seated in alignment in the station 100.

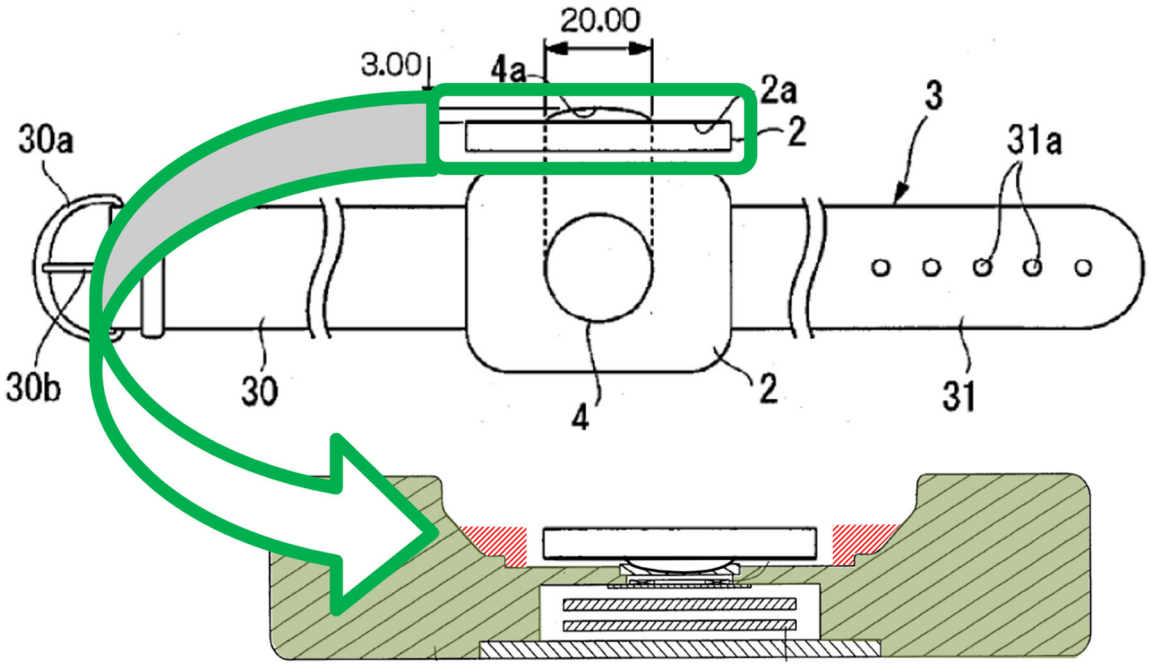


See EX1006, Fig. 1; col. 6:4–11.

Similar to the complementary concavity shown above, Honda's cross section view also shows complementary convex and concave surfaces:



See id., Fig. 2. A POSITA would have understood from these teachings that the Kotanagi embodiment having a convex protruding cover should be provided a complementary concavity in the charging station, so the socket can be "shaped to be slightly larger than" the device being charged. EX1006 at col. 6:9. This is illustrated below:



See EX1005, Fig, Fig. 10; EX1006, Fig, Fig. 2 (annotation of Kotanagi's watch in Honda's station).

246. A POSITA would have readily made these modifications based on the teachings of Kotanagi and Honda. For example, a POSITA would have known from Honda to maintain a distance between transmitter-side and receiver-side coils of approximately 3 to 5 mm (or less) (see Honda's discussion of Fig. 14 showing transmission efficiency as a function of distance—EX1006 at col. 13:3–32), and therefore provided a concavity for the convex protrustion if the receive-side coil is located behind it.

247. Further, **Jabori** teaches in a similar context that convex / concave shapes promote alignment for wireless power transmission:

FIG. 4-5 are a computing device and wireless power transmitter according to example implementation. In some examples the enclosure 105 and a docking station 405 may have a **shape that promotes the alignment** caused by the haptic modules to align the wireless power transmitter 455 with the wireless power module 130. One example of such a shape is the computing device enclosure 105 has a **convex** shape and the docking station 405 includes **concave** shape.

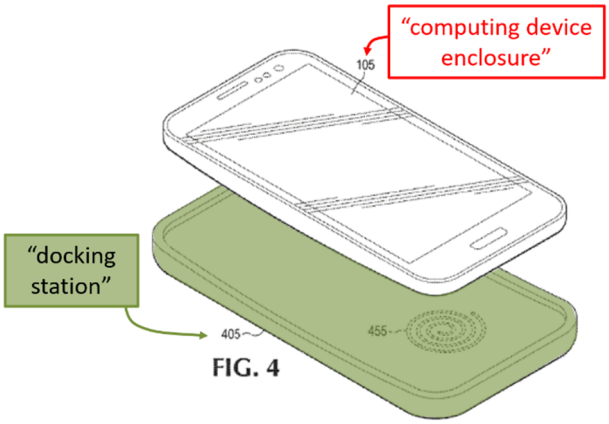
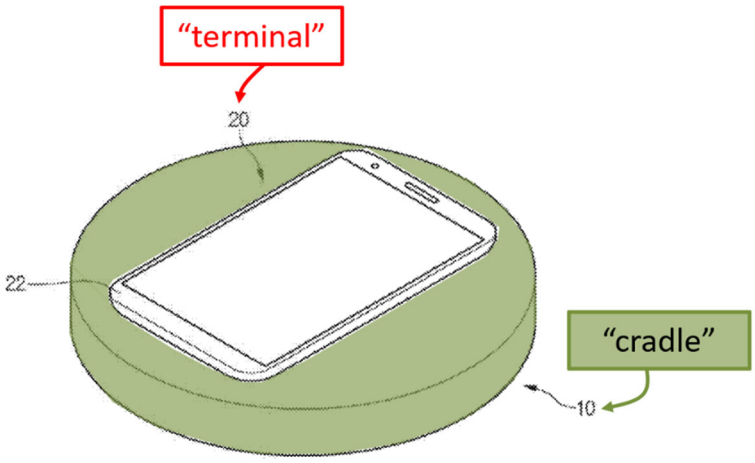


FIG. 4

EX1017 at [0017]; *see id*. Fig. 4; *see id*. at [0013].

248. Moreover, **Park** teaches that for wireless charging stations (where a cradle can hold and charge a wireless power receiving apparatus, or "terminal"), "At least a portion of the top of the cradle 10 may have the same shape as the back of the terminal 20." EX1012 at 22; EX1015 at 18.



See EX1012, Fig. 5; EX1015, Fig. 5.

249. A POSITA would consider this teaching to support the modifications illustrated above for alignment and charging when the device has a convex cover.

250. Based on the above, Claim 12 would have been obvious over Kotanagi, Honda, and Jabori. Alternatively, Claim 12 would have been obvious over Kotanagi, Honda, and Jabori, further combined with Park.

a. Motivation to Combine and Reasonable Expectation of Success

251. As discussed above with respect to Ground 1, a POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi and Honda and had a reasonable expectation in doing so. For example, they both teach wireless charging and biosensing of a pulse signal and are analogous art.

252. A POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi, Honda, Park, and Jabori as Honda teaches that alignment of the wireless charging coils is "required to be accurate" and that misalignment of the wireless charging coils reduces or modifies the magnetic flux of the wireless charging field. EX1006 at col. 1:53–59, Fig. 10.

253. A POSITA would have looked to Park and Jabori as they both teach methods for aligning wireless charging devices, and a POSITA would have found their teachings obviously substitutable with those found in Honda.

254. To add to this, I myself have participated in the design and construction of a watch that is seated in a matching dock or "cradle." EX1036 at col. 4:27–48. In approximately 1997 I participated in the invention of the watch and docking station below:

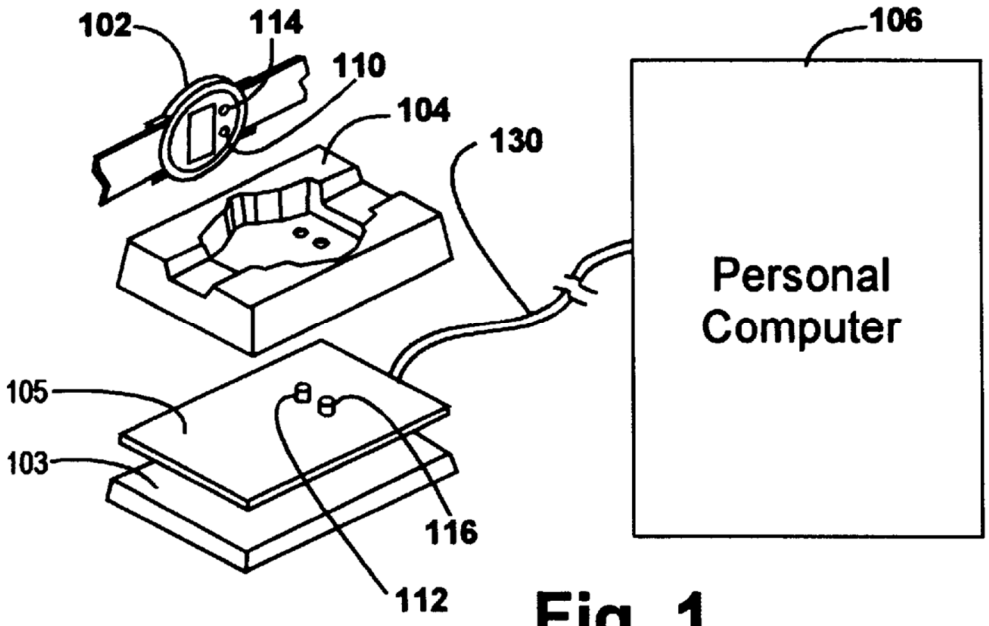


Fig. 1

EX1036, Fig. 1.

255. Using complimentary surfaces to facilitate the alignment of a watch in the dock or cradle was known in the art for many years prior to September 2014. Although my patent (EX1036) shown above does not incorporate a wireless charging coil, the watch in Fig. 1 requires alignment in order to facilitate data transfer between the watch and the cradle housing. For example, the patent states "The cradle housing 104 is preferably shaped configured to receive and align the

case of the watch 102 so that, when the watch 102 is placed in the shaped nest provided by 104, the watch IR emitter 110 is thereby aligned in close proximity with the cradle IR detector 112." EX1036 at col. 4:38–42. Thus, a POSITA would have known prior to 2014 that complimentary or convex shapes may be used to facilitate alignment in a dock or cradle, at least because such configurations were known in the art for many years prior to 2014.

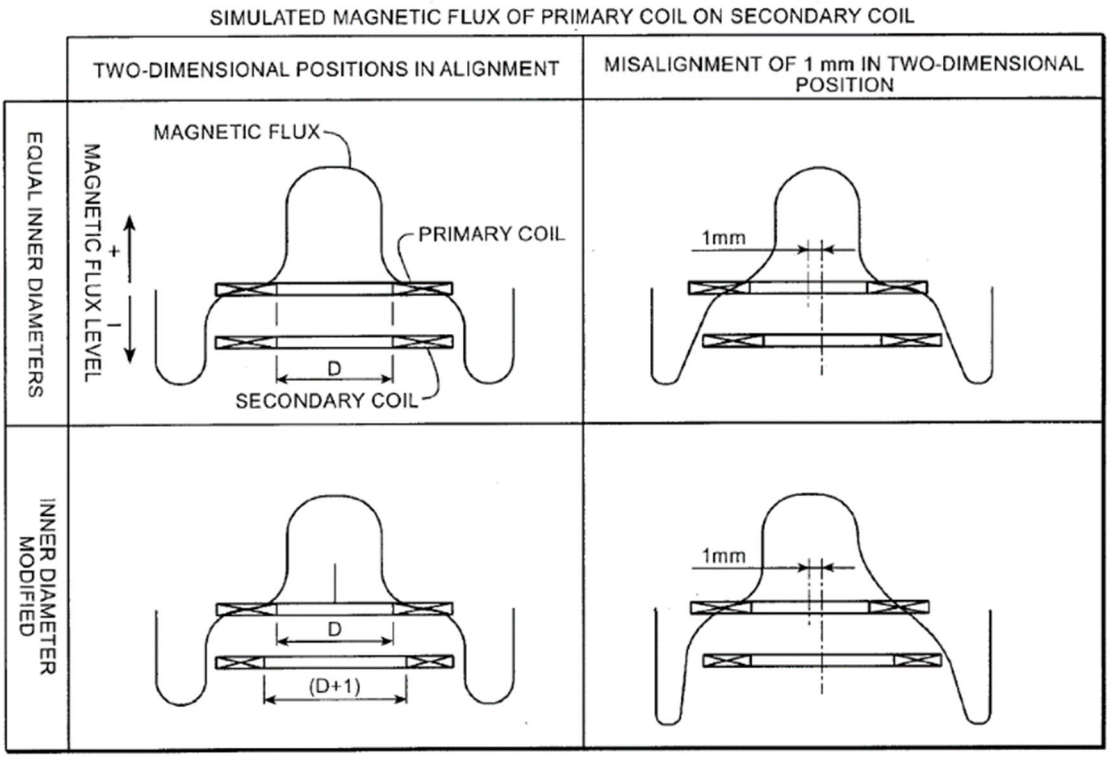
256. This motivation to combine also applies equally to the other claims rejected under Ground 4 and dependents from Claim 12. Further motivations to combine are provided throughout this Declaration.

2. Dependent Claim 13

257. Claim 13 depends from Claim 12 and adds "**the wearable electronic device is magnetically coupled to the external inductive power transmitter dock through the cover and the biosensor module**."

258. Kotanagi's teaching of a "transformer or the like for supplying power to a recharger and to the inside of the housing" to "recharge the battery in a contactless state" would have been understood by a POSITA to teach these limitations because transformers utilize coils and contactless charging is known to use electromagnetic induction. EX1005 at ¶53.

259. Honda explains that electromagnetic induction causes magnetic coupling between two coils as part of wireless charging:



Id., Fig. 10.

> A station-side coil 110 is arranged in the portion of the socket 101 of the station 100, facing the watch-side coil 210, and is covered with a cover glass 111 . . . When the electronic watch 200 is placed onto the station 100, the station-side coil 110 and the watch-side coil 210 are physically out of contact with each other, but **magnetically coupled** with each other because the surfaces of coil winding of both coils are generally in parallel to each other.

Id. at col. 6:28–40. Thus, if "magnetically couple" refers to the coupling that results from electromagnetic induction, Claim 13 is obvious in view of Kotanagi and Honda.

260. Alternatively, the claimed "magnetic coupling" may refer to a separate magnetic *alignment* feature, hinted in this passage from the '783 patent: "The device

may also include a first alignment magnet positioned within the receive coil and configured to align the device with respect to a second alignment magnet positioned within the external transmit coil." EX1001 at col. 5:37–40. This is likely not the intended meaning of the patent drafter, since the claim does not use a version of the term "align" and instead uses the term "magnetically coupled." EX1001 at cols. 58–60. Moreover, the claims do not recite secondary magnets for magnetic alignment that would be consistent with this construction, as the claims only refer to magnetic coupling in the context of inductive charging. *Id.*

261. Nevertheless, such magnetic alignment for wireless charging is known in the art. Honda explains both the necessity for, and difficulty of, exact alignment:

> In the conventional art, the surfaces of coil winding of the two coils are in parallel with their centers in alignment with each other when the portable electronic apparatus is placed into the station. Placing the two coils into alignment by simply seating the portable electronic apparatus into the Station is difficult because the positions of the coils attached in the station and the portable electronic apparatus are required to be accurate.

EX1006 at col. 1:48–56. Under this interpretation of "magnetic coupling," a POSITA would have been motivated by Honda to look to **Park**, which teaches using magnets to align devices in wireless charging stations:

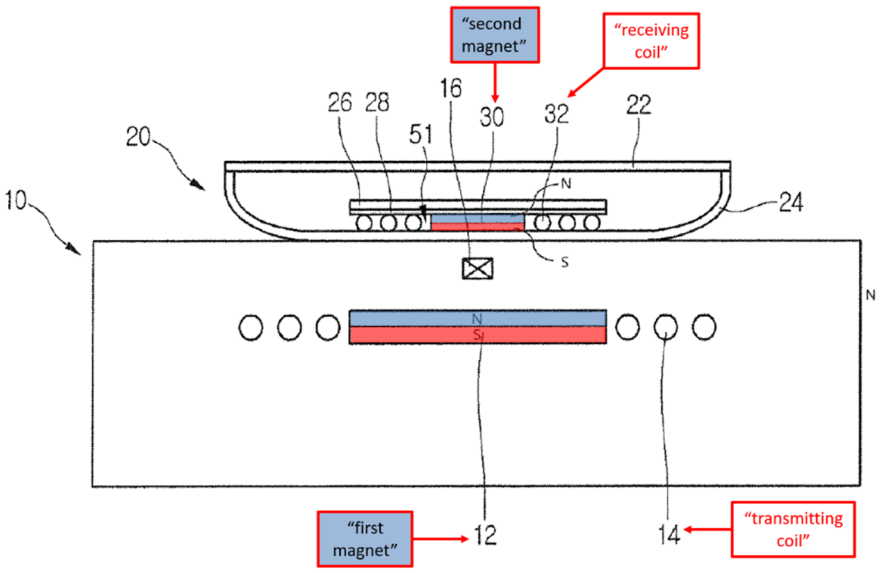


FIG. 14 is a view illustrating a polarity arrangement method of permanent magnets provided in a wireless power transmitting apparatus and a wireless power receiving apparatus . . . .

Permanent magnets having polarities (N pole and S pole) may be used as the magnets. . . .

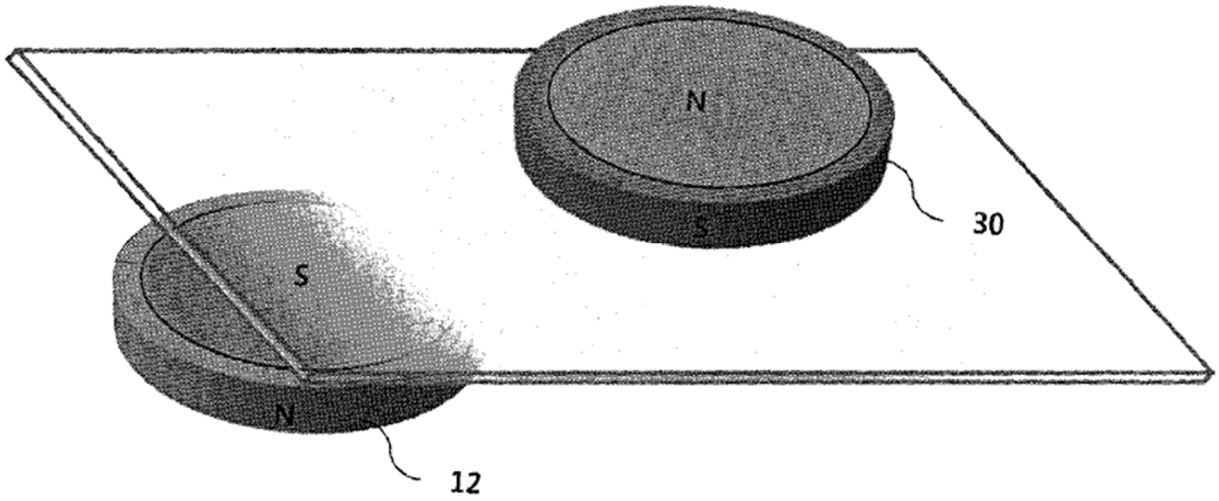
[P]olarity magnetized at the top of the first magnet 12 provided in the cradle 10 may be different from that magnetized at the bottom of the second magnet 30 of the terminal 20 facing the top of the first magnet 12. . . .

When the back cover 24 of the terminal 20 is placed on the top of the terminal 10, therefore, attractive force may be generated between the first magnet 12 and the second magnet 30.

EX1015 at 31, Fig. 14; EX1012 at col. 16:39–67, Fig. 14.

Park further explains alignment with reference to its Figure 16:

[A] user may incorrectly place the terminal on the cradle 10 . . . . [A]ttractive force may be generated between the first magnet 12 and the second magnet 30 . . . . The distance between the first magnet 12 and the second magnet 30 may be reduced due to the generated attractive force. . . . [W]ireless power transfer efficiency may be optimized due to the reduced distance between the first magnet 12 and the second magnet 30.



EX1015 at 34, Fig. 16; EX1012 at col. 18:9–25, Fig. 16.

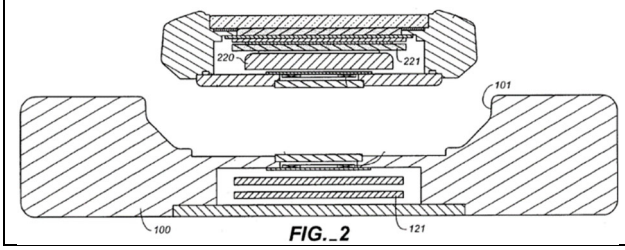
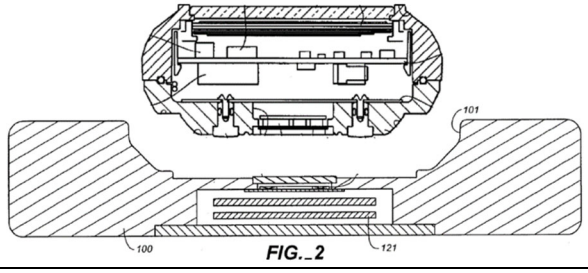
262. Based on the above, Claim 13 would have been obvious over Kotanagi and Honda. Alternatively, Claim 13 would have been obvious over Kotanagi and Honda, combined with Park.

3. Dependent Claim 17

263. Claim 17 depends from Claim 15 and adds "**the wireless charging receive coil is configured to receive power from an external inductive power transmitter dock; the electronic watch defines a convex contoured surface along the bottom portion; and the convex contoured surface is configured to facilitate alignment with a concave contoured surface of the external inductive power transmitter dock**."

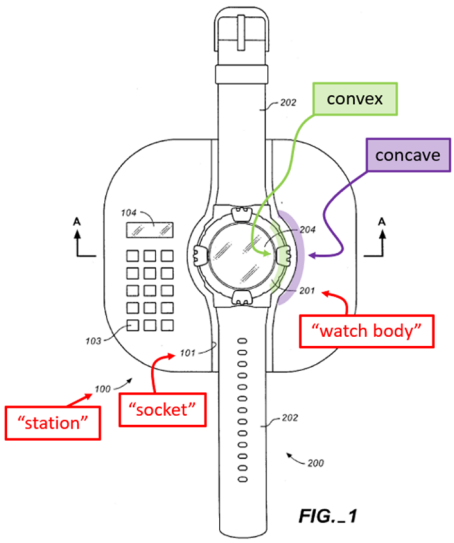
264. A POSITA would have known at the time of the '783 Patent's invention that Kotanagi's recharging in a "contactless state" (EX1005 at ¶53) involves a

wireless charging receive coil that receives power from an external inductive power transmitter dock. This would have suggested modifying Kotanagi to include Honda's coil (see Claim 9 and Claim 15 above). Consistent with Honda's teaching to align by seating a watch in a station "socket" (EX1006 at col. 6:7), a POSITA would also have readily used Honda's charging station (or something similar), with Kotanagi's watch, as shown in the figures below.

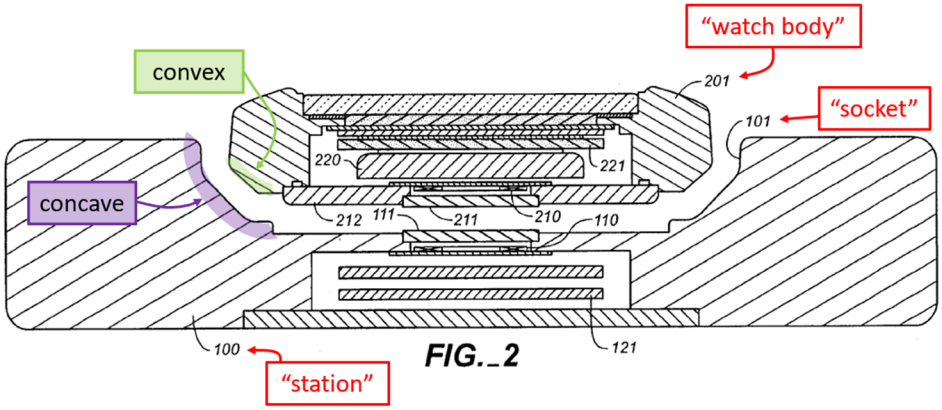
Honda's watch, with Honda's station (see EX1006 at 3):	Kotanagi's watch, with Honda's station (see EX1006 at 3, EX1005 at 27):
	

After addressing any potential scale differences, a POSITA would have readily combined Kotanagi and Honda at least because the figures suggest complementary shapes. Thus, Honda and Kotanagi teach a charging dock and facilitating alignment as claimed.

265. As shown above for Claim 12, Honda's charging station (EX1006, Figs. 1,2) has "concave contoured" surfaces and uses these complementary shapes for charging alignment. Example concave or near-concave surfaces in Honda's wireless charging station are shown here, where Honda's watch body is correspondingly convex or near-convex.



EX1006, Fig. 1.



EX1006, Fig. 2.

266. Figure 2 shows two different convex or near-convex contoured surfaces "along the bottom portion" of Honda's watch, one to the right, and one to the left. Although Honda's watch has a central flattened portion between these two sides, the complementary shapes and rounded edges in these figures would have suggested to a POSITA that a concave charging socket can be used to align a convex device.

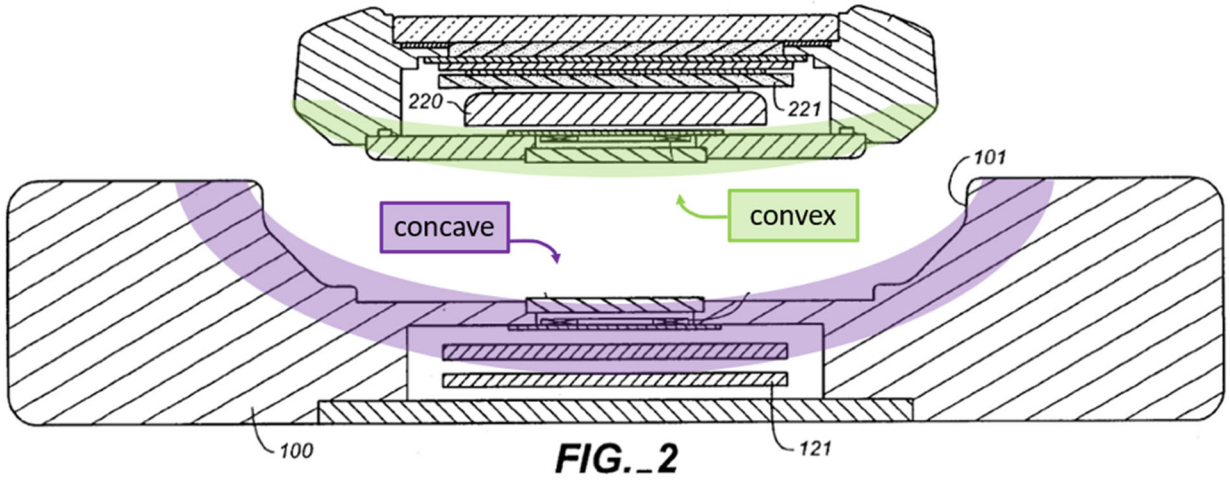
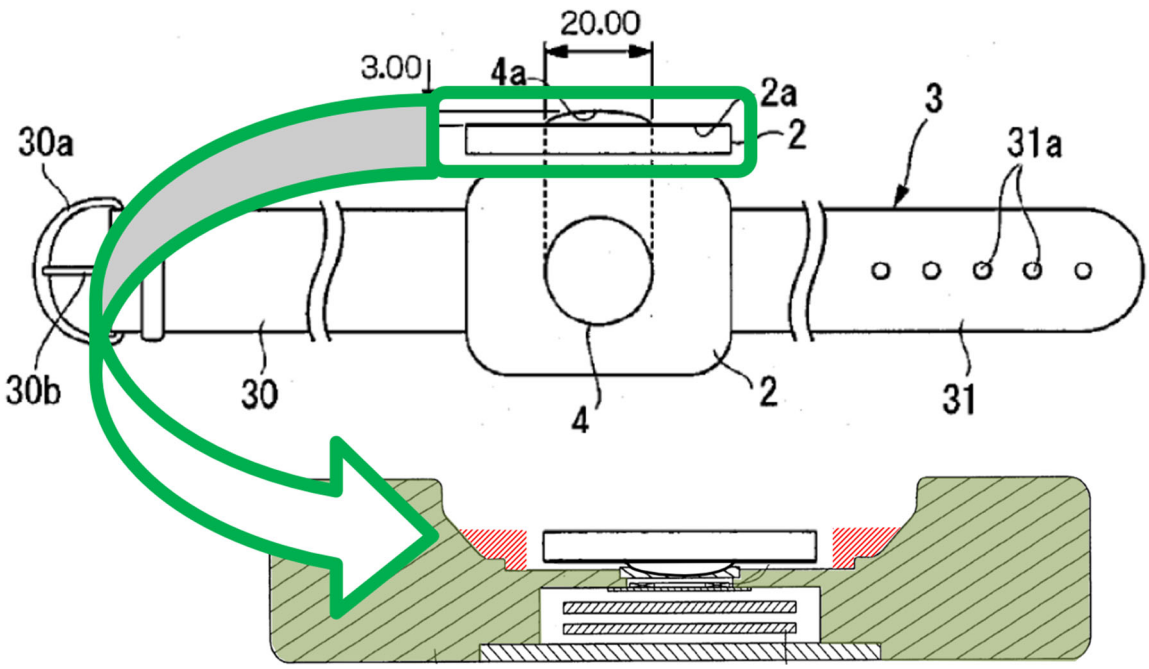


FIG._2

See id.

267. Kotanagi's Figure 10 teaches an electronic watch that defines a convex contoured surface along the bottom portion, (EX1005 at ¶80) and consistent with the above discussion of Claim 12, a POSITA would have understood to use the Kotanagi watch's convex contoured surface "to facilitate alignment with a concave contoured surface of the external inductive power transmitter dock," as claimed, at least based on Honda's statement that the socket can be "shaped to be slightly larger than" the device being charged. *Id*. at col. 6:9.



See EX1005, Fig. 10; EX1006, Fig. 2 (annotation of Kotanagi's watch in Honda's station).

268. A POSITA would have readily made these modifications based on the teachings of Kotanagi and Honda. For example, a POSITA would have known from Honda to maintain a distance between transmitter-side and receiver-side coils of approximately 3 to 5 mm (or less) (see Honda's discussion of Fig. 14 showing transmission efficiency plotted against distance—EX1006 at col. 13:3–13), and therefore provided a concavity for the convex protrustion where the receive-side coil is located behind it.

269. Further, **Jabori** teaches shapes for wireless power transmission that promote alignment, describing a device with a "convex shape" and a docking station

with a "concave shape." *See* EX1017 at [0017]. From this, a POSITA would have understood to further modify the combination of Kotanagi and Honda as claimed.

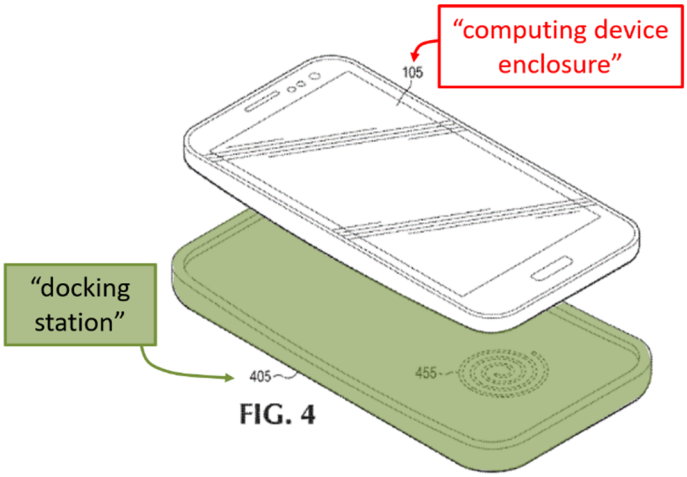


FIG. 4

EX1017, Fig. 4.

270. This is further supported by **Park**, which teaches facilitating alignment with a cradle that "may have the same shape" as the device being charged. EX1012 at [0102]; EX1015 at 18.

271. Based on the above, Claim 17 would have been obvious in view of Kotanagi, Honda, and Jabori. Alternatively, Claim 17 would have been obvious in view of Kotanagi, Honda and Jabori, combined with or in view of Park.

4. Dependent Claim 18

272. Claim 18 depends from Claim 17 and adds "**wherein the convex contoured surface is configured to protrude toward a portion of skin of the user when the electronic watch is worn.**"

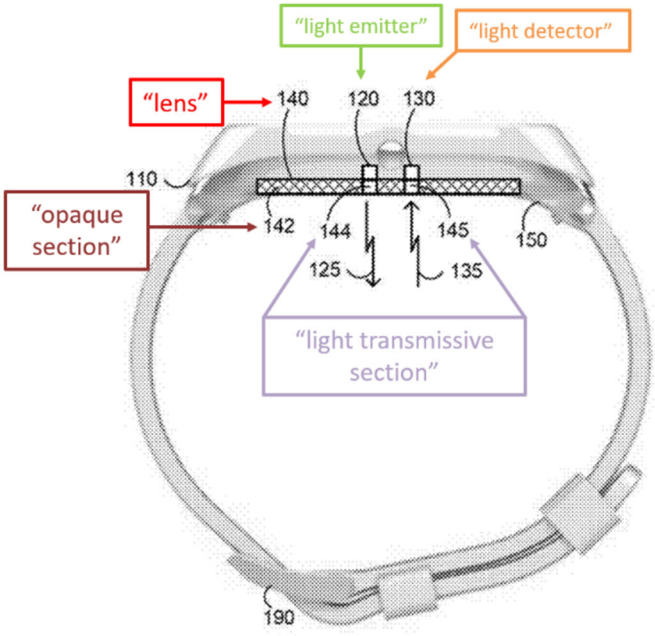
273. As discussed with respect to Claims 12 and 17, Kotanagi, Honda, and Jabori teach convex surfaces. See supra § XI(D)(1) and § XI(D)(3). Kotanagi's "protruding part 4" (e.g., Fig. 10, EX1005, Fig. 10) protrudes toward a user's skin. When mounted to a wrist, the protrusion "facilitates contact between the living body surface and the lower surface of the protruding part." *Id*. at ¶9. Likewise, Honda's watch is configured to be "fastened to a wrist of a user" to "detect biological information." EX1006 at col. 6:15–20. Accordingly, Kotanagi alone, or as modified by Honda, teaches these limitations and Claim 18 would have been obvious over Kotanagi and Honda. Alternatively, Claim 18 would have been obvious over Kotanagi, Honda, and Jabori combined with Park.

E. Ground 5: Claims 3 and 14 are unpatentable because they would have been obvious in view of Kotanagi, Honda, and Fraser and optionally in further combination with Kateraas.

1. Dependent Claim 3

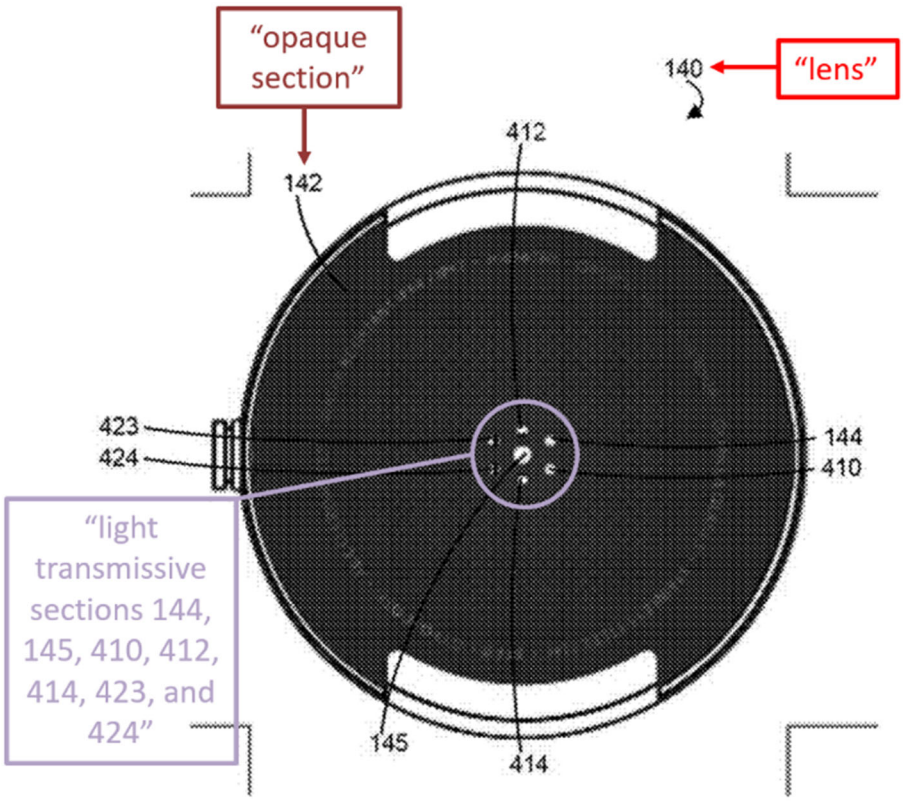
274. Claim 3 depends from Claim 1 and adds "**the ceramic cover defines a first opening to transmit the light from the light source; and the ceramic cover defines a second opening to receive the light reflected from the region of skin**."

275. The analysis of Ground 3, Claim 3 applies here, except Fraser is used to further teach cover openings for light transmission (emission and reception). Fraser teaches an array of "light transmissive sections 144, 410, 412, 414, 423, and 424 [that] can transmit light from the light emitters 120, 322, 324, 326 of FIG.3 and other light emitters." EX1041 at [0027]. In the figure below, arrow 125 shows light emission throught the light transmissive section 144:



EX1041 at 2.

276. Fraser also teaches a light transmissive section (145) that is a transmissive opening for the detector: "The light transmissive section 145 can transmit light reflected from a user to the light detector 130 of FIG. 3." EX1041 at [0018]. In the figure above, light transmitted through light transmissive section 145 is shown as arrow 135. A plan view of light transmissive sections taught by Fraser is shown below:



EX1041 at 5.

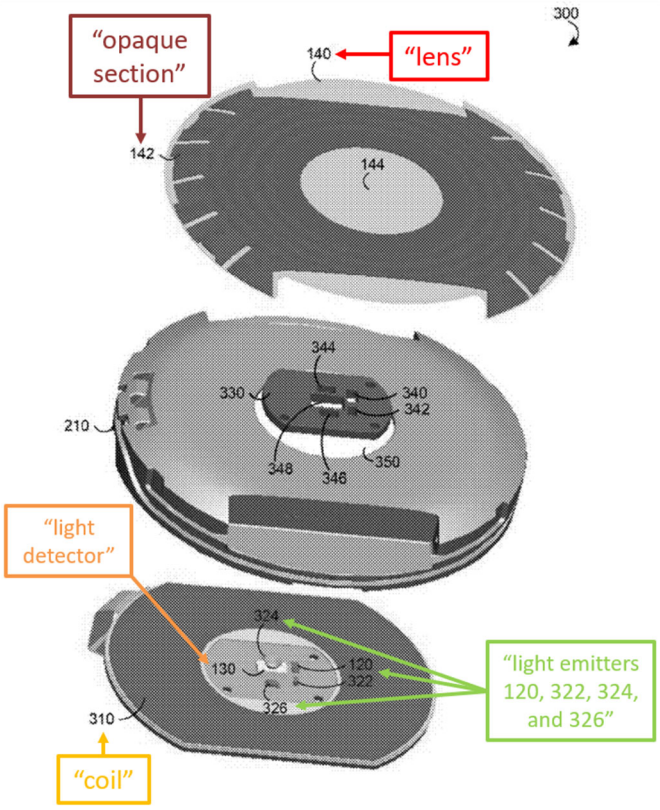
277. Fraser teaches that the lens may be transparent and have a "screen printed layer, a spray painted layer, or other opaque layer." *Id.* at [0018]. In an

alternative embodiment the "[t]he lens 140 can also provide the opaque section 142 by being opaque and the transmissive sections 144 and 145 can be etched, molded, drilled, laser cut, or otherwise formed to provide transmissive sections 144 and 145 in the lens 140." *Id.* at [0018].

278. Thus, Fraser teaches a second window to receive light (light transmissive section 145) and a first window to transmit light (the light transmissive sections surrounding 145). These transmissive sections may be embedded in a single lens or cover that defines these windows as Fraser teaches that the "lens 140 can have an opaque layer 142 including the light transmissive sections 144 and 145. The lens 140 can also be an opaque lens including the light transmissive sections 144 and 145 as **apertures** in the lens." EX1041 at [0018] (emphasis added).

279. **Motivation to Combine**

280. It would have been obvious to combine Kotanagi and Fraser for various reasons. For example, both teach optical biosensing and contactless/wireless charging, and they are analogous art. EX1005 at ¶53, EX1041 at [0026]. Fraser's light emitters are surrounded by a wireless charging coil, as shown below:



EX1041 at 4.

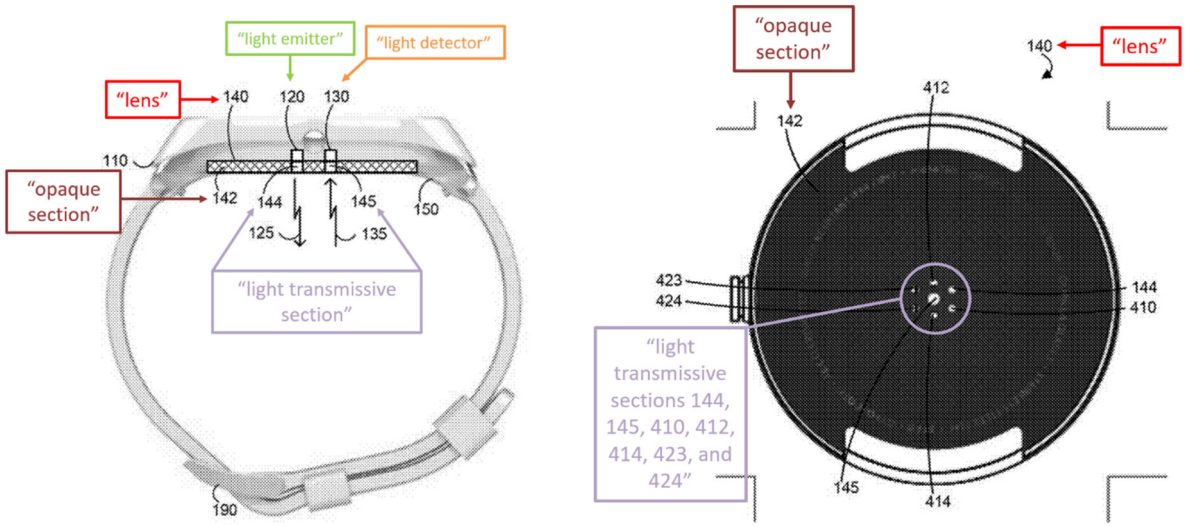
281. Moreover, Fraser teaches that a watch may employ "light transmissive sections to focus emitted and received light." EX1041 at [0029]. Because Kotanagi's watch is intended to emit and receive light, a POSITA would have looked to Fraser for how to focus or guide the light and would have modified Kotanagi's structure with a reasonable expectation of success. This motivation also applies to Claim 14, below.

2. Dependent Claim 14

282. Claim 14 depends from Claim 9 and adds "**the biosensor module includes an array of optical components; and the cover includes an array of**

windows, each window aligned with a corresponding optical component of the array of optical components."

283. The analysis of Ground 3, Claim 14 applies here, except Fraser is used instead of Kateraas to teach an array of windows aligned with an array of optical components. In the same field of endeavor as Kotanagi, Fraser teaches an array of "light transmissive sections 144, 410, 412, 414, 423, and 424 [that] can transmit light from the light emitters 120, 322, 324, 326 of FIG.3 and other light emitters." EX1041 at [0027]. Fraser's array of light transmissive sections aligned with respective optical components are depicted in the figures below:



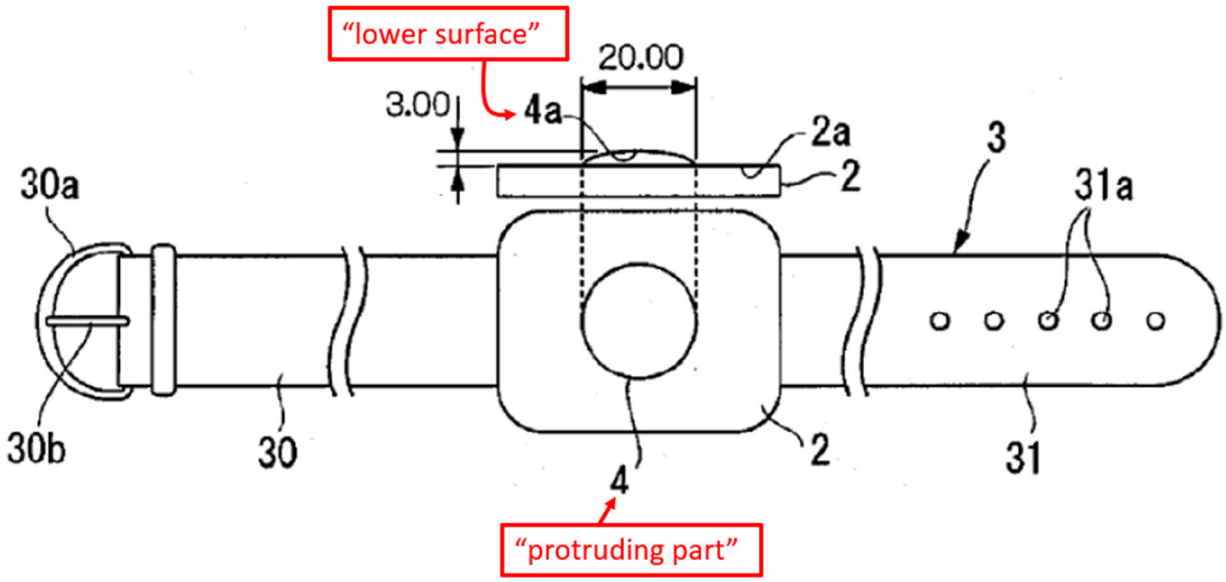
EX1041 at 2, 5.

F. Ground 6: Claim 8 is unpatentable because it would have been obvious in view of Kotanagi, Honda, and Jabori and optionally in further combination with Kateraas and/or Park.

1. Dependent Claim 8

284. Claim 8 depends from Claim 1 and adds "**wherein: the ceramic cover has a convex contoured shape that protrudes toward the user; and the convex contoured shape facilitates alignment between the ceramic cover and a mating surface of the external wireless charging device**."

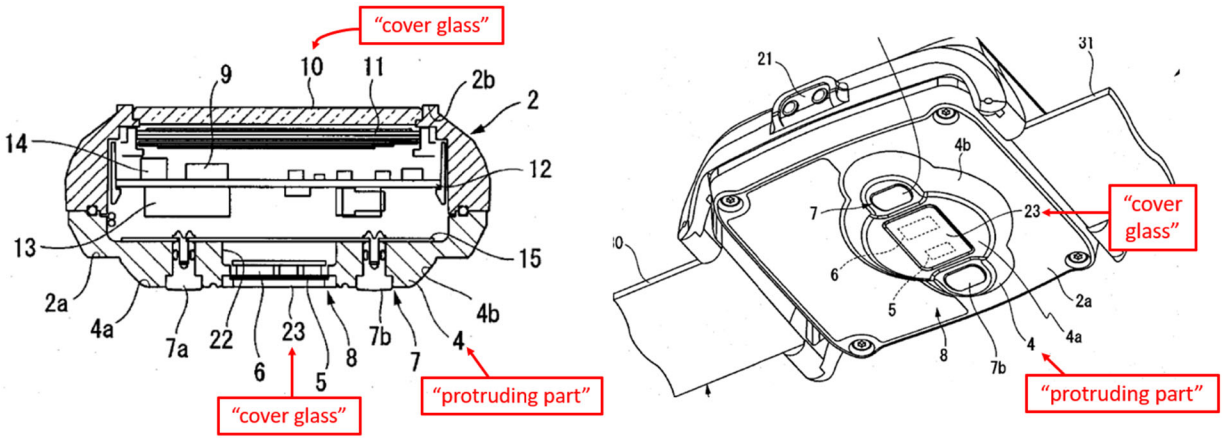
285. Kotanagi's Figure 10 shows a protruding part with a convex contoured shape that protrudes toward the user: "Further, a curved surface may be formed from the center toward the outer edge of the lower surface 4a of the protruding part 4, as illustrated in FIG. 10." EX1006 at ¶80.



EX1005, Fig. 10.

Kotanagi does not specify many details of this protruding part. However,

Kotanagi elsewhere includes a cover glass within a "protruding part 4":



EX1005, Figs. 5, 7 . As shown above with respect to Figure 10, Kotanagi also shows that a "cover glass" can span the entire top opening of its housing.

A POSITA would have understood from these teachings that Kotanagi's lower cover glass could likewise span an entire opening, such that the "protruding part 4" of Figure 10 could be a "cover glass."

286. The '783 patent explains that "In the field of wearable devices, the cover 609 may also be referred to generically as a crystal or cover glass, regardless of the material that is used to form the cover 609." EX1001 at col. 21:56–59. Although this statement is made in the context of the "cover 609," it explains that "cover glass" is a term of art. *Id.* Kotanagi uses this term of art to refer to the "cover glass 23." EX1005 at ¶55. Accordingly, a POSITA would have understood the Kotanagi "cover glass 23" to not be limited to only glass. Similarly, the protruding

part 4 of Figure 10 could be formed from other transparent materials, such as discussed with respect to Kateraas above.

287. As noted above, Kotanagi also teaches wireless charging, or charging "in a contactless state." EX1005 at ¶53.

288. Honda also teaches using complementary shapes (including convex and concave shapes) to facilitate alignment for charging. Honda's wireless charging station has multiple concave surfaces (e.g., to the left and right when viewed from above, and to the left and right when viewed in cross-section) where Honda's watch body is correspondingly convex. EX1006, Figs. 1, 2, 16a, 16b. Honda explains how this helps align the device for charging:

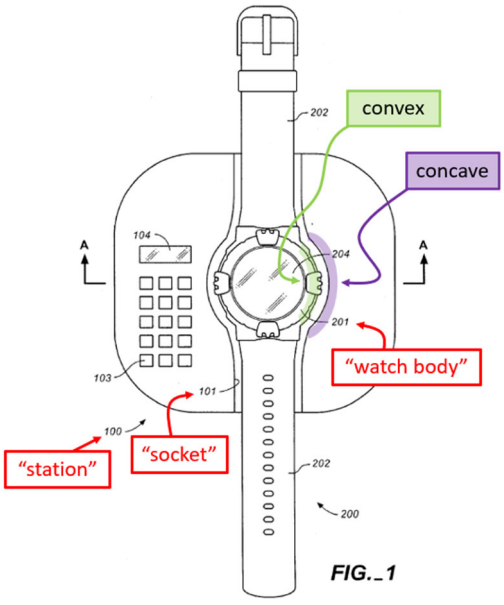


FIG. 1 is a plan view showing the construction of the station and the electronic watch according to this embodiment. As shown, an

> electronic watch 200 is seated in a socket 101 of a station 100 when a charging operation or a data transmission operation is performed. Since the socket 101 is shaped to be slightly larger than a body 201 of and a band 202 of the electronic watch 200, the watch body 201 is seated in alignment in the station 100.

EX1006, Fig. 1, col. 6:4–11.

289. Similarly, the bottom of Honda's watch has a generally convex profile, mating with a generally concave profile of the station. As seen in the cross-section view below, the side portions of the watch body that are convex when viewed from above (Figure 1), are also convex when viewed from the side (Figure 2):

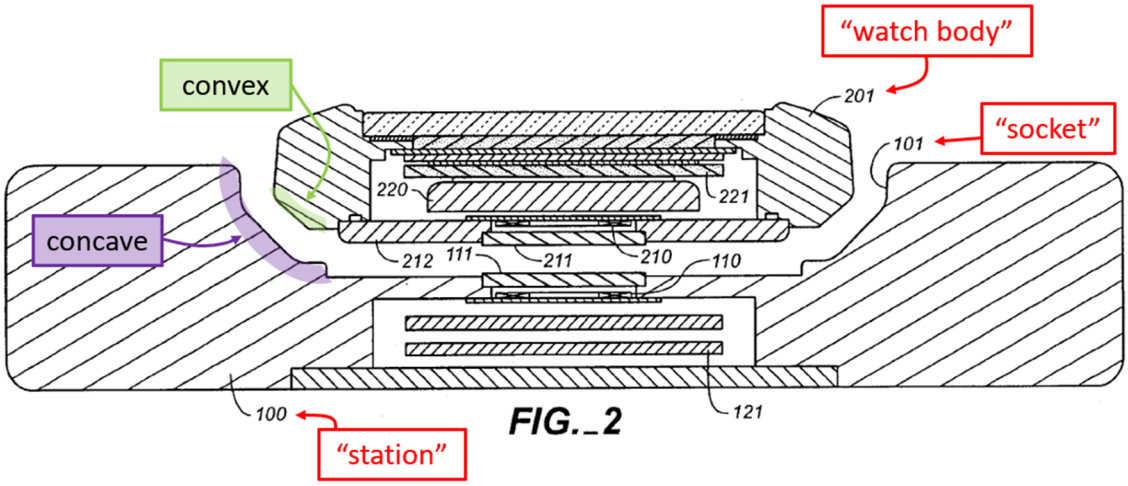


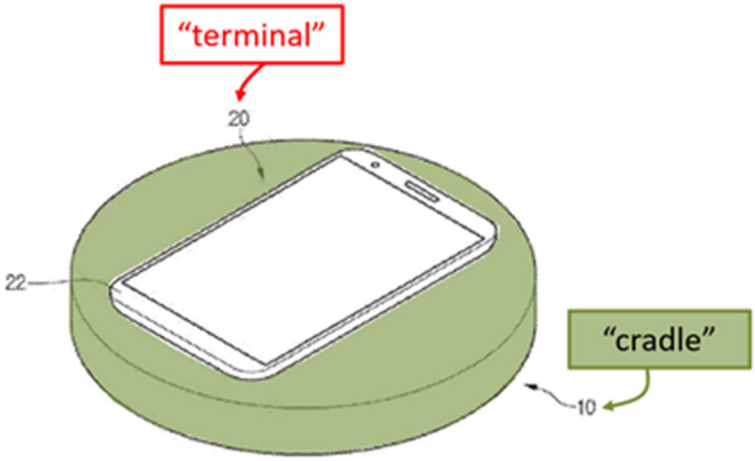
FIG._2

Id., Fig. 2.

290. A POSITA would have understood from these teachings to use Kotanagi's convex "protruding part 4" to facilitate alignment by forming a correspondingly concave cradle portion in a charging station as taught by Honda.

291. Moreover, **Park** teaches that for wireless charging stations (where a cradle can hold and charge a wireless power receiving apparatus, or "terminal"),

"[t]he top of the cradle 10 may contact one surface of the terminal 20 in a surface contact manner. At least a portion of the top of the cradle 10 may have the same shape as the back of the terminal 20." EX1012 at 22; EX1015 at 18.



EX1012, Fig. 5; EX1015, Fig. 5. Although this does not explicitly mention a convex contoured shape, a POSITA would readily consider complementary convex and concave shapes based on this teaching of a "cradle."

292. Further, **Jabori** teaches in a similar context that convex / concave shapes promote alignment for wireless power transmission:

> FIG. 4-5 are a computing device and wireless power transmitter according to example implementation. In some examples the enclosure 105 and a docking station 405 may have a **shape that promotes the alignment** caused by the haptic modules to align the wireless power transmitter 455 with the wireless power module 130. One example of such a shape is the computing device enclosure 105 has a **convex** shape and the docking station 405 includes **concave** shape.

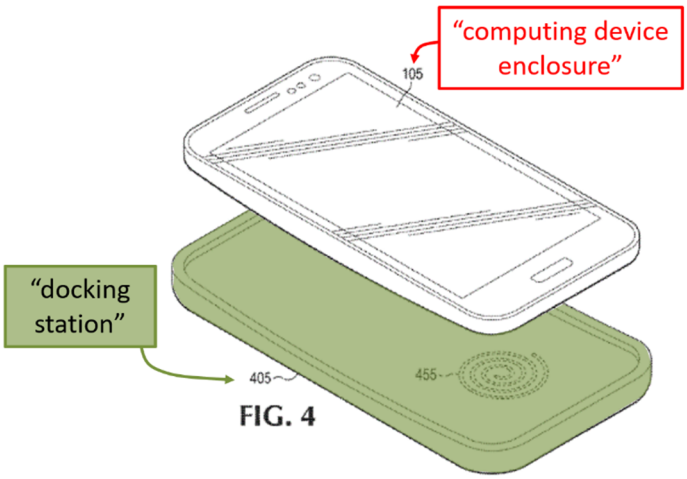


FIG. 4

EX1017 at [0017]; *see id*. Fig. 4; *see id*. at [0013].

293. Based on the above, Claim 8 would have been obvious in view of Kotanagi, Honda, and Jabori. Alternatively, Claim 8 would have been obvious in view of Kotanagi, Honda, and Jabori, combined with Kateraas and/or Park.

2. Motivation to Combine and Reasonable Expectation of Success

294. As discussed above with respect to Ground 1, a POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi and Honda. As discussed above with respect to Ground 2, a POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi, Honda and Park. As discussed above with respect to Ground 3, a POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi, Honda and Kateraas. As discussed above with respect to Ground 4, a

POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi, Honda, Jabori, and Park.

295. A POSITA would have been motivated before the effective filing date to combine the teachings of Kotanagi, Honda, Kateraas, Park, and Jabori as Kotanagi teaches "contactless charging" and Honda teaches that alignment of the wireless charging coils is "required to be accurate" and that misalignment of the wireless charging coils reduces or modifies the magnetic flux of the wireless charging field. EX1006 at col. 1:53–59, Fig. 10; EX1005 at ¶53.

296. A POSITA would have looked to Park and Jabori as they both teach methods for aligning wireless charging devices, and a POSITA would have found their teachings obviously substitutable with those found in Honda. A POSITA would have had a reasonable expectation of success in combining these references as complimentary and convex shapes enhance the alignment of wireless charging.

297. To add to this, I myself have participated in the design and construction of a watch that is seated in a matching dock or "cradle." EX1036 at col. 4:27–48. Using complimentary or matching surfaces to facilitate the alignment of a watch in the dock or cradle was known in the art for many years prior to September 2014 as discussed above with respect to Ground 4, Claim 12.

G. Condensed Summary of Opinions

298. A summary of my opinions of the grounds of obviousness is provided below:

Ground	Claim(s)	Prior Art Combination	Optional Combination Prior art
1	9–11, 15, 19, and 20	Kotanagi and Honda	
2	16	Kotanagi and Honda	Park
3	1–7 and 14	Kotanagi and Honda	Kateraas
4	12–13 and 17–18	Kotanagi, Honda, and Jabori	Park
5	3 and 14	Kotanagi, Honda, and Fraser	Kateraas
6	8	Kotanagi, Honda, and Jabori	Kateraas and/or Park

H. Objective Indicia of Nonobviousness Supports the Validity of the Challenged Claims.

299. As explained in Section 0I, below, lack of objective evidence of nonobviousness further supports my opinion that the challenged claims would have been obvious to a POSITA.

XII. LACK OF OBJECTIVE INDICIA OF NONOBVIOUSNESS SUPPORTS INVALIDITY OF THE CHALLENGED CLAIMS

300. I understand that "secondary considerations" should be considered but do not control an obviousness conclusion, particularly where, as here, a strong *prima facie* showing of obviousness exists. I am not aware that the patent owner has provided any evidence of secondary considerations, and any such evidence would likely not outweigh the strong *prima facie* case of obviousness outlined in this declaration. Of course, if any such evidence is brought to my attention I am able to analyze and weigh it, along with the other evidence. I understand that Petitioner is reserving the right to respond to any evidence of secondary considerations.

XIII. CONCLUSION

301. For these reasons, it is my opinion that each of Claims 1–20 of the '783 Patent would have been obvious to a POSITA at the relevant time in September 2014.

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