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. 10,942,491

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: 3/17/2023

R. James Duckworth, Ph.D

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1. Independent Claim 7 71

a. [7a] "A wearable electronic device comprising:" 71

b. [7b] "a housing formed from a conductive material and defining a first opening opposite to a second opening;" 72

c. [7c] "a band attached to the housing and configured to secure the wearable electronic device to a user;" 74

d. [7d] "a display positioned in the first opening;" 75

e. [7e] "a cover comprising a non-conductive material and positioned over the second opening, the cover forming a portion of an

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exterior surface of the wearable electronic device" 75

f. [7f] "a biosensor module positioned below the cover configured to pass an optical signal through a window defined within the non-conductive material of the cover; and" 77

g. [7g] "a wireless charging receive coil aligned with the second opening and below the cover, the wireless charging receive coil configured to inductively couple to an external wireless charging device through the non-conductive material of the cover." 79

h. Motivation to Combine Kotanagi and Honda 86

2. Dependent Claim 11 88

3. Independent Claim 14 90

a. [14a] "An electronic device comprising: a housing defining a first opening and a second opening;" 90

b. [14b] "a display positioned at least partially within the first opening;" 92

c. [14c] "a biosensor module aligned with the second opening;" 93

d. [14d] "a wireless charging receive coil positioned within the housing and aligned with the second opening;" 93

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e. [14e] "a battery operably coupled to the wireless charging receive coil; and" 96

f. [14f] "a cover formed from an optically transparent material and disposed over the biosensor module and the wireless charging receive coil, wherein:" 97

g. [14g] "the electronic device is configured to receive wireless power through the optically transparent material of the cover using the wireless charging receive coil; and" 100

h. [14h] "the electronic device is configured to measure a heart rate of a user through the optically transparent material of the cover using the biosensor module." 105

i. Motivation to Combine Kotanagi and Honda 105

4. Dependent Claim 16 107

a. "wherein: the biosensor module comprises: a light source; and a detector;" 107

b. "the light source and the detector are configured to measure changes in light absorption by a region of skin of the user;" 107

c. "the electronic device is configured to compute the heart rate using the measured changes in light absorption; and" 108

d. "the display is configured to display information associated with the heart rate." 109

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B. Ground 2: Claims 1-3, 5, 13, and 17 are unpatentable because they would have been obvious over Kotanagi, Honda, and Choi. 113

1. Independent Claim 1 113

a. [1a] "An electronic watch comprising:" 113

b. [1b] "a housing formed from a metal material and defining a rear opening along a rear portion of the housing;" 114

c. [1c] "a touch-sensitive display positioned at least partially within the housing;" 115

d. [1d] "a band coupled to the housing and configured to couple the electronic watch to a user;" 116

e. [1e] "a cover formed from a dielectric material and forming a seal along the rear opening of the housing;" 117

f. [1f] "an optical sensor positioned within the housing and configured to transmit an optical signal through the dielectric material of the cover;" 119

g. [1g] "a charging coil positioned within the housing and configured to receive wireless power through the dielectric material of the cover;" 120

h. [1h] "a first electrode positioned along a rear surface of the electronic watch; and a second

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electrode positioned along the rear surface of the electronic watch, wherein:" 123

i. [1i] "the electronic watch is configured to measure a heart rate using the optical sensor, and" 123

j. [1j] "the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode." 124

k. Motivation to Combine Kotanagi, Honda, and Choi 126

2. Dependent Claim 2 130

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1. Dependent Claim 4 157

a. Motivation to Combine Kotanagi, Honda, Choi, and Park 158

G. Ground 7: Claims 10 and 19 are unpatentable because they would have been obvious over Kotanagi, Honda, and Jabori. 158

1. Dependent Claim 10 158

a. Motivation to Combine Kotanagi, Honda, and Jabori. 164

2. Dependent Claim 19 166

H. Ground 8: Claim 6 is unpatentable because it would have been obvious over Kotanagi, Honda, Choi, and Jabori. 166

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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 Owner Masimo Corporation ("Masimo"). I am making this declaration at the request of Masimo in the matters of *Inter Partes* for claims 1–19 of U.S. Patent No. 10,942,491 ("the '491 Patent"). I understand that Apple has asserted the '491 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 Exhibit 1003.

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 '491 Patent. In conducting the analyses and forming the opinions set forth in this Declaration, I have reviewed and considered the '491 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 ’491 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, Choi, Orr, Fraser, 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. 10,942,491 (’491 Patent)
1002	File History of the ’491 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”)
1011	PCT Publication No. WO 2015/034149 Al (“Choi PCT”)
1012	U.S. Publication No. US 2015/0214749 A1 (“Park”)

Exhibit No.	Description
1013	Reserved
1014	U.S. Publication No. 20120221254 A1 ("Kateraas")
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")
1018–1019	Reserved
1020	PCT Patent Pub. WO 2015150199 A1 ("Coppola PCT")
1021	Reserved
1022	U.S. Patent No. 4,129,124 ("Thalmann")
1023	Korean Patent Application No: 10-2013-0107833 ("Choi")
1024	Reserved
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")
1032	Reserved

Exhibit No.	Description
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)
1039	Y. Mendelson, "Wearable Wireless Pulse Oximetry for Physiological Monitoring," PPL Workshop (2008).
1040	Reserved
1041	U.S. Publication No. 20150355604 A1 ("Fraser")
1042–1046	Reserved
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 earliest alleged priority date 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 '491 Patent and the materials discussed herein.

III. EXPERIENCE AND QUALIFICATIONS

6. 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.

7. 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.

8. 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.

9. 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.

10. For over 30 years, I developed and taught courses at WPI relevant to the technology disclosed in the '491 Patent. The classes I developed and taught included associated laboratory exercises and projects, which I also developed. As reflected in my curriculum vitae (Exhibit 2003), 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

'491 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.

11. 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.

12. 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.

13. 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 Exhibit 1036. This wearable electronic device had some similar functionality to the consumer product described in the '491 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, 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 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. Citations to documents having square brackets "[]" for paragraph numbering use brackets instead of paragraph symbols "¶".

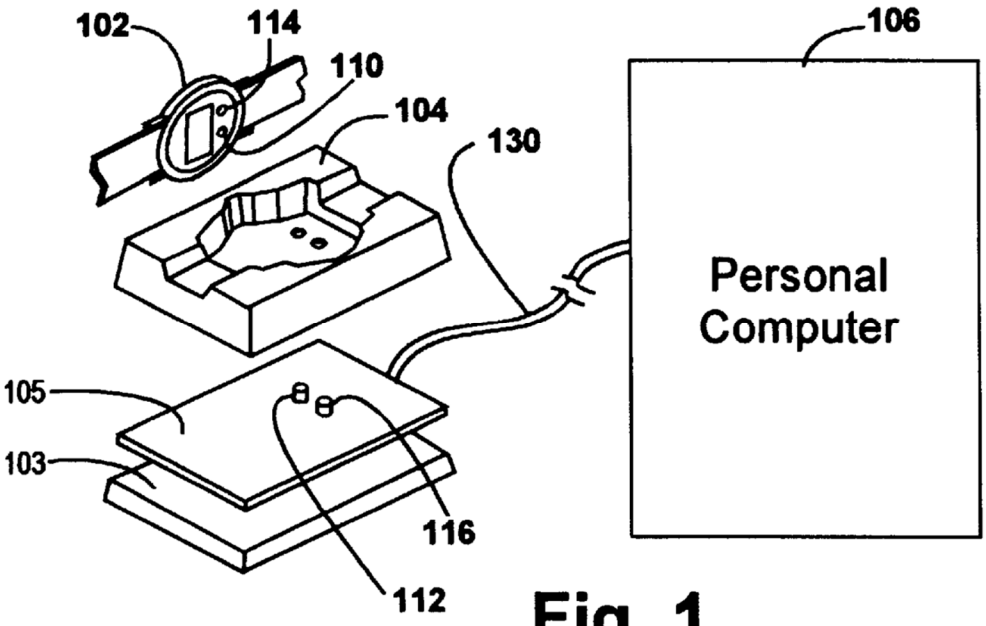


Fig. 1

EX1036 at Fig. 1.

14. 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 Exhibit 1037. 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 6:28–65. Figure 1 and Figure 4 of the '755 patent are shown below.

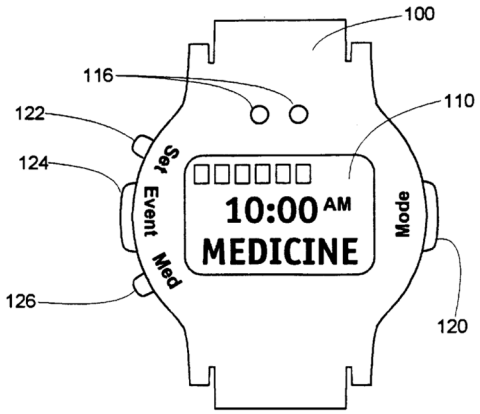


Fig. 1

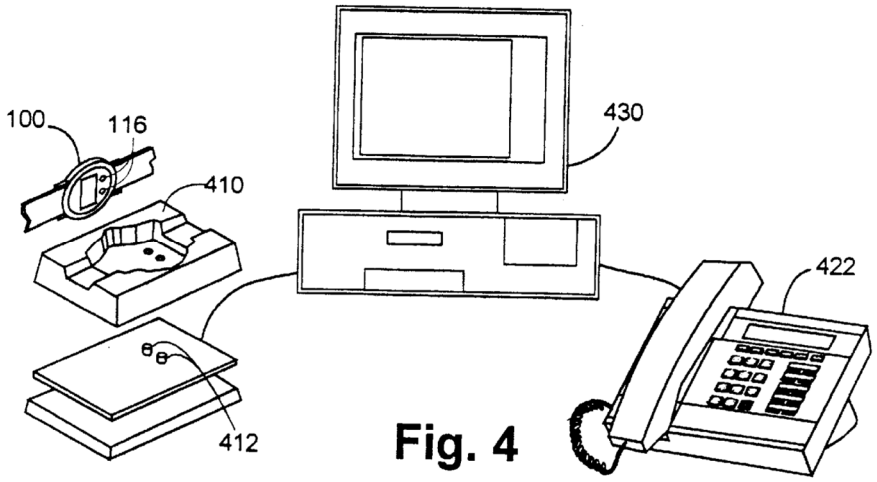


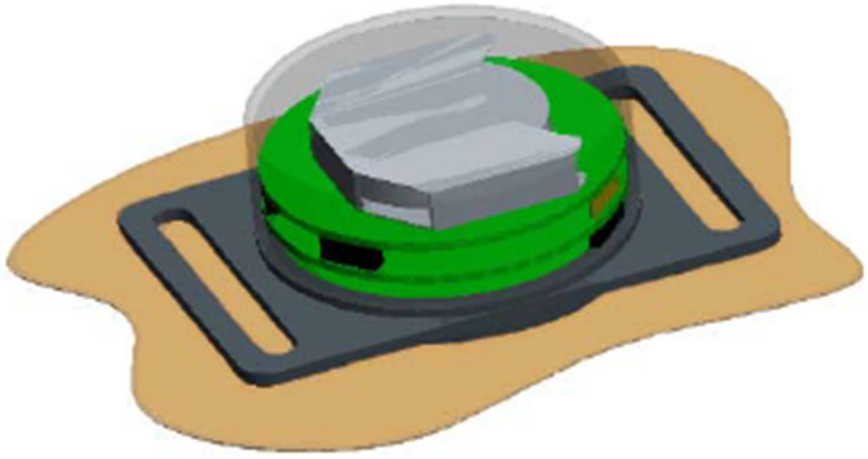
Fig. 4

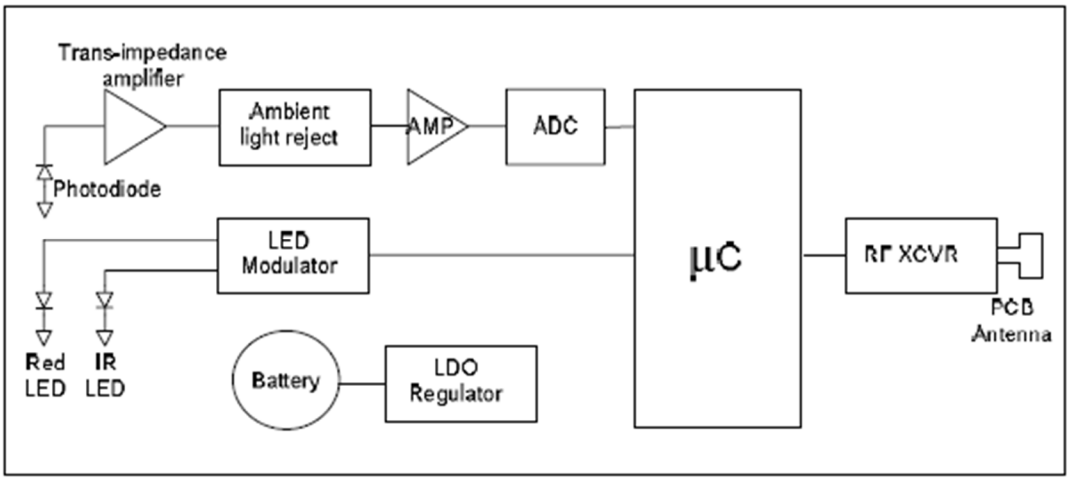
EX1037 at Figs. 1, 4.

15. 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 Exhibit 1038. 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.

16.





17.EX1038 at 2.

18. 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 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).

19. 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" (EX1039 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 Exhibit 1039.

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

21. U.S. Patent No. 7,292,189, issued in 2007, titled "Methods and Apparatus for High Resolution Positioning"

22. U.S. Patent No. 9,476,963, issued in 2016, titled "Search and Rescue Method and System"

23. U.S. Patent No. 9,658,309, issued in 2017, titled "Precision Location Method and System"; and

24. 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 Exhibit 1003.

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 '491 Patent and certain prior art to the '491 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. Although it often does not explicitly refer to Graham factors (1) and (2), this petition addresses each of these factors in great detail, finding that given the scope and content of the prior art, differences between this art and the claimed subject matter are limited—concluding that the claims are not patentable. For factor (4), 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, factor (1), 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. I understand that this "as a whole" assessment typically involves a 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. These rationales provide the foundation for all the obviousness combinations discussed in this declaration, whether explicitly recognized or not.

35. I understand that the obviousness analysis must be performed from the perspective of a POSITA, which occurs at the time of the alleged invention. I understand this requirement is to help avoid using 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—is 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 have,

at the relevant time, interpreted 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 that even if a certain result or characteristic may be present in the prior art, that is not always 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 1–19 of the '491 Patent, I believe Claims 1–19 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 '491 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 '491 Patent is determined as of September 2, 2014, which is the earliest effective filing date of the '491 Patent. I also understand that Apple has not alleged that the '491 Patent is entitled to an effective filing date other than September 2, 2014.

41. A POSITA of the '491 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 the law as it has been explained to me—such as *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.

1. "non-conductive cover material"

45. Claim 1 recites "a cover formed from a dielectric material." EX1001 58:5. Claim 3 further limits Claim 1 and specifies: "the cover is formed from a transparent substrate; and the transparent substrate comprises one or more of a glass or a sapphire material." EX1001 58:28–30. Thus, glass and sapphire materials are dielectric and transparent materials, as recognized in the '491 patent Claim 3.

46. Claim 7 recites "a cover comprising a non-conductive material." EX1001 58:56. The prior art references used in this declaration teach that glass is an electrically non-conductive material. For example, Honda teaches an "insulating body (glass, for example)." EX1006 15:62. Honda additionally teaches that "cover glasses 211 and 111 may be replaced with *other* insulating materials." *Id*. 16:14–15 (emphasis added). Accordingly, a POSITA would have understood that glass and sapphire are electrically non-conductive, dielectric, and optically transparent materials.

2. "defines at least one window" and "window defined"

47. Claims 2, 7, and 8 recite that a window is "defined" in the cover. The '491 patent does not provide an explanation of what a "window" is, although the

'491 patent often recites "windows or apertures." EX1001 28:38–29. The '491 patent describes the windows as follows:

> 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 . . . . [T]he 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. . . . 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 26:12–19 (emphasis added). *Id*. 40:46–67.

48. Accordingly, the '491 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 immediately behind that sheet. *Id*. 40:46–67.

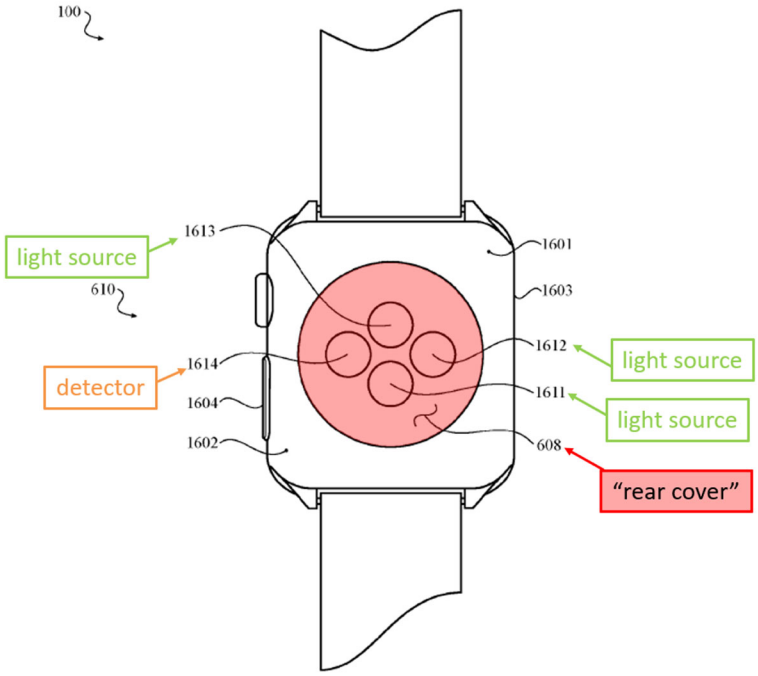


FIG. 16

See EX1001 at 22 (Fig. 16, annotated[2]).

49. Thus, to "define" an opening simply means to allow passage of light to a relevant component through an opening. In the '491 patent, the single rear cover 608 "defines" multiple openings by allowing passage of light through the round portions labeled 1611–1614 in Fig. 16.

[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.

VII. SUMMARY OF OPINIONS

50. 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 1–19 of the '491 Patent would have been obvious to a POSITA based on the teachings of the prior art at the time of invention.

51. It is my opinion that:

- Ground 1: Claims 7, 11, 14, and 16 are unpatentable over Kotanagi and Honda.
- Ground 2: Claims 1-3, 5, 13, and 17 are unpatentable over Kotanagi, Honda, and Choi.
- Ground 3: Claims 8 and 15 are unpatentable over Kotanagi, Honda, and Fraser.
- Ground 4: Claim 9 is unpatentable over Kotanagi, Honda, and Orr.
- Ground 5: Claims 12 and 18 are unpatentable Kotanagi, Honda, and Park.
- Ground 6: Claim 4 is unpatentable over Kotanagi, Honda, Choi, and Park.
- Ground 7: Claims 10 and 19 are unpatentable over Kotanagi, Honda, and Jabori.

- Ground 8: Claim 6 is unpatentable over Kotanagi, Honda, Choi, and Jabori.

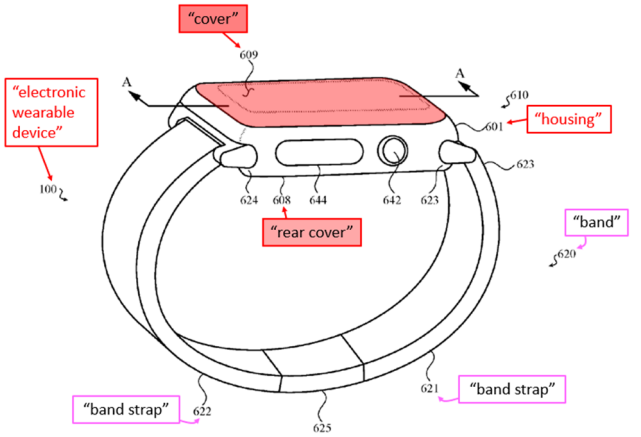
52. Below, I provide a detailed analyses supporting my opinions.

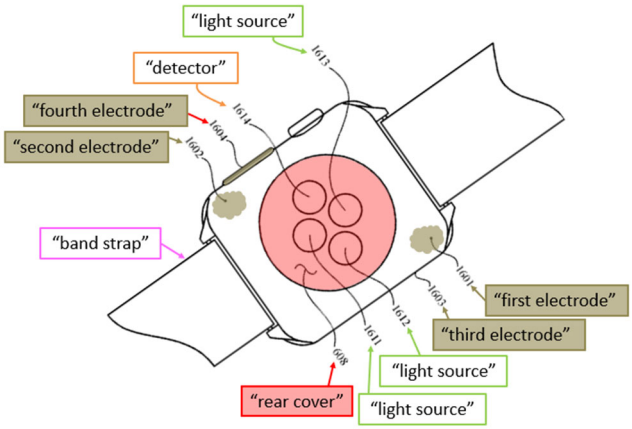
VIII. THE '491 PATENT

A. Overview of the '491 Patent

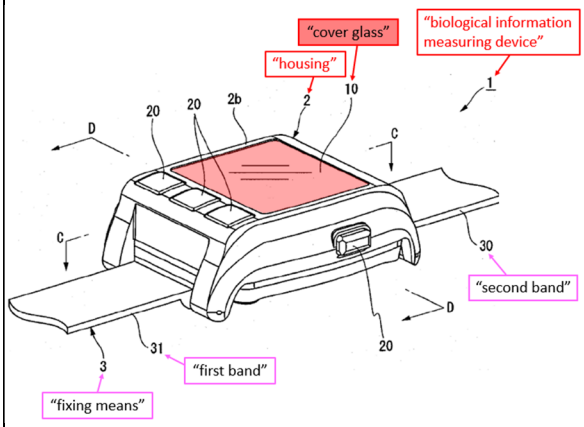
53. Apple's '491 patent purports to claim novel improvements to health-monitoring smart watches. However, in my opinion the challenged claims recite features that were well known prior to the '491 Patent. Their combinations in the claims provided no results or benefits that would have been unexpected to a POSITA. Some of those features are shown in the annotated figures below comparing the '491 Patent to figures from a 2005 patent to Kotanagi:

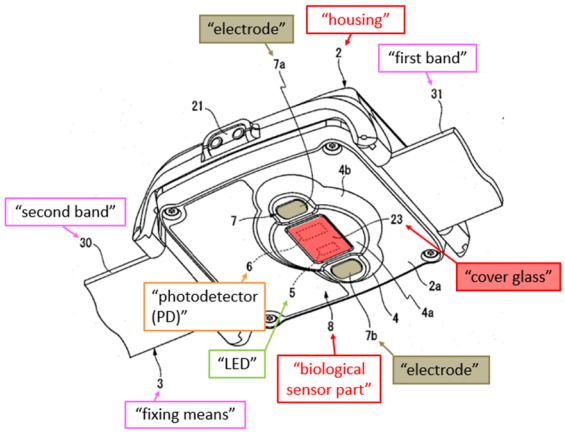
'491 Patent





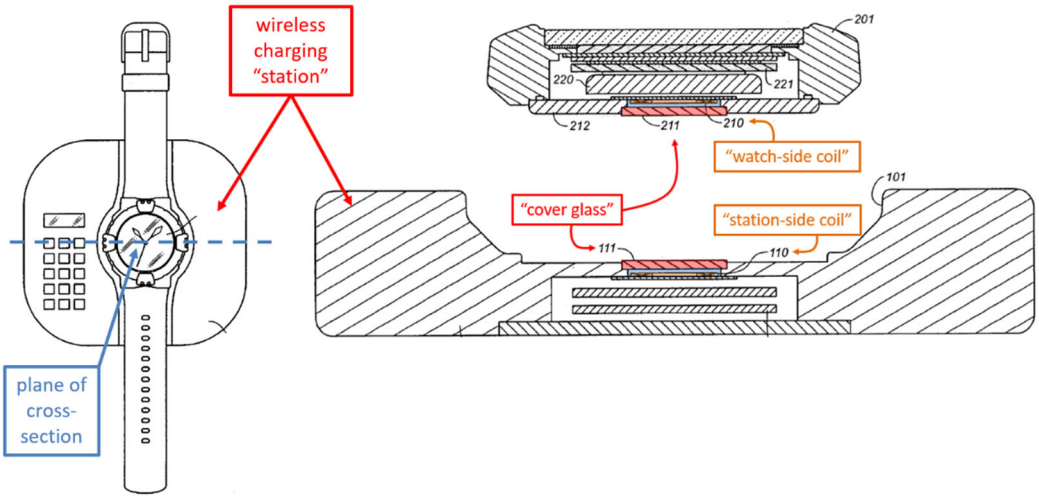
Prior Art – Kotanagi





EX1001 at Figs. 6, 16; EX1005 at Figs. 4, 5.

54. Kotanagi was a material oversight in the examination of the '491 patent, as its teachings in combination with other references make obvious the limitations recited in the '491 patent. For example, the independent claims of the '491 patent recite wireless charging coils and charging through the back cover of the biosensing watch, limitations which were incorporated into the independent claims prior to allowance. EX1002 at 595–599. However, Kotanagi teaches charging in a "contactless state" (EX1005 ¶53) and other references disclosed wireless charging through the back cover of the biosensing watch more than a decade before the earliest priority of the '491 patent. Specifically, such wireless charging in a biosensing watch was disclosed in the 2001 publication "Honda," which is illustrated briefly below:



EX1006 at 2, 3.

55. Finally, the ’491 patent recites electrodes in various dependent claims and independent Claim 1. However, placing electrical contacts on the back side of a watch was known according to Kotanagi, as annotated above, and other references as will be explained in detail in the grounds of this declaration.

B. Prosecution History of the ‘491 Patent

56. I have reviewed Exhibit 1002, the prosecution history of the ‘491 patent, to help form my opinion in this matter. The following highlights only some portions of that file history.

57. The Examiner rejected Claims 21–40 in a Non-Final Rejection on May 13, 2020. EX1002 at 1119–1131. Applicant thereafter amended the independent claims on August 13, 2020 to recite that wireless power is sent “through” a sensor cover that is “dielectric” (Claim 21, issued Claim 1), “non-conductive” (Claim 28, issued Claim 7), and “optically transparent” (Claim 35, issued Claim 14). *Id.* at 595–599. Applicant emphasized these amendments in an interview, then summarized the amendments to Claim 21 (issued Claim 1) as follows: “the cited references do not disclose or suggest an electronic watch that includes an optical sensor and a charging coil that are configured to pass both optical signals and wireless power signals through dielectric material of a single cover.” *Id.* at 601–603. A similar summary was provided for Claim 28 (issued Claim 7) and Claim 35 (issued Claim 14) substituting “non-conductive” and “transparent” for “dielectric.” *Id.* In response to

these amendments and arguments the Examiner allowed the claims on November 4, 2020. *Id.* at 468–473.

58. Importantly, the ’491 prosecution history shows that the Examiner did not consider, and Applicant did not cite, any of the references that that Petitioner relies on in the grounds of this Declaration. *See generally id*. These references teach what the Applicant said was missing from the prior art: a watch with an optical sensor and charging coil, both configured to pass their signals through a single glass cover. *See* EX1005 at ¶55; EX1006 15:47–49.

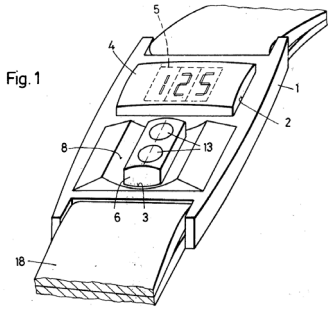
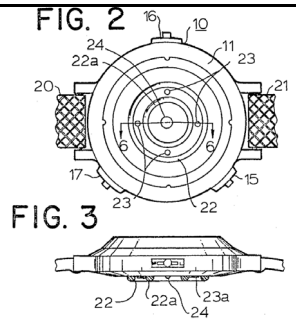
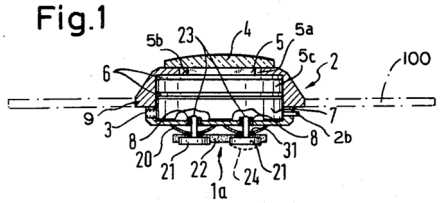
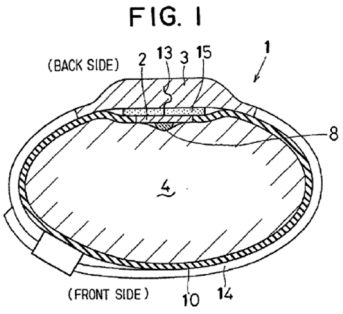
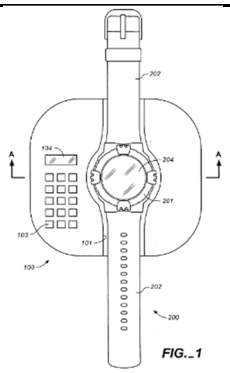
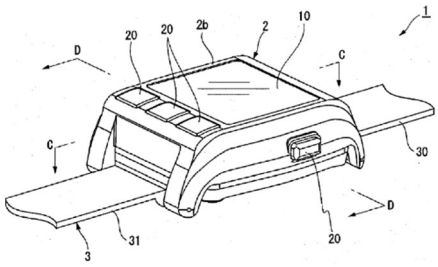
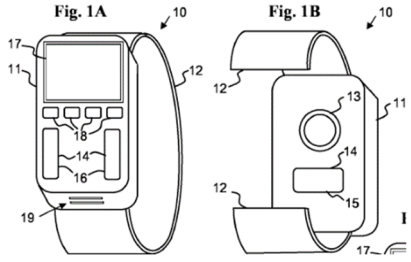
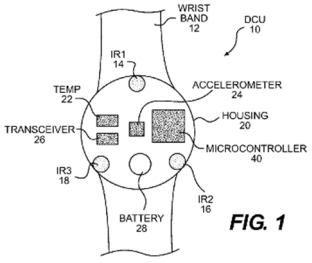
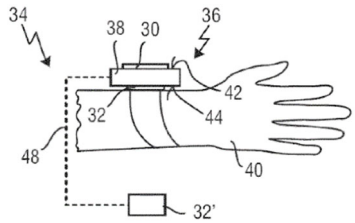
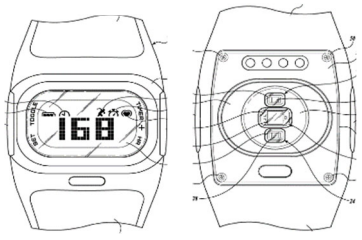
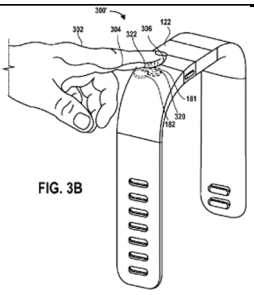
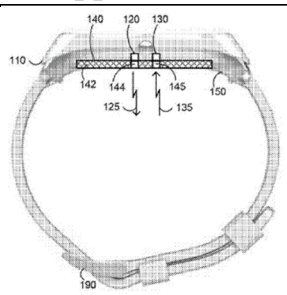
C. Priority of the ’491 Patent

59. I understand the ’491 patent was filed March 20, 2020, which is a continuation of U.S. Application No. 15/261,912, filed on September 10, 2016, U.S. Application No. 15/261,914, filed on September 10, 2016, U.S. Application No. 15/261,917, filed on September 10, 2016, and U.S. Application No. 14/842,617, filed on September 1, 2015.

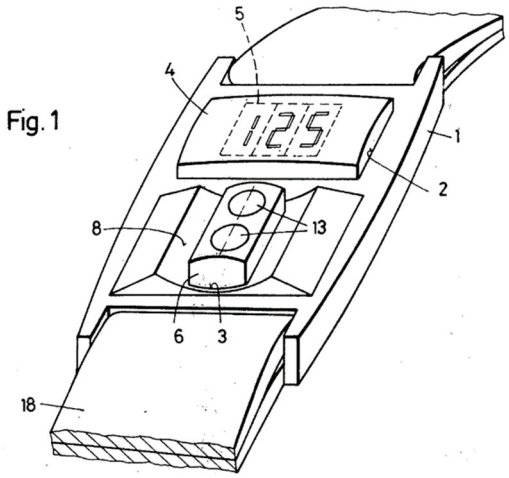
60. U.S. Application No. 14/842,617 claims priority to provisional application 62/044,974, filed on September 2, 2014. EX1001 at 1; EX1002 at 1478–1479. Thus, the earliest alleged priority date of the ’491 Patent is September 2, 2014. EX1002 at 1209, 1479.

IX. BIOSENSING WATCHES THROUGH THE DECADES

61. 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.

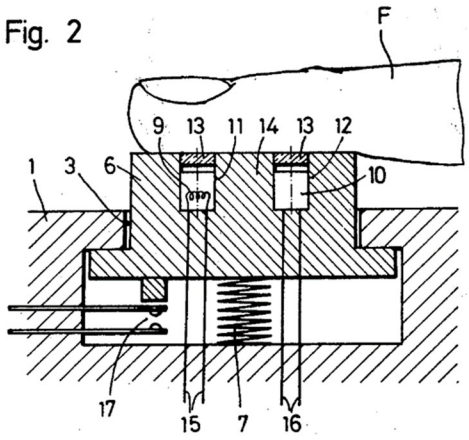
 Thalmann (EX1022) - **1978** US Pat. 4,129,124	 Cramer (EX1026)-**1980** US Pat. 4,224,948	 Schmid (EX1029) - **1980** US Pat. 4,375,219
 Ohsaki (EX1007) - **2001** PCT Pub. 2001/0056243	 Honda (EX1006) - **2001** US Pat. 6,265,789	 Kotanagi (EX1005) - **2005** PCT Pub. WO2005/092182
 Shmueli (EX1008) - **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

62. 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.

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



Id., Fig. 2.

64. 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.* 2:17–25. Thus, Thalmann teaches a wristwatch device for pulse detection.

65. 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 3:34–36. This particular configuration is shown below:

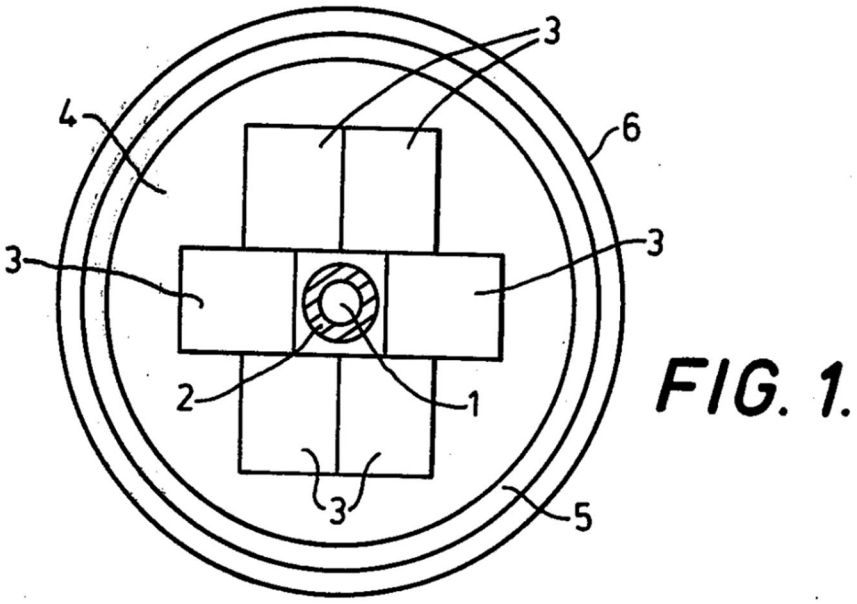


FIG. 1.

Id., Fig. 1.

66. 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:

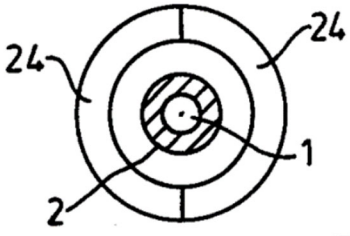


FIG. 4.

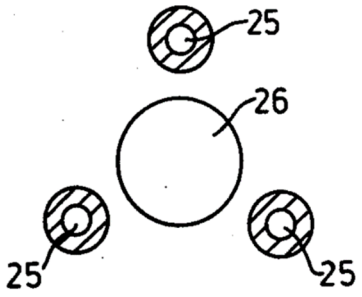


FIG. 5.

Id., Figs. 4, 5.

67. 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." EX1025 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.

68. 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 5:41–42.

FIG. 1

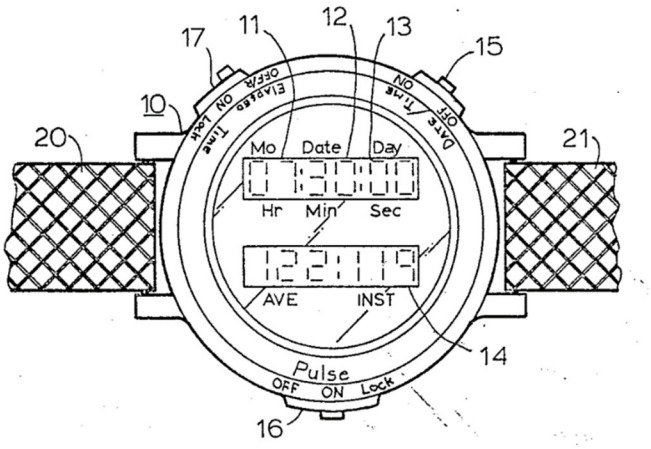


FIG. 2

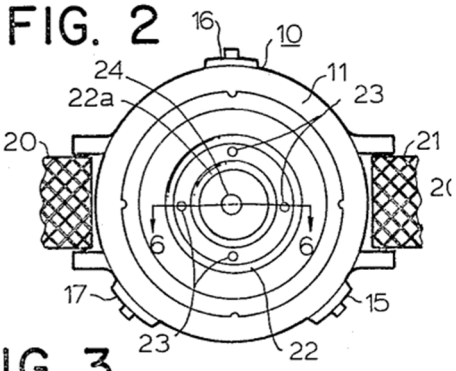
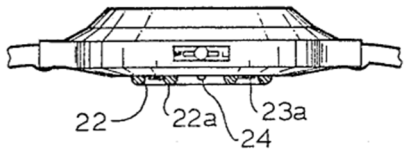


FIG. 3



Id., Figs. 1,2.

69. 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 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.

70. 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 5:10–15; 2:52.

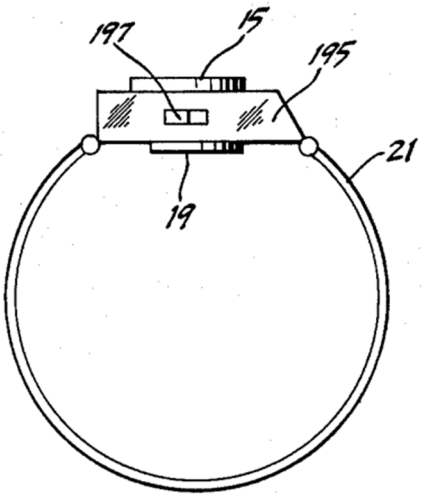


Fig. 2

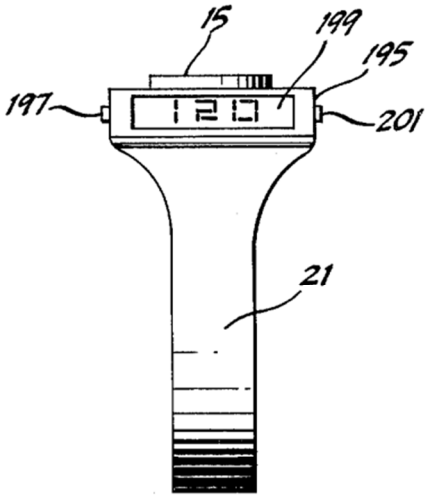
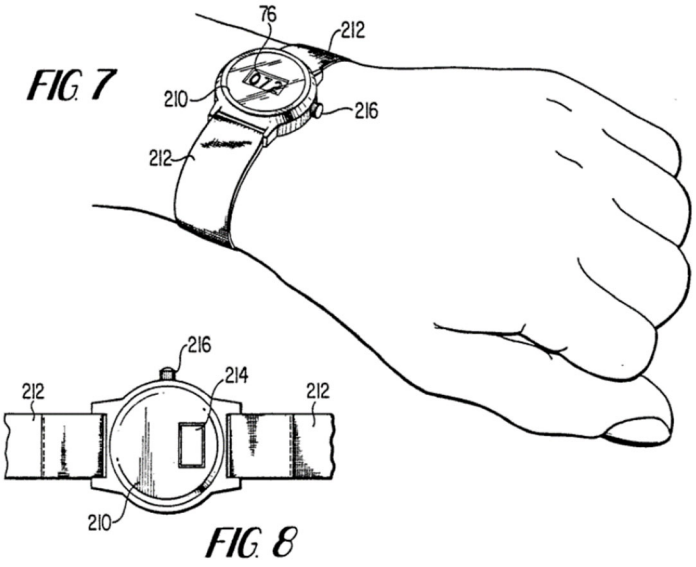


Fig. 3

Id., Figs. 2,3.

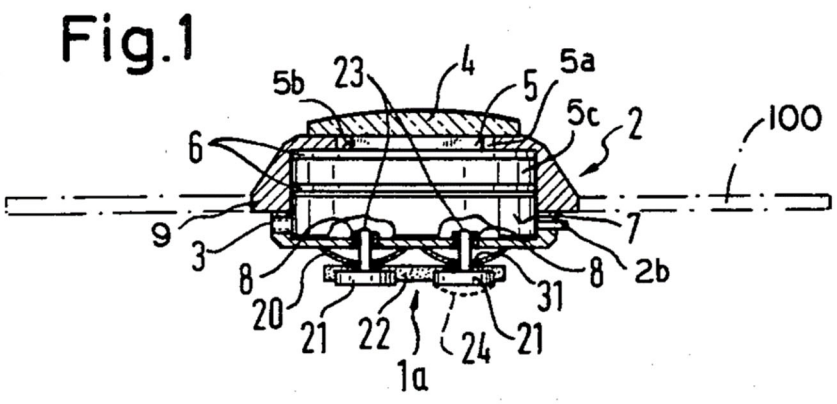
71. Charnitski notes that its watch is superior to the prior art because "electrodes of electrode section 11 have the ability to produce an ECG signal without the necessity of preparing the skin of a living subject with a material such as a conductive gel to accept the electrodes." EX1027 7:5–8.

72. 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 6:15–20. These sensors function as a cardiotachometer by measuring systolic heartbeats. EX1028 1. Steuer's system is shown below:



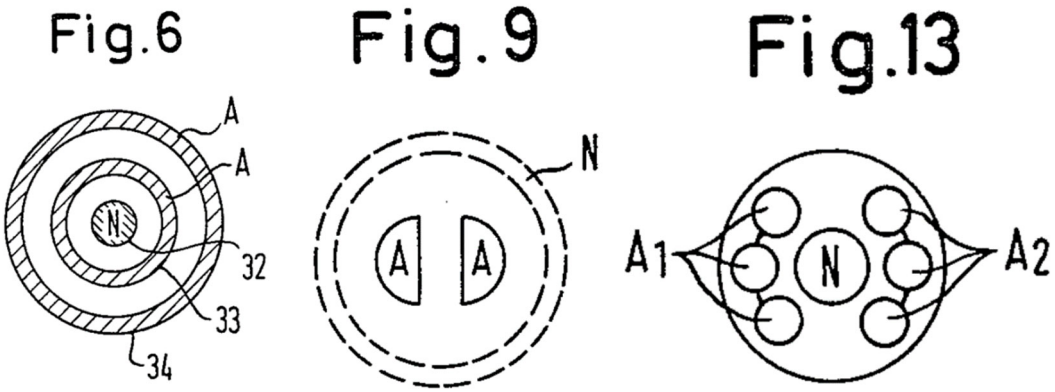
Id., Fig. 8.

73. 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 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 5: 35, 48.



Id., Fig. 1.

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



Id., Figs. 6, 9, 13.

75. 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 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 4:17–22.

76. 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 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 2:33–38.

77. 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 5:46. Embedded within the front electrode 4a is the optical sensor composed of "LED 7" and "photo-transistor 5." EX1030 3:46–47. These are shown below:

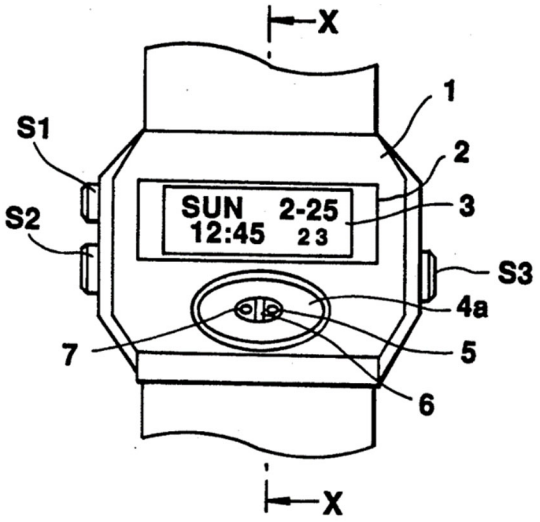


FIG.1

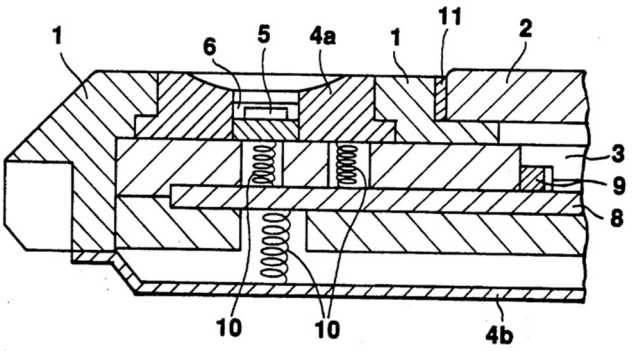


FIG.2

Id., Figs. 1, 2.

78. 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 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 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.

79. 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 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 7:34–38. This is shown below:

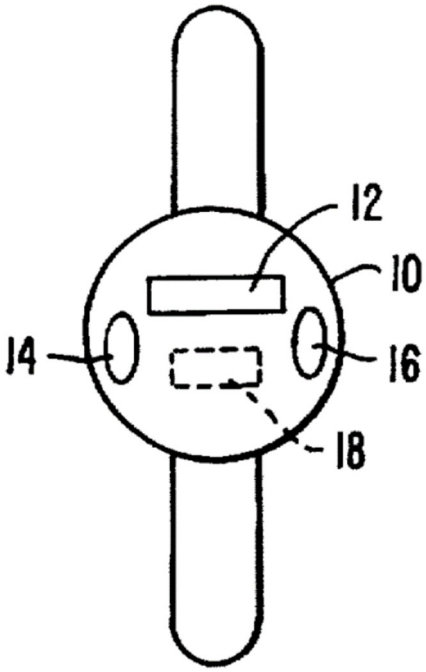
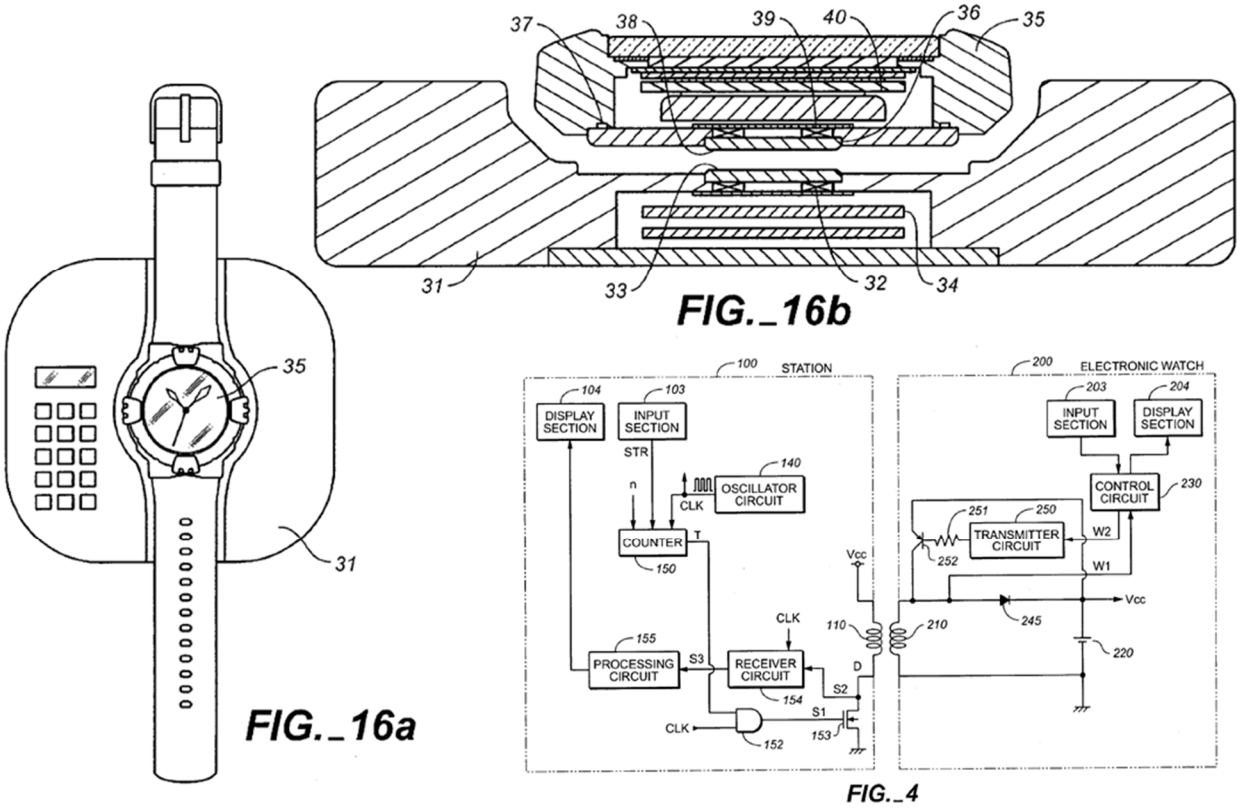


FIG. 1.

Id., Fig. 1.

80. Lo teaches that "[t]he digital watch embodiment uses a three contact approach to help eliminate noise." EX1031 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.

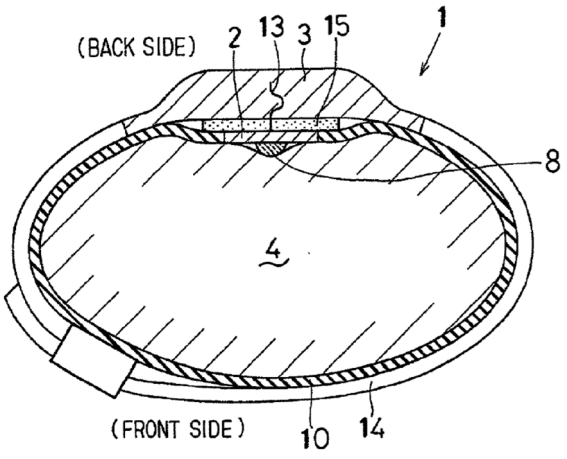
81. In the year 2001, Honda was granted patent 6,265,789 ("Honda," EX1006). Honda describes and illustrates a portable electronic device in the form of a wristwatch and teaches wireless charging of such devices using a wireless charging "station." EX1006 6:7. The watch gathers "biological information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



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

82. 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.

83. In the same year, Ohsaki (EX1007) was published as US 2001/0056243 Al with an optical heart rate sensor embedded in a protrusion on the back side of a watch as shown below:



EX1007 at 2.

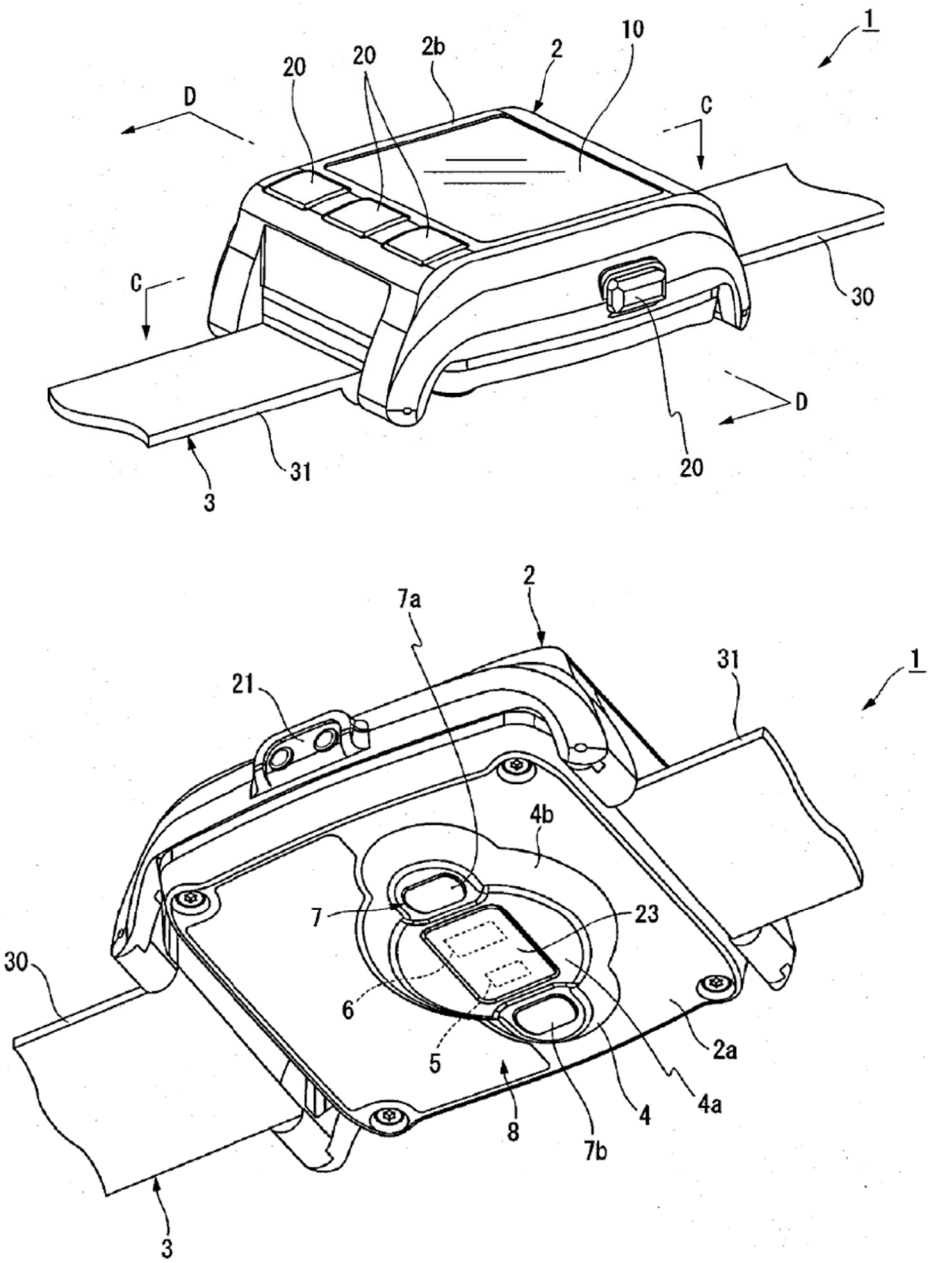
84. In the year 2005 Kotanagi was published as WO 2005092182 ("Kotanagi," EX1007). Kotanagi describes and illustrates a wristwatch as a "biological information measuring device." EX1005 at Abstract. Kotanagi describes its biological sensor, at least in part, as:

85. 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.

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



EX1005, Figs. 4, 5.

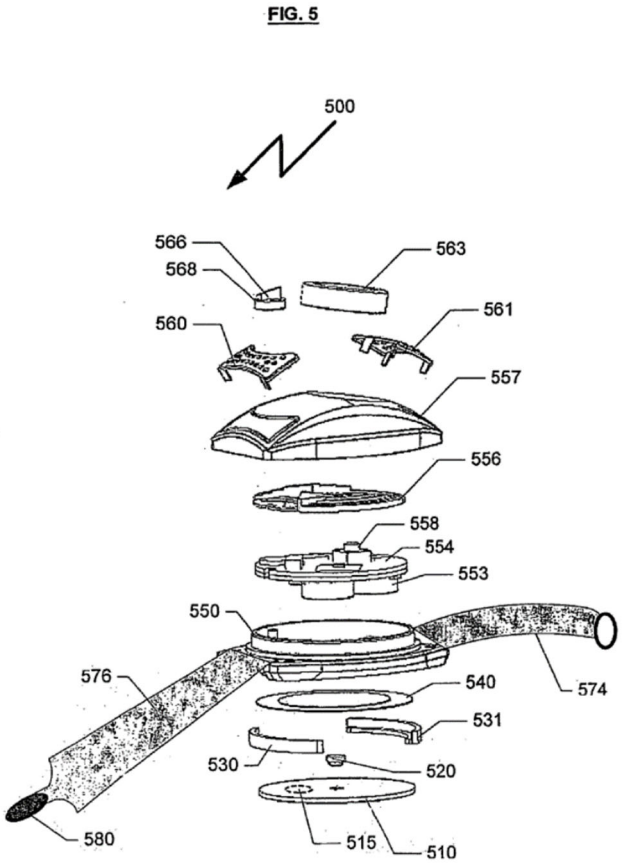
87. In the same year, 2005, Goldreich was published as US 20050116820 A1 ("Goldreich," EX1033). Goldreich disclosed a wristwatch device which may display "medical information to the user on a local LCD display, such that the user is optionally and preferably able to read the result locally." EX1033 [0015].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

88. 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.

89. EX1033 [0015]; see also *id.* [0104] teaching "device 500 may optionally measure other activities of the body including but not limited to ECG".

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 [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 [0124]. Goldreich's device is shown below:



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 [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 [0244]. Tran's watch, showing electrode 1381, electrode 1383, and wrist band 1374, is below.

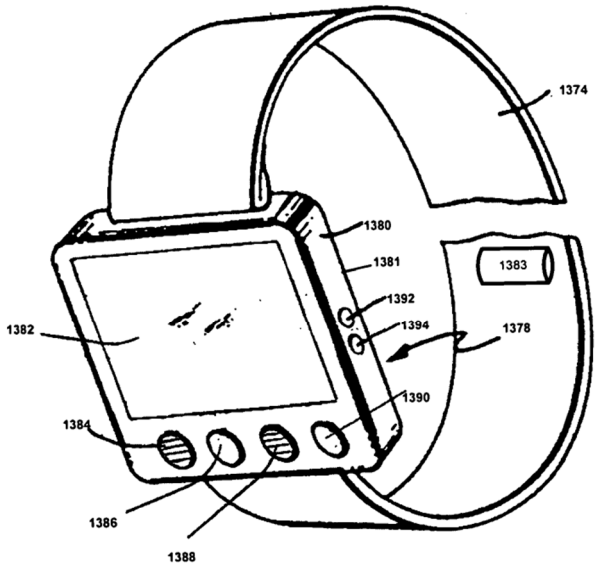


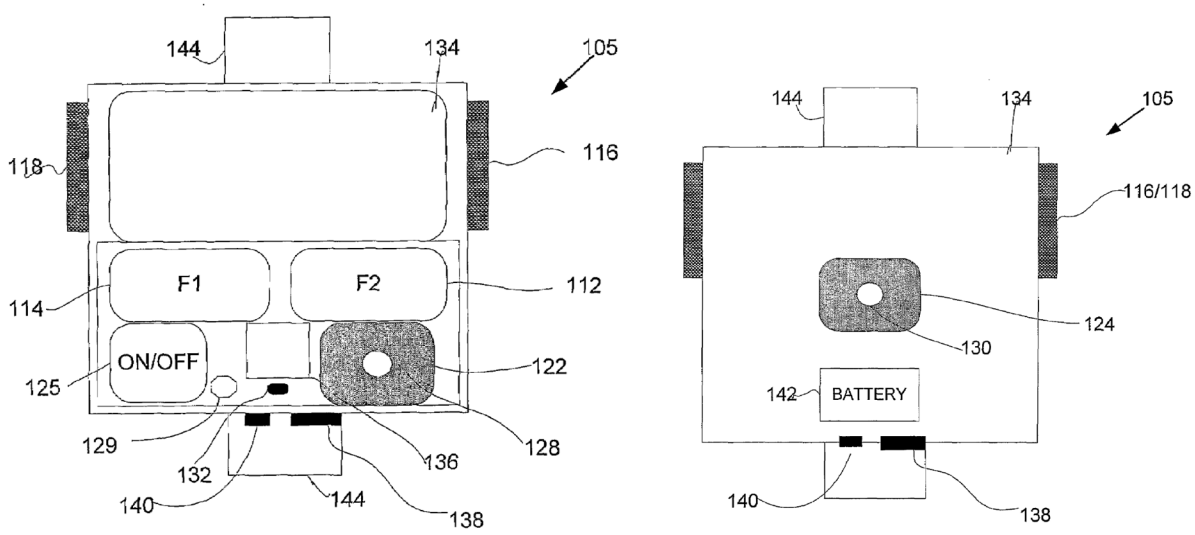
FIG. 6A

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 [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 [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 [0029]. The blood oxygen, pulse, and ECG sensors on the front and back of the watch are shown below:



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 [0058]. The sensor array may comprise "accelerometer 24; infrared sensors 14, 16, and 18; and/or temperature sensor 22." EX1014 [0058]. Kateraas Figure 1 is shown below:

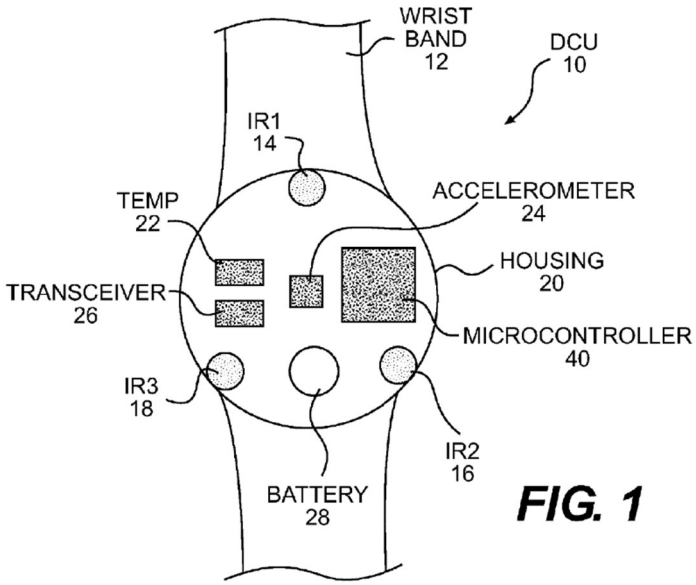


FIG. 1

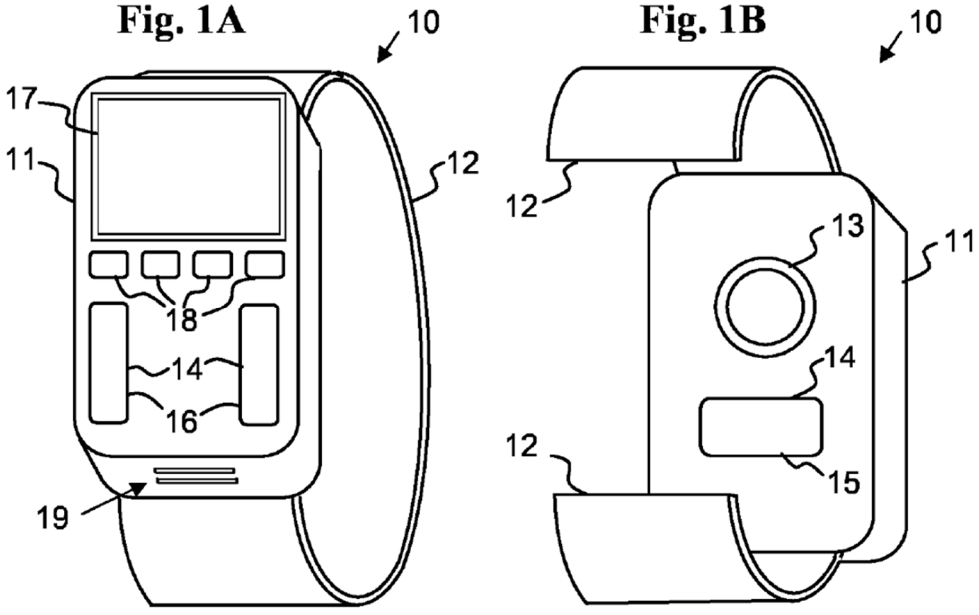
EX1014, Fig. 1.

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 [0014]. Some of these biological markers are "pulse rate, body temperature, blood oxygen content, or any other suitable marker." EX1014 [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 [0059].

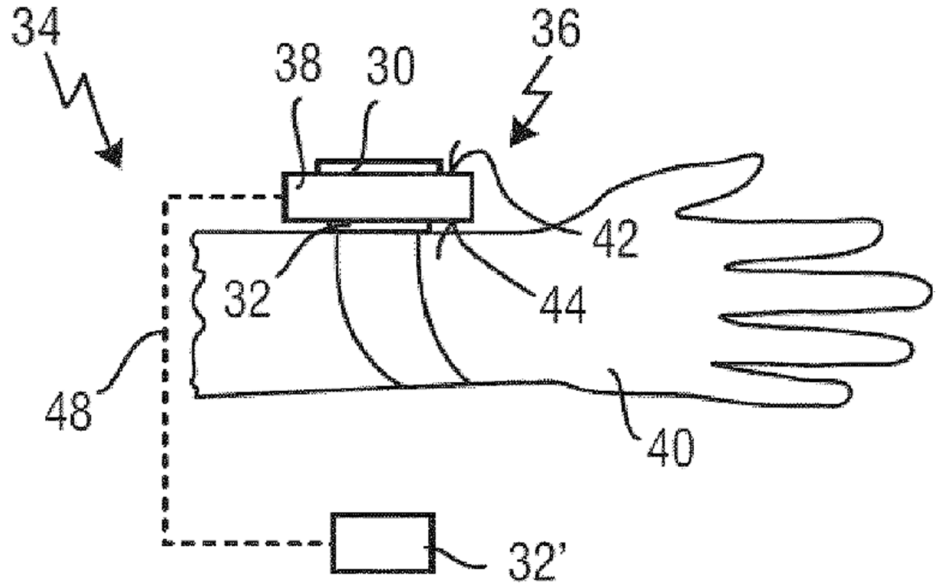
98. Thus, a POSITA would have known from the disclosure in Kateraas that the underside of a biosensing watch may have an "array" of sensors covered by a transparent, sapphire window.

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 sensing" contacts 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; *see also* Fig. 7 (showing a block diagram for ECG measurement). Shmeuli's device is shown in Fig. 1A and 1B below.



EX1008, Fig. 1A, 1B.

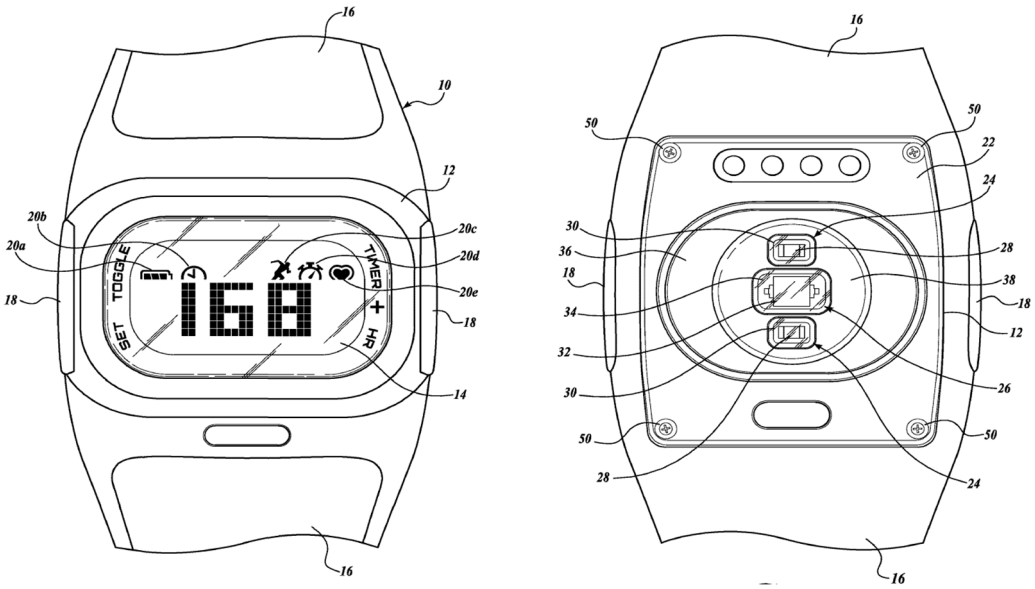
100. In March of 2014 Coppola (EX1020) was filed as EP Application 141631147. Coppola taught the placement of multiple electrodes on the back, front, side, and auxiliary portion of a biosensing watch. EX1020 14:14–16. Coppola also teaches the incorporation of an optical PPG sensing unit. EX1020 at 11.



EX1020 at 28.

101. Coppola teaches that it is advantageous to move an ECG electrode from the front to the side of a watch because "By placing first electrode 30 not on the front side 42, but on the side of the watch or on the strap instead, the GUI element 46 can cover the whole front side 42 of the watch." EX1020 14:14–16. Thus, a POSITA would have understood that a biosensing watch may comprise multiple electrodes on different surfaces of a watch along with an optical PPG sensing unit.

102. In April of 2014 Fei (EX1010) was filed as US provisional application 61/976388. Like the other watches that came before it, Fei teaches the incorporation of an optical emitter and optical detectors on the rear surface of a watch for measuring "heart rate, glucose level, apnea, respiratory stress, and other physiological conditions." EX1010 at 4.



EX1010 at 17, 18.

103. In May of 2014 Yuen (EX1016) was published as US Publication 2014/0135594. Yuen teaches the incorporation of an optical sensor on the front side of a watch to measure "heart rate, heart rate variability, heart rate recovery" and other physiological parameters. EX1016 [0098]. Yuen explicitly teaches that the optical sensors may be covered by a "ceramic" material. EX1016 [0070].

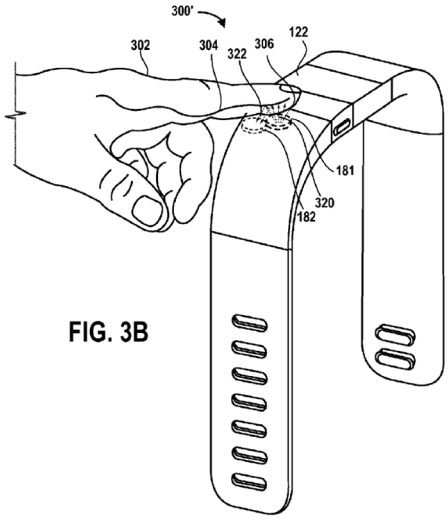
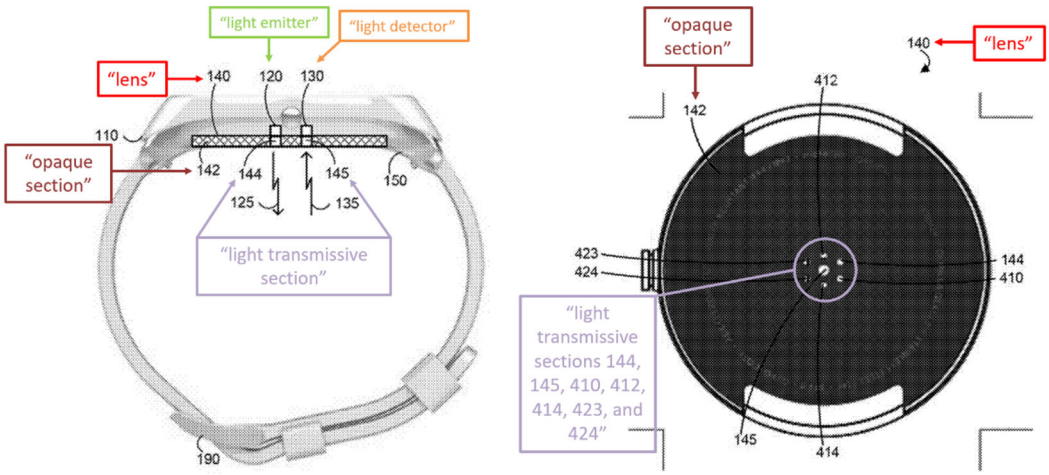


FIG. 3B

EX1016 at 6.

104. In August 2014 Fraser (EX1041) was filed as US 2015/0355604 A1. Fraser teaches multiple optical emitters and a light detector that are aligned with transmissive sections in a lens cover that spans the back side of its biosensing watch. EX1041 [0017]–[0018]. Fraser also teaches the incorporation of a wireless charging coil surrounding the optical emitters and detector. EX1041 [0026].



See EX1041 at 2, 5.

105. Thus, a POSITA would have known from Fraser that a biosensing watch may incorporate an array of emitters and detector, a lens with light transmissive sections aligned with the optical components, and a wireless charging coil.

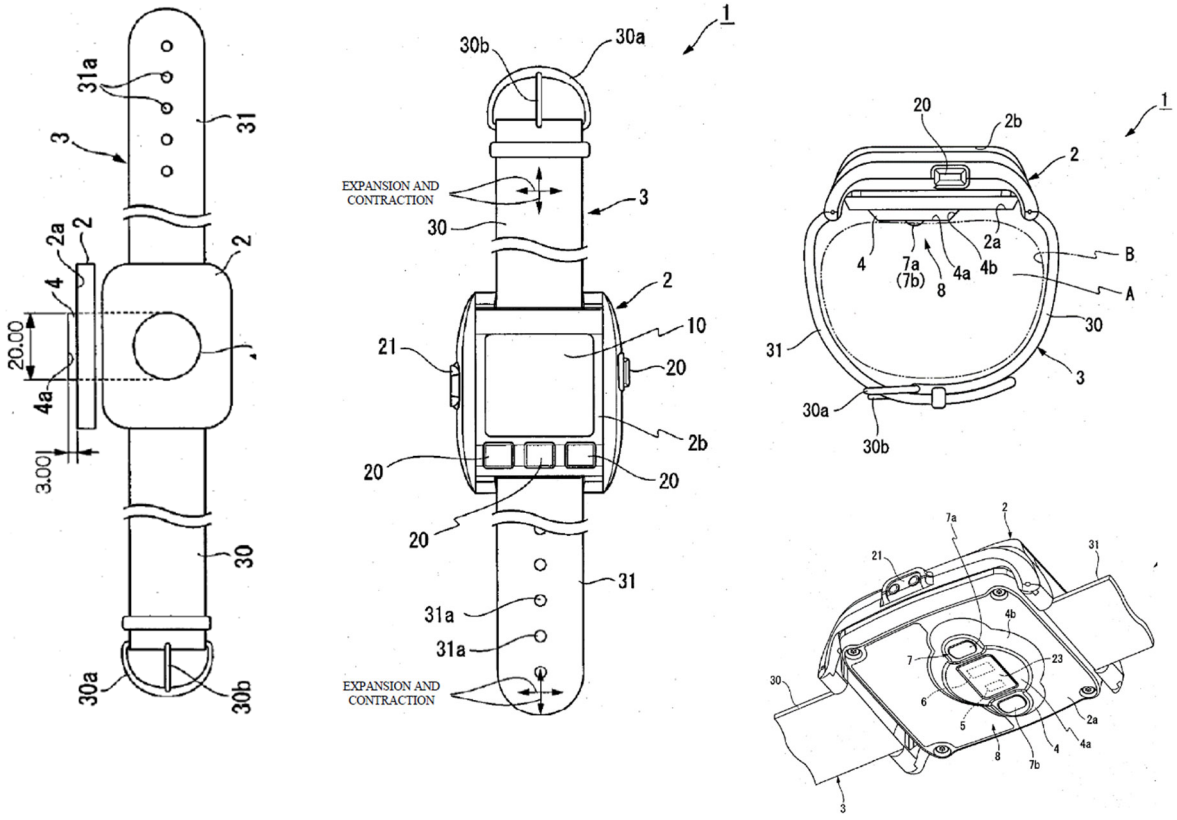
106. This overview is not meant to be exhaustive, and other advancements were made in the field of biosensing watches. However, an explanation of the decades of technology in the field of biosensing watches prior to September 2014 may be helpful in understanding the general knowledge of a POSITA as it relates to the challenged patent. Further, it is important to note that the '491 prosecution history shows that none of these references were cited by or considered by the Examiner during the prosecution of the '491 patent. *See* EX1002 generally. The '491 prosecution history reveals that the Examiner was only aware of a sister application to EX1029, Schmid. *Id.* at 1129–1132.

X. INTRODUCTION TO SELECTED PRIOR ART REFERENCES

A. Kotanagi (EX1005)

107. As noted above, the '491 patent was believed to be distinguishable from the prior art based in part on the transparent, non-conductive, or dielectric properties of the rear cover (608) EX1002 at 595–603. Kotanagi teaches this and many of the other limitations.

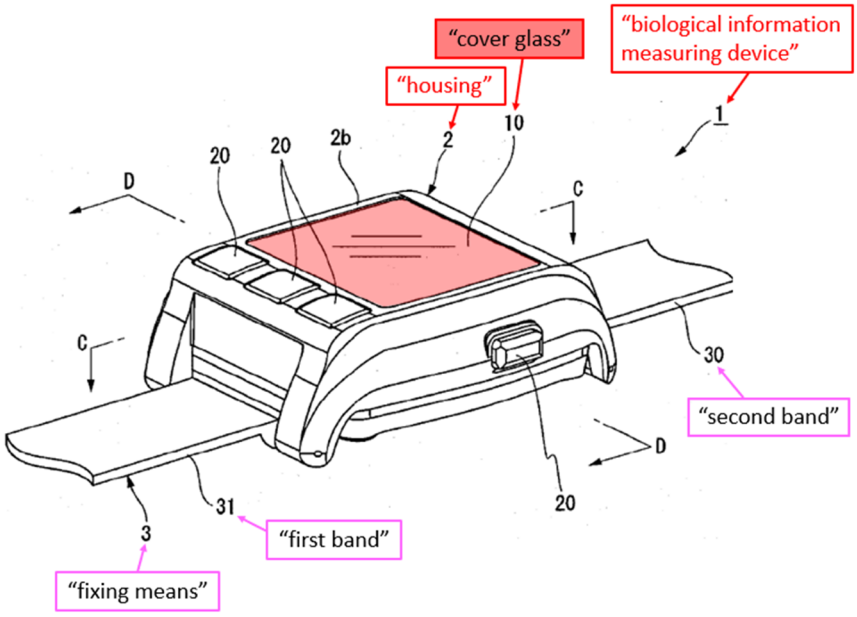
108. PCT Patent Publication WO 2005092182 ("Kotanagi," EX1005) claims an earliest priority date of March 26, 2004, more than a decade before Apple's '491 patent application was filed. EX1005 at 1. Kotanagi was not cited or reviewed in the '491 patent's prosecution history and is not listed on the face of the '491 patent. EX1002 generally; EX1005 at 1. Kotanagi describes and illustrates a "biological information measuring device" in the form of a wristwatch:



EX1005 at Figs 1, 2, 5, 8.

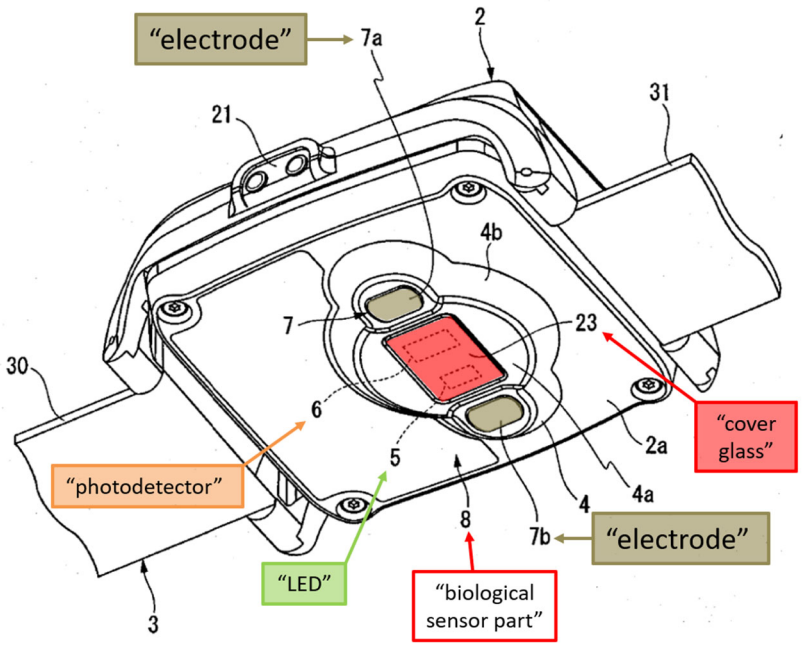
109. The watch has touch electrodes and sensors (behind a glass window in a protruding bulge at its base) for directing optical signals to and, receiving optical reflection from, a user's skin. Kotanagi teaches that the device can be charged

wirelessly. EX1005 at ¶53. The upper surface contains a glass electronic display, and it has a wristband:



Id. at Fig. 4.

110. The lower (skin-facing) surface of Kotanagi's wristwatch contains biological sensors. It has two electrodes and at least one optical biosensor below a cover glass (23), shown below:



Id. at Fig. 5.

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

B. Honda (EX1006)

112. The '491 patent was believed to be distinguishable from the cited prior art based on a "non-conductive," "optically transparent," and dielectric material through which wireless power is sent EX1002 at 595–603. Honda teaches this and many of the other limitations.

113. U.S. Patent No. 6,265,789 to Honda ("Honda," EX1006) issued July 24, 2001, more than a decade before Apple's '491 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 '491 patent's prosecution

history and is not listed on the face of the '491 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" and transmitting wireless power through its rear "cover glass." *Id.* 4:21–28, 14:40–54. 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 8:40–42.

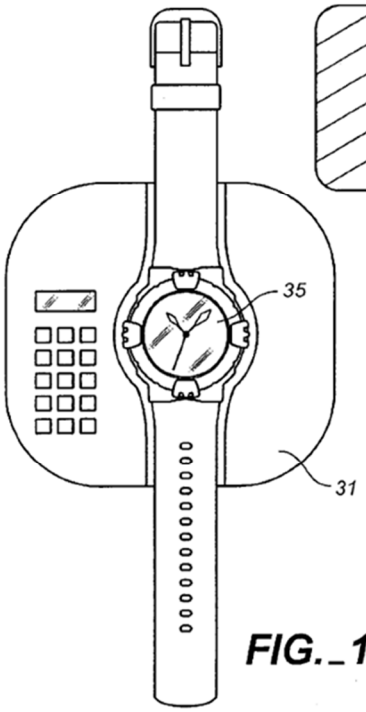


FIG._16a

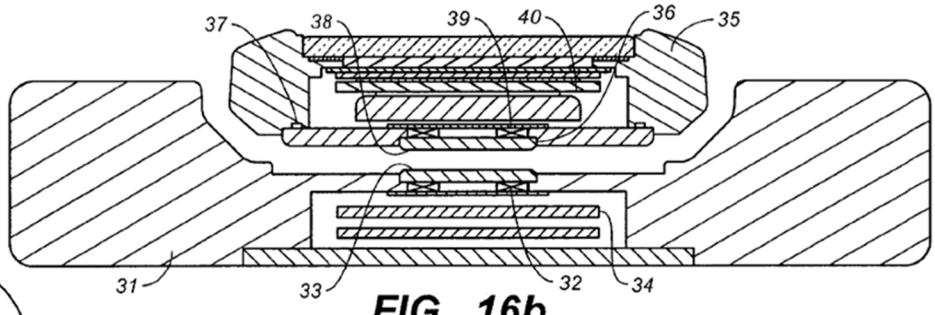


FIG._16b

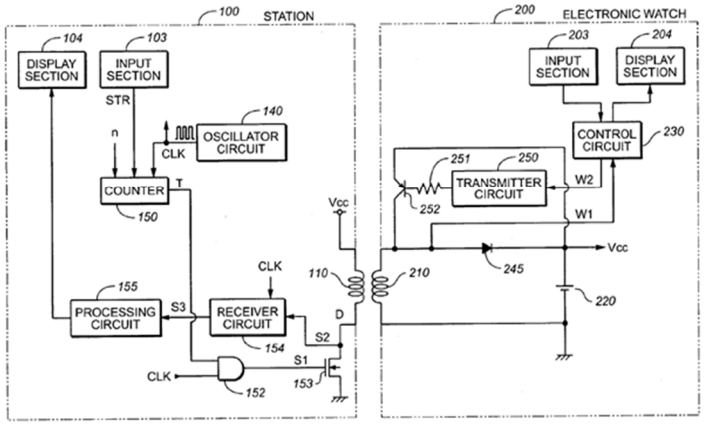


FIG._4

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

C. Status of References as Prior Art

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

Exhibit No.	Description	Prior Art Basis
1001	'491 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
1011	Choi	Post-AIA 35 U.S.C. §102(a)(2) – effectively filed September 9, 2013 (see EX1023)
1012	Park	Post-AIA 35 U.S.C. §102(a)(2) – effectively filed January 28, 2014 (see EX1015)
1017	Jabori	Post-AIA 35 U.S.C. §102(a)(2) – effectively filed January 30, 2014
1025	Orr	Post-AIA 35 U.S.C. §102(a)(1) – issued August 7, 1979
1041	Fraser	Post-AIA 35 U.S.C. §102(a)(2) –filed August 19, 2014

115. In my opinion, these references constitute analogous art because they are from the same field of endeavor as the '491 patent, e.g., biosensing watches and wireless charging of personal electronic devices. They are also reasonably pertinent to a particular problem with which the inventor was involved, e.g., biosensors and wireless charging through the rear cover 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 '491 Patent" (*supra* section VIII(A)) 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.

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

116. I understand Park (EX1012) was published July 30, 2015 and is prior art under post-AIA 35 U.S.C. § 102(a)(2) because it claims priority to U.S. provisional 61/932,258 ("Park Provisional" EX1015) filed January 28, 2014, which is before September 2, 2014, the earliest effective filing date of the '491 patent. EX1012 at 1.

117. The Park Provisional provides the same relevant disclosure as Park, and parallel citations to EX1012 and EX1015 are provided herein. Figure sets in these exhibits are identical. EX1012 at 2–14; EX1015 at 53–65. The Park Provisional

provides support[3] for at least Park's Claim 1. *See* EX1012 at 25; paragraph spanning EX1015 at 5–6; Thus, based on my review of the two documents and my understanding of the law, Park is entitled to the provisional's priority date of January 28, 2014.

118. The Park Provisional provides support for at least one claim in Park. To demonstrate this, Claim 1 of Park is reproduced below:

> 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

[3] It has been explained to me 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. Nevertheless, I understand that Masimo makes such a showing out of an abundance of caution in view of Board cases applying *Dynamic Drinkware* to certain post-AIA cases.

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.

119. This claim is supported by at least by Park's disclosure below:

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.

120. 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,
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.

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

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

122. I understand that 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 '491 patent. EX1017 at 1. Thus, based on my understanding of the law, Jabori is prior art as of January 30, 2014.

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

123. I understand that PCT. Pub. No. WO 2015/034149 ("Choi PCT", EX1011) was published on March 12, 2015 and is prior art under post-AIA 35 U.S.C. § 102(a)(2) because it designates[4] the United States and claims an effective filing date that predates the earliest effective filing date of the '491 patent. EX1011 at 1. Choi PCT has a predating effective filing date because it claims priority to KR10-2013-0107833 ("Choi", EX1023) filed September 9, 2013. EX1011 at 1; EX1023 at 2.

[4] *See* 35 U.S.C. § 374 stating "The publication under the treaty defined in section 351(a), of an international application designating the United States shall be deemed a publication under section 122(b), except as provided in section 154(d)."

124. I understand that Choi PCT has literal support from the Korean filing of September 9, 2013, and Choi provides support for every limitation relied upon in this declaration. Choi PCT's Figures 1–8 are identical to Choi. Compare EX1011 at 24–30 and EX1023 at 28–33. Further, limitations relied upon in this declaration are accompanied by citations to both Choi and Choi PCT.

125. It is my understanding that Choi provides support for at least one claim in Choi PCT. To demonstrate this, Claim 1 of Choi PCT is shown below:

> 1. A wearable device, comprising:
> a first sensor configured to detect a first biosignal generated in response to a gesture performed by a user;
> a second sensor configured to detect a second biosignal of the user;
> a memory configured to store, with respect to at least one user, information of the first biosignal and the second biosignal; and
> a processor configured to
> initiate user authentication based on a result of determining whether the detected first biosignal corresponds to the stored information, and
> authenticate the user by comparing the detected second biosignal to the stored information.
>
> EX1011 at 20.

126. Claim 1 of Choi PCT is supported by at least Choi's Korean abstract:

> A wearable device is disclosed. The wearable device includes a first sensor configured to detect a first biosignal generated in response

> to a gesture performed by a user, a second sensor configured to detect a second biosignal of the user, a memory configured to store, with respect to at least one user, at least one information representing directly or indirectly the first biosignal and the second biosignal, and a processor configured to initiate user authentication by determining whether the first biosignal detected by the first sensor corresponds to the information stored in the memory, and authenticate the user by comparing the second biosignal detected by the second sensor with the information stored in the memory.

EX1023 at 2.

127. A claim chart comparison of the published claim and support (EX1023) are shown below:

Published Claim 1 (EX1011 at 20)	Support (EX1023 at 2)
A wearable device, comprising:	A wearable device is disclosed.
a first sensor configured to detect a first biosignal generated in response to a gesture performed by a user;	The wearable device includes a first sensor configured to detect a first biosignal generated in response to a gesture performed by a user,
a second sensor configured to detect a second biosignal of the user;	a second sensor configured to detect a second biosignal of the user,
a memory configured to store, with respect to at least one user, information of the first biosignal and the second biosignal; and	a memory configured to store, with respect to at least one user, at least one information representing directly or

Published Claim 1 (EX1011 at 20)	Support (EX1023 at 2)
	indirectly the first biosignal and the second biosignal,
a processor configured to	and a processor configured to
initiate user authentication based on a result of determining whether the detected first biosignal corresponds to the stored information, and	initiate user authentication by determining whether the first biosignal detected by the first sensor corresponds to the information stored in the memory,
authenticate the user by comparing the detected second biosignal to the stored information.	authenticate the user by comparing the second biosignal detected by the second sensor with the information stored in the memory.

128. Thus, based on my understanding of the law, Choi supports at least one claim in the Choi PCT publication and is entitled to the earliest priority date of September 9, 2013.

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

129. I understand Fraser (EX1041) is a U.S. patent publication. Filed August 19, 2014, it predates the earliest priority of the ’491 patent and is therefore prior art. 35 U.S.C. § 102(d)(1).

XI. ANALYSIS OF SPECIFIC GROUNDS

130. In my opinion, claims 1–19 of the '491 patent would have been obvious in view of the prior art to a POSITA at the relevant time. The cited references teach every claim limitation, though not always using identical terminology. *See In re Bond*, 910 F.2d 831, 832 (Fed. Cir. 1990) (disclosure need not be *ipsissimis verbis*). My reasoning is further set forth below.

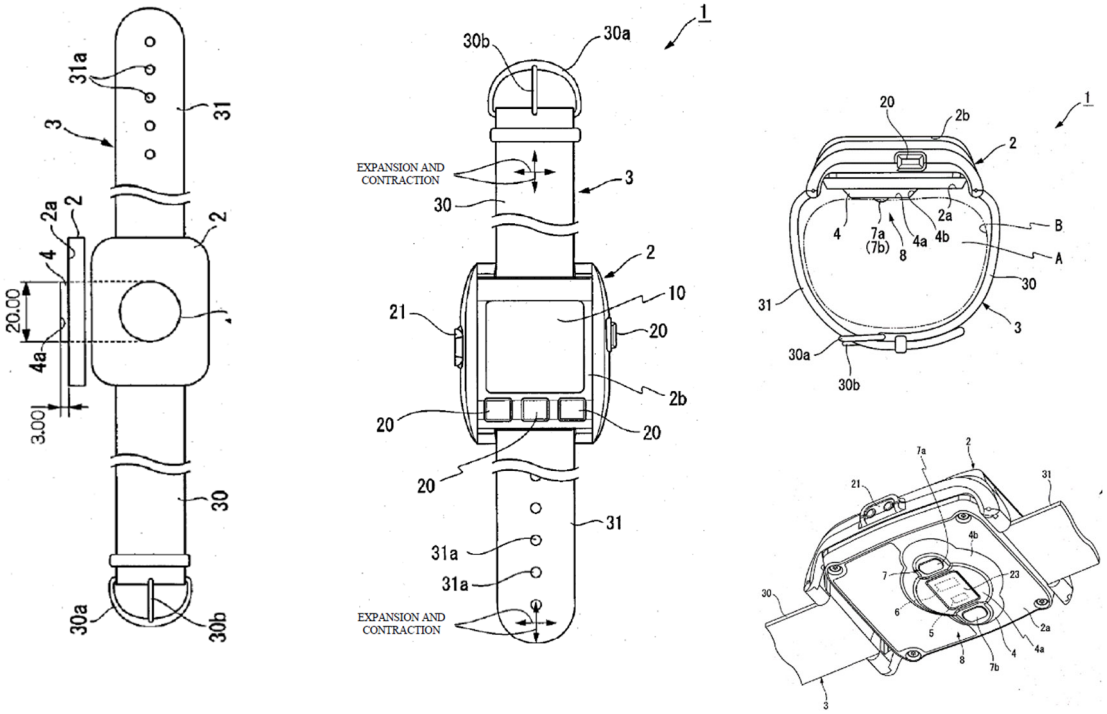
A. Ground 1: Claims 7, 11, 14, and 16 are unpatentable because they would have been obvious over Kotanagi in view of Honda.

1. Independent Claim 7

[7a] 7. A wearable electronic device comprising:
- [7b] a housing formed from a conductive material and defining a first opening opposite to a second opening;
- [7c] a band attached to the housing and configured to secure the wearable electronic device to a user;
- [7d] a display positioned in the first opening;
- [7e] a cover comprising a non-conductive material and positioned over the second opening, the cover forming a portion of an exterior surface of the wearable electronic device;
- [7f] a biosensor module positioned below the cover configured to pass an optical signal through a window defined within the non-conductive material of the cover; and
- [7g] a wireless charging receive coil aligned with the second opening and below the cover, the wireless charging receive coil configured to inductively couple to an external wireless charging device through the non-conductive material of the cover.

a. [7a] "A wearable electronic device comprising:"

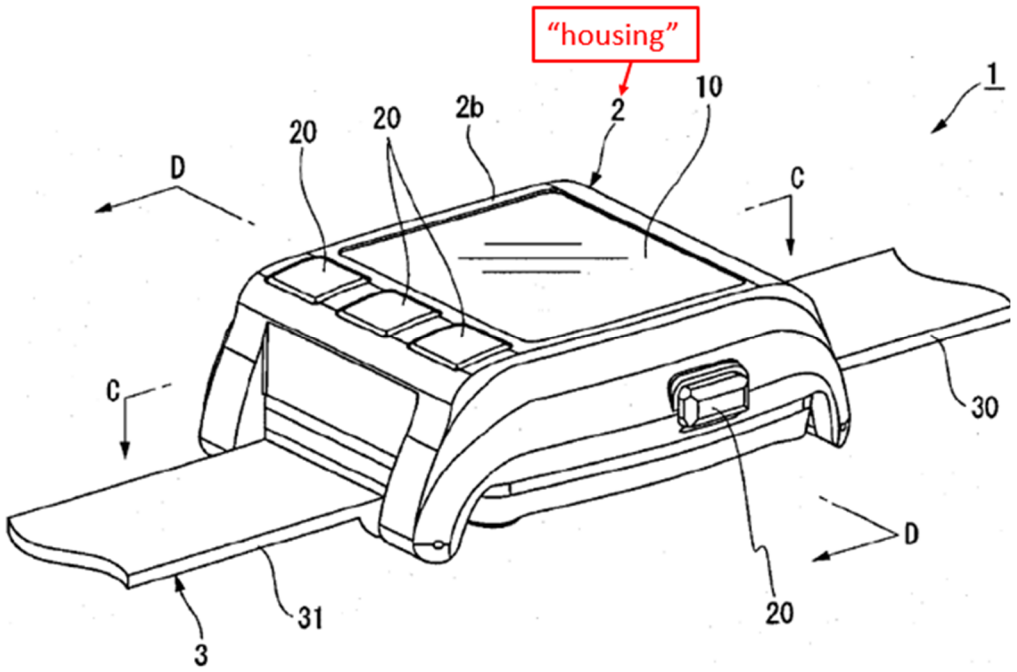
131. Kotanagi describes a "wristwatch-type device which detects pulse rate as a type of biological information while mounted to the wrist." EX1005 at ¶44.



Id. at 23, 24, 26, 28 (Figs. 1, 2, 5, 8).

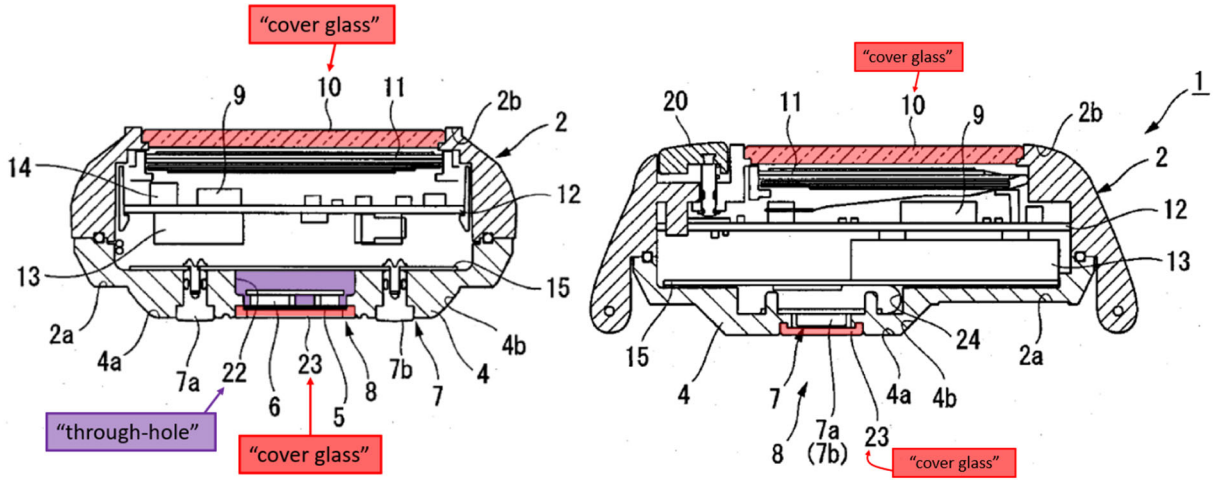
b. [7b] "a housing formed from a conductive material and defining a first opening opposite to a second opening;"

132. Kotanagi teaches "The housing 2 . . . is made of plastic or a metal material such as aluminum." EX1005 at ¶48.



133. EX1005 at 25 (Fig. 4). A POSITA would have understood that aluminum is strongly conductive, thus Kotanagi teaches a conductive housing. Moreover, Honda explicitly describes its metal housing as "conductive." EX1006 13:22–32.

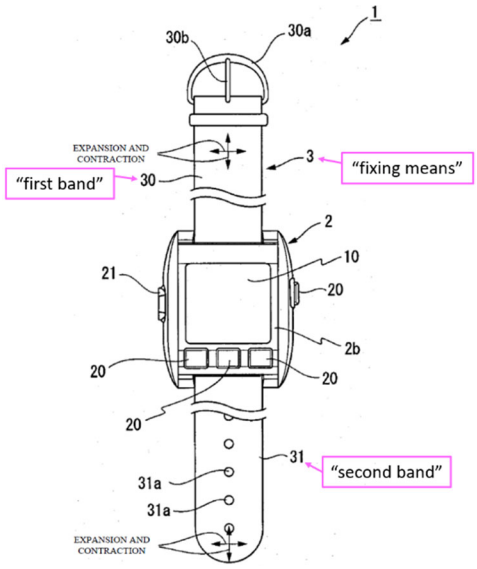
134. Kotanagi's housing has a "first opening" at the top and a "second opening" ("through-hole 22") at the bottom, both shown in the cross-sections below. The cover glass 10 and the cover glass 23 span these openings, and both have been shaded here:



EX1005 at 27 (Figs. 7, 6).

c. [7c] "a band attached to the housing and configured to secure the wearable electronic device to a user;"

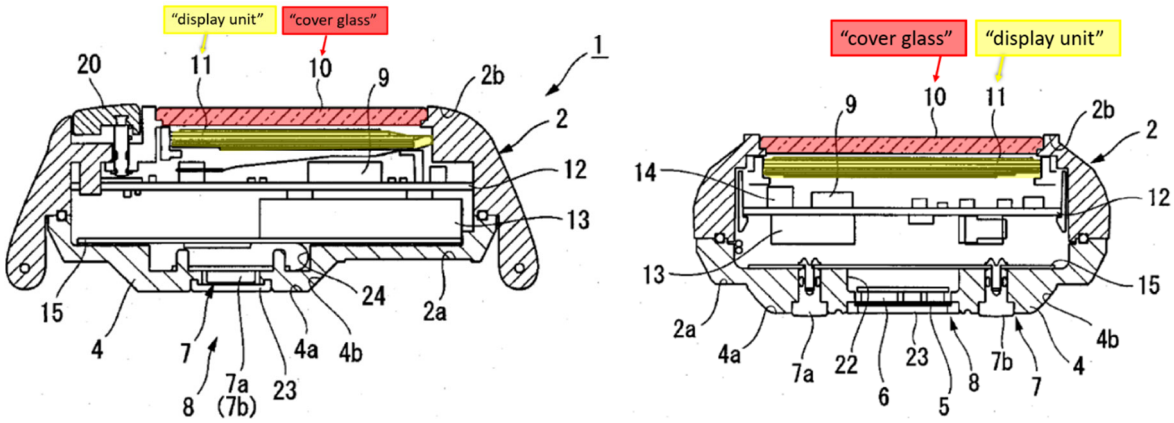
135. Kotanagi has a "means for fixing" the device "to an arm" (*id*., Abstract) and explains: "The fixing means 3 has a first band 30 and a second band 31 having base end sides that are attached to the housing 2 to enable mounting to the wrist." (*id*. ¶60).



See id. at 23 (Fig. 1).

d. [7d] "a display positioned in the first opening;"

136. Kotanagi teaches that "a display part 11 for displaying . . . pulse rate . . . and various other information is disposed inside the cover glass 10." EX1005 at ¶48.

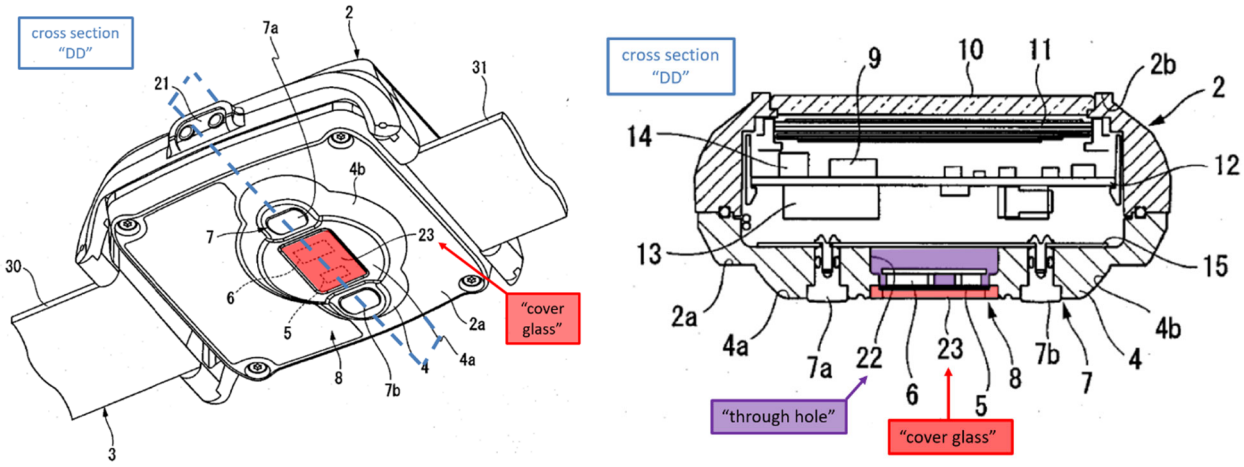


See EX1005 at 25, 27 (Figs. 6, 7).

e. [7e] "a cover comprising a non-conductive material and positioned over the second opening, the cover forming a portion of an exterior surface of the wearable electronic device"

137. Kotanagi teaches that "cover glass 23 is fixed to the housing 2 so as to block the through-hole 22." EX1005 at ¶55. A POSITA would have known that glass is a non-conductive material, and Honda teaches this. EX1006 15:62 ("insulating body (glass, for example)"), *id.* 16:14–15 ("cover glasses 211 and 111

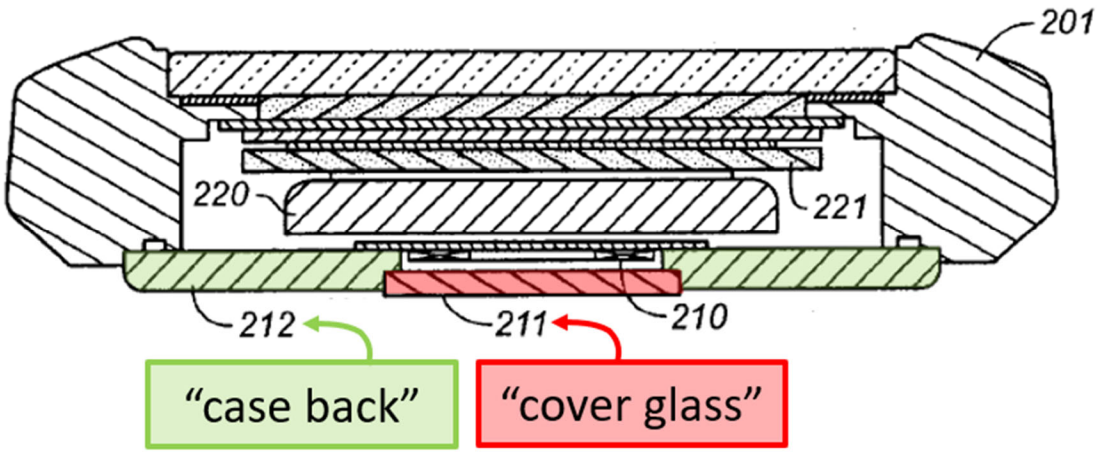
may be replaced with *other* insulating materials") (emphasis added).[5] Kotanagi's cover glass is positioned as claimed and forms a portion of the exterior surface, as shown in the figures below:



See EX1005 at 26.

138. Moreover, Honda, which issued in 2001, discloses a biosensing watch with a metal case back and a non-conductive glass cover, as shown in this cross-section:

[5] Dependent Claim 3 (analyzed in Ground 2 below) states that the '491 "dielectric" cover is glass or sapphire, confirming that the applicant considered glass an electrically insulating material and a dielectric.



See EX1006 at 3 (Fig. 2).

139. Honda teaches "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 15:47–49. Honda additionally teaches that "the cover glasses 211 and 111 may be replaced with other insulating materials." *Id.* 16:14–15. Finally, Honda teaches the benefits of using an insulating, non-conductive body as a cover for the back side of a watch: "By arranging the insulating body in the portion where the coils face, compact design is promoted." *Id.* 15:65–66.

f. [7f] "a biosensor module positioned below the cover configured to pass an optical signal through a window defined within the non-conductive material of the cover; and"

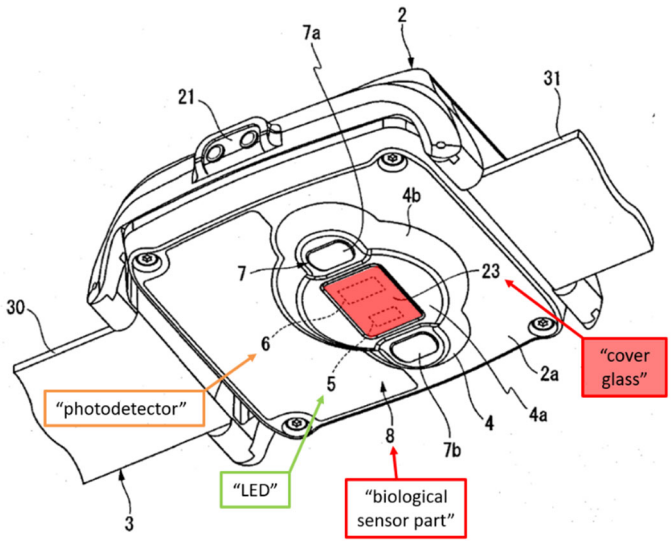
140. Kotanagi teaches the following optical biosensor module "disposed on the lower surface 4a of the protruding part 4":

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 …

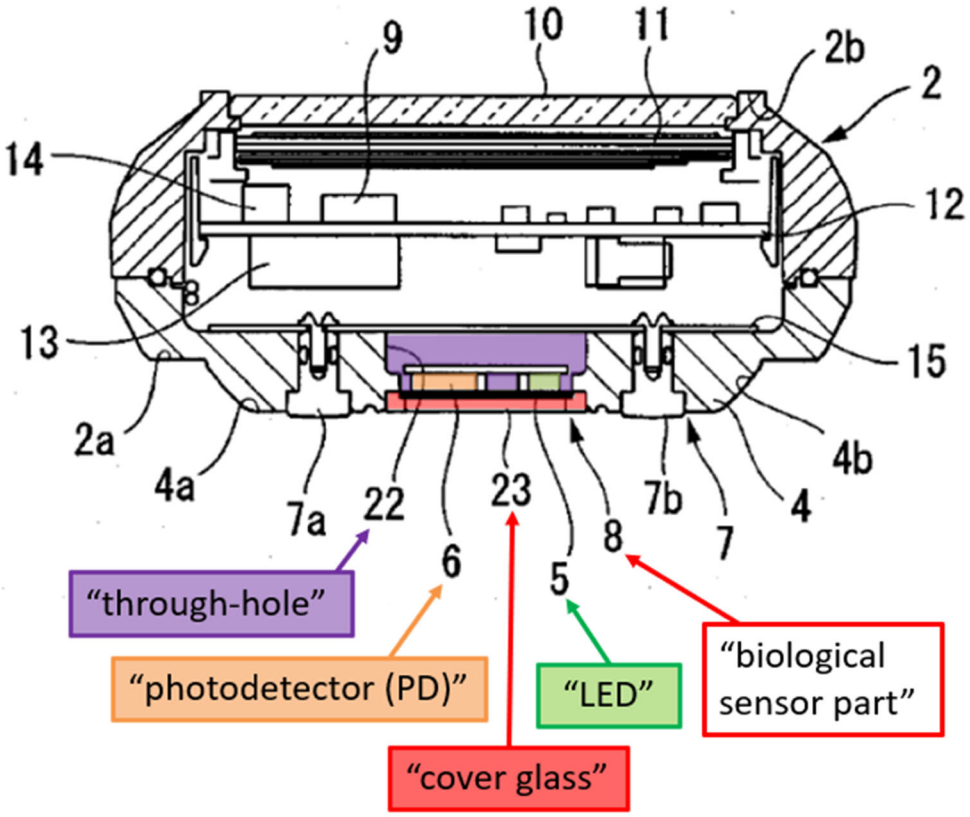
EX1005 ¶46.

141. These features are illustrated below (behind) the cover glass 23, as shown with dashed lines in Kotanagi's Figure 5:



See EX1005 at 26 (Fig. 5).

142. Kotanagi further explains that its "cover glass 23" covers optical components of its biosensor moldule: "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." *Id.* ¶55.



See Id. at 27 (Fig. 7).

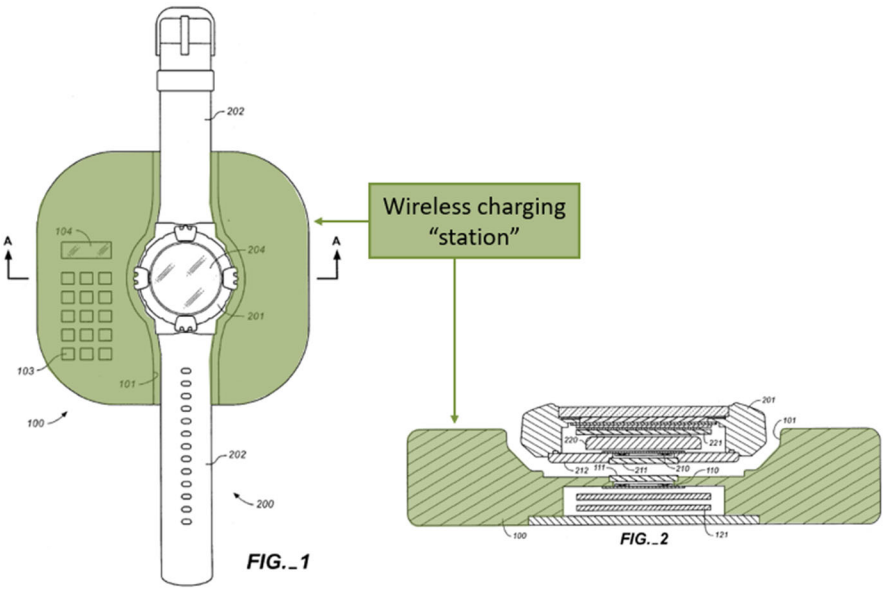
143. A POSITA would have understood from this context that because Kotanagi's "cover glass 23 is fixed to the housing 2 so as to block the through-hole 22" (EX1005 ¶55), its LED and photodetector work by passing optical signals through the cover glass. Thus, Kotanagi's cover glass passes optical signals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

g. [7g] "a wireless charging receive coil aligned with the second opening and below the cover, the wireless charging receive coil configured to inductively couple to an external

wireless charging device through the non-conductive material of the cover."

144. 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 '491 Patent's disclosure that transformers use coils and that such contactless charging involves a wireless charging receive coil.

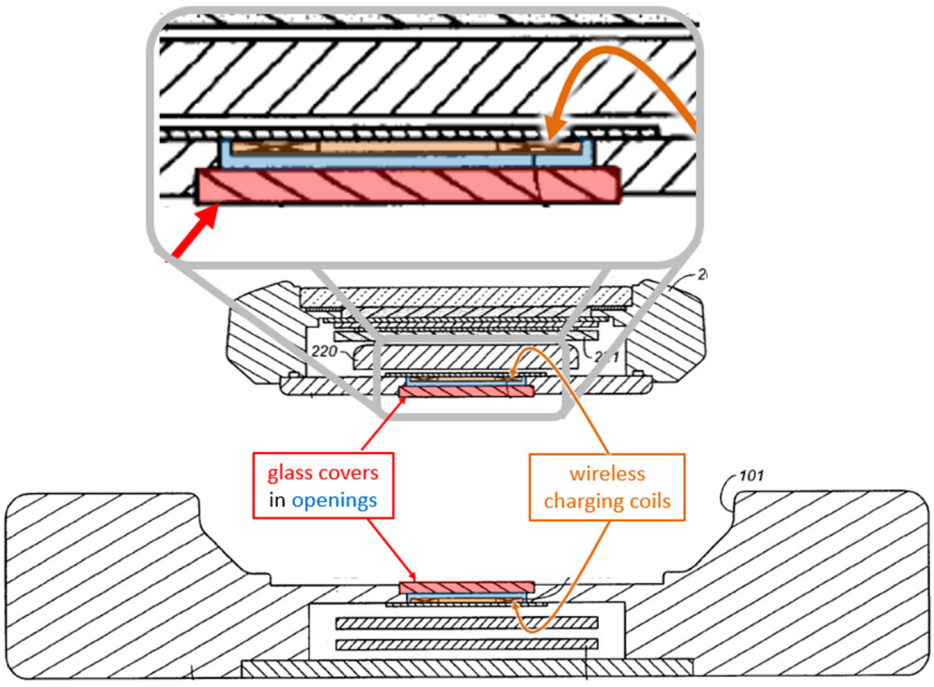
145. **Honda**, which issued in 2001, discloses such a contactless charging system for a biosensing wristwatch. Honda's Figure 1 shows a plan view of the watch in a charging station, with Figure 2 showing cross-section A-A of this arrangement:



See EX1006 at 2–3 (Figs. 1, 2).

146. Like Kotanagi, Honda teaches an optical biosensor: "the electronic watch 200 detects biological information including the pulse rate or the heart rate of the body." EX1006 6:17–20. Like Kotanagi, the Honda watch has a "cover glass" over an opening in the bottom face of the watch. *Id.* 6:24–25. These similarities increase a POSITA's expectation of a successful combination.

147. Behind Honda's cover glass 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.* 6:22–25. Honda thus teaches a "wireless charging receive coil" "aligned with" the opening, and "below the cover," as claimed:

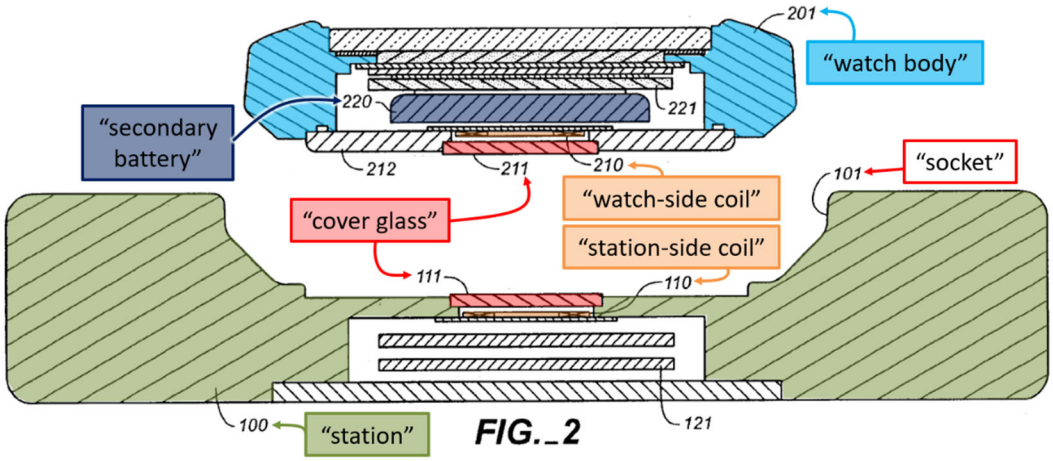


See EX1006 at 3 (Fig. 2).

148. Honda further teaches inductive coupling of the charging station coil and the watch coil:

> 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.

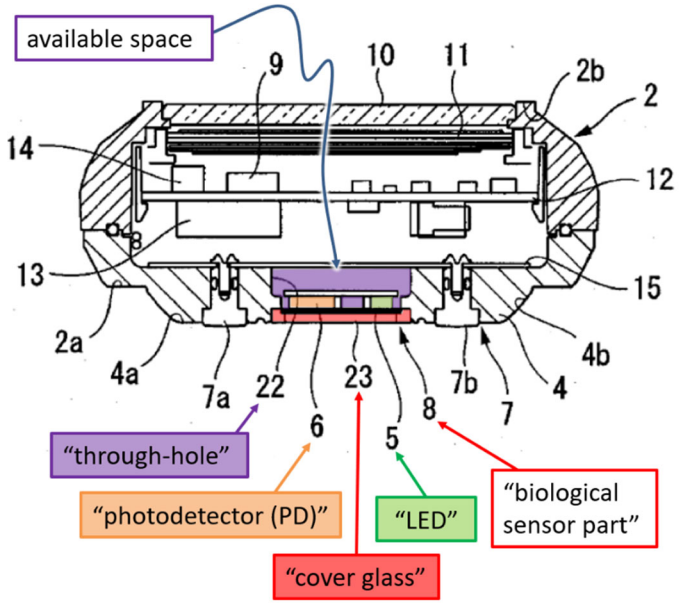
EX1006 6:36–40.



See id. at 3 (Fig. 2).

149. 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 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

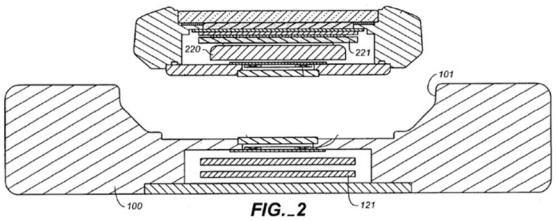
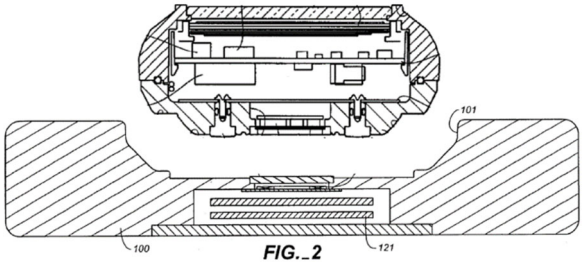
resulting magnetic flux would pass through the cover glass, as taught by Honda. The purple shading in the figure below shows that space was already available in Kotanagi's "through-hole" behind and around the outside of the other listed components, making the modification from Honda simple and feasible, with a high expectation of success:



See EX1005 at 27 (Fig. 7).

150. Honda teaches using its wireless receive coil cooperatively with an "external wireless charging device," through a nonconductive cover material, as claimed. A POSITA would have known that Kotanagi's transformer for recharging in a "contactless state" (EX1005 ¶53) involves such a charging device. Consistent with Honda's teaching to align by seating a watch in a station "socket" (EX1006

6:7), a POSITA would 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):
 FIG._2	 FIG._2

151. After addressing any potential scale differences, a POSITA would have readily combined Kotanagi's watch with Honda's charging station at least because the figures suggest complementary shapes. Thus, Honda and Kotanagi teach that aligning and positioning the coil within Kotanagi's watch as described above also configures the coil "to inductively couple to an external wireless charging device through the non-conductive material of the cover" as claimed.

152. Moreover, Honda's Figure 15 and related text (see below) teach metal covers are inferior for power transmission. EX1006 at 14. Honda teaches:

> If a conductive member is used for the housings between the transmitter-side coil and the receiver-side coil in the power transmission system that works on electromagnetic induction, eddy currents occur in the conductive member, impeding the transmission, and the use of the conductive member is not appropriate for a high-efficiency transmission.

Id. 13:25–32.

153. A POSITA would have known from Honda's disclosure to wirelessly charge through a non-conductive material as "eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling." EX1006 2:48–50. Honda's experiments in this setting confirm this arrangement, as Honda shows wireless charging through a glass surface is at least an order of magnitude more efficient that charging through stainless steel:

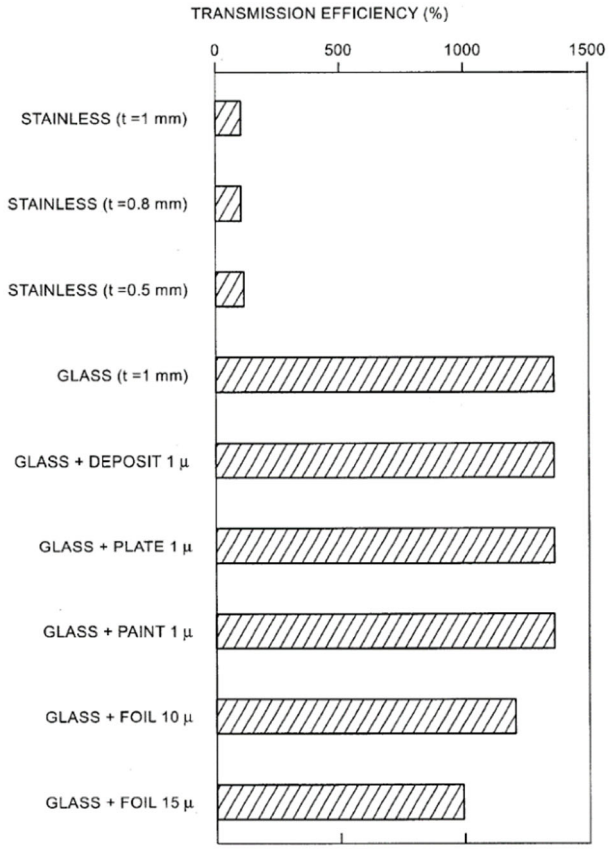


FIG._15

EX1006 at 14.

154. Thus, a POSITA would have aligned Honda's coil with Kotanagi's opening such that inductive coupling occurs "through the non-conductive material of the cover," as claimed.

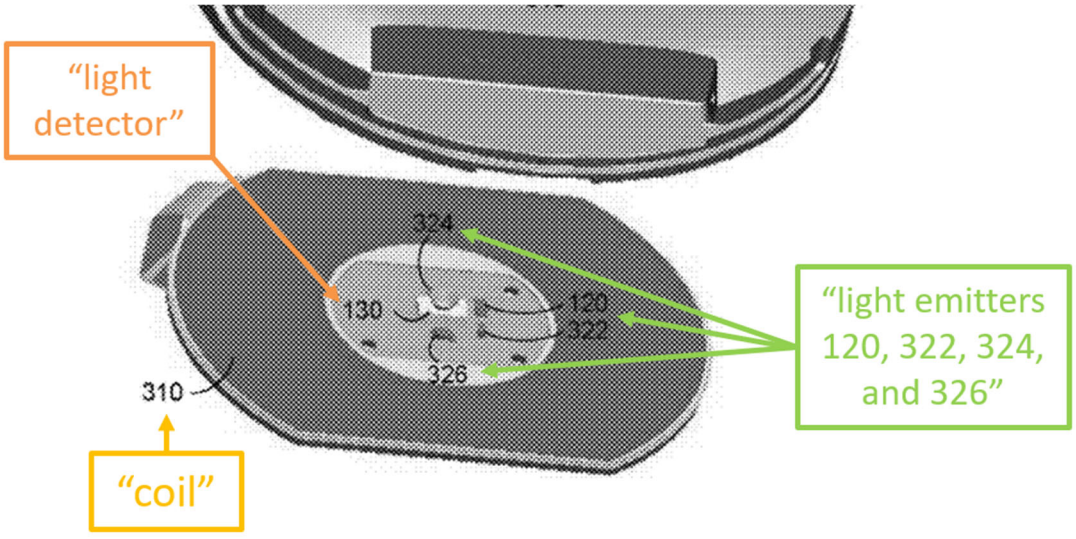
h. Motivation to Combine Kotanagi and Honda

155. As shown above in § IX regarding biosensing watches from the 1970's to the 2010's, this is a crowded field. Prior to September 2014 a POSITA would have had a reasonable expectation of success in the combining the features of Kotanagi and Honda. Further, Kotanagi and Honda are both assigned to Seiko companies. *See* EX1005 at 1; EX1006 at 1. Thus, a POSITA having Kotanagi would have also had access to Honda and readily combined teachings from the two references. Kotanagi teaches a pulse rate biosensor watch that may be charged in a "contactless state" (EX1005 ¶53), motivating a POSITA to look to Honda for familiar elements that do nothing more than yield predictable results. Honda teaches wireless watch charging and sensors for measuring pulse/heart rate of the body (EX1006 6:14–20, 8:40–42), motivating a POSITA to look to Kotanagi to implement a predictable variation. Thus, there is an express teaching and motivation in both references that the subject matter in each is to be combined with the other.

156. Moreover, existing similarities between the watch embodiments of Kotanagi and Honda would have caused a POSITA to expect success when combining features or inserting components from one into the other. Both have a

watch shape, both have biosensors, and both have a cover glass over an opening in the bottom face of the watch. As explained above, e.g. in relation to limitation [**7g**], components from Honda would have readily fit within or otherwise combined with Kotanagi's embodiments. For example, a POSITA would have readily implemented Kotanagi's teachings using structures for contactless or wireless charging from Honda.

157. Although Fraser is not cited in Ground 1, Fraser (applied *infra* § XI(C)) provides evidence that it would have been feasible to make the second modification option discussed above: to enlarge Kotanagi's opening and cover glass to make room for a coil behind the cover glass, surrounding the LED and PD. Fraser teaches a wireless "charging coil 310 surrounding the light emitters 120, 322, 324, and 326 and the light detector 130." EX1041 [0026]. This is shown below:



EX1041 at 4.

158. Fraser teaches that "[t]he light emitters 120, 322, 324, and 326 and the light detector 130 can be placed in the middle of the charging coil 310 to reduce the thickness of the apparatus." EX1041 [0026]. Fraser also teaches that its watch is superior to the prior art because it provides "all of the features desired by users, such as effective biometric sensor features while maintaining a desirably small size." EX1041 [0005]. Thus, a POSITA would have understood that one motivation for placing a wireless charging coil around an optical biosensor would be to provide a desirable thickness for Kotanagi's biosensing watch.

159. For these reasons and those explained above, a POSITA would have been motivated to combine Honda and Kotanagi. These motivations to combine also apply to the other Ground 1 combinations and dependents from Claim 7. Further motivations to combine are provided throughout this declaration.

2. Dependent Claim 11

160. Claim 11 depends from Claim 7 and further adds, "**wherein: the cover forms a waterproof seal with the housing along a perimeter of the cover**."

161. Kotanagi teaches covering its wired charging terminal to protect the terminal from "water droplets, dust, or the like." EX1005 at ¶53. Kotanagi then suggests replacing the terminal and instead "recharg[ing] the rechargeable battery 13 in a contactless state." Id. Thus, Kotanagi recognizes contactless charging as a

solution for preventing "water droplets, dust, or the like" from penetrating the device.

162. Similarly, Honda teaches the benefits of 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 1:24–31 (emphasis added).

163. Honda teaches that 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 15:36–38 (emphasis added). Honda teaches a watch that is waterproof up to five atmospheres. *Id*. 13:22–25.

164. From the above, a POSITA would have recognized the water droplet problem from Kotanagi and that the Honda's "cover forms a waterproof seal with the housing along a perimeter of the cover" as claimed. A POSITA would have expected to successfully achieve a water-tight seal (and be motivated to establish such a seal) in Kotanagi not only because of Honda's success, but also based on the general knowledge of watches successfully using sealants, rubber gaskets, etc. to

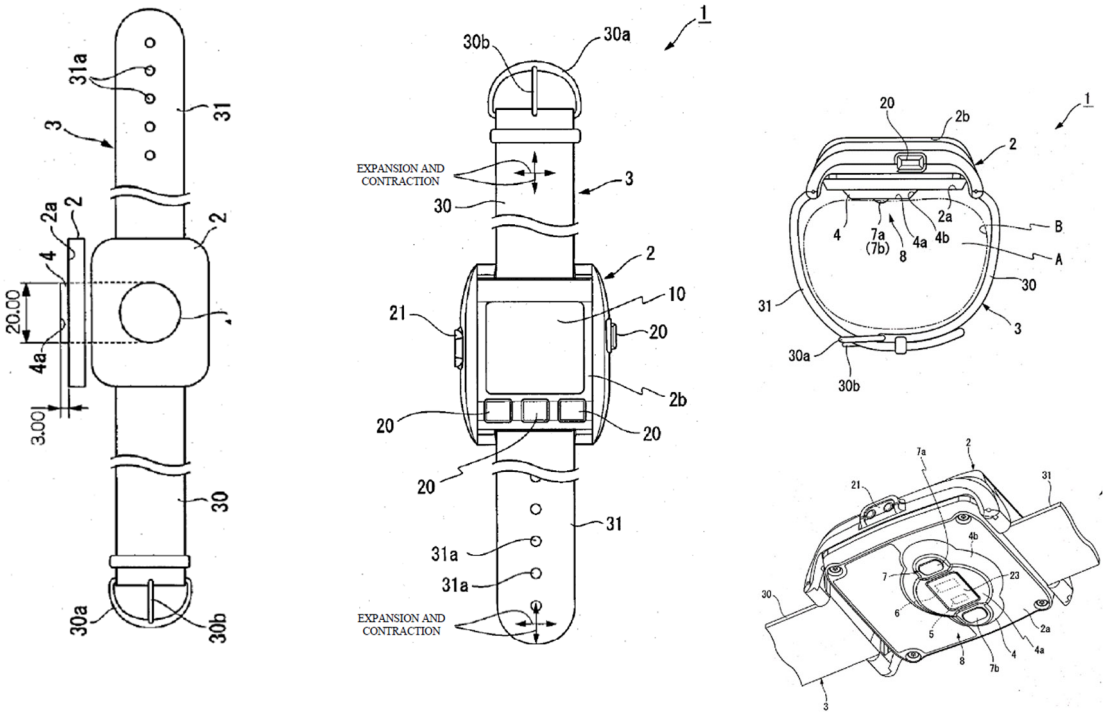
prevent moisture from harming internal electrical components, allowing watch wearers to wash hands, swim, and dive. *See* EX1006 2:32–33 (teaching an embodiment having a "waterproof-structured with gaskets so that internal circuits are not wetted with water"). Thus, a POSITA would have found it obvious to employ a rear cover that forms a waterproof seal with the housing.

3. Independent Claim 14

[14a] 14. An electronic device, comprising:
- [14a] a housing defining a first opening and a second opening;
- [14b] a display positioned at least partially within the first opening;
- [14c] a biosensor module aligned with the second opening;
- [14d] a wireless charging receive coil positioned within the housing and aligned with the second opening;
- [14e] a battery operably coupled to the wireless charging receive coil; and
- [14f] a cover formed from an optically transparent material and disposed over the biosensor module and the wireless charging receive coil, wherein:
  - [14g] the electronic device is configured to receive wireless power through the optically transparent material of the cover using the wireless charging receive coil; and
  - [14h] the electronic device is configured to measure a heart rate of a user through the optically transparent material of the cover using the biosensor module.

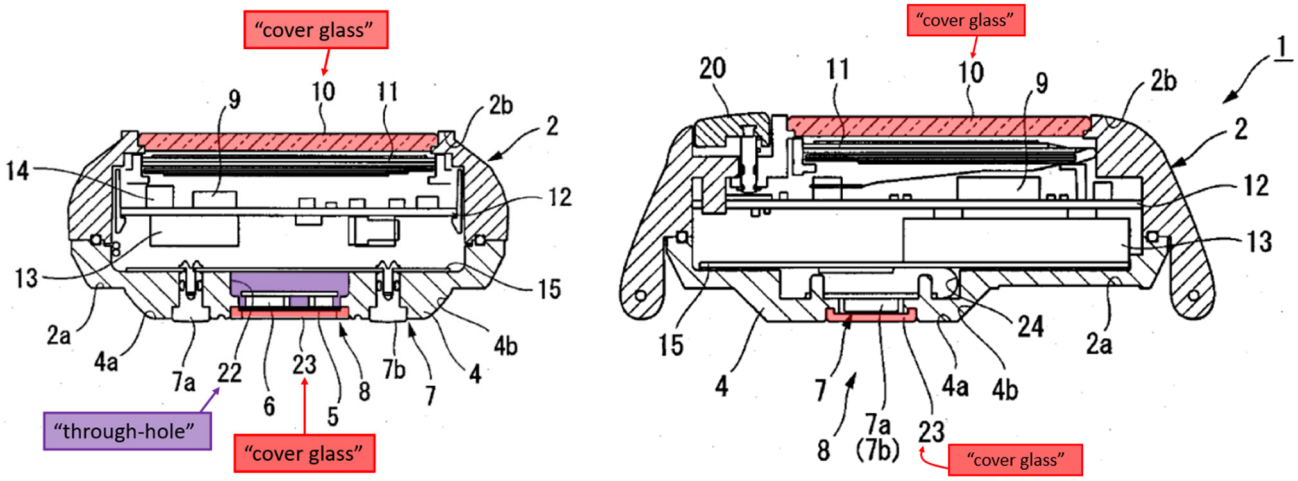
a. [14a] "An electronic device comprising: a housing defining a first opening and a second opening;"

165. Kotanagi teaches an electronic device as shown below:



Id. at 23, 24, 26, 28 (Figs. 1, 2, 8, 5).

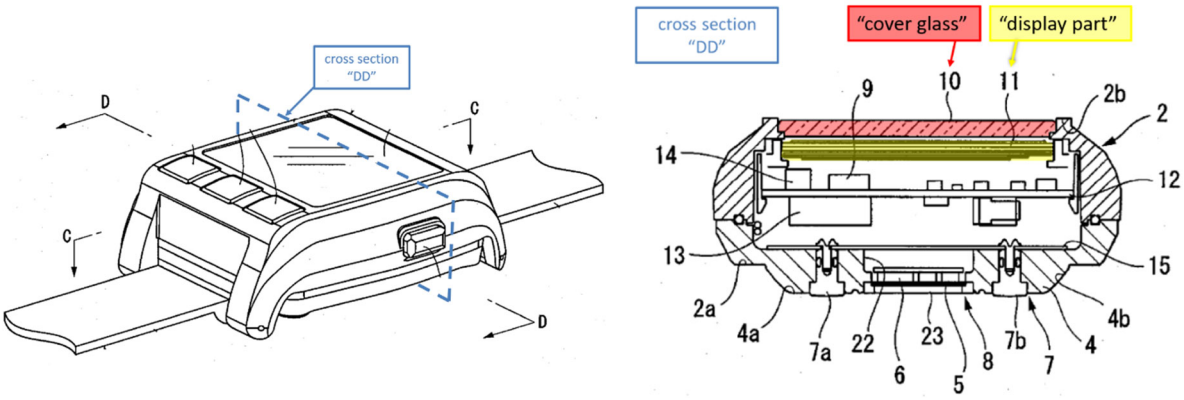
166. Kotanagi's housing has a "first opening" at the top and a "second opening" ("through-hole 22") at the bottom, both shown in the cross-sections below. The cover glass 10 and the cover glass 23 span these openings:



EX1005 at 27 (Figs. 7, 6).

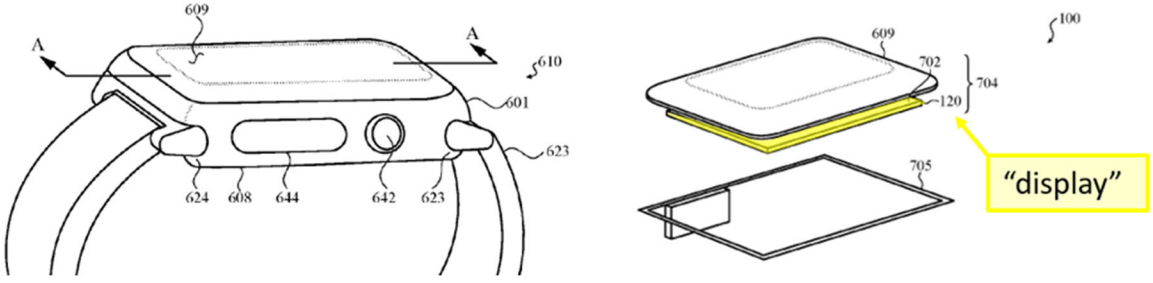
b. [14b] "a display positioned at least partially within the first opening;"

167. Kotanagi teaches "A cover glass 10 . . . is fitted into the central portion of the upper surface 2b of the housing 2, and a display part 11 . . . is disposed inside the cover glass 10." Ex 1005 at ¶48.



See id. at 25, 27 (Figs 5, 7).

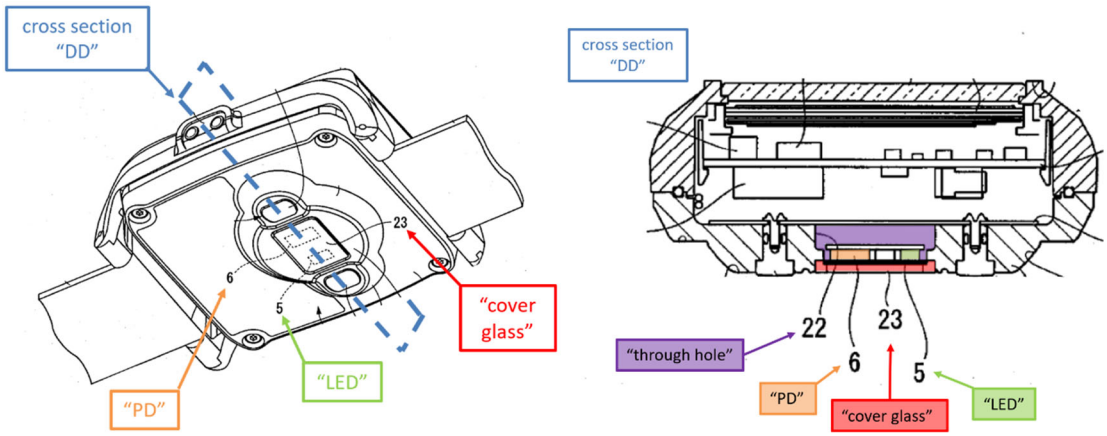
168. This is consistent with the '491 patent's display, which is also under a cover glass in the opening.



See EX1001 at 12–13 (Figs. 6, 7). Accordingly, Kotanagi teaches this limitation.

c. [14c] "a biosensor module aligned with the second opening;"

169. Kotanagi teaches a "biological sensor part" aligned with the opening:



See EX1005 at 26, 27.

170. "The 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.

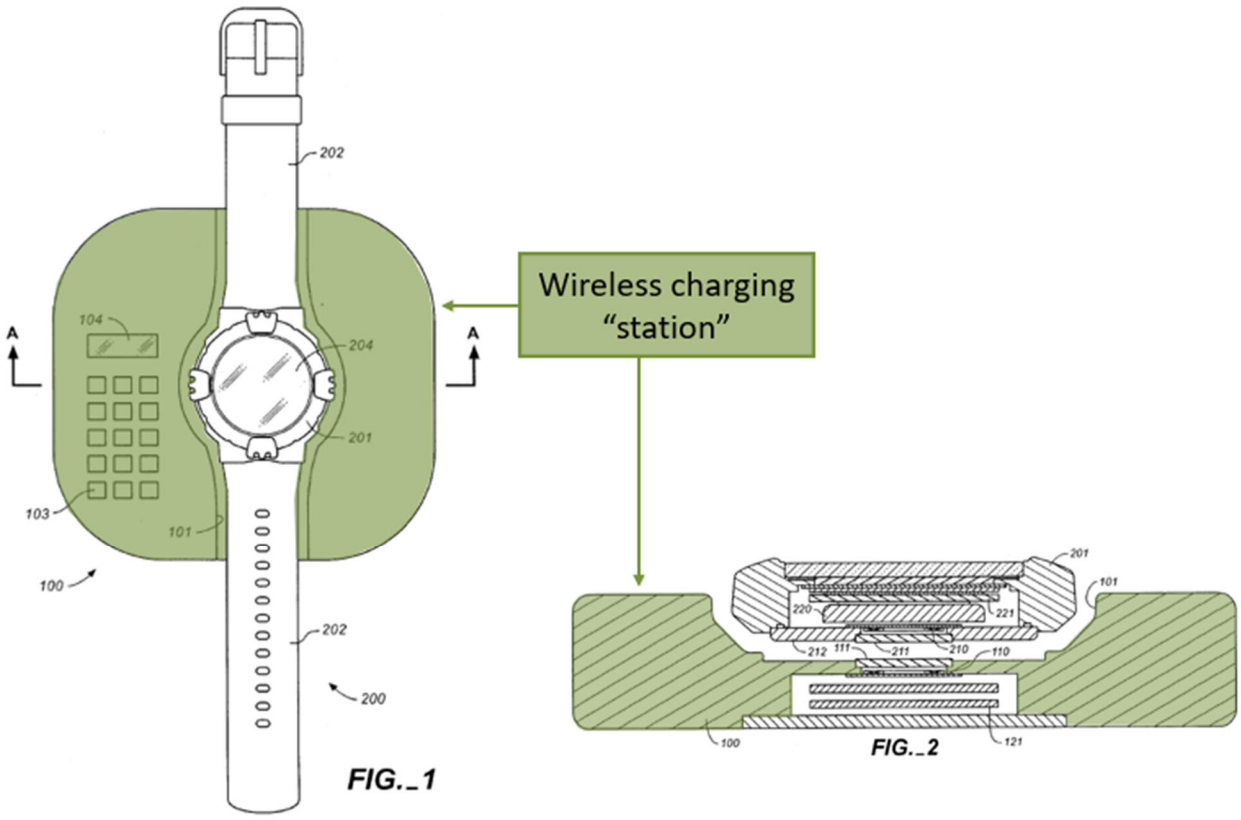
d. [14d] "a wireless charging receive coil positioned within the housing and aligned with the second opening;"

171. As discussed above with regard to [14a] Kotanagi teaches a "second opening" ("through-hole 22") at the bottom of its watch.

172. 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 '491 Patent's invention that

transformers use coils and that contactless charging uses a wireless charging receive coil.

173. Honda, which issued in 2001, 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 cross-section A-A of this arrangement:

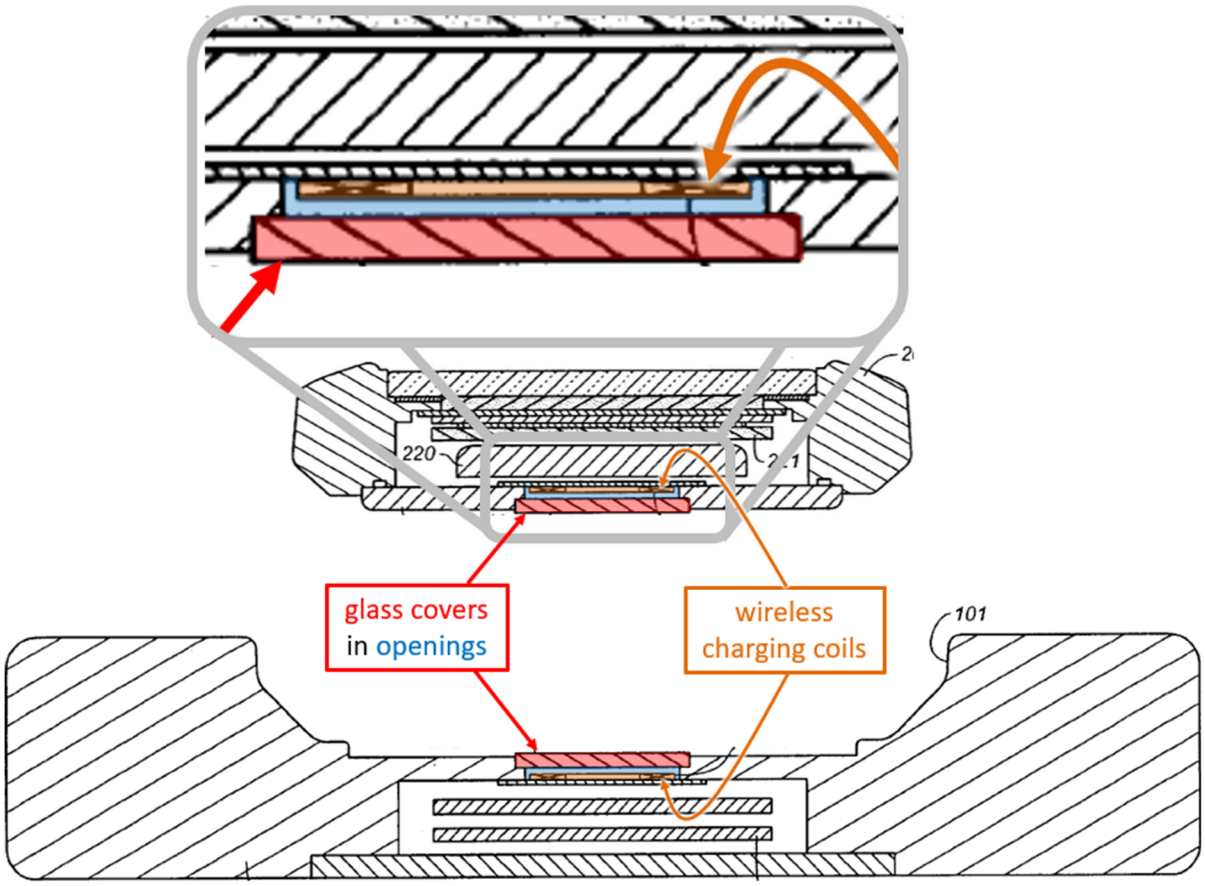


See EX1006 at 2–3 (Figs. 1, 2).

174. 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 6:17–20. Like Kotanagi, the Honda watch has a "cover glass" that spans an opening in the bottom surface of the watch. *Id.* 6:24–25. These similarities make it more likely that a POSITA would have combined these references.

175. Within its housing and behind its cover glass, Honda illustrates a "wireless charging receive coil" "aligned with the opening," as claimed:



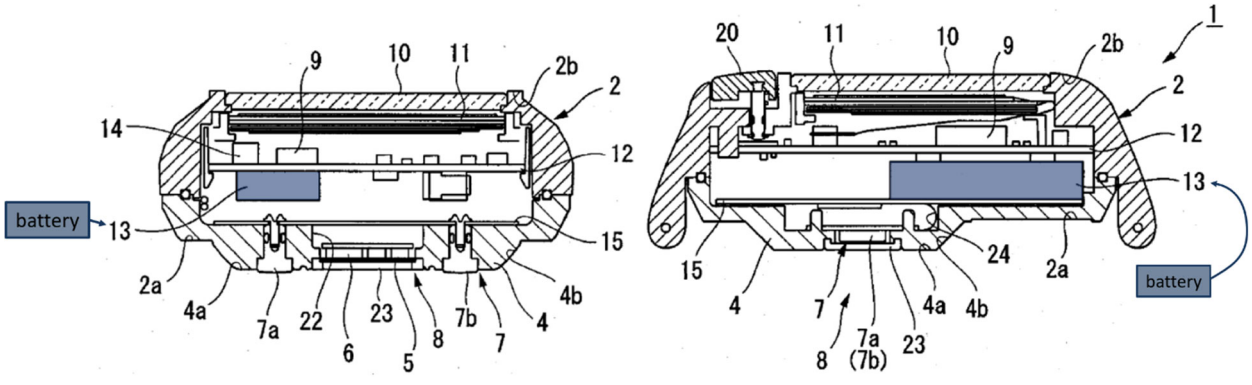
See EX1006 at 3 (Fig. 2).

176. A person of ordinary skill in the relevant field or "art" at the time of the '491 patent (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 charge this way would have looked to Honda—assigned to another Seiko company and providing compatible disclosure—to implement Kotanagi's stated goal. Honda's watch structure is similar in size and purpose to the watch of Kotanagi and Honda teaches incorporating a sensor for "pulse rate" or "heart rate". EX1006 6:17–19. Thus, a POSITA would have had a reasonable expectation of success in fitting Honda's wireless charging receive coil within Kotanagi's housing (e.g., in its "through-hole 22") for Kotanagi's expressed purpose of contactless recharging.

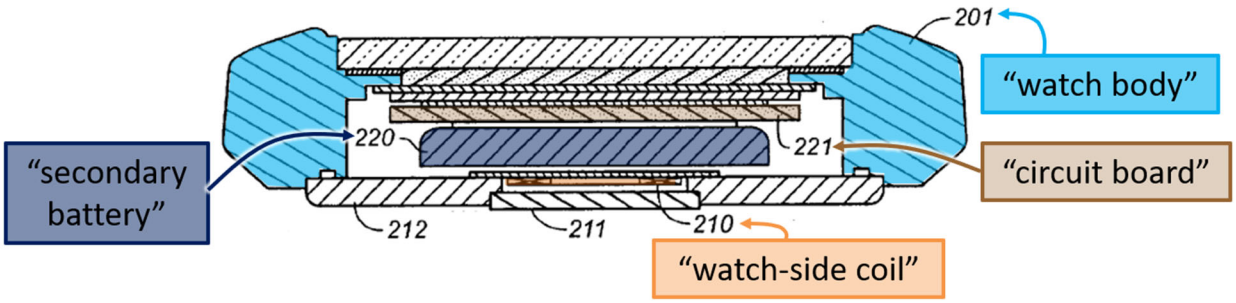
e. [14e] "a battery operably coupled to the wireless charging receive coil; and"

177. Kotanagi teaches a "rechargeable battery 13," which can be connected for "contactless," or wireless, charging. EX1005 at ¶53. The battery is illustrated in the cross-sections of Kotanagi's Figures 6 and 7:



See EX1005 at 27 (Figs. 6, 7).

178. 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 6:25–27.

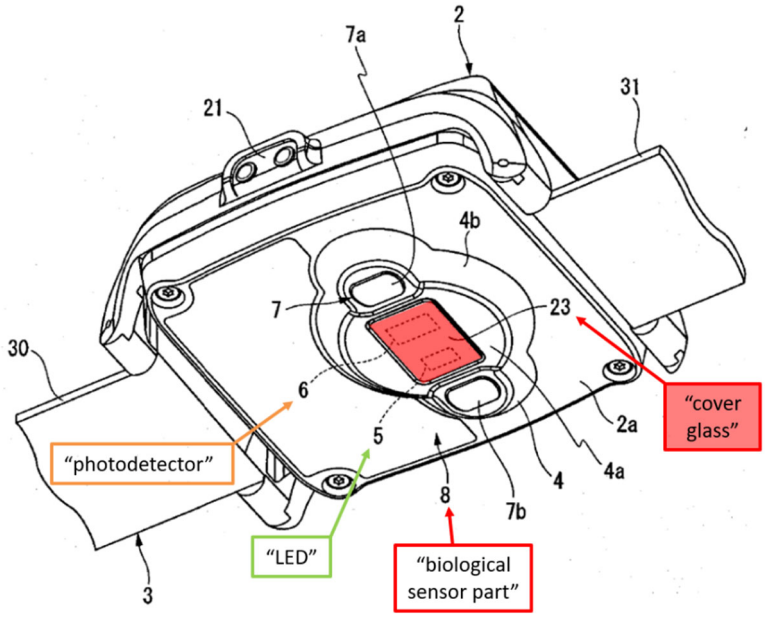


See id. at 3 (Fig. 2).

179. To obtain power, a POSITA would have included a coil in the Kotanagi device and connected it to Kotanagi's battery, as taught by Honda's battery connection from coil to battery.

f. [14f] "a cover formed from an optically transparent material and disposed over the biosensor module and the wireless charging receive coil, wherein:"

180. Kotanagi illustrates its photodetector 6 and LED 5 with dashed lines to indicate they lie behind the cover glass 23, forming an optical "biosensor module":



181. *See* EX1005 at 26 (Fig. 5). Kotanagi's cover glass is optically transparent, because from their positions behind this cover the "data processing part 9 emits light from the LED 5 toward the living body" and the "[t]he PD 6 receives … reflected light." EX1005 at ¶65.

182. **Honda**'s cover glass is also optically transparent: "since the glass member is typically transparent, the internal coil and electronic components are seen through from the outside." EX1006 13:53–55.

183. Honda shows wireless charging efficiencies (Fig. 15) with different covering materials and thicknesses, suggesting that a variety of different types of materials may be used as a covering for wireless charging coils.

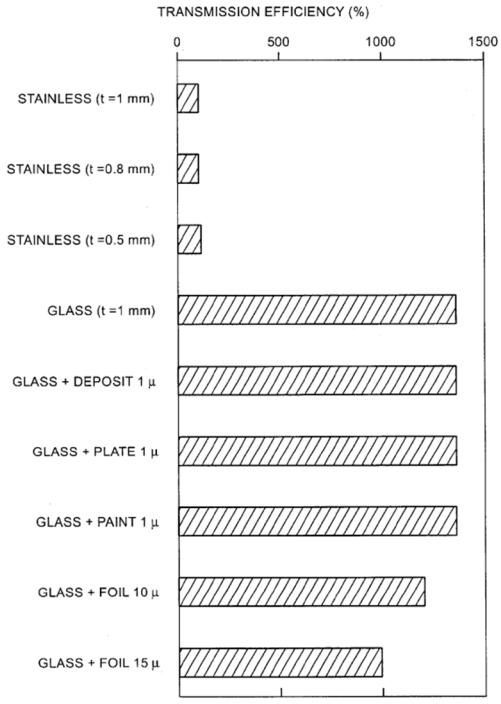


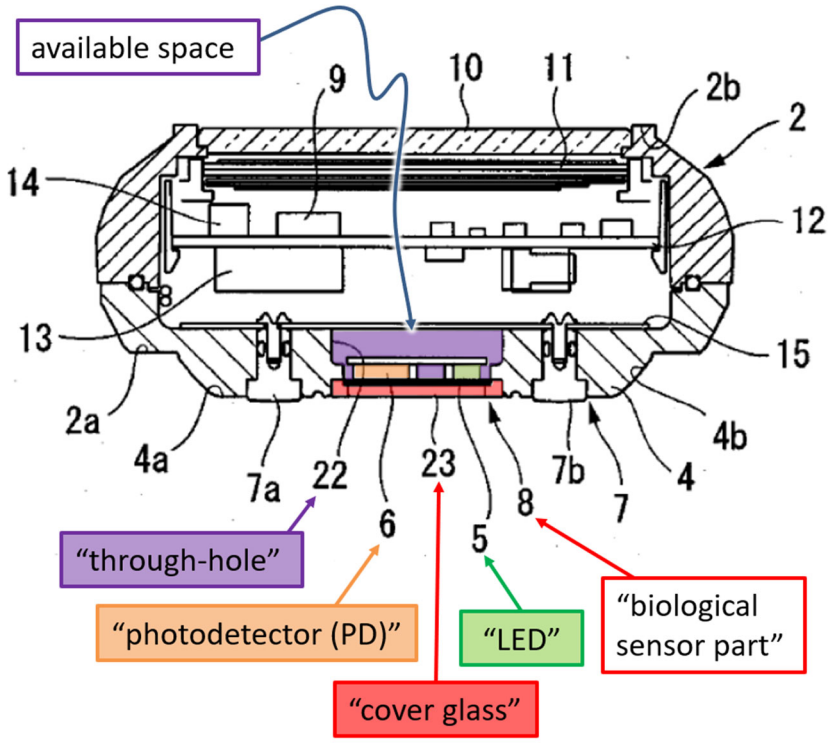
FIG._15

EX1006 at 14.

184. From the figure above, a POSITA would have understood that glass may optimally be used as a transparent material to cover a wireless charging receive coil.

185. 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 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 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 at 27 (Fig. 7).

g. [14g] "the electronic device is configured to receive wireless power through the optically transparent material of the cover using the wireless charging receive coil; and"

186. As noted above, Kotanagi teaches recharging its battery "in a contactless state" and that glass may be used as a material for its optical biosensor. EX1005 at ¶53, ¶55.

187. Honda also teaches the use of a transparent glass cover to receive wireless power at a charging station. EX1006 13:53–55 ("since the glass member is typically transparent, the internal coil and electronic components are seen through from the outside."). Honda's charging station passes wireless power to the receive coil through the physics of induced currents and magnetic flux. Honda illustrates the physics in detail as follows:

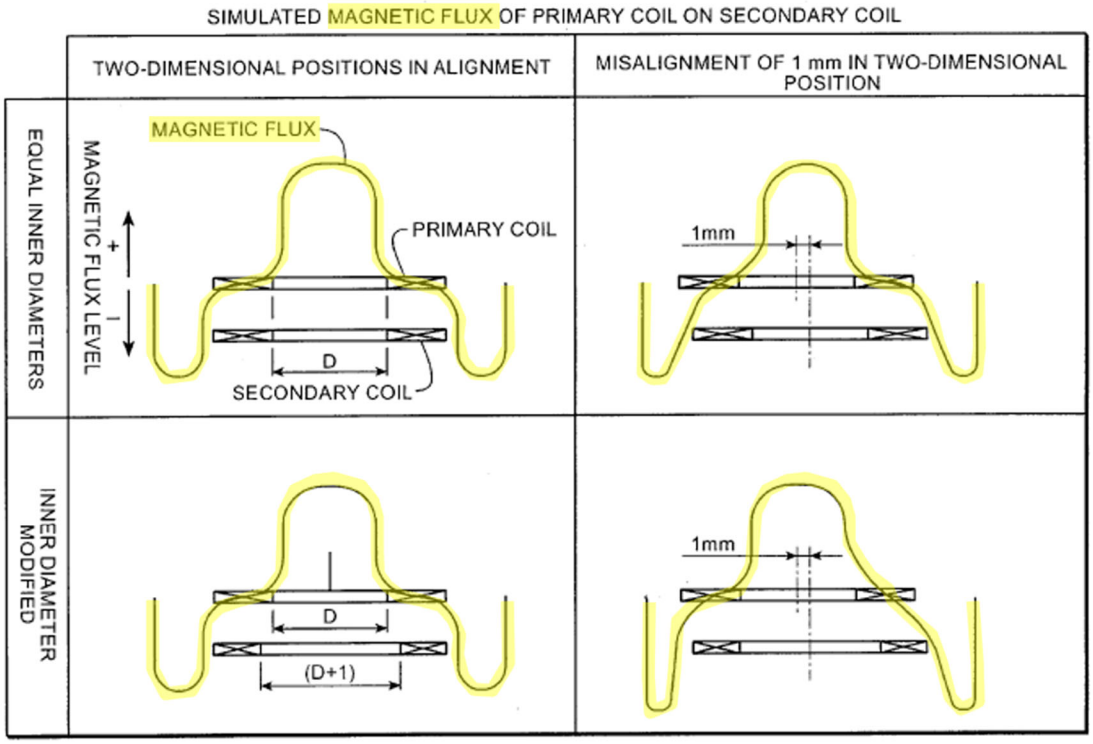


FIG._10

Id. at 9 (Fig. 10).

188. 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.

EX1006 6:28–35;

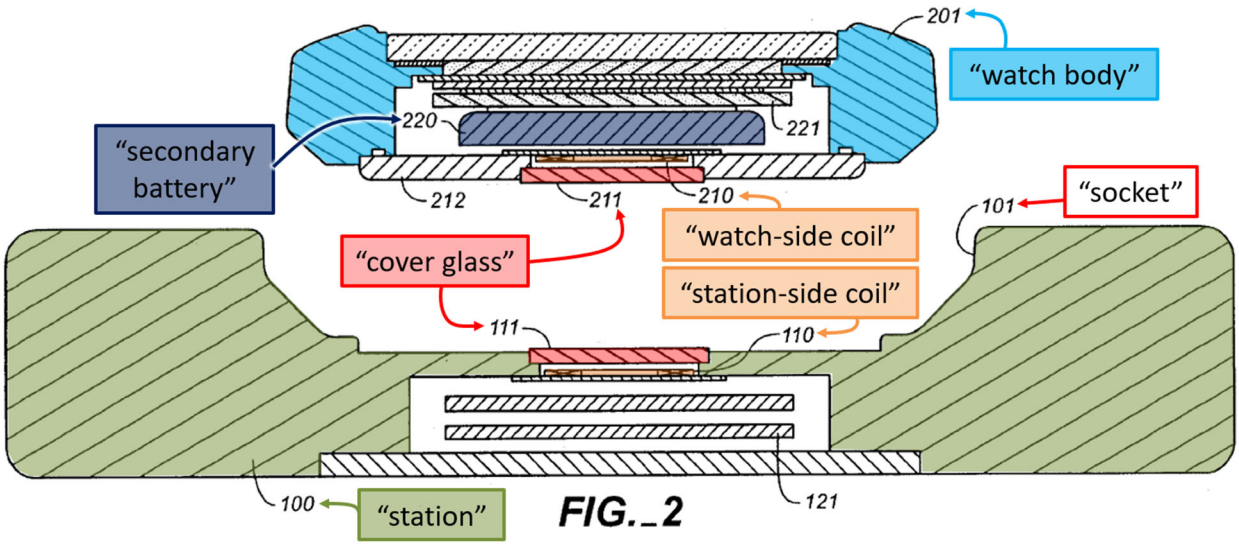


FIG._2

See id. 1006 at 3 (Fig. 2).

189. 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 align a charging receive coil behind this cover glass (in a similar position and with a similar 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.

190. Moreover, Honda's Figure 15 and related text (see below) teach metal covers are inferior for power transmission due to, e.g., eddy currents. EX1006 at 14; *id*. 2:48–50 ("eddy currents take place in the electrically conductive metal material, weakening the electromagnetic coupling"). A POSITA would have known from Honda's disclosure to wirelessly charge through a non-conductive material such as glass as "the use of the conductive member is not appropriate for a high-efficiency transmission." EX1006 13:30–31. Honda's experiments show wireless charging through a glass surface is at least an order of magnitude more efficient that charging through stainless steel:

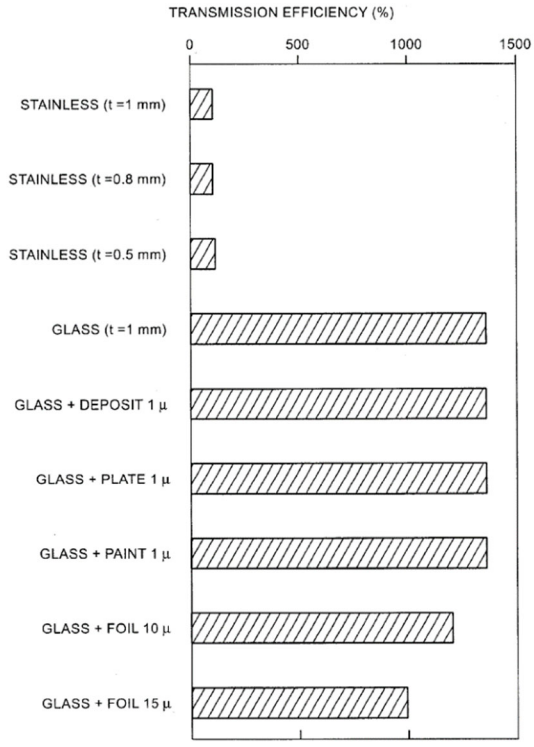


FIG._15

EX1006 at 14, *see also* 13:45-48 ("the use of an insulating material for the external housing results in a transmission efficiency ten times as high as the one achieved by a stainless product.").

191. Thus, a POSITA would have aligned Honda's coil with Kotanagi's opening such that inductive coupling occurs through the glass cover.

192. Accordingly, Kotanagi in view of Honda teach the cover "configured to pass wireless power from an external wireless charging device to the wireless charging receive coil."

h. [14h] "the electronic device is configured to measure a heart rate of a user through the optically transparent material of the cover using the biosensor module."

193. As explained for limitation [**7f**], Kotanagi teaches passing an optical signal through the material of the cover. Kotanagi also teaches measuring a "pulse signal" from reflected light that is transmitted through cover glass: "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." EX1005 at ¶65. Kotanagi's data processing part 9 converts the pulse signal into a "pulse rate." EX1005 at ¶66. A POSITA would have known that pulse rate is a function of heart rate, directly correlated with heart rate, and is a manifestation of heart rate, as pulsing fluctuations in blood flow result from and have the same cadence as heart contractions. Honda also teaches that its watch may detect "pulse rate or heart rate of the body through an unshown sensor." EX1006 6:17–20; 8:40–42. For at least these reasons, these limitations are taught by the combination of Kotanagi and Honda.

i. Motivation to Combine Kotanagi and Honda

194. Kotanagi and Honda are both assigned to Seiko companies. *See* EX1005 at 1, EX1006 at 1. Thus, a POSITA having Kotanagi would have also had access to Honda and readily combined teachings from the two references. Prior to

September 2014, a POSITA would have been motivated to make the modifications explained above based on teachings of both Kotanagi and Honda and would have had a reasonable expectation of success in doing so. Kotanagi teaches a pulse rate biosensor watch that may be charged in a "contactless state," motivating a POSITA to look to Honda for familiar elements that do nothing more than yield predictable results. EX1005 at ¶53. Honda teaches wireless watch charging and sensors for measuring pulse/heart rate of the body, motivating a POSITA to look to Kotanagi to "implement a predictable variation." EX1006 6:14–20; 8:40–42.

195. Moreover, existing similarities between the main watch embodiments of Kotanagi and Honda would have caused a POSITA to expect success when combining features or inserting components from one into the other. Both have a watch shape, both have biosensors, and both have a cover glass over an opening in the bottom face of the watch. As explained above, e.g. in relation to limitation [**7g**], components from Honda would have readily fit within or otherwise combined with Kotanagi's embodiments. For example, a POSITA would have readily implemented Kotanagi's teachings using structures for contactless or wireless charging from Honda.

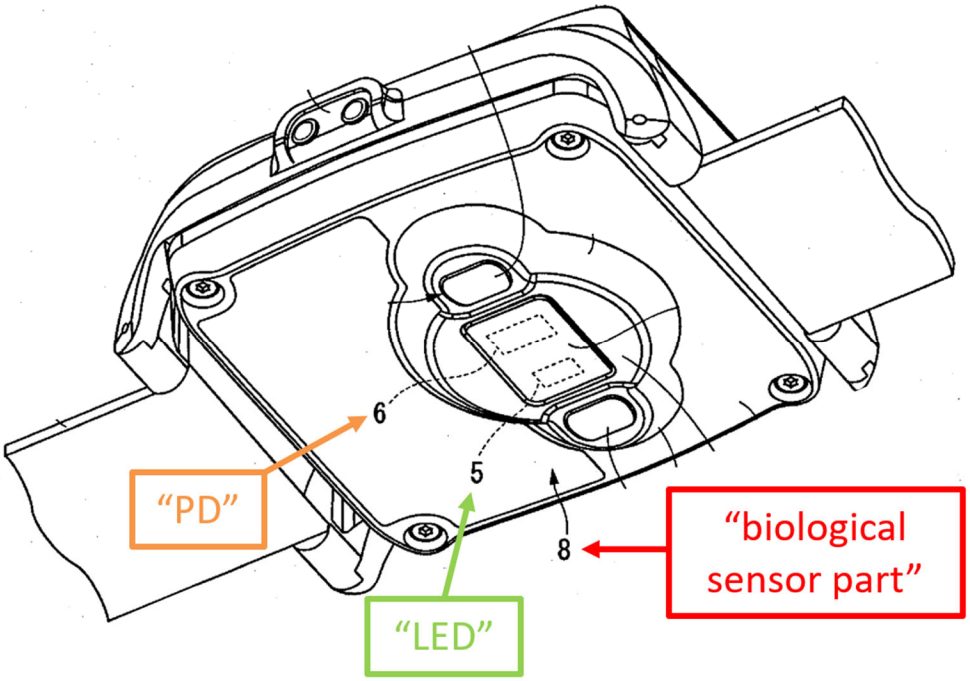
196. For at least these reasons and those stated with respect to Claim 7 in section XI(A)(1)(h) above, a POSITA would have been motivated to combine Kotanagi and Honda prior to September 2014.

4. Dependent Claim 16

197. Claim 16 depends from claim 14 and further adds:

a. "wherein: the biosensor module comprises: a light source; and a detector;"

198. Kotanagi teaches an optical biosensor module (8) comprising an LED light (5) and a detector (PD 6) as shown:



See EX1005 at 26.

b. "the light source and the detector are configured to measure changes in light absorption by a region of skin of the user;"

199. Kotanagi teaches that its optical biological sensor measures changes in light absorption: "since 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 … the PD 6 can generate a pulse signal." EX1005 at ¶65.

c. "the electronic device is configured to compute the heart rate using the measured changes in light absorption; and"

200. Kotanagi's device "extracts a pulse signal corresponding to the pulse from the reflected signal, and calculates the pulse rate." EX1005 at ¶3.

201. Kotanagi teaches that it receives reflected light, but that it "computes" a pulse signal from the reflected light:

> The data processing part 9 includes IC parts such as a CPU, and has a function of detecting the pulse rate by temporarily amplifying the pulse signal generated by the PD6 with an amplifier, performing prescribed processing such as Fast Fourier Transform processing (FFT processing), and then analyzing the processing results. In addition, the data processing part 9 records the detected pulse rate in the memory 14 and displays the pulse rate …

EX1005 at ¶50.

202. Pulse rate and pulsing fluctuations in blood flow are directly correlated to heart rate and are a manifestation of heart rate, as the fluctuations in blood flow are a result of the cadence of heart contractions.

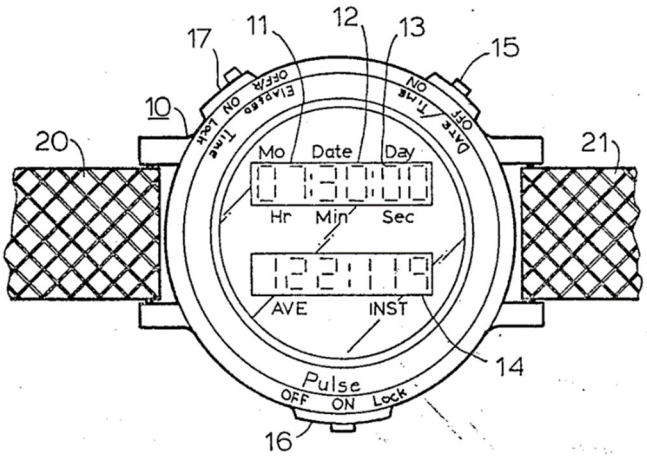
203. Honda additionally teaches that its watch may detect "pulse rate or heart of the body through an unshown sensor." EX1006 6:17–20, 8:40–42.

d. "the display is configured to display information associated with the heart rate."

204. Kotanagi teaches "wherein a display part for displaying detected biological information is provided on an upper surface of the main body." EX1005 at 21. Thus, Kotanagi teaches a display "configured to display information associated with the heart rate."

205. Moreover, it was common at the time to display information "associated with the heart rate." For example, 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, 1:56–2:3.

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

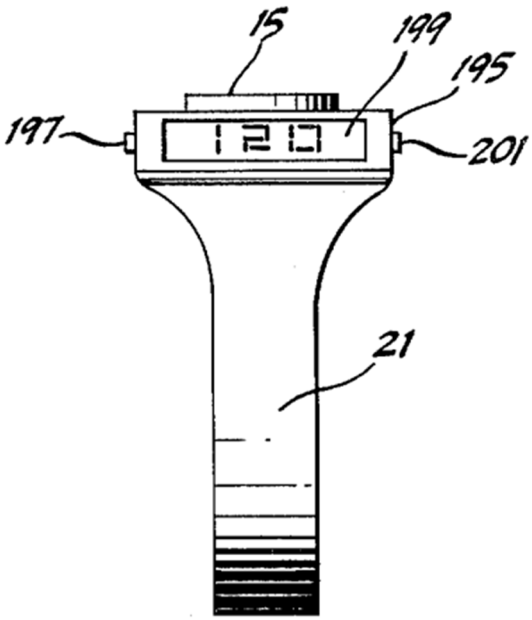


Fig. 3

> 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; 10:9–19; 11:9–16.

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

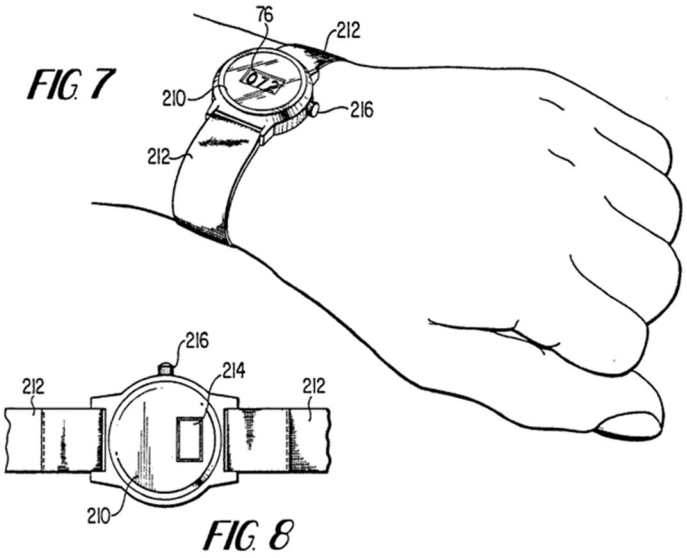


FIG. 8

> [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.

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

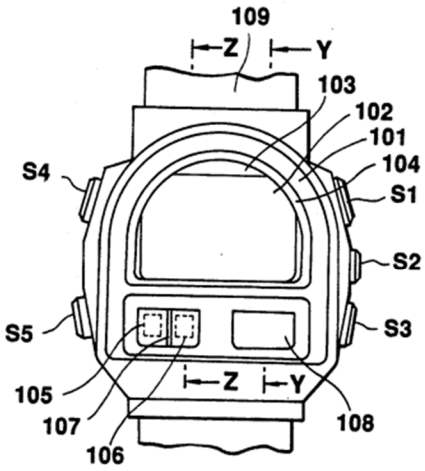


FIG. 8

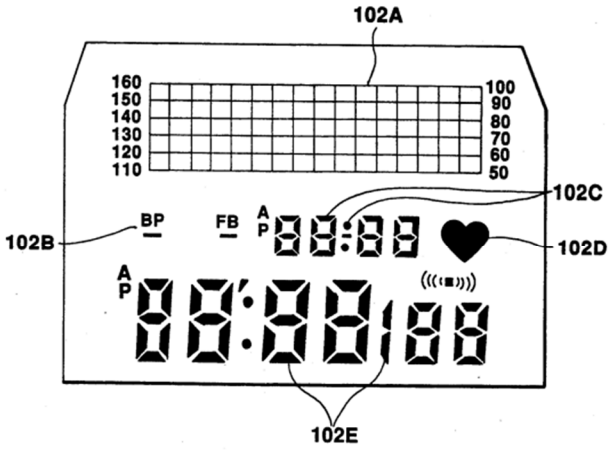


FIG. 9

> 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; 9:38–57

209. The above evidence further demonstrates it was commonly known to display information "associated with" heart rate.

B. Ground 2: Claims 1-3, 5, 13, and 17 are unpatentable because they would have been obvious over Kotanagi, Honda, and Choi.

1. Independent Claim 1

[1a] 1. An electronic watch comprising:
[1b] a housing formed from a metal material and defining a rear opening along a rear portion of the housing;
[1c] a touch-sensitive display positioned at least partially within the housing;
[1d] a band coupled to the housing and configured to couple the electronic watch to a user;
[1e] a cover formed from a dielectric material and forming a seal along the rear opening of the housing;
[1f] an optical sensor positioned within the housing and configured to transmit an optical signal through the dielectric material of the cover;
[1g] a charging coil positioned within the housing and configured to receive wireless power through the dielectric material of the cover;
[1h] a first electrode positioned along a rear surface of the electronic watch; and
[1h] a second electrode positioned along the rear surface of the electronic watch, wherein:
[1i] the electronic watch is configured to measure a heart rate using the optical sensor, and
[1j] the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode.

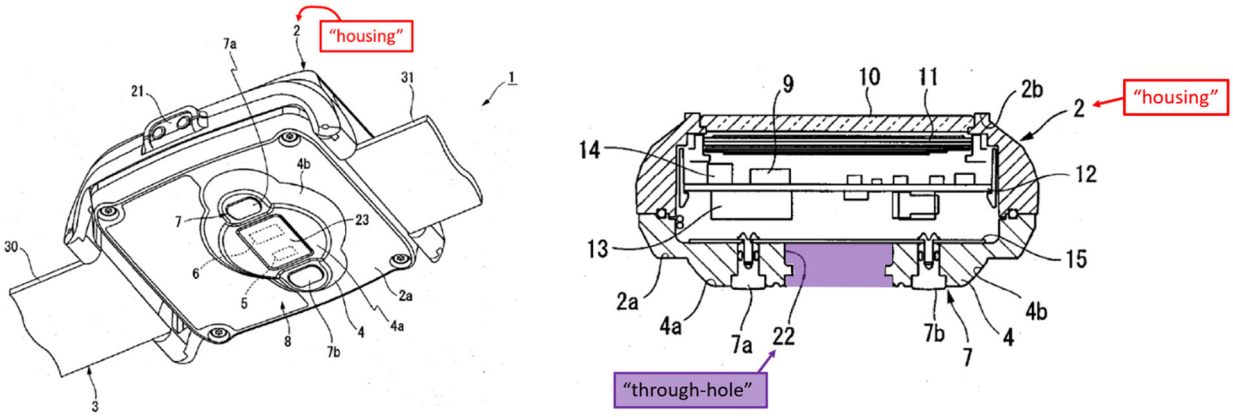
a. [1a] "An electronic watch comprising:"

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

b. [1b] "a housing formed from a metal material and defining a rear opening along a rear portion of the housing;"

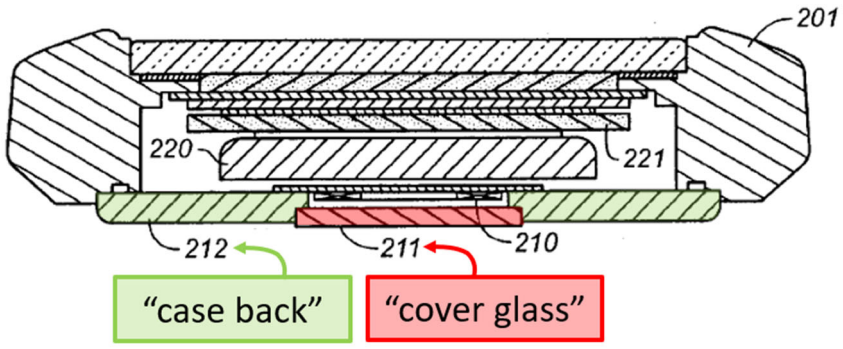
211. Kotanagi teaches "The housing 2 . . . is made of plastic or a metal material such as aluminum." EX1005 at ¶48.

212. These limitations are obvious based on the analysis for limitation [**7b**]. To summarize, Kotanagi's housing 2 can be made of "a metal material such as aluminum." EX1005 at ¶48. A "through-hole 22" is formed in the center of the lower surface" (*id*. ¶55):



See EX1005 at 26, 27 (Figs. 5, 7) (optical biosensor module removed).

213. Similarly, Honda teaches a case back 212 "typically made of a metal" and a "cover glass" 211 spanning a rear opening (EX1006 15:47–49):

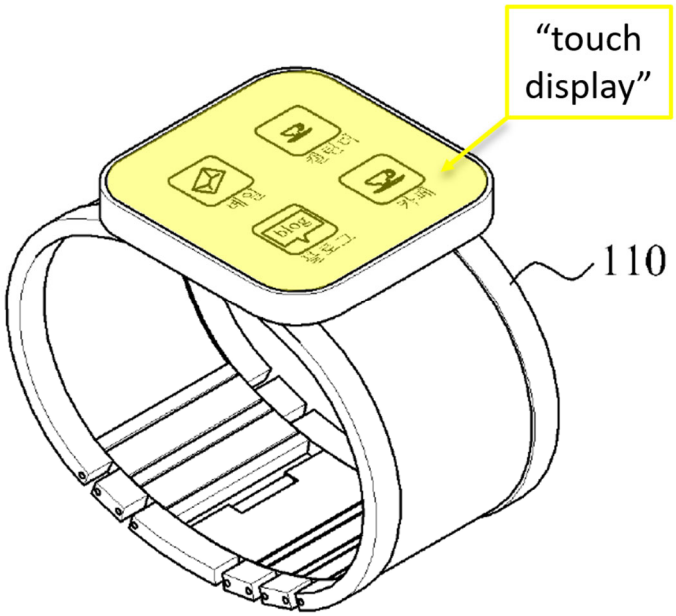


See id. at 3 (Fig. 2). Thus, Kotanagi and Honda teach these features.

c. [1c] "a touch-sensitive display positioned at least partially within the housing;"

214. Kotanagi teaches a "liquid crystal display device" that may display information based on "input from each button 20." EX1005 at 11.

215. In the same field of endeavor, Choi teaches a biosensing watch. A "surface" of this device has "a display visible to the user, for example, a touch display" that it describes as "a front 130" (EX1023 [32]; EX1011 [43]):



See EX1023 at 28 (Fig. 1); EX1011 at 24 (Fig. 1).

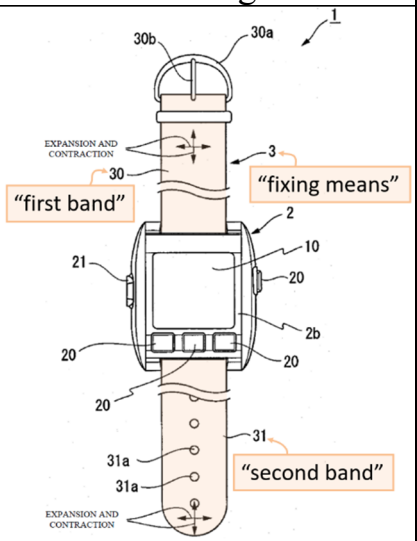
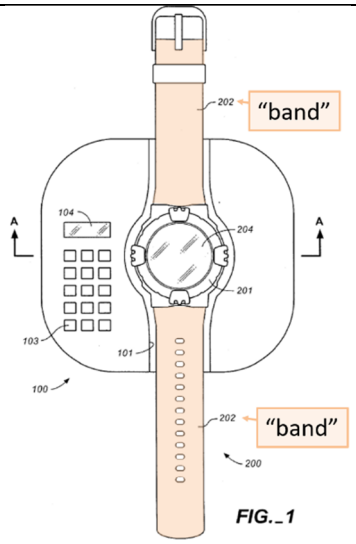
216. A POSITA would have been motivated to incorporate a touchscreen in Kotanagi as a touchscreen reduces the need to provide buttons on the front side of Kotanagi's device. Incorporating a touchscreen would increase the size of

Kotanagi's screen (without expanding device size), reduce the number of separate components and moving parts in Kotanagi's watch (reducing mechanical failure risk), and provide additional functionality not enabled by hardware buttons alone (a touchscreen or virtual "buttons" can be programmed for varying situations and functions, while the changing screen can provide context to reduce a need for user training). Further, touchscreens were known in the art,[6] and this combination provides familiar elements that do nothing more than yield predictable results.

d. [1d] "a band coupled to the housing and configured to couple the electronic watch to a user;"

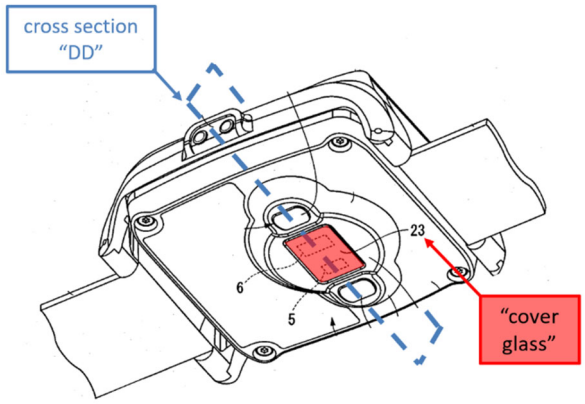
217. These features are taught by Kotanagi, as shown for limitation [**7c**]. A band configured to "secure" the "device" to a user is also configured to "couple" the "watch" to a user. Honda and Choi also have such bands:

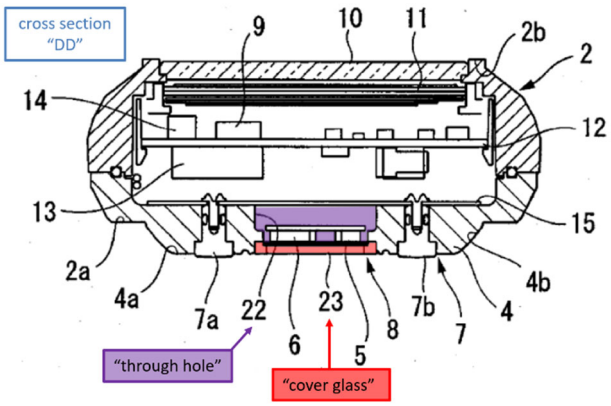
[6] *See* EX1041 [0020] (teaching a biosensing watch with a "touch screen display"); EX1016 [0046] (teaching a biosensing watch with "touch sensitive screen inputs"); EX1020 at 5:5 (teaching a "touch screen" for a biosensing watch).

Kotanagi	Honda	Choi
		
See EX1005 at 23 (Fig. 1).	*See* EX1006 at 2 (Fig. 1).	*See* EX1023 at 3, 28 (Fig. 1); EX1011 at 24 (Fig. 1).

e. [1e] "a cover formed from a dielectric material and forming a seal along the rear opening of the housing;"

218. Kotanagi teaches a "a cover glass 23 is fixed to the housing 2." EX1005 at 12. This forms a seal over the through-hole in the rear opening:

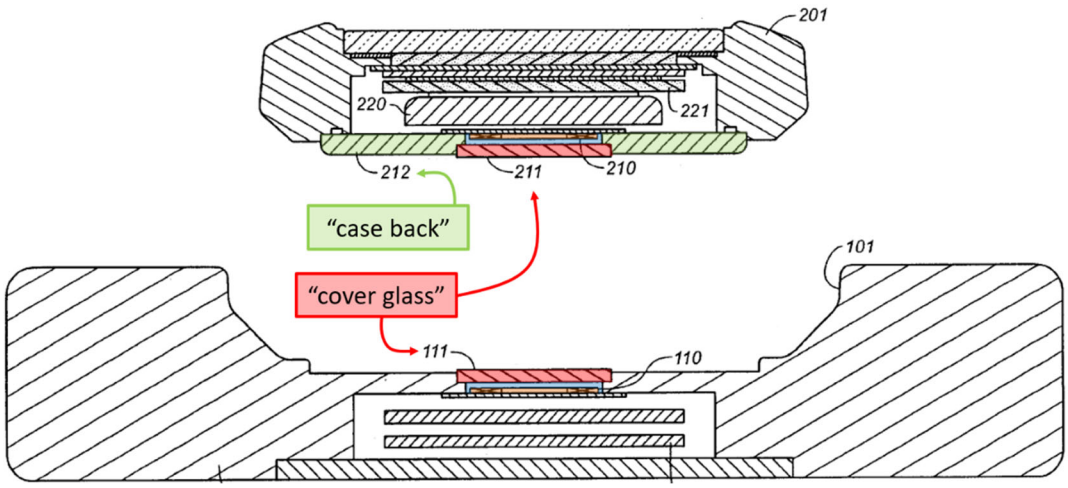




See EX1005 at 26, 27 (Figs. 5, 7).

219. A POSITA would have known that Glass is a non-conductive material, and Honda teaches this. EX1006 15:62 ("insulating body (glass, for example)"). Dependent Claim 3 (analyzed in Ground 2 below) states that the '491 cover is glass or sapphire, confirming that the applicant considered glass a dielectric material. Thus, a POSITA would have understood Kotanagi's "cover glass 23" teaches this limitation.

220. Moreover, Honda teaches cover glasses 111 and 211 that form a seal around Honda's rear opening:



See EX1006 at 3 (Fig. 2).

221. Honda teaches that "the cover glasses 211 and 111 may be replaced with other insulating materials." *Id.* 16:14–15. Thus, Honda disclosure recognizes glass' insulating and dielectric properties.

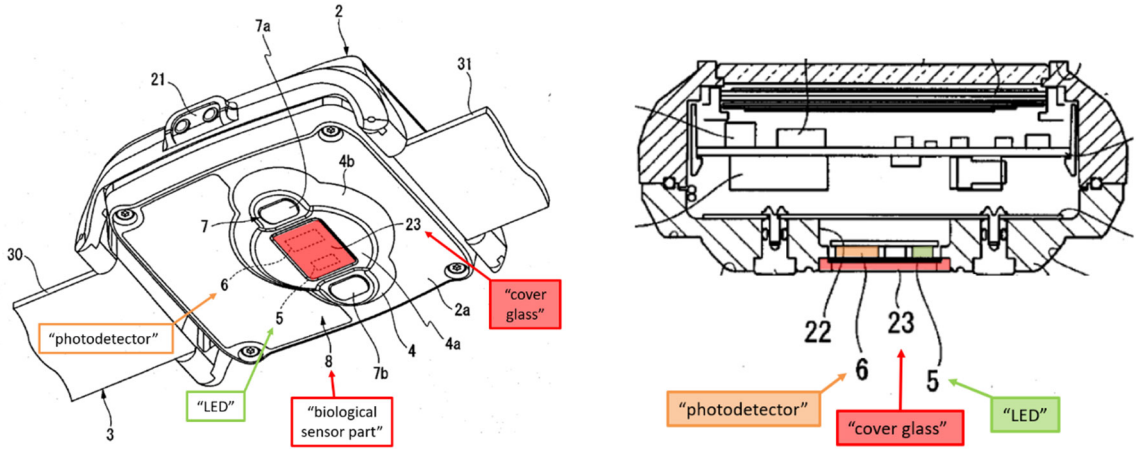
222. As shown with regarding to Ground 2, Claim 11 Kotanagi is concerned with protecting from "water droplets" (EX1005 ¶53) and Honda teaches

"waterproofness" (EX1006 1:24–31; 15:36–38) up to five atmospheres (id. 13:22–25). Thus, a POSITA would have understood from these references that insulating dielectric materials may be used to both cover and seal the rear opening of a watch.

223. Further, from the teachings of Honda a POSITA would have found the application of gaskets or other sealing membranes to Kotanagi as obvious. Honda teaches that if a device is exposed to water portions of the device may be "waterproof-structured with gaskets so that internal circuits are not wetted with water." EX1006 2:30–34. Thus, a POSITA would have applied waterproof structures, such as gaskets, if necessary to improve the waterproofness of an electronic device and protect the internal circuitry.

f. [1f] "an optical sensor positioned within the housing and configured to transmit an optical signal through the dielectric material of the cover;"

224. Kotanagi teaches an LED "for emitting light toward the living body" and a photodetector "for receiving reflected light from the living body." EX1005 at ¶46. Both are positioned within the housing immediately behind the cover glass:

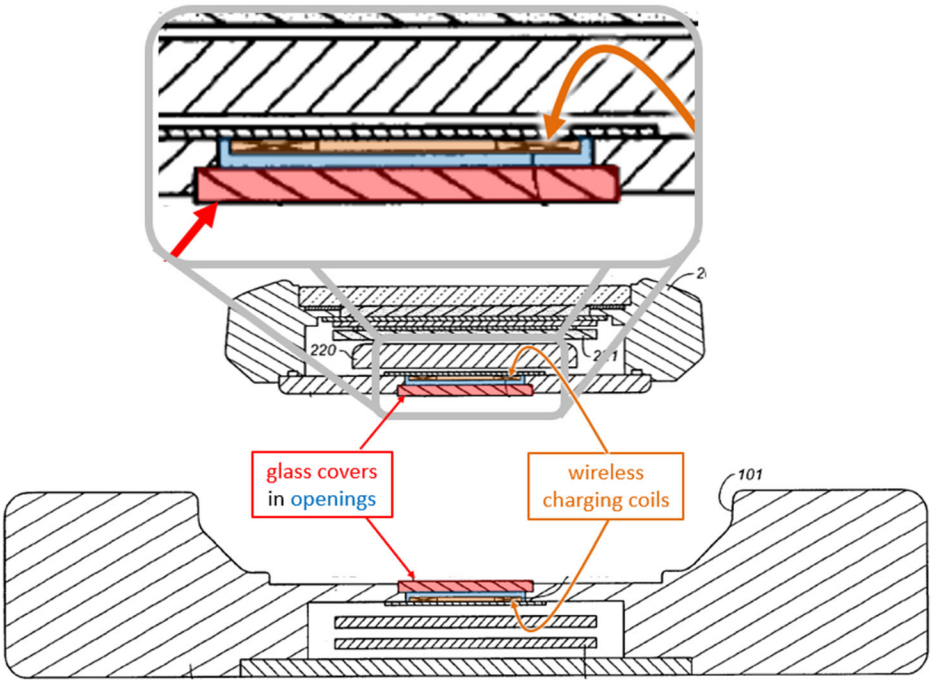


225. *See* EX1005 at 26, 27 (Figs. 5, 7). A POSITA would have understood that because Kotanagi's "cover glass 23 is fixed to the housing 2 so as to block the through-hole 22" (EX1005 ¶55), its LED and photodetector transmit and receive optical signals *through* the cover glass. Thus, Kotanagi's teachings satisfy this limitation.

g. [1g] "a charging coil positioned within the housing and configured to receive wireless power through the dielectric material of the cover;"

226. The discussion of limitation [**7g**] above explains why Kotanagi and Honda teach a charging coil "aligned with the second opening and below the cover"; this is also "within the housing" as claimed here. That discussion also explains how Kotanagi and Honda teach a coil configured to "inductively couple" (transferring power) through a "non-conductive" (dielectric) cover. Accordingly, the [**7g**] analysis also shows how the present limitations are obvious. To summarize, Kotanagi teaches "contactless" recharging (EX1005 ¶53) and Honda explicitly

teaches how to do this (EX1006 4:36) with charging coils transmitting power through a cover glass:



See EX1006 at 3 (Fig. 2).

227. Honda teaches that "the cover glasses 211 and 111 may be replaced with other insulating materials." Id. 16:14–15.

228. A POSITA would have known to wirelessly charge through dielectric or non-conductive material because Honda teaches that wireless charging through a non-conductive material is at least an order of magnitude more efficient than charging through a metal, such as stainless steel. This is shown in *id*. at 14 (Fig. 15).

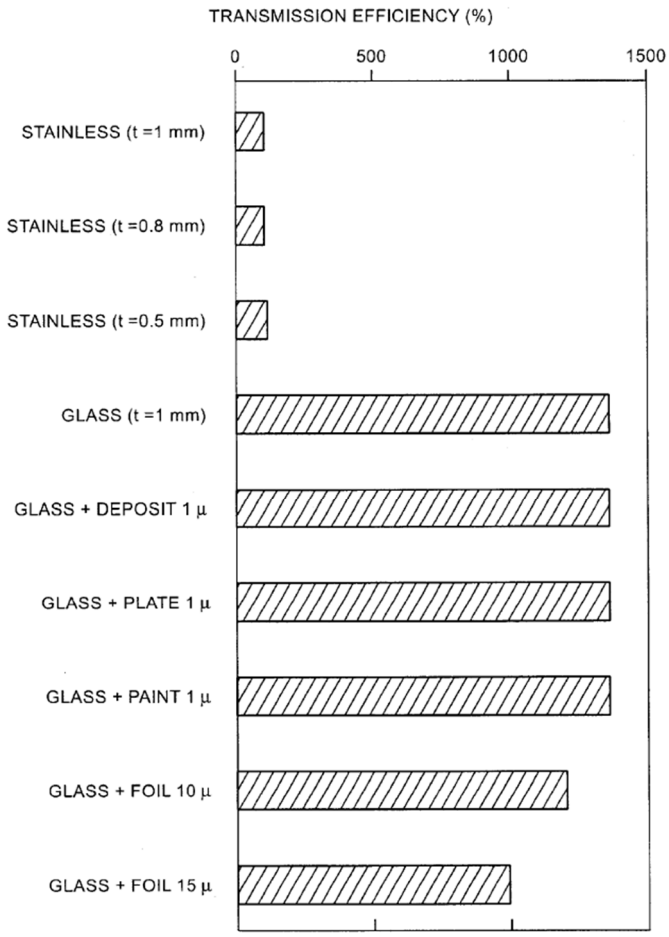
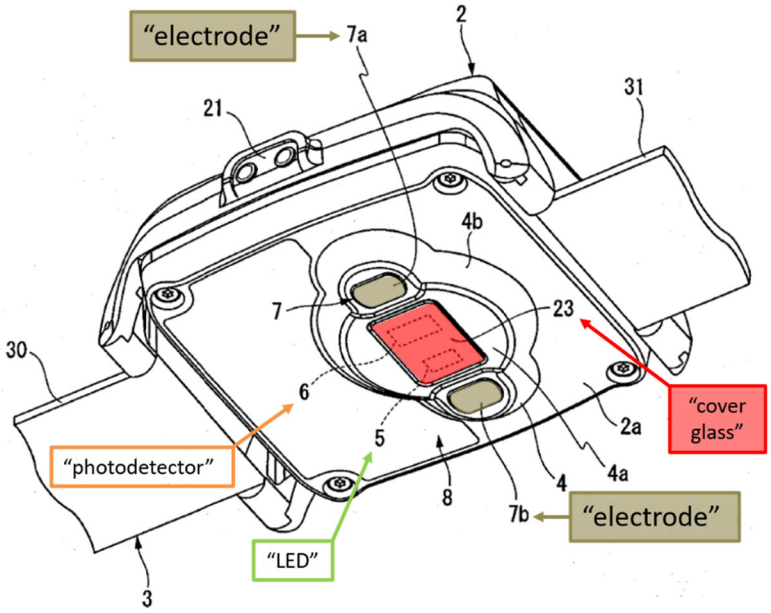


FIG._15

229. A POSITA would also have known to pass power through the glass based on general knowledge of electrical shielding, teaching that complete metal enclosures prevent electromagnetic charge from penetrating. This is confirmed by Honda's transmission experiments. EX1006 13:33–63. Thus, to achieve the wireless charging goal expressed in Kotanagi, a POSITA would have naturally positioned the coil near Kotanagi's glass-covered opening for power reception.

h. [1h] "a first electrode positioned along a rear surface of the electronic watch; and a second electrode positioned along the rear surface of the electronic watch, wherein:"

230. Kotanagi teaches a "pair of electrodes" that assess a physical parameter of the skin based upon a "potential difference" between the electrodes. EX1005 at ¶¶59, 86. Kotanagi teaches that "the electrodes need not be a pair, and a plurality of electrodes, for example, may be provided." EX1005 at ¶14; *see* ¶86. This is illustrated below:



See id. at 26 (Fig. 5).

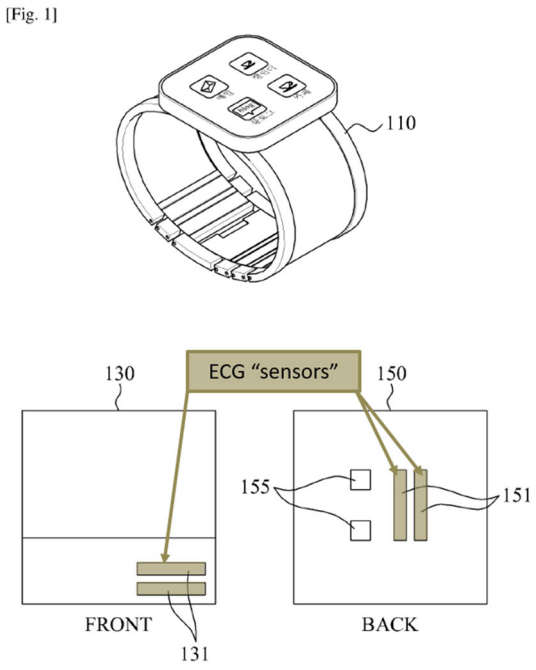
i. [1i] "the electronic watch is configured to measure a heart rate using the optical sensor, and"

231. As explained for limitation [**14h**], Kotanagi teaches measuring a heart rate using the biosensor module (which includes the optical sensor). Kotanagi's watch "generates a pulse signal (biological information signal) corresponding to the

amount of received light" reflected from blood vessels. EX1005 at ¶65. Honda's watch also "detects biological information including the pulse rate or the heart rate of the body." EX1006 6:17–19. Accordingly, the claimed combination of Kotanagi and Honda satisfies this limitation.

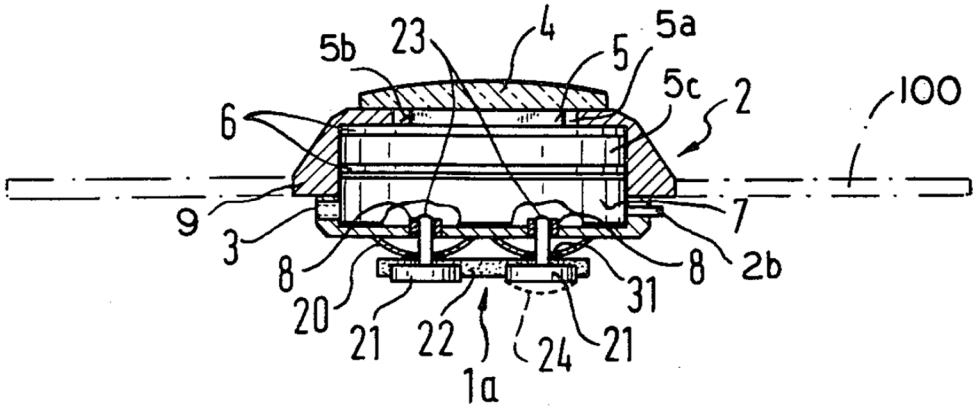
j. [1j] "the electronic watch is configured to measure an electrocardiogram using the first electrode and the second electrode."

232. Kotanagi's rear electrodes cooperate with the optical sensor to achieve pulse measurement. In the same field of endeavor, Choi uses electrodes to directly obtain an electrocardiogram: "To detect the ECG signal . . ., a signal detected in at least two different portions of the body of the user may be needed, and thus, the sensors 131 and 151 are provided on the front 130 and on the back 150, respectively" (EX1023 [45]; EX1011 [52]):



See EX1023 at 28 (Fig. 1); EX1011 at 24 (Fig. 1).

233. In view of Kotanagi's alternative teachings—e.g., the electrodes "need not be a pair, and a plurality of electrodes, for example, may be provided" (EX1005 ¶14, *see* ¶86) and Choi's teaching that front and back sensors may not be needed (EX1023 [45]; EX1011 [52])—a POSITA would have considered alternative electrode arrangements for ECG measurement. Although Schmid is not used in the grounds of this rejection, a POSITA would have known by September 2, 2014 (given its availability in at least 1980), that a pair of ECG electrodes can be spaced as close as 4–5 mm on the back of a watch (EX1029 3:7–15), as well as for surgical applications, without harming accuracy (*id*. 4:34–45).



See EX1029 at 2 (Fig. 1). In view of this knowledge, a POSITA would have used Kotanagi's existing electrodes and Choi's teachings to either: (1) use signals from Kotanagi's existing electrodes to obtain an ECG; or (2) add one or more additional electrodes to Kotanagi and use both it and the existing electrodes to obtain an ECG.

Limitation [**1j**] does not require that the first and second electrodes are the only electrodes used to measure the ECG. Thus, under either of these scenarios, Kotanagi, Honda, and Choi render obvious limitation [**1j**]. EX1003 ¶225–227.

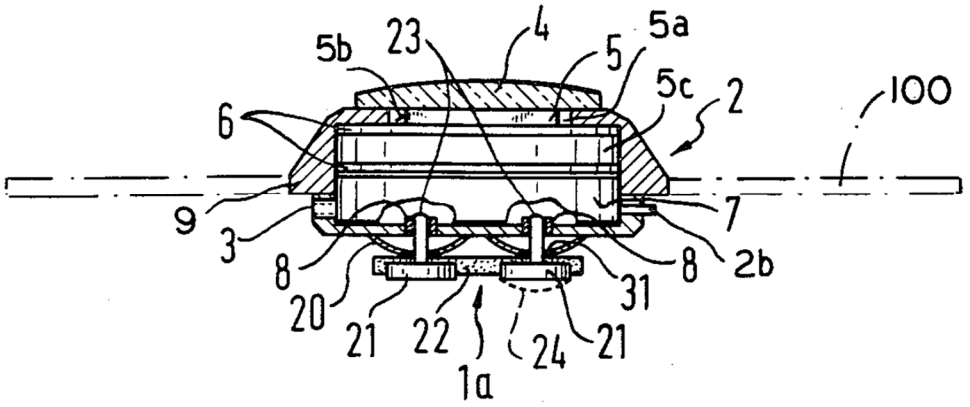
k. Motivation to Combine Kotanagi, Honda, and Choi

234. The reasons to combine Kotanagi and Honda provided above (e.g., *supra* § XI(A)(1)(h)) also apply here. These include the teachings of both Kotanagi and Honda—e.g., for wireless charging. Both were owned by Seiko companies, suggesting that they would have both been available to a POSITA having one or the other. This and their underlying similarities (wrist-watch shapes, optical biosensors directed toward the wrist, similar cover glass, available space for a coil, etc.) would have caused a POSITA to expect success in combining them.

235. As shown above in § IX regarding biosensing watches from the 1970's to the 2010's, prior to September 2014 a POSITA would have had a reasonable expectation of success in the combining the features of Kotanagi and Choi as a natural combination of the many permutations of biosensing watches in the prior art. A POSITA would have also been motivated before the effective filing date to combine the teachings of Kotanagi and Choi as each of them teach a watch with both optical and electrode biosensors. Kotanagi teaches "a plurality of electrodes" to detect electrical potential of skin contact. EX1005 at ¶¶14,86. Choi teaches similar electrodes, but obtains an ECG or obtains an "impedance signal," which is analogous

to the electrical potential taught in Kotanagi. EX1023 [56]; EX1011 [50]. Because Kotanagi already has multiple electrodes, any further modification from Choi (e.g., process electrode signals differently or add an electrode) would have been mere combinations of familiar elements according to known methods to yield predictable results.

236. Choi states that for ECG detection, signals from two different body portions "may" be needed, and it therefore provides sensors 131 and 151 on both the front 130 and back 150. EX1023 [52]. However, a POSITA would have known that this is not required. This is evidenced at least by the disclosure of Schmid, which issued in 1983, and teaches a watch for ECG measurements with two skin contact electrodes (21) on the rear side of the watch:



EX1029 at Fig. 1.

237. Schmid teaches that two electrodes (measurement or input electrodes) "can be disposed in close proximity with measurement results which *nevertheless*

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 4:16–23 (emphasis added), see also 4:40–45 ("The electrode set or assembly can then be provided on the underarm or the upper leg portions of the patient without introducing into the monitored circuitry values which might detrimentally affect the results, i.e. without giving results which are less precise than those obtained with conventional widely spaced electrodes").

238. Schmid further teaches that an ECG electrode structure is not particularly limited and that active electrodes ("A" or "33" and "34") and a neutral (ground) electrode ("N" or "32") may be arranged in "various configurations" (EX1029 6:36), some of which are shown below:

Fig.6

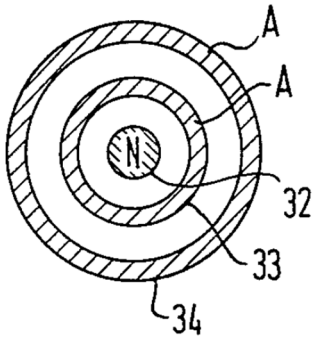
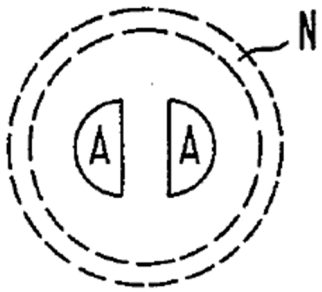
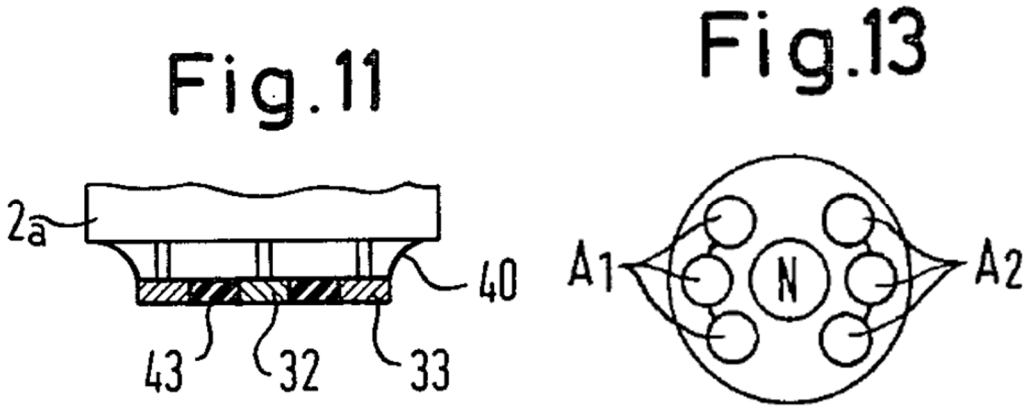


Fig.7



Fig.9





Id., Figs. 6, 7, 9, 11, 13.

239. A POSITA would have understood from Schmid that the configuration of ECG electrodes is not particularly limited and may be accomplished with two ECG skin contact electrodes that can be spaced as close as 4–5 mm on the back of a watch (EX1029 3:7–15). . Thus, the configuration of Kotanagi's electrodes to measure an ECG would have been an application of 1980's era technology with an expectation of success and resulted in a watch with improved biosensing.

240. Further, as discussed above in § IX regarding biosensing watches through the decades, multiple biosensing watches had ECG measurement capabilities prior to September 2014. *See* EX1027 7:5–8 (teaching a watch having "the ability to produce an ECG signal without the necessity of preparing the skin of a living subject"); EX1030 5:46 (teaching a watch with optical biosensors and "ECG wave detecting electrodes"); EX1031 7:26–27 (teaching a "digital wrist watch for the EKG type heart rate monitor."); EX1033 [0119] (teaching "three electrodes that

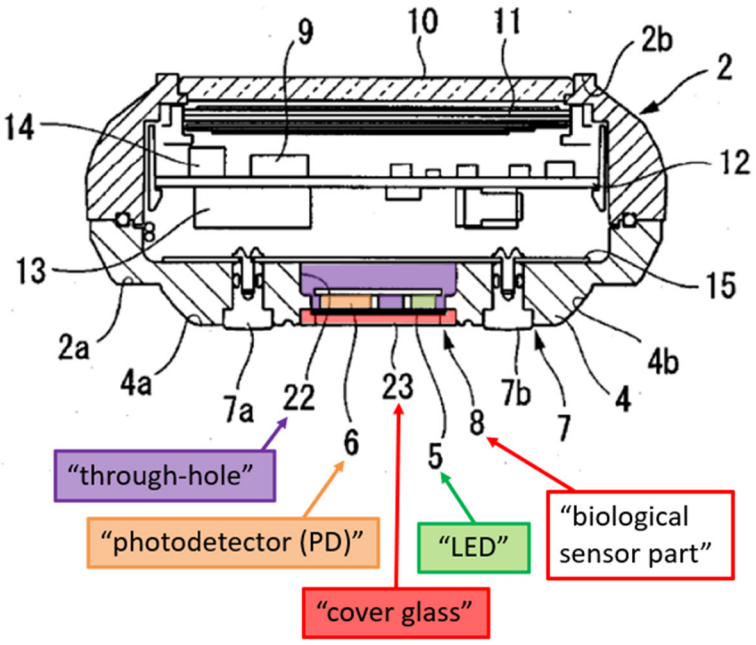
may be used for measuring electrochemical activity of the user's body (e.g. ECG, or tonus activity)"); EX1034 [0237] (teaching a watch that "enables differential EKG or ECG to be measured"); EX1035 [0028] (teaching a watch with "ECG RA," "ECG LA," and "ECG REF" electrodes"); EX1008 at 11 (teaching "ECG sensing" contacts).

241. For these reasons and those explained above, a POSITA would have been motivated to combine Choi with Kotanagi as modified by Honda. These motivations also apply to the other Ground 2 combinations and dependents from Claim 1. Further motivations to combine are provided throughout this declaration.

2. Dependent Claim 2

242. Claim 2 depends from Claim 1 and adds **"the cover defines at least one window for the optical sensor; and the cover protrudes outward from a rear housing surface of the housing."**

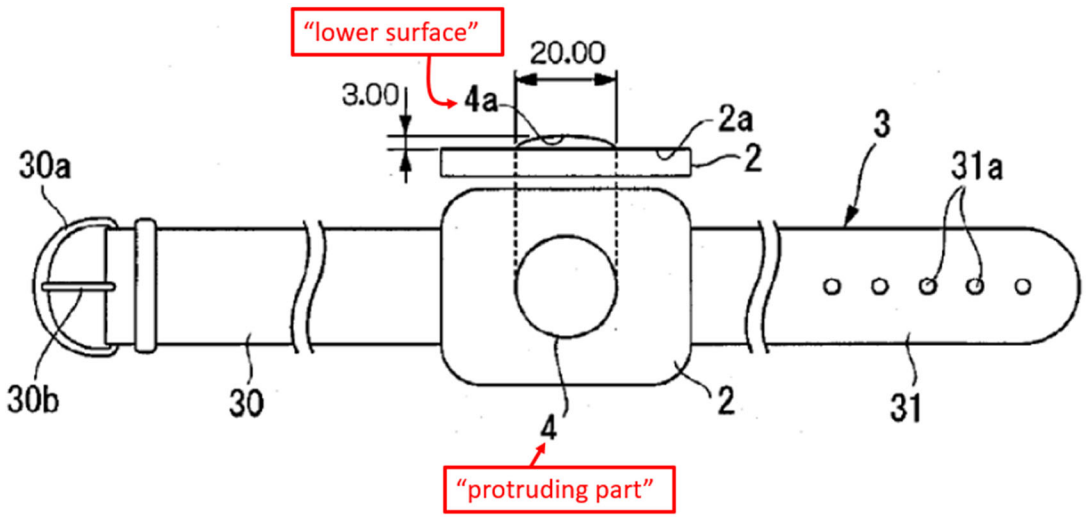
243. Kotanagi teaches a single opening in its base, with a cover glass, and an LED and a photodetector both positioned in that opening immediately behind the cover glass:



See EX1005 at 27 (Fig. 7).

244. Kotanagi's cover glass 23 covers the opening of through-hole 22, thereby spanning the areas shown for both the LED and photodetector and defining at least one window for them.

245. Kotanagi's Figure 10 also shows a disk-shaped protruding part with a curved 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.



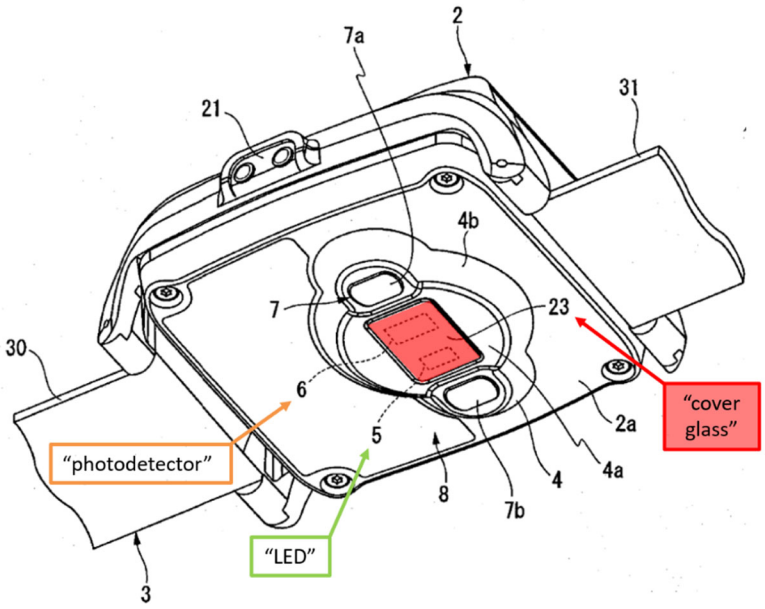
See id. at 28 (Fig. 8).

246. Kotanagi elsewhere includes a cover glass within a "protruding part 4" EX1005 at ¶55. Figure 10 does not show a separate cover glass 23, but for Kotanagi's optical detection to function properly, the protruding part 4 must be transparent. Thus, a POSITA would have understood from Kotanagi's Figure 10 that the entire protruding part can form a curved "cover glass" that spans the through-hole 22. *Id*. at 28. Accordingly, a POSITA would have understood that Kotanagi teaches the limitations of Claim 2.

3. Dependent Claim 3

247. Claim 3 depends from Claim 1 and adds **"the cover is formed from a transparent substrate; and the transparent substrate comprises one or more of a glass or a sapphire material."**

248. Kotanagi teaches a "cover glass 23" that allows light to pass through from "LED 5" and is "reflected" from skin such that "PD 6 receives this reflected light." EX1005 at ¶65.



See EX1005 at 26 (Fig. 5).

249. Thus, Kotanagi teaches a cover glass that is transparent to light, as the light is transmitted through and reflected back through the cover glass. Honda also uses a cover glass on the rear portion of its watch and teaches that "since the glass member is typically transparent, the internal coil and electronic components are seen through from the outside." EX1006 13:53–55. Accordingly, both references teach that a transparent glass member may be used in an opening on the rear side of a watch, and a POSITA would have understood that Kotanagi in view of Honda teaches the limitations of Claim 3.

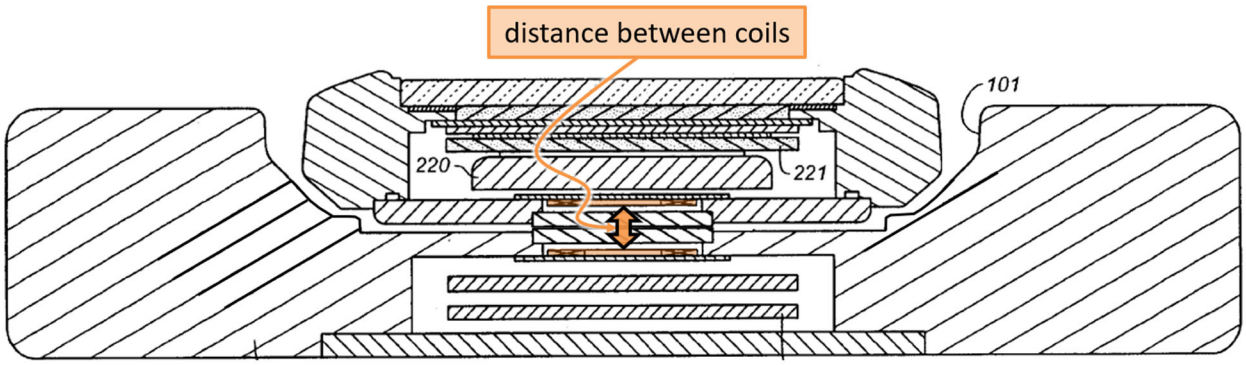
4. Dependent Claim 5

250. Claim 5 depends from Claim 1 and adds **"wherein: the electronic watch further comprises a near-field communication system; and the near-field communication system is configured to transmit signals through one or more of the housing or the cover."**

251. Kotanagi teaches that its watch "may be provided with an additional function such as a wireless communication means for enabling wireless communication with other electronic devices" such as "by means of wireless communication such as Bluetooth." EX1005 at ¶88. A POSITA would have understood that Kotanagi's wireless communication is not limited toBluetooth, since that is listed as an example; this person would have also considered other common wireless protocols such as "near-field communication" ("NFC") based on this teaching. In the prosecution history of the '491 patent, the U.S. Patent Examiner interpreted "near-field communication" broadly. The Examiner gave Bluetooth as an example of a near-field communication system: "[prior art reference Hong] includes a near-field communication system (i.e. Bluetooth) configured to transmit signals." EX1002 at 1124. Thus, under the Examiner's construction, Kotanagi's Bluetooth satisfies this limitation.

252. Honda also teaches that its wireless charging coils may facilitate near-field data transfer to the charging station: "Through the electromagnetic coupling

between the two coils, a signal can be transmitted in a two-way communication in a non-contact fashion from the station to the portable electronic apparatus or from the portable electronic apparatus to the station." EX1006 1:38–42. This data transfer is a near-field communication, traversing a few millimeters. *Id.* 13:3–13.



See EX1006 at 3.

253. Given that Honda teaches nesting a device almost completely within a socket 101 as shown above, when combining Honda with Kotanagi, a POSITA would have considered "near-field" communication as an example of both Honda's "two-way communication" (EX1006 1:39–40) and Kotanagi's "wireless communication." (EX1005 at ¶88).

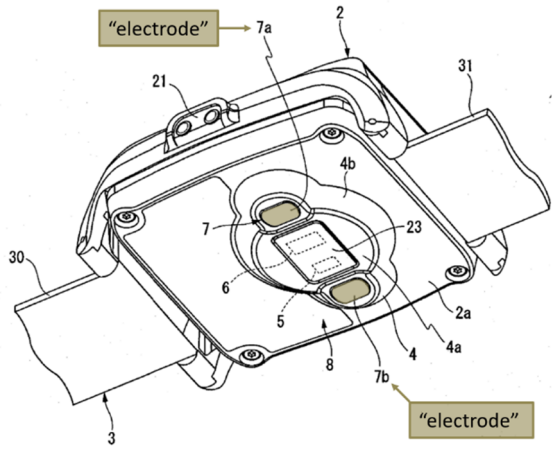
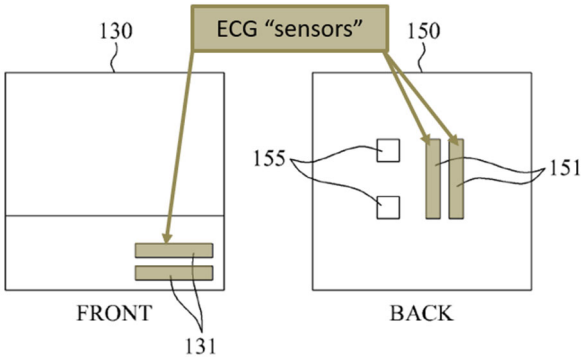
254. Thus, a POSITA would have found Kotanagi and Honda to teach the Claim 5 limitations.

5. Dependent Claim 13

255. Claim 13 depends from Claim 7 and further adds **"wherein: the wearable electronic device further comprises: a first electrode positioned along**

a rear surface of the wearable electronic device; and a second electrode positioned along the rear surface of the wearable electronic device; and the wearable electronic device is configured to measure an electrocardiographic characteristic using the first and second electrodes."

256. The discussions of limitations [**1h**] and [**1j**] above explain why Kotanagi ("pair of electrodes," EX1005 at ¶¶14, 86) and Choi ("sensors" for "ECG signal," EX1023 [45]; EX1011 [52]) teach these limitations. The following figures from these references summarize these teachings:

Kotanagi	Choi
 *See* EX1005 at 26 (Fig. 5).	 *See* EX1023 at 28 (Fig. 1); EX1011 at 24 (Fig. 1).

Thus, a POSITA would have understood that Kotanagi in view of Choi teaches the limitations of Claim 13.

6. Dependent Claim 17

257. Claim 17 depends from claim 14 and further adds: "**wherein: the electronic device further comprises: a first electrode disposed along an exterior**

of the electronic device; and a second electrode disposed along the exterior of the electronic device; and the first and second electrodes are configured to measure an electrocardiographic characteristic of the user."

258. As discussed for limitations [**1h**] and [**1j**], and Claim 13, Kotanagi and Choi teach exterior first and second electrodes and Choi teaches measuring an electrocardiographic characteristic.

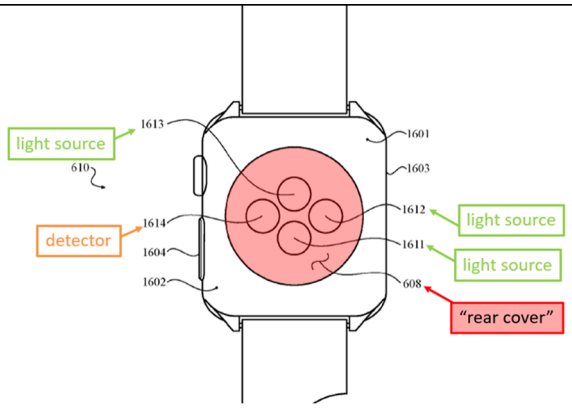
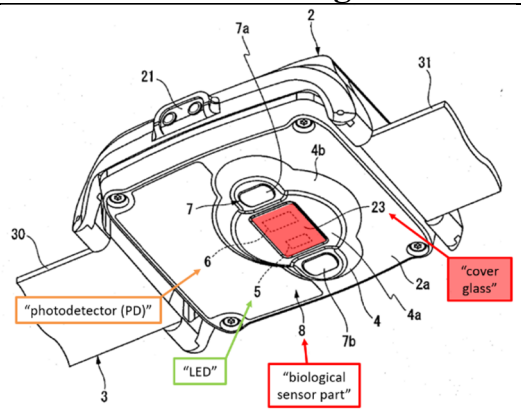
C. Ground 3: Claims 8 and 15 are unpatentable because they would have been obvious over Kotanagi, Honda, and Fraser.

1. Dependent Claim 8

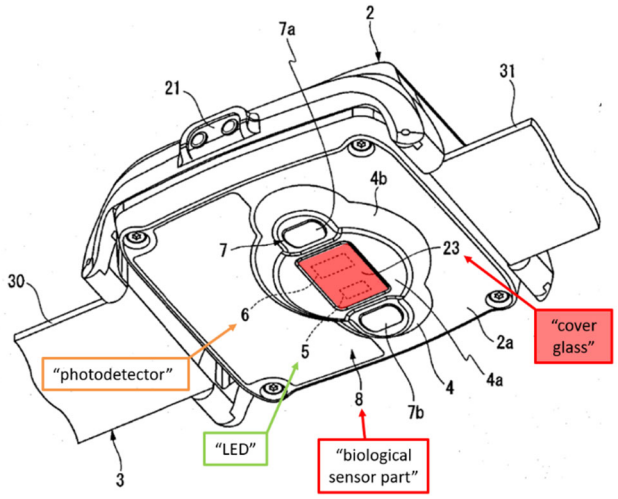
259. Claim 8 depends from Claim 7 and further adds, "**wherein: the window is a first window; the cover defines a second window; and the biosensor module comprises: a light source configured to emit light toward a region of skin of the user through the first window: and a detector configured to receive light reflected from the region of the skin through the second window**."[7]

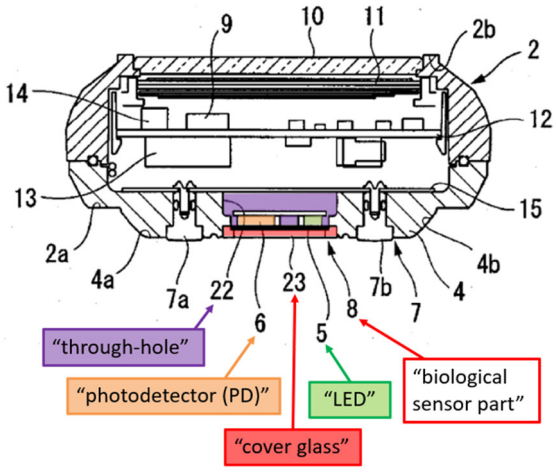
260. Similar to the '491 patent and consistent with the claim construction provided in *supra* § VI(2) above, Kotanagi teaches a single opening in its base spanned by a single cover glass:

[7] The second colon in Claim 8 appears to be a typo and is being interpreted as a semicolon.

’491 Patent	Kotanagi
 *See* EX1001 at 22 (Fig. 16).	 See Ex1005 at 26 (Fig. 5).

261. Kotanagi teaches 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:





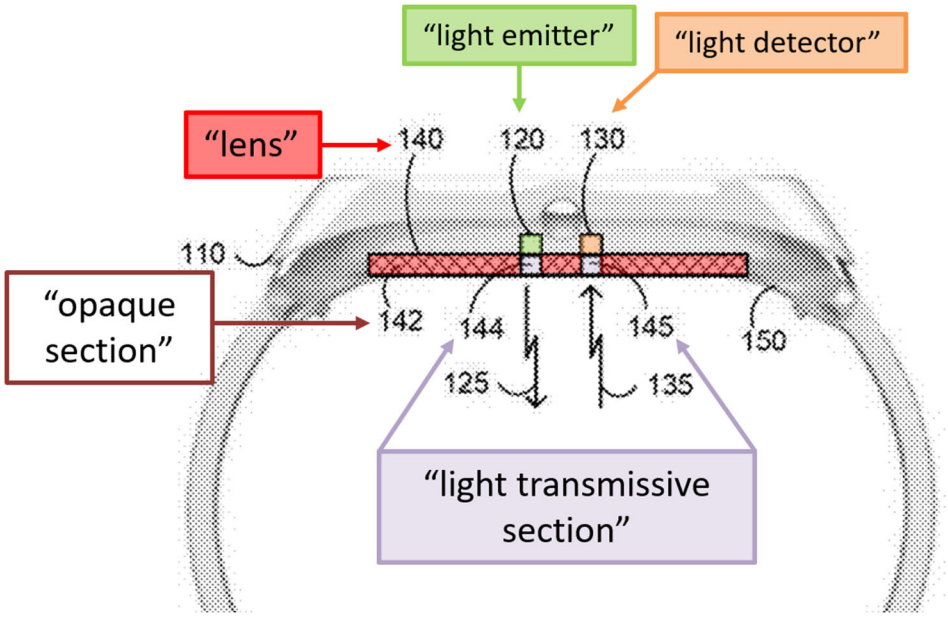
See EX1005 at 26, 27 (Figs. 5, 7).

262. This arrangement provides operational access to both of these features by allowing light to pass through. Kotanagi’s cover glass therefore defines both the first and second windows as claimed.

263. If this claim is interpreted such that there must be two *separate* apertures, the two areas surrounded by dashed lines in Kotanagi's Figure 5 would suggest to a POSITA 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.[8]

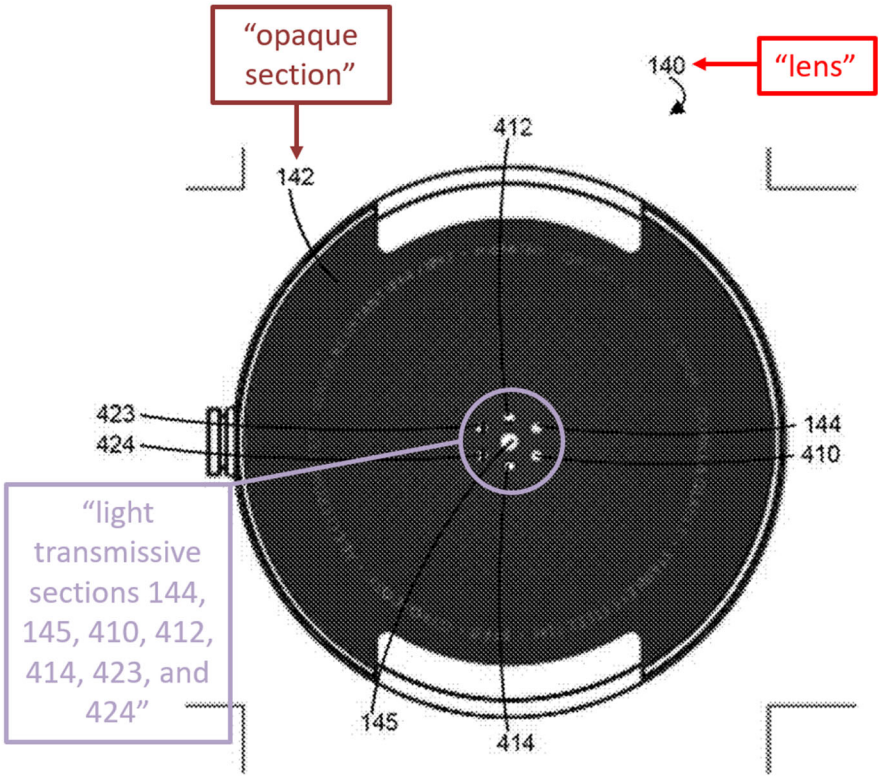
264. Additionally, Fraser teaches that the back cover of a biosensing watch may be used for "photoplethysmography, pulse Oximetry, and other biometric sensing" and that a single cover glass may define openings with light transmissive sections. Fraser's array of "light transmissive sections 144, 410, 412, 414, 423, and 424" can "transmit light from the light emitters 120, 322, 324, 326 of FIG.3 and other light emitters." EX1041 [0016], [0027]. In this figure, arrow 125 shows light emission:

[8] *See In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960) (mere duplication of parts has no patentable significance unless a new and unexpected result is produced.).



See id. at 2 (detail of Fig. 1).

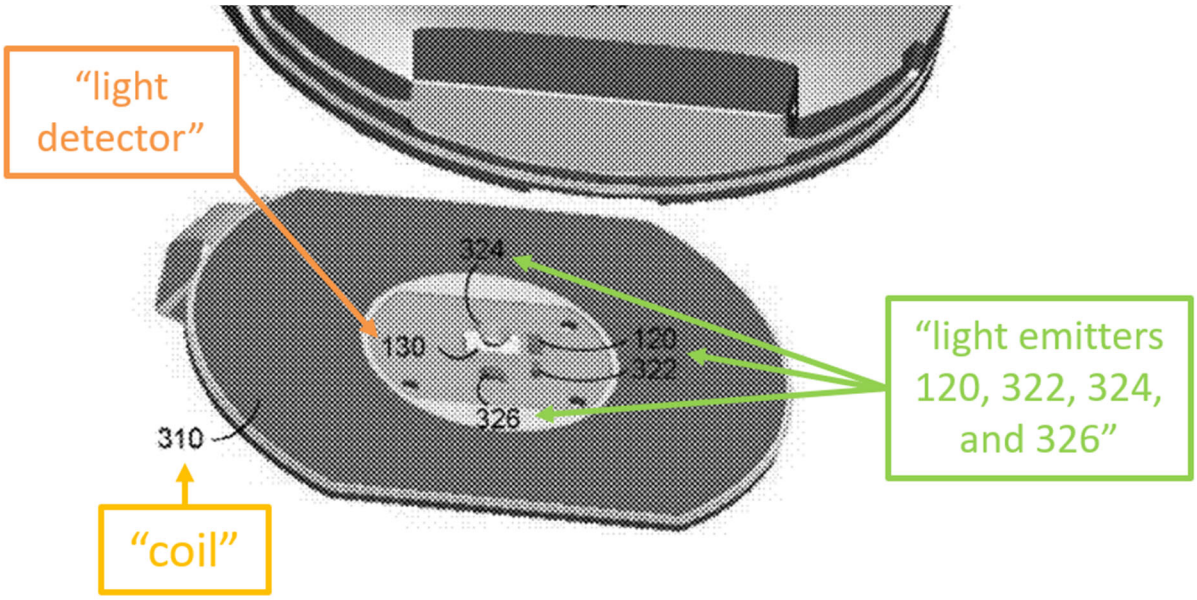
265. Fraser also teaches that "light transmissive section 145 can transmit light reflected from a user to the light detector 130 of FIG. 3." *Id*. [0027]. In the figure above, light coming in is shown with arrow 135. Fraser's "light transmissive sections" can be "etched, molded, drilled, [or] laser cut" into—forming "apertures" in—an opaque lens (*id*. [0018]):



See id. at 5 (Fig. 4). Thus, Fraser also teaches the claimed cover windows for light transmission (emission and reception).

a. Motivation to Combine Kotanagi, Honda, and Fraser

266. The reasons to combine Kotanagi and Honda provided elsewhere in this declaration (e.g., *supra* § XI(A)(1)(h) with regard to Claim 7, Ground 1) also apply here. It would have further been obvious to a POSITA to add Fraser to Kotanagi (as modified by Honda) for various reasons. For example, both teach optical biosensing of pulse or heart rate and contactless / wireless charging. EX1005 at ¶53, EX1041 [0026]. Fraser's light emitters are surrounded by a wireless charging coil:



EX1041 at 4 (Fig. 3).

267. Thus, Fraser is analogous to Kotanagi as modified by Honda, and Fraser would have confirmed a POSITA's expectation of success in adding a wireless charging coil to Kotanagi.

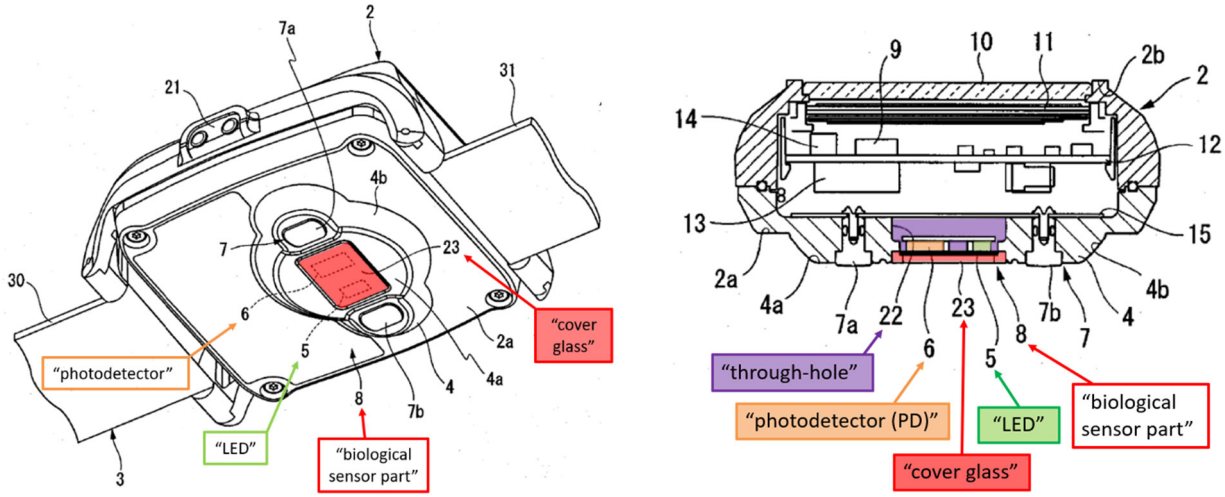
268. Moreover, Fraser teaches that a biosensing watch may employ "light transmissive sections to focus emitted and received light." EX1041 [0029]. Because Kotanagi's watch is intended to emit and receive light for the same purpose, a POSITA would have been motivated to look to Fraser for how to focus or guide the light and would have modified Kotanagi's structure (e.g., to surround light transmissive sections with opaque sections) with a reasonable expectation of success.

269. These motivations to combine also apply to the other Ground 3 combinations, shown below. Further motivations to combine are provided throughout this declaration.

2. Dependent Claim 15

270. Claim 15 depends from Claim 14 and adds: **"wherein: the biosensor module includes an array of optical components; and the cover defines an array of windows, each window of the array of windows aligned with a respective optical component of the array of optical components."**

271. As explained above for Claim 8, Kotanagi's LED and photodetector are positioned immediately behind its the cover glass for operational access:



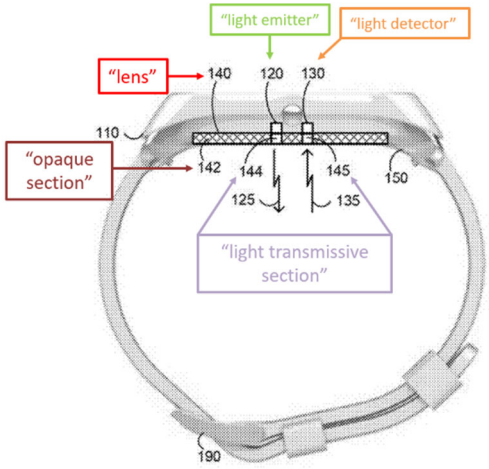
See EX1005 at 26, 27 (Figs. 5, 7).

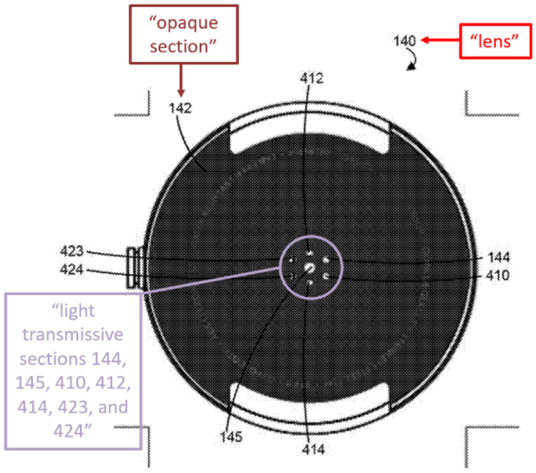
272. Kotanagi's LED and PD teach the claimed "array of optical components." Because Kotanagi's cover glass provides sufficient space for simultaneous optical access to both components (see the separate dashed outlines on

cover glass 23 in Fig. 5 above), Kotanagi teaches an array of windows "aligned with" respective optical components in the array. Even if this claim is interpreted to require separate and individual windows, at a minimum, the two areas surrounded by dashed lines in Kotanagi's Figure 5 would have suggested to a POSITA to put windows in those aligned positions. Kotanagi's larger window is functionally equivalent to the claimed two windows, because it is large enough to accommodate both the transmission and reception of light to the two optical components; creation of two smaller windows instead of one larger one would create no new and unexpected result.[9]

273. Moreover, Fraser teaches that the back cover of a biosensing watch may be used for "photoplethysmography, pulse Oximetry, and other biometric sensing" and have an array of windows aligned with respective optical components, where each window is defined by an array of "light transmissive sections 144, 410, 412, 414, 423, and 424" that can be "etched, molded, drilled, [or] laser cut" into—forming separate windows or apertures in—an opaque lens. EX1041 [0016], [0027], [0018].

[9] *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960), (mere duplication of parts has no patentable significance unless a new and unexpected result is produced).





See EX1041 at 2, 5.

274. Fraser specifies that its windows are both separated from each other and aligned with optical components:

> [t]he light transmissive sections 144, 145, 410, 412,414, 423, and 424 can be separate and distinct from each other in the opaque section 142. The light transmissive sections 144, 410, 412, 414, 423, and 424 can transmit light from the light emitters 120, 322, 324, 326 of FIG.3 and other light emitters.

EX1041 [0027].

275. Thus, Fraser teaches a biosensor module with an array of windows aligned with an array of optical components, as claimed.

D. Ground 4: Claim 9 is unpatentable because it would have been obvious over Kotanagi, Honda, and Orr.

1. Dependent Claim 9

276. Claim 9 depends from Claim 7 and adds: "**wherein: the biosensor module comprises: at least one light source; and a set of detectors; and the at least one light source and the set of detectors are configured to operate as a photoplethysmogram (PPG) sensor**."

277. Kotanagi teaches a biological sensor with an LED, photodetector, and two electrodes (contact detection means 7) for detecting skin contact:

> 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 ¶46.

278. Together, these features operate as a PPG sensor—a device that uses a light source and a photodetector at the surface of skin to measure the volumetric

variations of blood circulation. Fraser, explained above with regard to Ground 3, teaches that "light detector 130 [] can detect light 135 reflected from the wrist of the user" and that "light emitter 120 and light detector 130 can be used for photoplethysmography." EX1041 [0016]. Also Choi, discussed above, teaches measuring "photoplethysmogram (PPG) signal" with a sensor on the rear surface of a biosensing watch. EX1011 [47]; EX1023 at 13. Thus, it was explicitly taught at least by Fraser and Choi that a "photoplethysmogram" may be performed on the rear side of a biosensing watch.

279. Kotanagi teaches optically measuring the pulsation of arteries in the wrist:

> The PD 6 . . . generates a pulse signal (biological information signal) corresponding to the amount of received light, and outputs the signal to the data processing part 9. That is, since 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 A (living body), the PD 6 can receive reflected light corresponding to the pulsation of arteries that is, pulse waves. As a result, the PD 6 can generate a pulse signal.

EX1005 ¶65.[10]

280. Thus, Kotanagi teaches a photoplethysmogram (PPG) sensor comprising a light source and a set of detectors (a photodetector and two contact detection means) for performing a PPG measurement, as Kotanagi teaches optical measurement occurs upon contact detection. EX1005 at ¶59. If the claim is interpreted as requiring two different photodetectors, such a configuration would have been obvious as a mere duplication of parts.[11]

281. Based on the above, Claim 9 would have been obvious in view of Kotanagi and Honda. Moreover, Claim 9 would have been obvious in view of Kotanagi, Honda, and Orr.

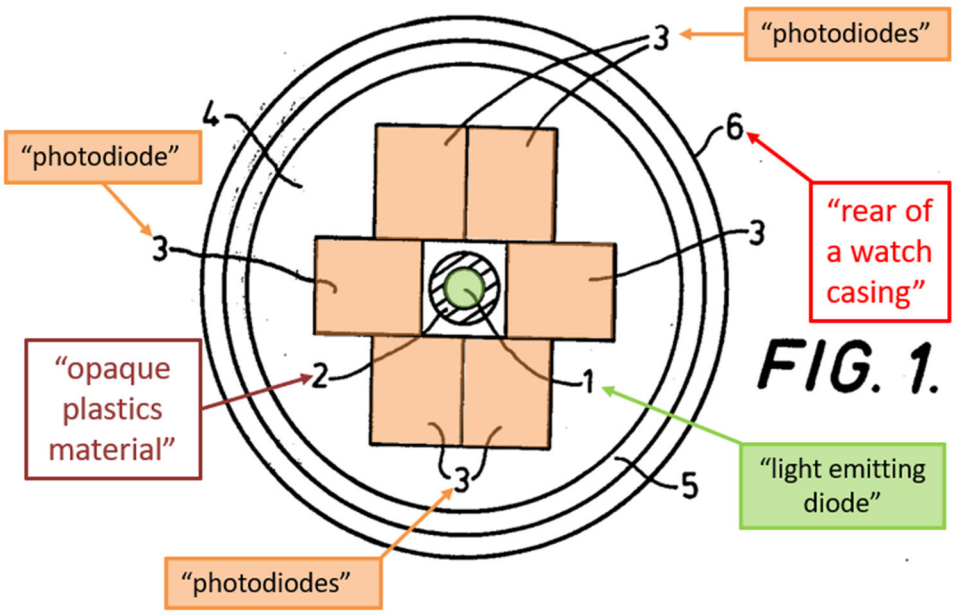
282. Orr, which was published in 1979, teaches a "light emitting diode 1 and [] photodiodes 3 disposed on the rear surface of a wristwatch casing 6." EX1025 3:34–35. Orr explains that a photodiode is a "semiconductor detector for detecting

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[10] Kotanagi is not required to use the word "photoplethysmogram" to read on this limitation. *See In re Bond,* 910 F.2d 831, 832 (Fed. Cir. 1990) (disclosure need not be *ipsissimis verbis*).

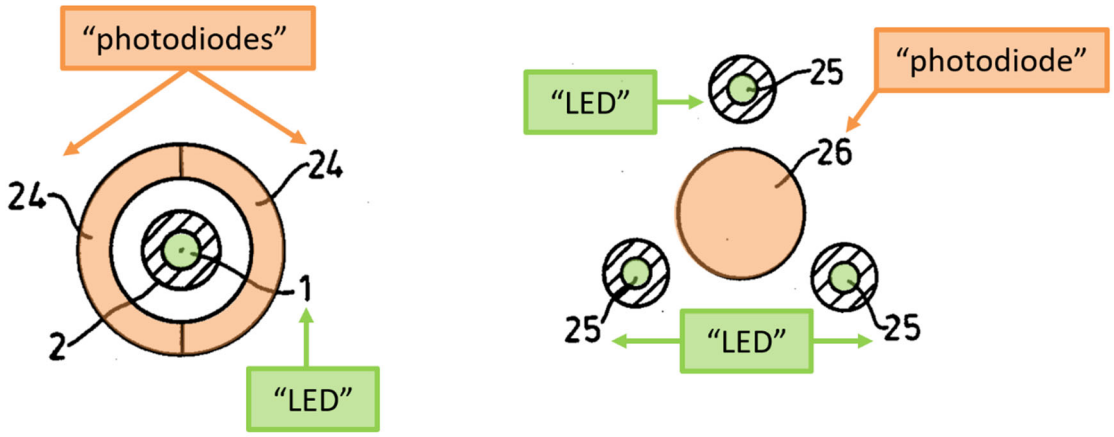
[11] *See In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960) (mere duplication of parts has no patentable significance unless a new and unexpected result is produced.).

variations in the light reflected from the skin." *Id*. 1:42–45, 6:19–21. Orr's LED is surrounded by "opaque plastics material 2" and the whole back surface is set in "transparent plastics material 4." EX1025 2:17–22. Orr's multiple photodiodes are shown here:



See EX1025 at 2.

283. Thus, Orr teaches a light source and set of multiple optical detectors operating as a PPG sensor. It would have been obvious to combine Kotanagi and Orr as they both teach the measurement of a heartbeat signal via sensors on the back side of a watch. Orr shows that the number and arrangment of photodiode sensors on the back side of a watch may vary, as Fig. 4 and Fig. 5 present differing numbers of photodiodes:



See EX1022 at 3.

284. Therefore, a POSITA would have found the arrangement and number of photodiodes on the back side of a biosensing wristwatch obvious in view of Orr.

285. As stated above, a photoplethysmogram (PPG) uses a light source and a photodetector at the surface of skin to measure the volumetric variations of blood circulation. Thus, Kotanagi and Orr teach a PPG measurement.

a. Motivation to Combine Kotanagi, Honda, and Orr

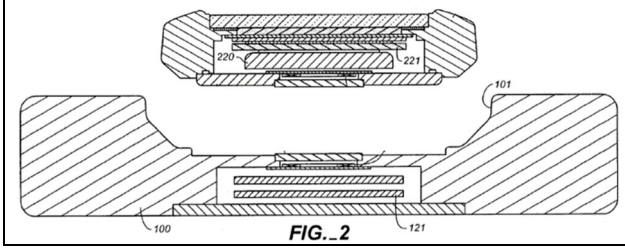
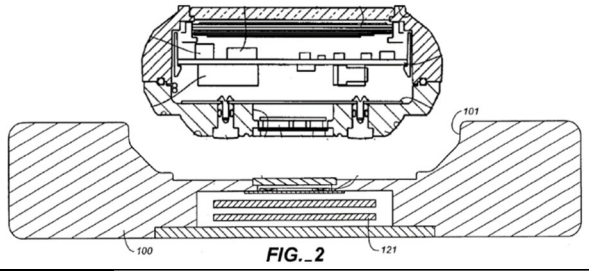
286. The reasons to combine Kotanagi and Honda provided elsewhere in this declaration (e.g., *supra* § XI(A)(1)(h)) also apply here. It would have further been obvious to a POSITA to add Orr for various reasons. For example, Orr teaches that multiple detectors can work together to provide higher current output (EX1025 3:22–25) and can help capture signals reflecting in unknown or multiple directions (*see id.* 2:19–21, 3:31–32). Moreover, additional detectors can provide a failsafe and backup function in case a single detector stops working.

E. Ground 5: Claim 12 and 18 are unpatentable because they would have been obvious over Kotanagi, Honda, and Park.

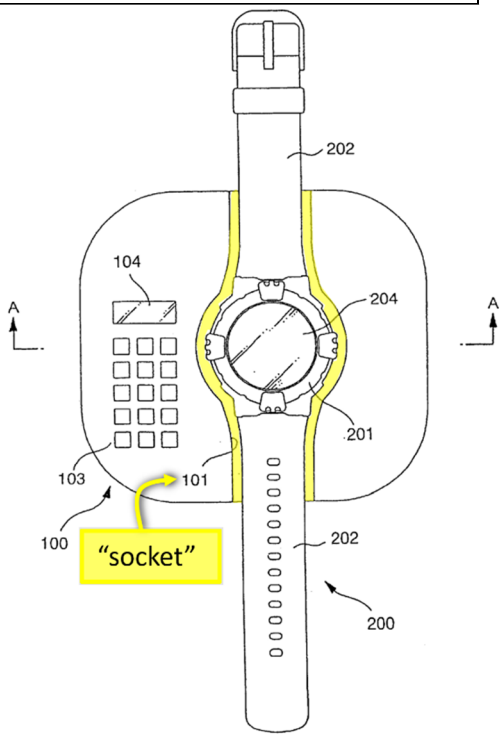
1. Dependent Claim 12

287. Claim 12 depends from Claim 7 and adds: "**wherein: the wearable electronic device further comprises a first magnet positioned within the housing and below the cover; the external wireless charging device comprises a second magnet; and the first and second magnets are configured to maintain alignment between the wearable electronic device and the external wireless charging device during a charging operation**."

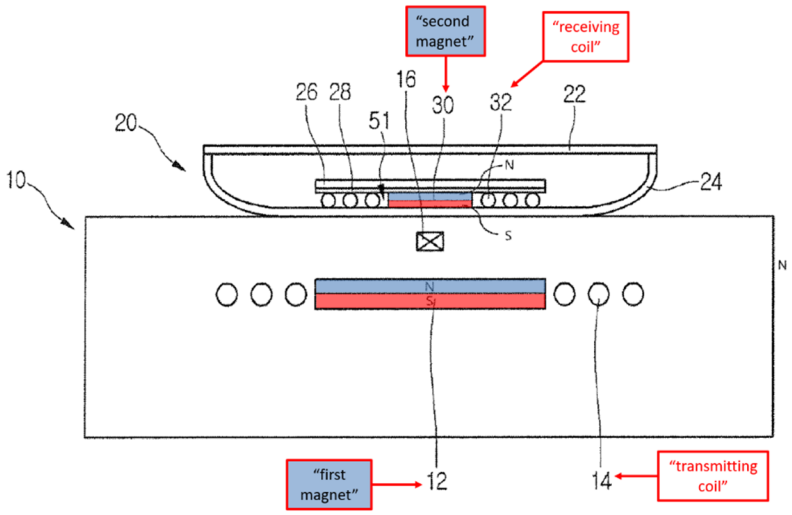
288. Because the Kotanagi and Honda watch devices are so similar, Kotanagi's device as modified by Honda (to include a wireless charging receive coil) would fit within (and interact similarly with) at least a scaled version of Honda's charging station.

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):
 FIG._2	 FIG._2

289. Honda facilitates alignment of its wireless charging coils via a socket. EX1006 at 2 (Fig. 1, adjacent). Honda teaches that wireless charging coils must be aligned with each other, or within at least 1 mm of alignment with each other, as "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 2 (Fig. 1); 1:53–56.



290. Honda's teaching of this difficulty would have motivated a POSITA to look for better ways to align for charging. Park teaches wireless charging alignment via a first magnet in a wireless charging station and a second magnet within the housing of an electronic device, as illustrated below:



See EX1015 at 64; EX1012 at 11.

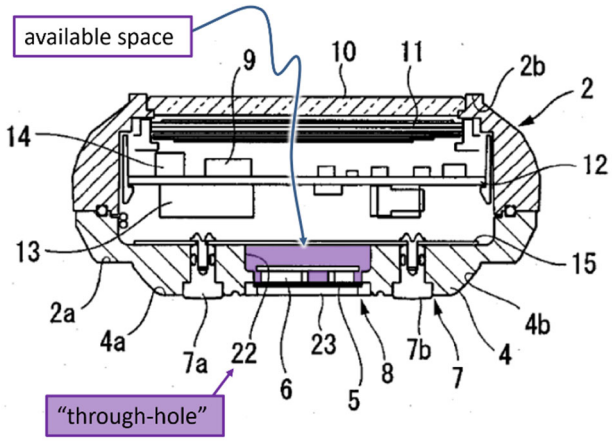
291. Park teaches that these magnets align and reduce the distance between the transmitting coil and the receiving coil, thus "improving wireless power transfer efficiency." EX1015 at 44; EX1012 [0192]. A POSITA would have used Park's teachings of magnetic alignment to insert magnets into the modified watch device of Kotanagi and the charging station of Honda (e.g., using Honda's socket for gross alignment and Park's magnets for fine or final alignment). Thus, a POSITA would have found the limitations of Claim 12 obvious in view of Kotanagi, Honda, and Park.

a. Motivation to Combine Kotanagi, Honda, and Park

292. The reasons to combine Kotanagi and Honda provided elsewhere in this declaration (e.g., *supra* § XI(A)(1)(h)) also apply here. Kotanagi and Honda are both assigned to Seiko companies. *See* EX1005 at 1, EX1006 at 1. Thus, a POSITA

having Kotanagi would have also had access to Honda and readily combined teachings from the two references.

293. A POSITA would have been further motivated before the effective filing date to combine the teachings of Honda and Park as they both teach the need for alignment in wireless charging. Honda provides alignment via a socket/recess, but acknowledges that fully accurate alignment is "difficult" to achieve. EX1006 at 1:53–59. Park provides alignment via permanent magnets. EX1015 at 42–43; EX1012 at 11. Given the similarity of the Honda and Park charging stations (e.g., both designed to use inductive coupling from coils in the station and device), and given the known properties of permanent magnets, inserting permanent magnets into station and device would have merely combined familiar elements according to known methods to yield predictable results. Moreover, the available space in Kotanagi's device could fit, or readily be adjusted to fit, both a charging receive coil (Honda and Park) and a permanent magnet (Park). This indicates a POSITA would have expected the combination would be successful.



See EX1005 at 27 (Fig. 7).

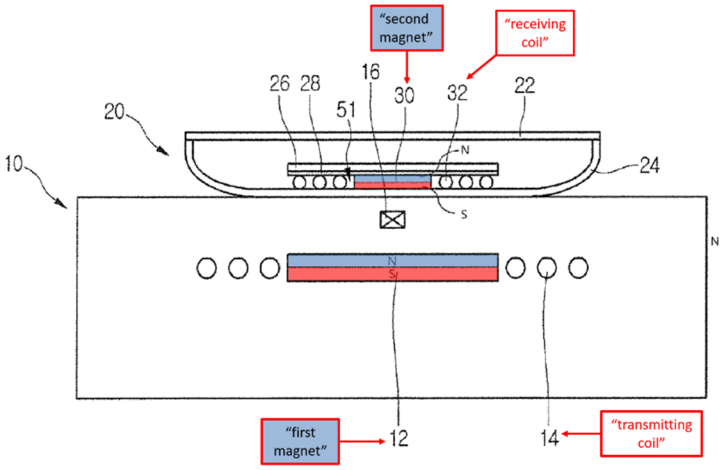
294. This motivation to combine also applies to other claims rejected under this ground (Ground 5), and Ground 6 (discussed below).

2. Dependent Claim 18

295. Claim 18 depends from Claim 14 and adds: "**wherein: the electronic device further comprises a magnet that is configured to magnetically couple the electronic device to an external inductive power transmitter dock through the cover.**"

296. The analysis for Claim 12 also applies here (where the "wireless charging device" of Claim 12 is analogous to the "inductive power transmitter dock" of Claim 18). To summarize, both Honda's charging station and Park's docking station cradle teach the claimed "external inductive power transmitter dock." Honda teaches that with its socket approach, "[s]ince the station-side coil 110 and the watch-side coil 210 face each other as shown in FIG. 2 and FIG. 3, both coils are

electromagnetically coupled." EX1006 9:41–43. Park teaches a permanent magnet that magnetically couples to a docking station cradle through the back side of an electronic device:



See EX1015 at 64; EX1012 at 11. Park further explains that when the first magnet and second magnet are close enough, a change in the flux density is sensed . . . indicating that the magnets are "coupled" to each other. EX1012 [0191]–[0192]; EX1015 at 44.

297. Thus, as explained with respect to Claim 12, a POSITA would have found it obvious to incorporate permanent magnets to align the device for magnetic coupling and wireless charging through the cover. Honda teaches that electromagnetic fields are felt most strongly through a non-conductive material (EX1006 13:33–63, Fig. 15), such as through the cover of Kotanagi's optical biosensor module. Honda has a similar cover glass that allows coupling and charging. Park also allows charging through the cover of its device. Thus, a

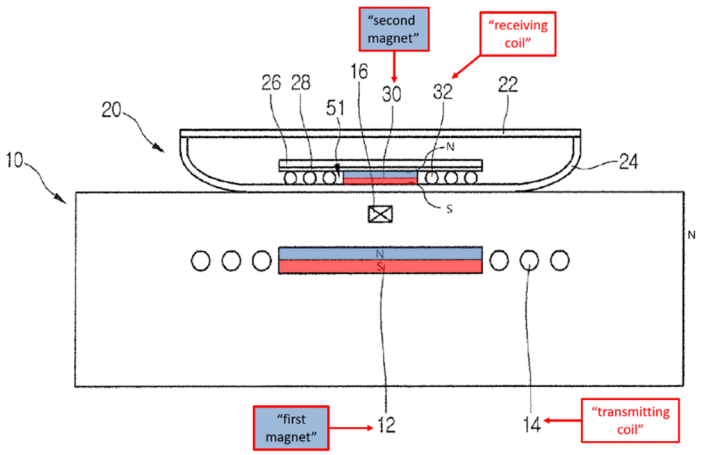
POSITA would have found the limitations of Claim 18 obvious in view of these references.

F. Ground 6: Claim 4 is unpatentable because it would have been obvious over Kotanagi, Honda, Choi, and Park.

1. Dependent Claim 4

298. Claim 4 depends from claim 1 and further adds **"wherein: the electronic watch further comprises a first magnet positioned within the housing; the first magnet is configured to couple to a second magnet positioned within a charging dock; and the first and second magnets are configured to maintain alignment of the electronic watch with respect to the charging dock."**

299. The analyses of Claims 12 and 18 also apply here. For example, Honda uses a socket for at least gross alignment (EX1006 at 2, Fig. 1), but acknowledges difficulty, suggesting a need for more precision (EX1006 1:53–54). Park teaches an electronic device comprising a first magnet and second magnet in a dock for more precise alignment during charging:



See EX1015 at 64; EX1012 at 11.

300. It would have been obvious to a POSITA to combine the teachings of Kotanagi with Honda and Park for at least the reasons stated above with regard to Claims 12 and 18.

a. Motivation to Combine Kotanagi, Honda, Choi, and Park

301. It would have been obvious to a POSITA to combine Kotanagi, Honda, Choi, and Park for various reasons. The reasons to combine Kotanagi and Honda provided elsewhere in this declaration (e.g., *supra* § XI(A)(1)(h)) also apply here. Similarly, the reasons to add Choi (e.g., *supra* § XI(B)(1)(k)) and to add Park (e.g., *supra* § XI(E)(1)(a)) also apply here. To summarize, Kotanagi teaches wireless charging and has space for Honda's wireless receive coil and Park's alignment magnet. Kotanagi's display and electrodes indicate a likelihood of success when adding Choi's touch-sensitive display and ECG electrode function. For these and the reasons explained elsewhere herein, a POSITA would have found the limitations of Claim 4 obvious in view of these references.

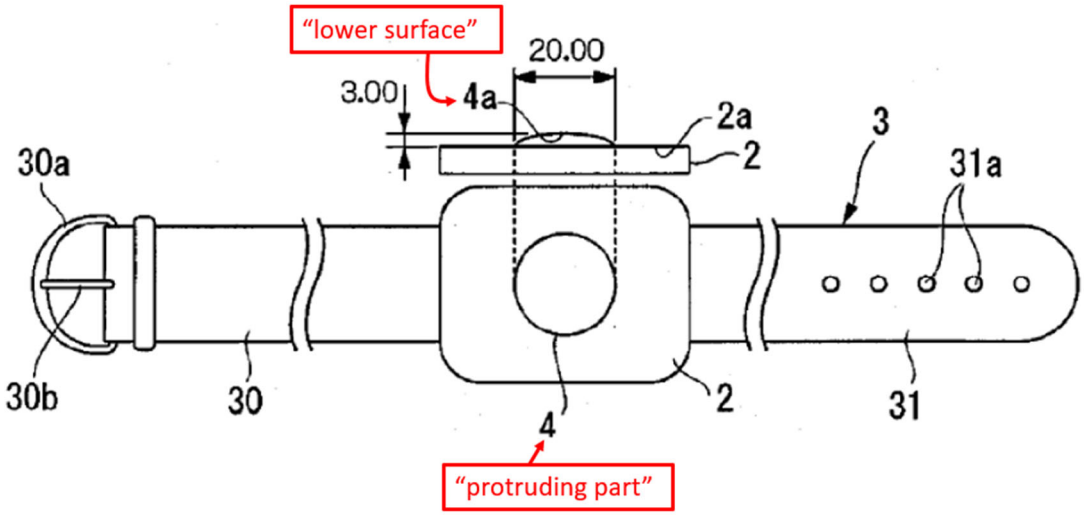
G. Ground 7: Claims 10 and 19 are unpatentable because they would have been obvious over Kotanagi, Honda, and Jabori.

1. Dependent Claim 10

302. Claim 10 depends from Claim 7 and further adds **"wherein: the cover protrudes outward from a rear surface of the housing; the cover defines a**

convex exterior profile; and the convex exterior profile facilitates alignment between the cover and a mating surface of the external wireless charging device."

303. The analysis provided above for Claim 2 shows that Kotanagi teaches a cover protruding outward from the rear of the housing. Kotanagi teaches this can form a convex exterior profile: "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 EX1006 at 28 (Fig. 8).

304. 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*. at 28. As noted above, Kotanagi also teaches wireless charging, or charging

"in a contactless state" (EX1005 ¶53). This would have motivated a POSITA to look to Honda for modifications to make for such wireless charging.

305. Honda teaches an external inductive power transmitter dock which it terms a "station" having a "socket" to facilitate alignment. EX1006 at 2 (Fig. 1). Honda also teaches using complementary shapes, with a "slightly larger" socket shape to assist with alignment for charging:

> [In] FIG. 1 . . . . an electronic watch 200 is seated in a socket 101 of a station 100 . . . . 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 6:4–11.

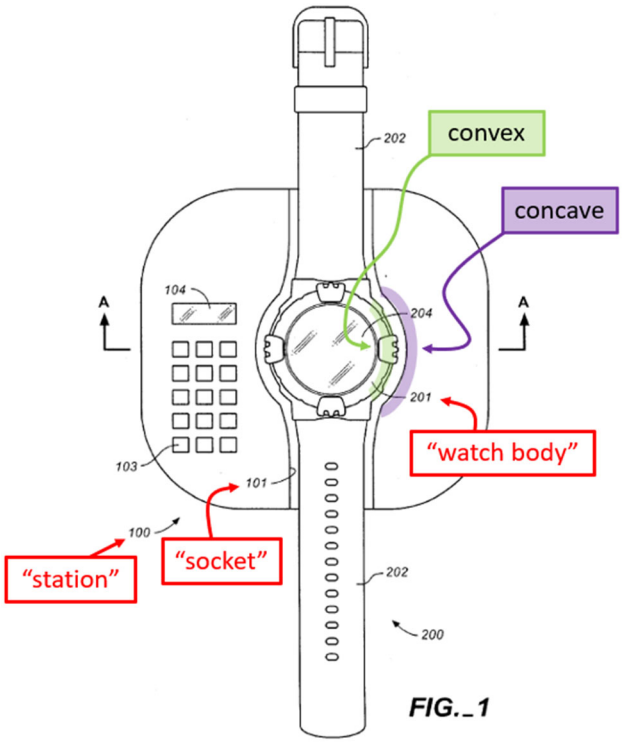
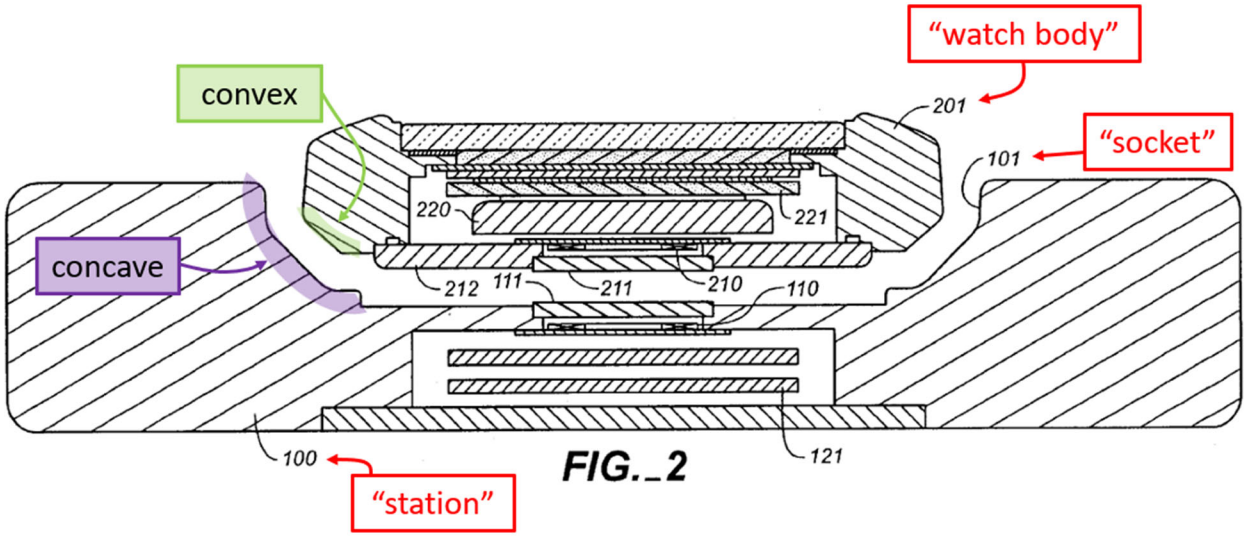


FIG._1

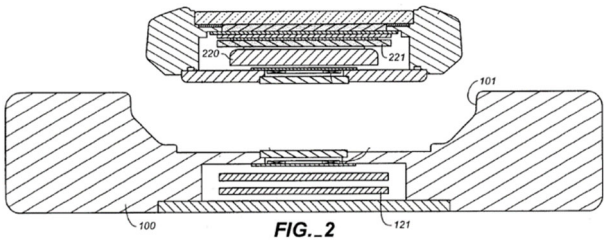
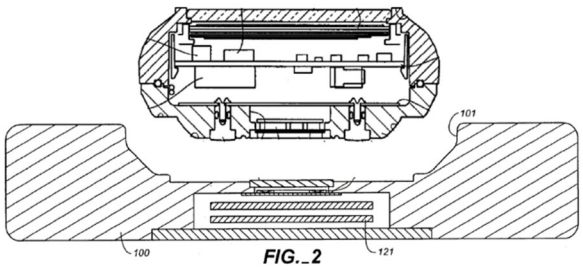
See Id. at 2 (Fig. 1).

306. Similar to the complementary concavity shown above, Honda's cross section view shows complementary convex and concave surfaces to facilitate alignment in a charging station:

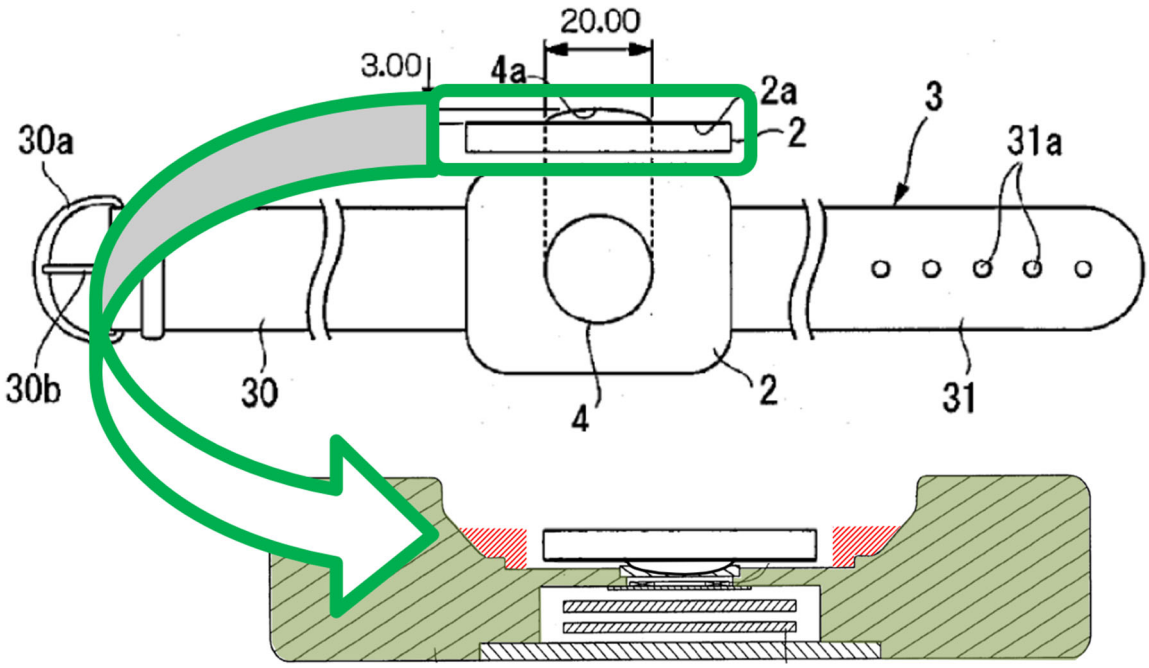


See id. at 3 (Fig. 2).

307. Honda's socket can already accommodate the shape of some Kotanagi embodiments quite well:

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):
	

308. However, a POSITA using Kotanagi's Figure 10 embodiment would have known to make a slight modification to Honda's socket, based on Honda's teachings, to provide a complementary concavity in the charging station, so the socket can be "shaped to be slightly larger than" the device being charged. EX1006 6:9.



309. *See* EX1005 at 28 (Fig. 8), EX1006 at 3 (Fig. 2) (annotation of Kotanagi's watch in a modified version of Honda's station).

310. 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 13:3–32), and therefore provided a concavity for the convex protrusion if the receive-side coil is located behind it.

311. 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.

EX1017 [0017] (emphasis added).

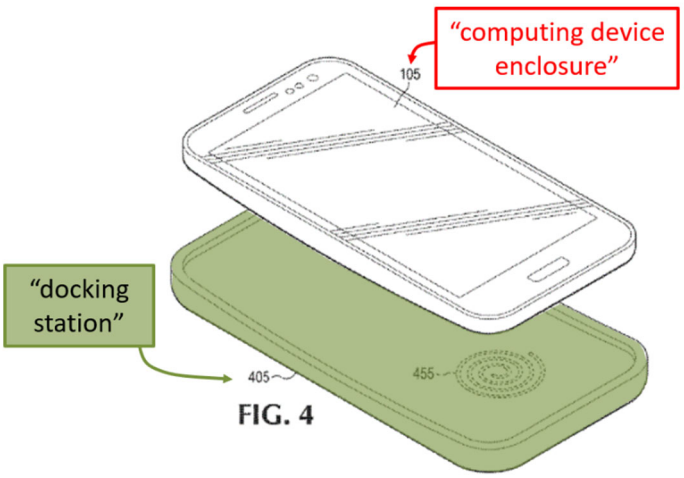


FIG. 4

See EX1017 at 16.

312. In view of these teachings, a POSITA would have found Claim 10 obvious over Kotanagi, Honda, and Jabori.

a. Motivation to Combine Kotanagi, Honda, and Jabori.

313. The reasons to combine Kotanagi and Honda provided elsewhere in this declaration also apply here. Kotanagi and Honda are both assigned to Seiko companies. *See* EX1005 at 1, EX1006 at 1. Thus, a POSITA having Kotanagi would have also had access to Honda and readily combined teachings from both. Such a person would have expected success because the devices they teach are so similar: both teach wireless charging and biosensing of a pulse signal.

314. A POSITA would have expected success in adding Jabori because it also teaches wireless or contactless charging. 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 1:56; *see id*. at 9 (Fig. 10). To achieve such accuracy, a POSITA would have looked to Jabori because it uses a nested approach to more accurately align wireless charging devices, and a POSITA would have found Jabori's teachings on convex/concave as a complementary enhancement to Honda's teachings.

315. 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 4:27–48. In approximately 1997 I participated in the invention of the watch and docking station below:

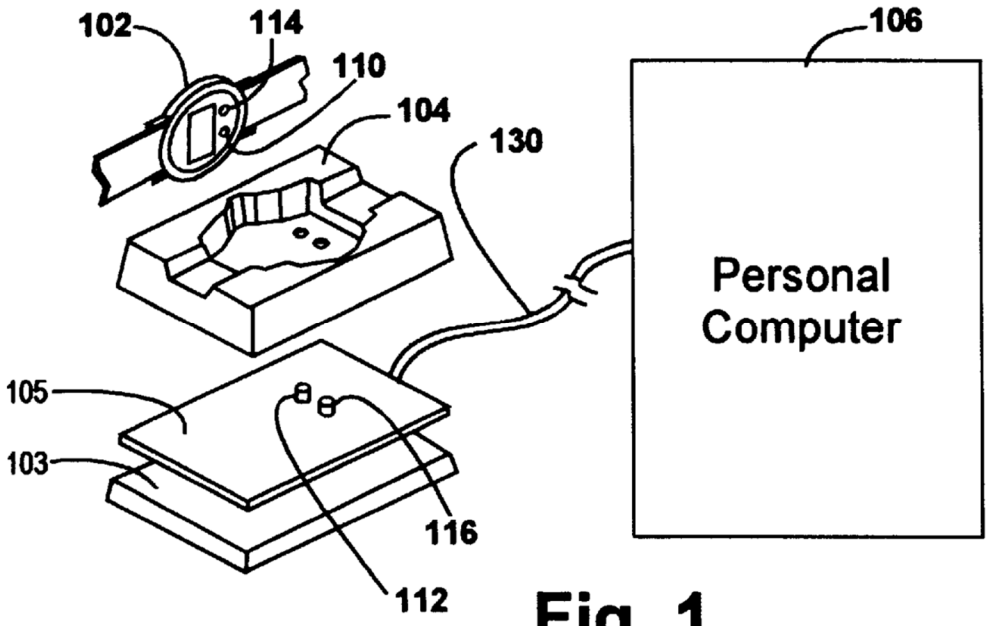


Fig. 1

EX1036, Fig. 1.

316. 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 "[t]he 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 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.

317. This motivation applies as well to other claims rejected using Jabori, including under Grounds 7 and 8. Further motivations to combine are provided throughout this declaration.

2. Dependent Claim 19

318. Claim 19 depends from claim 14 and adds **"wherein the cover protrudes outward from a rear surface of the housing to facilitate alignment between the cover and a mating surface of an external wireless charging device."**

319. The analysis of Claim 10 applies here to show obviousness over Kotanagi, Honda, and Jabori, including the reasons to combine discussed above. Claim 19 does not require a "convex" protrusion, but it is otherwise analogous to Claim 10.

H. Ground 8: Claim 6 is unpatentable because it would have been obvious over Kotanagi, Honda, Choi, and Jabori.

1. Dependent Claim 6

320. Claim 6 depends from claim 1 and further adds **"wherein: the cover defines a convex exterior profile; and the convex exterior profile facilitates**

alignment between the cover and a mating surface of an external wireless charging device."

321. The analysis of Claim 10 applies here to show obviousness of these additional limitations over Kotanagi, Honda and Jabori, including the reasons to combine discussed above. The analysis of Claim 1 applies as well. To summarize, Kotanagi teaches many of the claim limitations, Honda teaches a watch biosensing device as well as specific structures for wireless charging, Choi teaches a watch biosensing device as well as a touch-sensitive display and using electrodes for ECG measurement. Kotanagi's Figure 10 already teaches a convex exterior profile and Honda teaches mating and alignment; Jabori's specific teaching of a convex/concave mating arrangement (EX1017 at [0017]) shows that a POSITA would have found Claim 6 obvious in view of these references.

322. As discussed with regard to Ground 8, a POSITA would have found obvious a cover with an exterior profile that facilitates alignment with the cover and a mating surface of an external wireless charging device in view of the disclosure in Park and Jabori.

a. Motivation to Combine Kotanagi, Honda, Choi, and Jabori

323. A POSITA would have been motivated to combine these references for at least the reasons provided under Grounds 2 (Claim 1) and 7 (Claims 10 and 19). Moreover, nothing about the addition of Choi would frustrate the purpose of—or

teach away from—the Jabori teachings or modifications discussed above. Although in Ground 7 it was not necessary to include Choi, neither Choi's touch-screen display nor Choi's processing of electrode data for ECG purposes would have been contrary to Jabori's nested (convex/concave) approach to device alignment for wireless charging.

XII. CONDENSED SUMMARY OF OPINIONS

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

Ground	Claim(s)	Prior Art Combination
1	7, 11, 14, and 16	Kotanagi and Honda
2	1–3, 5, 13, and 17	Kotanagi, Honda, and Choi
3	8 and 15	Kotanagi, Honda, and Fraser
4	9	Kotanagi, Honda, and Orr
5	12 and 18	Kotanagi, Honda, and Park
6	4	Kotanagi, Honda, Choi, and Park
7	10 and 19	Kotanagi, Honda, and Jabori
8	6	Kotanagi, Honda, Choi, and Jabori

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

325. 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.

XIV. CONCLUSION

326. For these reasons, it is my opinion that each of Claims 1–19 of the '491 Patent would have been obvious to a POSITA prior to September 2, 2014.

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