

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Gloria Lin, et al.
U.S. Patent No.: 10,076,257 Attorney Docket No. 50095-0157IP1
Issue Date: August 11, 2020
Appl. Serial No.: 14/136,658
Filing Date: December 20, 2013
Title: SEAMLESSLY EMBEDDED HEART RATE MONITOR

DECLARATION OF DR. THOMAS W. KENNY

I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

I hereby declare that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true. I further declare 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 the Title 18 of the United States Code.

Dated: October 10, 2023

By: 
Thomas W. Kenny, Ph.D.

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I. QUALIFICATIONS AND BACKGROUND INFORMATION

1. My education and experience are described more fully in my curriculum vitae, attached as Appendix A to this declaration. For ease of reference, I have highlighted certain information below.

2. My academic and professional background is in Physics, Mechanical Engineering, Sensing, and Robotics, with a research specialization focused on microfabricated physical sensors, and I have been working in those fields since the completion of my Ph.D. more than 30 years ago. The details of my background and education and a listing of all publications I have authored in the past 35 years are provided in my curriculum vitae, attached as Appendix A. Below I provide a short summary of my education and experience which I believe to be most pertinent to the opinions that I express here.

3. I received a B.S. in Physics from University of Minnesota, Minneapolis in 1983, and a Ph.D. in Physics from University of California at Berkeley in 1989. I was educated as a Physicist specializing in sensors and measurement. My Physics Ph.D. thesis involved measurements of the heat capacity of monolayers of atoms on surfaces, and relied on precision measurements of temperature and power using time-varying electrical signals, and also on the design and construction of miniature sensor components and associated electrical circuits for conditioning and conversion to digital format.

4. After completion of my Ph.D. in Physics at U.C. Berkeley in 1989, I joined the Jet Propulsion Laboratory (JPL) in Pasadena, CA, as a staff scientist, and began working on miniature sensors and instruments for small spacecraft. This work involved the use of silicon microfabrication technologies for miniaturization of the sensors, and served as my introduction to the field of micro-electromechanical systems (MEMS), or the study of very small mechanical sensors powered by electricity and used for detection of physical and chemical signals.

5. While at JPL, we developed accelerometers, uncooled infrared sensors, magnetometers, seismometers, force and displacement sensors, soil chemistry sensors, miniature structures for trapping interstellar dust, and many other miniature devices. Some of these projects led to devices that were launched with spacecraft headed for Mars and for other interplanetary missions. Much of this work involved the use of physical sensors for detection of small forces and displacements using micromechanical sensors.

6. I am presently the Richard Weiland Professor at the Department of Mechanical Engineering at Stanford University, where I have taught for the past 29 years. I am also currently the Senior Associate Dean of Engineering for Education and Student Affairs at Stanford.

7. For almost all of these 29 years, I have taught courses on Sensors and Mechatronics at Stanford University. The “Introduction to Sensors” course is a

broad overview of all sensing technologies, from thermometers, to inertial sensors, ultrasound devices, flow sensors, optical and IR sensors, chemical sensors, pressure sensors, and many others, and has included sensors based on changes in capacitance, resistance, piezoelectricity. This course specifically included different mechanisms for sensing heart rate, blood pressure, blood chemistry, cardiovascular blood flow and pressure drops, intraocular pressure and other physiological measurements, as well as activity monitoring (step counting, stair-counting, etc). I first taught this course at Stanford in the Spring of 1994, and I offered this course at least annually until 2016, when my duties as Senior Associate Dean made this impractical, yet have continued to offer this course periodically since, including these last two years.

8. The “Introduction to Mechatronics” course is a review of the mechanical, electrical and computing technologies necessary to build systems with these contents, which include everything from cars and robots to cellphones and other consumer electronics devices. In this class, we routinely use IR, LEDs, and photosensors as a way of detecting proximity to objects in the space around miniature robots. We also use inertial sensors to detect movement, and a number of sensors, such as encoders to measure changes in position and trajectory. I was one of the instructors for the first offering of this course in 1995, and this course has been offered at least once each year ever since, except for the pandemic year of

2021. The 2023 offering was highly-successful with 80 undergraduate and graduate students from many engineering and science disciplines.

9. I am co-author of a textbook titled “Introduction to Mechatronic Design,” which broadly covers the topic of integration of mechanical, electronic and computer systems design into “smart products.” This textbook includes chapters on Microprocessors, Programming Languages, Software Design, Electronics, Sensors, Signal Conditioning, and Motors, as well as topics such as Project Management, Troubleshooting, and Synthesis.

10. My research group at Stanford has focused on the area of microsensors and microfabrication—a domain in which we design and build micromechanical sensors using silicon microfabrication technologies. The various applications for these technologies are numerous.

11. I have advised 75 Ph.D. students that have completed Ph.D. degrees and many more M.S. and B.S. students in Engineering during my time at Stanford.

12. I have published over 250 technical papers in refereed journals and conferences in the field of sensors, MEMS, and measurements. I have further presented numerous conference abstracts, posters, and talks in my field. I am a named inventor on 50 patents in my areas of work.

13. From 2020 to 2022 I served as CEO of Applaud Medical, a startup that I co-founded in 2015. Applaud is developing improved methods for treatment

of kidney stones, and during my time as CEO, we initiated a FDA-regulated pivotal clinical trial on our first product, concluded an Australian clinical study on our second product, and positioned the company for on-boarding of an experienced CEO with resources to guide the company through all remaining trials and to a successful outcome.

14. I received the Office of the Secretary of Defense Award for Exceptional Public Service in 2010, the IEEE Sensors Council Technical Achievement Award in 2011, and was named Fellow of the ASME in 2014. I was awarded the 2018 IEEE Daniel Noble Award for Emerging Technologies. In 2022, I was elected to the National Academy of Engineering.

15. I have previously served as an expert on a patent infringement case involving the mounting and use of pressure sensors on guidewire catheters for cardiovascular procedures that included a number of sensing aspects, such as recording static and dynamic pressure signals, and compensating for electrical and mechanical errors. I have also previously served as an expert on a patent infringement case involving the design and use of miniature inertial sensors. That case involved the design and operations of micromechanical sensors, and particularly the use of inertial sensors for detection of states of movement and rest. I have also served as an expert in a patent infringement case involving the use of sensors on athletic shoes for determining athletic performance. I served as an

expert in a patent infringement case involving optical proximity sensors in smartphones. More recently, I have served as an expert witness in cases involving the use of optical sensors for determination of physiological parameters such as heart rate and blood oxygenation, inertial sensors for determination of posture and gait, and in another case related to noise cancellation in wearable electronic devices. My CV, Appendix A, includes a full listing of all cases in which I have testified at deposition or trial in the preceding several years.

16. I have been retained on behalf of Apple Inc. to offer technical opinions relating to U.S. Patent No. 10,076,257 (“the ’257 Patent”) and prior art references relating to its subject matter. I have reviewed the ’257 Patent, and relevant excerpts of the prosecution history of the ’257 Patent. Based on my experience and education, and the acceptance of my publications and professional recognition by societies in my field, I believe that I am qualified to offer opinions as to the knowledge and level of skill of one of ordinary skill in the art at the time of the invention of the ’257 patent (which I further describe below).

17. In addition to any materials cited in the present declaration, I have also reviewed the following references:

18. EX1001 U.S. Patent No. 10,076,257 B2

19. EX1002 Prosecution History of U.S. Patent No. 10,076,257 B2

20. EX1003 Declaration of Dr. Ronald D. Berger (“Berger Declaration”)
21. EX 1004 Curriculum vitae of Dr. Ronald Berger
22. EX 1005 Markel U.S. Patent Appl. No. 11/492,278
23. EX 1006 Nissilä U.S. Patent No. 6,775,566
24. EX 1007 Righter U.S. Patent No. 5,191,891
25. Ex. 1008 Farrington U.S. Patent No. 7,502,643
26. EX 1009 Cardiology Explained EUAN A. ASHLEY & JOSEF NIEBAUER, CARDIOLOGY EXPLAINED (2004)
27. EX 1010 Cudahy U.S. Patent No. 5,184,620
28. EX 1011 Sujdak U.S. Patent No. 6,847,836
29. EX 1012 Geddes U.S. Patent No. 4,606,352
30. EX 1013 Ceballos U.S. Patent No. 6,522,915
31. EX 1014 Gilles U.S. Patent No. 4,635,646
32. EX 1015 Weiss U.S. Patent No. 5,623,926
33. EX 1016 Apple’s Complaint Complaint, Apple Inc. v. AliveCor, Inc., Case No. 4:22-cv-07608-HSG, Dkt. No. 1 (N.D. Cal., Dec. 12, 2022)
34. EX 1017 Hobson U.S. Patent No. 7,876,274.

35. *Masimo Corporation v. Apple Inc.*, IPR2023-00745 Pap. 4 (Petition) (PTAB Mar. 22, 2023)

36. I have also reviewed various supporting references and other documentation as further noted in my opinions below.

37. Counsel has informed me that I should consider these materials through the lens of one of ordinary skill in the art related to the '257 Patent at the time of the earliest possible priority date of the '257 Patent, and I have done so during my review of these materials. The '257 Patent claims the benefit of priority to a provisional application filed January 23, 2009 ("the Critical Date"). Counsel has informed me that the Critical Date represents the earliest possible priority date to which the challenged claims of '257 Patent are entitled, and I have therefore used that Critical Date in my analysis below.

38. I have no financial interest in the parties or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

39. In writing this declaration, I have considered the following: my own knowledge and experience, including my work experience in the fields of mechanical engineering, computer science, biomedical engineering, and electrical engineering; my experience in teaching those subjects; and my experience in

working with others involved in those fields. In addition, I have analyzed various publications and materials, in addition to other materials I cite in my declaration.

40. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the '257 Patent. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art as of the Critical Date, or before. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the '257 Patent and the prior art discussed below.

II. OVERVIEW OF CONCLUSIONS FORMED

41. This declaration explains the conclusions that I have formed based on my analysis. To summarize those conclusions, based upon my knowledge and experience and my review of the prior art publications listed above, I believe that:

- Markel does not render obvious claims 1-14 of the '257 Patent
- Markel in view of Nissila does not render obvious claims 1-22 of the '257 Patent
- Markel in view of Righter does not render obvious claims 12, 13, and 19.

III. LEVEL OF ORDINARY SKILL IN THE ART

42. In my opinion, a person of ordinary skill in the art as of the Critical Date of the '257 Patent (hereinafter a "POSITA") would have had at least a

bachelor's degree in electrical engineering, mechanical engineering, biomedical engineering, computer engineering, physics, or a related field, and would have had at least two years of relevant work experience with capture and processing of data or information, including but not limited to physiological information, or equivalents thereof. Less work experience may be compensated by a higher level of education and vice versa.

43. Based on my experiences, I have a good understanding of the capabilities of one of ordinary skill. Indeed, I have taught, participated in organizations, and worked closely with many such persons over the course of my career. Based on my knowledge, skill, and experience, I have an understanding of the capabilities of one of ordinary skill. For example, from my industry experience, I am familiar with what an engineer would have known and found predictable in the art. From teaching and supervising my post-graduate students, I also have an understanding of the knowledge that a person with this academic experience possesses. Furthermore, I possess those capabilities myself.

IV. CLAIM CONSTRUCTION

44. I understand the Patent Trial and Appeal Board ("Board") construes claim terms as having their ordinary and customary meaning to a POSITA at the time of invention (i.e., the same standard used in district court). I have applied this

standard in rendering my opinions on claim construction. In addition, I have been asked to assume that the claims are not indefinite.

45. At this time, I do not think there is a need to construe explicitly any claim language because doing so would have no effect on analyses of AliveCor's asserted grounds. However, I reserve the right to address any construction proposed by Petitioner or the Board.

V. THE '257 PATENT

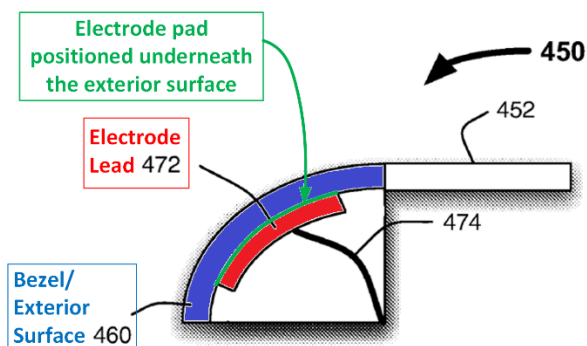
A. Overview

46. The '257 Patent is directed to an electronic device that includes a sensor for detecting a user's cardiac signal. EX1001, 2:1-2. Among other benefits, the sensor can be used to unlock the device in response to "authentica[ing] a user based on the attributes of the user's heartbeat." *Id.*, 49-2:3.

47. A "heart sensor 112 can include one or more leads connected to the exterior of the electronic device." EX1001, 6:3-8. "The cardiac signals detected by the heart sensor leads can be coupled to a processor incorporated in heart sensor 112, or instead provided to processor 102." *Id.*, 6:10-16. "The processor may then analyze the received signals and generate, from the received signals, one or more characteristic quantities of the user's heartbeat or heart rate for authentication." *Id.*

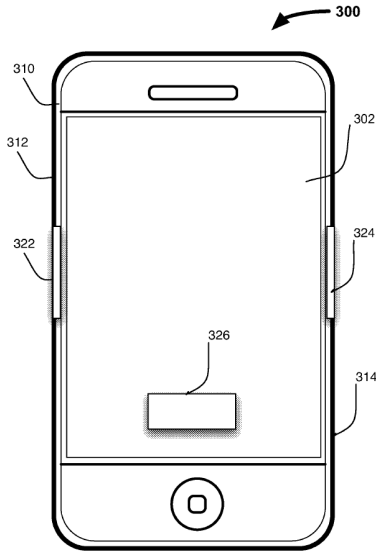
48. The '257 Patent provides several example configurations for its disclosed electronic device. Among them, "FIG. 4B is a cross-sectional view of

another illustrative electronic device having a bezel with an embedded heart sensor lead,” where lead 472 is placed “underneath the outer surface of the bezel.” *Id.* 9:45-49. Lead 472 in FIG. 4B is coupled to a respective connector (424 and 474) that “transmit[s] the signals to a processor” of the device. *Id.*, 9:51-52.



'257 Patent, FIG. 4B (annotated)

49. The '257 Patent also discloses an embodiment where “[a] lead 326 [is] embedded in or behind display 302.” EX-1001, 8:40-52. “Lead 326 can be operative to detect a user's heart activity as the user moves a finger across display 302, for example in the vicinity of or directly over lead 326 (e.g., as the user drags a finger over lead 326 to move a slider when unlocking the electronic device).” *Id.* “Using lead 326, the electronic device can detect an electrical signal from a different portion of the user’s body (e.g., leads 322 and 324 detect signals through a first hand, and lead 326 detects signals through the second hand), which can provide the processor with additional information for determining characteristics of the user's cardiac activity.” *Id.*



'257 Patent, FIG. 3

B. Overview of the Prosecution History

50. The application leading to the '257 Patent was filed on December 20, 2013, claiming priority to provisional application number 61/111,498 filed on November 5, 2008 through a chain of continuation. The '257 Patent went through an examination that involved three substantive office actions including prior art rejections based on Ceballos (US 6,522,915), Gilles (US 4,635,646), and Weiss (US 5,632,926). Subsequently, the '257 Patent was allowed on May 22, 2018, and issued on September 18, 2018.

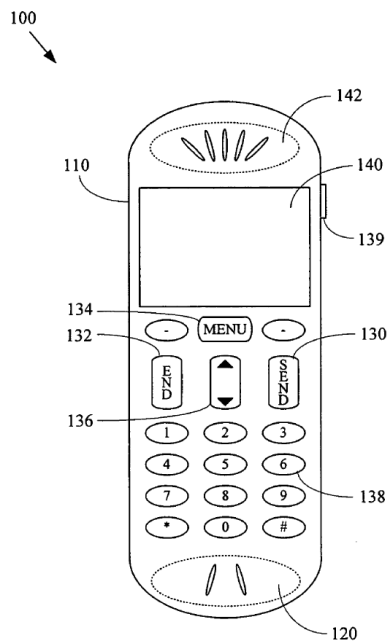
VI. OVERVIEW OF PETITIONER'S APPLIED ART

51. Petitioner has applied Markel as the primary reference in all three grounds of the Petition, applied Nissilä as the secondary reference in Ground 2 in

challenging claims 1-22 of the '257 Patent, and applied Righter as another secondary reference in Ground 3 in challenging claims 12-13 and 19 of the '257 Patent. Pet. 1.

A. Markel

52. Markel describes “electronic devices with cardiovascular monitoring capability.” EX1005, [0004]. In greater detail, Markel discloses a “mobile communication device [(MCD)] 100” that includes electrodes “adapted to detect cardiac activity of a user of the [mobile communication device, (MCD)] 100.” *Id.*, [0033], [0035].



EX1001, FIG. 1

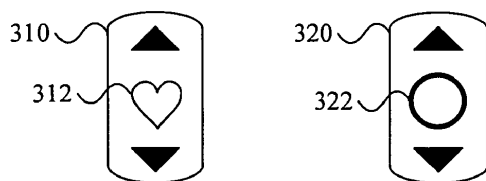
53. Markel discloses that the electrodes “generally comprise conductive material.” *Id.*, [0037]. Markel then continues with providing examples of such conductive material by explaining that:

For example, an electrode may comprise a metallic surface exposed for user contact. Also for example, an electrode may be formed from conductive plastic (or another material) that may be integrated into various molded components of the mobile communication device. For example, various conductive plastics (e.g., graphite-impregnated plastic or the like) may provide sufficient conductivity for an electrode to perform adequately.
Id.

54. Markel also notes that “[e]lectrodes (or other sensors) may be shaped, positioned or formed with various physical features.” *Id.*, [0038]. For example, “[e]lectrodes may[] be identified for the user in any of a variety of manners or may be generally concealed from the user.” *Id.*, [0039].

55. To clarify what it means by an identifiable (i.e., unconcealed) versus a concealed electrode, Markel provides several examples of identifiable “electrode[s] that] comprise a visible or tactile indicium to indicate the location of the electrode[s] to a user,” versus concealed electrodes that “comprise molded conductive plastic with *little or no visible indication of the electrode presence*” when “a user need not be aware of the presence of the electrode.” *Id.*, [0039-40]. FIG. 3 depicts examples of identifiable electrodes. In FIG. 3, “[f]or example, the first pushbutton 310 comprises a heart-shaped indium 312 (or other visible characteristic) to notify a user of the location of the electrode and also the function

of the electrode.” *Id.* “Also for example, the second pushbutton 320 comprises a circular projection (or other tactile characteristic) to notify a user of the location of the electrode.” *Id.*



EX1005, FIG. 3

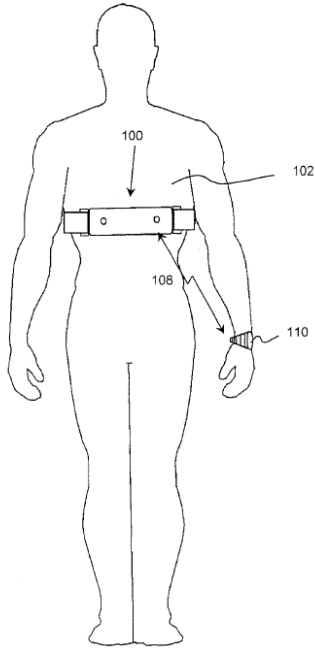
56. “In general, one or more electrodes (or other sensors) may be positioned such that the one or more electrodes **contact** a user during normal (or typical) use of the MCD 100.” *Id.*, [0041]. In FIGs. 2-6, Markel promotes placement of the electrodes **on** different parts of a “cellular or portable telephone” as the MCD. Such placement of the electrodes facilitate user engagement with the electrode during the use of the telephone. *See e.g., id.*, [0045] (“FIG. 4 provides a non-limiting example of [the] electrode placement,” where “first and second electrodes may be **disposed on** a main body portion 110 of the MCD 100,” as presented in “FIG. 4”); *id.*, [0046] (“FIG. 5 provides a non-limiting example of [the] electrode placement,” where the electrodes are “**disposed on** a main body portion 110 of the MCD 100 and a pushbutton”); *id.*, [0047] (“FIG. 2 provides non-limiting examples of [electrode] placement,” where the “electrodes may be **disposed on** a same pushbutton of the mobile communication device 100”); (“FIG.

6 provides a non-limiting illustration of [electrode] placement,” where “a first electrode may be *disposed on* a handheld portion of the MCD 100, and a second electrode may be *disposed on* (or proximate) an earpiece of the MCD100.” “Such electrode placement may, for example, provide for *user contact with both electrodes* during the process of listening to the MCD 100”).

B. Nissila

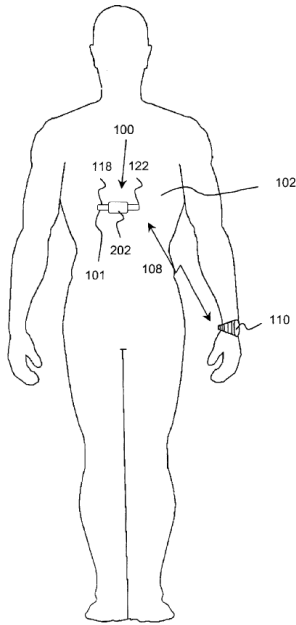
57. Nissila “relates to an electrode structure and a heart rate measuring arrangement for measuring an ECG signal on the skin of a person’s chest,” so that the arrangement can be “used in connection with exercise and sports.” EX1006, Abstract, 1:6-9.

58. Nissila recognizes that problems with the conventional “belt-like” electrode structures were that such electrodes were “poorly suited for long-term, continuous use” because (i) “they chafe the skin easily,” (ii) “[t]he belt-like structure of the electrode belt[] limits its optimal positioning substantially at the heart with persons having large quantities of muscular or other tissue in the chest area,” and (iii) “slim adults and children have troubles in wearing the rigid electrode belt, because it does not bend sufficiently to follow the contours of a human body with a narrow chest.” *Id.*, 1:37-39 and 1:57-2:14.



EX1006, FIG. 1 (depicting a conventional “belt-like” electrode structure)

59. Nissila’s solution is a “band-like” electrode structure “having an inner surface to be placed against the skin of the person’s chest.” *Id.*, 2:16-32. “[T]he inner surface of the electrode structure is an adhesive surface for attaching the electrode structure to the skin of the person’s chest.” *Id.* The “band-like component of the electrode structure is of flexible, soft material that fits the skin closely, and as a consequence it is comfortable and inconspicuous to wear and does not chafe the skin.” *Id.*, 2:62-67. FIG. 2 of Nissila depicts Nissila’s “band-like” “electrode structure 100 placed on the chest 102.” *Id.*, 4:64-65, 5:3-4. “At a first end of the electrode structure 100 there is a first electrode 118 and at a second end of the electrode structure 100 there is a second electrode 122.” *Id.*, 5:6-9.



EX1006, FIG. 2 (illustrating Nissila’s proposed “band-like” electrode structure)

60. The “band 101 [has] an inner surface 116 against the skin of the person’s chest and an outer surface 120 opposite thereto.” *Id.*, 5:5-6. “The inner surface 116 of the electrode structure is an adhesive surface, by which the electrode structure 100 is attached to the skin 102 of the person’s chest.” *Id.*, 5:18-20.

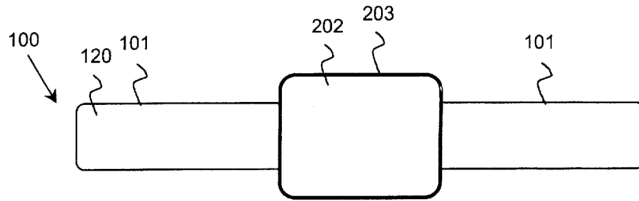


FIG. 3

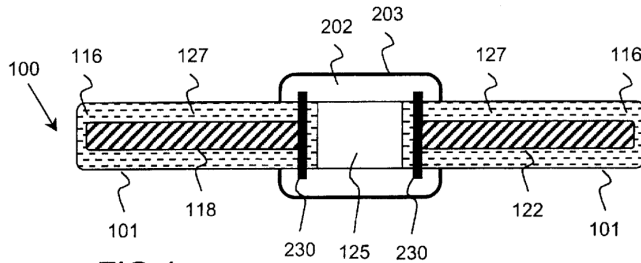


FIG. 4

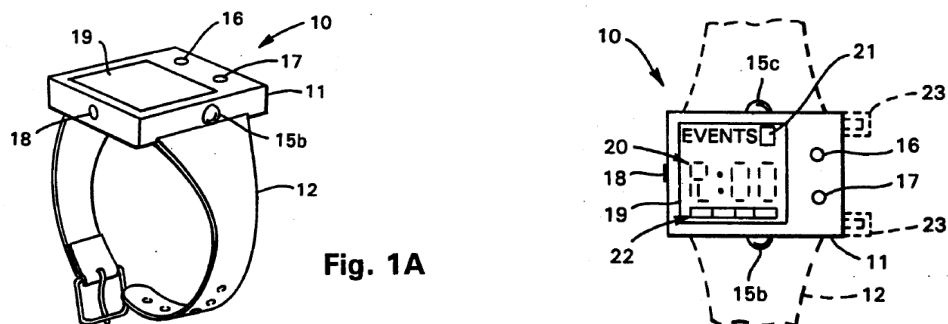
EX1006, FIG. 3 (top), and FIG. 4 (bottom)

C. Righter

61. AliveCor relies on Righter's disclosure of a "watch" that is "convenient and comfortable *for a user to wear*," to assert the obviousness of combining Righter with the devices disclosed in Markel. Pet., 86-87. Righter's watch includes a "pair of conductive electrodes 15b, 15c provided on opposing side surfaces of the casing 11, where they can be easily *contacted by the thumb and forefinger*, respectively, *of the user's right hand* (assuming the unit is being worn on the left wrist)." EX1007, 1:65-67, 2:65-3:2. Righter emphasizes on the importance of the electrode-skin contact feature, and notes that:

[the] electrodes are made of a suitable conducting material, preferably silver or silver chloride, and to reduce undesirable *electrode-skin* artifact "noise" signals arising from contact variations, at least the side electrodes 15b, 15c ... are small enough in size *to be covered completely by the user's finger and/or thumb*, and have a curved, as opposed to flat, surface geometry.

EX1007, 5:7-15.



EX1007, FIGs. 1A (left) and 1B (right)

VII. ANALYSIS

A. Ground 1 Fails To Demonstrate That Markel Renders Obvious At Least Claims 1-14

62. AliveCor's Ground 1 asserts that "Markel renders obvious claims 1-22 of the '257 Patent." Pet., 1. I disagree at least with respect to AliveCor's assertions and arguments with respect to claims 1-14 of the '257 Patent for multiple reasons, as described in more detail below.

63. AliveCor is mistaken in arguing that "Markel renders obvious [claim element 1[b.3]-1[b.4] of the '257 Patent]." Pet., 16. Claim element 1[b.3] recites: "*wherein the first pad is positioned underneath the exterior surface of the first portion,*" and claim element 1[b.4] recites "*wherein the first pad is configured to detect a first electrical signal of the user's cardiac signal via the user's skin's contact with the exterior surface of the first portion of the enclosure.*"

64. AliveCor asserts that there are two interpretations for elements 1[b.3] and 1[b.3]: (i) a first interpretation that AliveCor refers to as “Apple’s interpretation,” and (ii) a second interpretation that AliveCor alleged as “*correct* interpretation.” Pet., 16. Under each of the two interpretations, AliveCor provides a respective mapping to claim elements 1[b.3]-1[b.4]. Pet., 16-21. However, both of AliveCor’s interpretations are flawed. The first (and broader) interpretation is substantively deficient because AliveCor improperly maps two distinct features in the claim to the same element in Markel. With respect to the second interpretation, AliveCor erroneously claims that Markel renders obvious placing an electrode underneath a conductive plastic layer to conceal the electrode, but the identification of the electrode and the method of concealment in Markel are different from the assertions in the AliveCor Petition.

65. Specifically, Markel is clear throughout its disclosure that electrodes are *placed on* the exterior surface of its device. *See* generally EX1005. Accordingly, AliveCor fails to demonstrate that Markel renders obvious independent claim 1 and its dependents claims 2-14.

66. In the sections below, I will focus on independent claim 1 and explain the deficiencies of AliveCor’s mappings of claim limitations to Market under either of its interpretations.

1. Under its First Interpretation, AliveCor Fails to provide a Proper Mapping of Independent Claim 1

67. Under its first interpretation, AliveCor asserts that “[a] surface of an exposed electrode pad [] is configured to detect a cardiac signal via direct contact with the user’s skin” meets the claim limitation of elements 1[b.3]-1[b.4]. Pet., 16. AliveCor argues that “Markel discloses that its ‘second electrode’ may include an exposed electrode pad that is configured to detect a cardiac signal via direct contact with the user’s skin,” and thus meets the claim limitation of elements 1[b.3]-1[b.4] under its first interpretation. Pet., 17-19. To arrive this conclusion, AliveCor attempts to find “an exposed electrode pad” in Markel’ electrodes, through two mappings.

68. In a first mapping, AliveCor states that “Markel teaches that the second electrode is ‘*positioned on the audio output portion 610*’ of the electronic device” and that “[s]uch electrode placement may, for example, provide for *user contact*” with the second electrode ‘during the process of listening’ to the electronic device. Pet., 17 (emphasis in original).

69. In a second mapping, AliveCor states that “[w]ith respect to Markel’s Figure 4 configuration, the second electrode is ‘*placed on the right side portion 420*’ of the electronic device” and “[s]uch electrode placement allows the electrode to “*contact a user* during normal (or typical) use of the [electronic device].” Pet., 18 (emphasis in original).

70. For each mapping, AliveCor then argues that because “*Markel*’s electrodes also ‘may comprise a metallic surface exposed for user contact,’ *Markel* [thus] “discloses that its ‘second electrode’ may include an exposed electrode pad that is configured to detect a cardiac signal via direct contact with the user’s skin.” Consequently, according to AliveCor, *Markel* renders obvious claim limitations 1[b.3]-1[b.4]. Pet., 16, 19.

71. In both of its mappings, AliveCor improperly maps two distinct features of claim 1—i.e., “first pad” and “exterior surface of the first portion”—to the same component in *Markel*—i.e., to an “audio output portion 610” in the first mapping, or “the right side portion 420” in *Markel* in the second mapping. Pet., 17-19. By contrast, independent claim 1 of the ‘257 patent recites an electronic device including “an enclosure,” and “a first lead comprising a first pad.” EX1001, 12:21-49. The structure of the claim language indicates that the “enclosure” and the “first lead comprising a first pad” are two distinct components of the claimed electronic device. I was informed that mapping a single component in a prior art reference to two distinct components of a challenged claim is improper. As such, for at least this reason, AliveCor fails to provide a proper mapping for the two distinct claimed features of the “enclosure” and the “first lead comprising a first pad” under its first interpretation.

2. Under its Second Interpretation, AliveCor fails to Demonstrate that Markel Discloses or Suggests “wherein [a] first pad is positioned underneath [an] exterior surface of [a] first portion” of Independent Claim 1

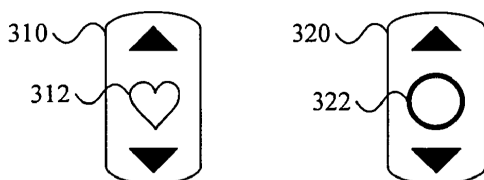
72. Under its second interpretation, AliveCor describes that the claim limitation of elements 1[b.3]-1[b.4] requires that the “first pad would have been configured to detect a first electrical signal of a cardiac signal via the user’s skin’s contact with the exterior surface of the electronic device’s[.]” Pet., 21.

73. Under its second interpretation of claim element 1[b.3], AliveCor and its expert, Dr. Berger, claim that based on Markel’s teachings, “[a] POSITA would thus have been motivated to place the pad of the ‘second electrode’ *underneath* the conductive plastic of the ‘audio output portion’” because “[t]his would have ‘substantially concealed (or hidden)’ the electrode pad from the user[.]” Pet., 20. AliveCor is simply wrong in its assertion that the Markel discloses or suggests placing an electrode pad *underneath* an enclosure of a device for multiple reasons, as explained below.

74. To be clear, Markel neither discloses placing an electrode underneath a conductive plastic layer, nor suggests hiding an electrode *underneath* the conductive plastic. Instead, Markel discloses the use of such conductive plastic to make/form its electrodes, yielding conductive plastic electrode structures that are said by Markel to conceal the electrodes contained within them when the “user

need not be aware of the presence of the electrode.” Ex. 1005, [0040]. In effect, Markel is disguising the electrode by making it appear to be a part of the plastic enclosure, and uses conductive plastic in this structure to provide the function of an electrode while maintaining the appearance of an ordinary part of the housing. Simply, Markel is hiding the electrode in plain sight.

75. In more detail, Markel discloses two scenarios: one where the electrodes are identifiable by the user, and the other where the electrodes are “concealed from the user.” EX1005, [0039]. Markel provides examples to show what it is means by identifiable versus concealed electrodes. For identifiable electrodes, “an electrode may comprise *a visible or tactile indicium* to indicate the location of the electrode to a user.” *Id.* For instance, in FIG. 3 (reproduced below) “the first pushbutton 310 comprises a heart-shaped indium 312 (or other visible characteristic)” and “the second pushbutton 320 comprises a circular projection (or other tactile characteristic) to notify a user of “the location of the electrode.” *Id.*



EX1005, FIG. 3.

76. Markel then goes on to explain that for ***concealed*** electrodes, “an electrode (or all electrodes) or other sensor may be substantially concealed (or

hidden) from a user” by having the electrode made of “*molded conductive plastic with little or no visible indication of the electrode presence.*” *Id.*, [0040]. In other words, Markel uses a “molded conductive plastic” to *make or form* its electrode in order to “conceal (or hide)” it from being identifiable from the rest of the device enclosure. Markel is specific in describing the intent to provide an electrode “...with little or no *visible* indication of the electrode presence.” EX1005, [0040]. Throughout Markel, concealing or hiding an electrode is accomplished through disguise – by use of conductive plastic as an electrode material which provides little or no visual indication of the electrode presence. Nowhere does Markel suggest positioning of an intermediate layer that would interrupt visual observation of the electrode. Instead, Markel proposes a surface electrode that doesn’t look like an electrode.

77. This is consistent with the rest of Markel, which discloses forming an electrode from “conductive plastic,” and molding the conductive plastic into the corresponding portion of the device. *See, e.g.*, EX1005, [0037] (“an electrode may be formed from a conductive plastic”); *id.*, [0045] (disclosing that first and second electrodes are placed on, e.g., molded into, regions 410b and 420b of the main body, where those regions, too, are made of conductive plastic and are separated by an insulating region 415); *id.*, [0047] (disclosing multiple exemplary pushbuttons that can be made of conductive plastic to form an electrode). In other

words, the concealed electrode in Markel *is*—i.e., “*made of*” or “*formed from*”—the conductive plastic, not underneath a conductive plastic layer.

78. Indeed, there is no disclosure in Markel to suggest another form of concealing the electrode beyond making the electrode from conductive plastics so that there is little or no visible indication of the electrode; and certainly, nothing about positioning the electrode underneath another layer to hide the electrode. A POSITA reading the disclosure of Markel in full context, would have understood that the concealment is achieved by the use of electrodes made from “molded conductive plastic with little or no visible indication.” EX1005, [0040]. A POSITA would have find nothing in cited portions of Markel to inform or encourage placement of an electrode underneath an exterior layer of a device. Simply, the electrodes in Markel are hidden in plain sight.

79. AliveCor provides no clear reason on why a POSITA would have found Markel’s method of concealment to be deficient in making the electrodes unidentifiable, nor why a POSITA would be further motivated to hide the electrodes underneath the exterior portion of the device. Instead, AliveCor improperly modifies Markel’s device and then relies on Dr. Berger’s unsupported declaration to conclude in hindsight that hiding the electrode underneath a plastic conductive layer is a form of concealment taught by Markel. EX1003, ¶¶122, 135-139.

80. In fact, AliveCor's improper modification of Markel's device (which is necessary to arrive at the claimed invention) by interjecting an intermediate layer is a concept that is never once mentioned in Markel's entire disclosure. Indeed, nowhere in Markel there is a suggestion on an alternative embodiment where the electrode would be hidden ***underneath*** an exterior portion of the device. It would have been understood by a POSITA reading Markel's disclosure, as a whole, that Markel does not teach a method of concealing an electrode by placing the electrode "underneath the exterior surface of" a first portion of the enclosure, as alleged by AliveCor. *See* Pet., 20.

81. As a second matter, nowhere does Markel disclose or suggest that its method of concealment involves placing an electrode pad ***underneath*** an enclosure of a device, as alleged by AliveCor (Pet., 20) because Markel's invention is instead directed to ***exposing*** its electrodes to ***provide for the user contact with the electrodes***. Indeed, Markel specifies throughout its disclosure that its electrodes are "disposed on" or "placed on" the exterior surface of the device to "provide for *user contact*" with the electrode. EX1005, [0045], [0050]. For example, with respect to the configurations in Figures 4 and 6, which AliveCor uses to map to claim 1, the electrode is "***placed on*** the right side portion 420," and "***disposed on*** the audio portion 610." EX1005, [0045], [0050]. "Such electrode placement" in

Markel is to “*provide for **user contact** with both electrodes*” when the user uses the device. *Id.*, [0050].

82. More specifically, Markel uses the same strategy for its electrode placement on the device’s exterior throughout its disclosure. Markel starts with providing an “exemplary mobile communication device 100 (‘MCD’).” EX1005, [0033]-[0034]. The electrodes in MCD 100 are “*disposed on* any, any combination of, or all of” the example external device components of MCD 100. *Id.*, [0042]. “Such electrode placement may, for example, provide for *electrode contact with a user* while the user is pushing a particular one or more pushbuttons.” *Id.* Markel provides examples of where the base for the electrode may be on the exterior body of MCD 100. *See e.g., id.*, [0045] (disclosing that in FIG. 4, “[a] first electrode may, for example, be *placed on* the left side portion 410 (e.g., placed on or molded into region 410b), and a second electrode may, for example, be *placed on* the right side portion 420.”); *id.*, [0046] (disclosing that the device “in FIG. 5 may comprise a first electrode 510 *positioned on a send button*, and a second electrode *disposed on* the back 520 of the mobile communication device.”); *id.*, [0047] (disclosing FIG. 2, where “electrodes may be *disposed on* a same pushbutton of the mobile communication device 100. In such an exemplary configuration, *a user may*, for example, *contact both electrodes* while operating the pushbutton.”); *id.*, [0050] (disclosing that “a first electrode in [FIG. 6 is]

disposed on a handheld portion of the MCD 100, and a second electrode may be *disposed on* (or proximate) an earpiece of the MCD100.”).

83. Even for devices that Markel discloses beyond MCD 100, Markel suggests disposing or placing the electrode *on* an exterior surface of the device. *See e.g., id.*, [0057] (“one or more cardiac sensors (e.g., electrodes) may be *disposed on* a steering wheel, shifting lever or other commonly contacted automobile component.”) *id.*, (“In such an exemplary configuration, each of the left and right hands may *advantageously contact respective cardiac sensors* for extended periods of time and also during stressful situations.”); *id.*, [0076] (disclosing that in FIG. 13, “keyboard 1300 may, for example, comprise one or more cardiac sensors 1310 (e.g. electrodes and/or acoustic sensors) *on a main body portion.*”); *id.*, [0077] (disclosing that in FIG. 14, “an electrode 1410 *on a central main* body portion of the mouse 1400.”). From this, it is apparent that visual concealment is used by Markel to impact the perception of a surface-positioned electrode, which belies movement of electrodes into a position that is underneath of another structure, as claimed by AliveCor. Indeed, contrary to AliveCor’s contention, nothing in Markel suggests placing an electrode “underneath” another layer. Indeed, contrary to AliveCor’s contention, nothing in Markel suggests placing an electrode “underneath” another layer. Thus, contrary to

AliveCor's contention, Markel does not suggest placing the electrode "underneath" another layer.

84. For at least the reasons provided above, AliveCor fails to demonstrate that Markel renders obvious all of the limitations of claim 1.

B. Ground 2 Fails To Demonstrate That The Applied Art Renders Obvious Claims 1-22

85. AliveCor fails to demonstrate that Markel in view of Nissila renders obvious claims 1-22 of the '257 Patent. Notably, AliveCor fails to provide a reason why a POSITA would have combined Markel and Nissila without relying on any hindsight. Further, AliveCor's combination analysis is critically flawed because AliveCor repeatedly conflates or misconstrues the teachings of the prior art references, as I explain in more detail below. Also, AliveCor's purported reasoning for why a POSITA would have been motivated to look to Nissila is based on an improper reading of Nissila's teachings.

86. AliveCor and its expert, Dr. Berger, erroneously allege that a POSITA would have been motivated to combine Markel and Nissila because "[they] share similar goals." Pet., 70. To explain this motivation, AliveCor improperly conflates Markel's and Nissila's usage of "concealed" and "inconspicuous," respectively, to create an inaccurate perception that these two references have a common purpose. As explained below, they do not. The context for using "concealment" in Markel is not even remotely relevant to the context for using

“inconspicuous” in Nissila. Markel and Nissila are not in pursuit of a common goal, and this becomes apparent from a comparison of Markel’s reference to electrode concealment and Nissila’s differentiated reference to merely rendering its device “inconspicuous.”

87. As described above (section VI.B, *supra*), Markel describes “concealing” its surface electrodes from its own user in certain embodiments. In particular, Markel explains that a surface electrode can be “substantially concealed (or hidden) from a user” since the “user need not be aware of the presence of the electrode.” EX1005, [0040]. For example, Markel’s “electrode may comprise molded conductive plastic with little or no visible indication of the electrode presence.” EX1005, [0040]. In this way, Markel conceals its surface electrodes by using electrodes made from a conductive plastic material in place of more commonly known metals, without applying indicia or labeling that would ordinarily be used for identifying the electrodes.

88. In contrast to Markel, nothing in Nissila teaches concealing an electrode from its own user. As described earlier (VI.B, *supra*), Nissila is directed to an electrode that “measur[es] an ECG signal on the skin of a person’s chest” on a device structure that includes “a band-like component [] that is fitted against the skin [] of the person’s chest.” EX1006, Abstract; 2:16-32. Unlike Markel, the user of Nissila’s device needs to be aware of the electrodes because “[i]n the solution of

the invention, *it is intended* that the electrode structure is placed on the skin of the user's chest.” EX1006, 2:61-3:5 Furthermore, as compared to conventional “electrode belts” found in the prior art that are “relatively rigid” structure and may “not bend sufficiently to follow the contours of a human body,” Nissila’s improved “electrode structure is of *flexible, soft material that fits the skin closely*, and as a consequence it is comfortable and *inconspicuous to wear*.” EX1006, 1:58-2:8, 2:61-3:5. And with this added context, it becomes clear that when Nissila states that its “electrode structure is inconspicuous,” it is referring to the facts that (i) the electrode structure—i.e., the whole device—is inconspicuous to wear, and (ii) the electrode structure “fits the skin closely” explains that the structure would not be visible *to others* when the electrode is facing the user’s skin and the structure is placed *under a user’s clothing*. EX1006, 2:61-3:5.

89. It is clear that Nissila’s usage of “inconspicuous” has nothing to do with visual concealment of electrodes from a user through its placement *underneath an exterior surface of the housing*, as alleged by AliveCor. Instead, Nissila’s electrodes are “inconspicuous” *to others*—not the user himself or herself—due to its electrodes’ flexibility and ability to conform when positioned facing the user’s skin and underneath a user’s shirt—not an exterior surface of the housing, as alleged by AliveCor. Nothing in Nissila’s disclosure describes using a visual concealment from the user of the electrode through, for example, the use of

a conductive polymer or any other means. Indeed, a POSITA would have understood that visual concealment of the electrode is simply unnecessary for Nissila's electrodes because these electrodes are physically placed facing the user's skin and underneath the user's clothing. This is further evidenced by FIGS. 4-9, which are embodiments showing that Nissila's electrodes 118, 122 are shown as visible along the inner surface 116 of the electrode structure 100. EX1006, FIG. 2.

90. Moreover, AliveCor fails to offer any reason (and there would be no reason) to justify incorporation of the features of Nissila's flexible electrode in Markel because Markel's electrodes are part of a protective housing for an electronic device and are not designed for adherence or conformity to a user's body. Any such conformance or adherence would interfere with the use of the device and lead to customer discomfort. Additionally, Markel's electrodes are not placed under clothing such that they would necessitate or benefit from being made from a "flexible, soft material that fits the skin closely." Thus, for at least these reasons and those discussed above, Markel and Nissilä do not share similar goals at all, as Dr. Berger purported in his declaration. Instead, the goals of these two references are distinct and unrelated. A POSITA would not have been motivated to combine Markel with Nissila, let alone the particular manner AliveCor alleges to arrive at the claimed elements.

91. For at least these reasons, AliveCor fails to demonstrate that Markel and Nissila render obvious claims 1-22.

C. Ground 3 Fails To Demonstrate That The Applied Art Renders Obvious Claims 12, 13, and 19

92. Claims 12 and 13 depend from claim 1, and are non-obvious over Markel at least for the same reasons discussed above. By relying on Righter, AliveCor does not attempt to cure the deficiencies of Markel, for example, with respect to claim feature [1b.3]. Pet., 86-89. Nor could AliveCor have credibly alleged that Markel's deficiencies were cured by Righter, or that a combination of Markel and Righter would cure those deficiencies.

93. For example, as discussed above, Markel is clear that its electrodes are *placed on* the device's exterior surface. Similarly, Righter emphasizes that its electrodes 15b, 15c are "*contacted by the thumb and forefinger.*" EX1007, 2:65-3:2. Indeed, not even AliveCor suggests that Righter would motivate a POSITA to turn away from the surface placement of electrodes taught by Markel, and instead place an electrode "underneath" an exterior surface of the device (i.e., claim feature [1b.3]).

94. Rather, AliveCor refers back to its flawed interpretation of Markel's disclosure to contend the obviousness of an electrode "substantially concealed (or hidden) from a user," and thus to assert that a combination of Markel and Righter would render claims 12 and 13 obvious. Pet., 87 (citing to para 40 of Markel).

But, as discussed above with respect to Ground 1, Markel never suggested hiding an electrode by placing it underneath an exterior surface. Rather, Markel's method of hiding is by making the electrode visually unidentifiable from the rest of the device's exterior surface.

95. Further, the design of the electrodes in Righter necessitates them to be in contact with the user's fingers in order to measure the user's ECG. *See e.g.*, EX1007, 2:56-3:2 ("electrodes 15b, 15c are provided on opposing side surfaces of the casing 11, where they can be easily **contacted by the thumb and forefinger**, respectively of the user's [] hand"). Righter emphasizes that its electrodes 15b, 15c "are made of a suitable conducting material...to reduce undesirable electrode-skin artifact 'noise' signals arising from contact variations," and are "designed to [be] small enough in size **to be covered completely by the user's finger and/or thumb**." EX1007, 3:7-14. Hiding Righter's electrodes underneath an exterior portion, which is what AliveCor suggests, is against the intended use of Righter's electrodes, because by doing so, the intended contact between the electrodes and user's fingers will be compromised. In fact a POSITA reviewing Markel and seeking improvements and then reviewing Righter would not consider an electrode beneath the external housing, as this would be an alternative that neither reference suggests in either of the references.

96. Further, AliveCor’s alleged motivation to combine fails to establish a basis for a POSITA to have believed that combining Righter to Markel would add to the convenience and comfort of using Markel’s device. AliveCor asserts that “[a] POSITA would have combined the electrode placement teachings of *Righter* on the electronic device of *Markel* because the electrode placement in *Righter* is ***convenient and comfortable***.” Pet., 87. Particularly, AliveCor relies on Righter’s disclosure of a “watch” that is “convenient and comfortable for a user to wear,” to assert the obviousness of combining Righter with the devices disclosed in Markel. Pet., 86-87.

97. AliveCor’s alleged motivation to combine fails because AliveCor record evidence fails to establish a basis for a POSITA to have believed that combining Righter to Markel would add to the convenience and comfort of using Markel’s device. AliveCor asserts that “[a] POSITA would have combined the electrode placement teachings of *Righter* on” “the right side portion 420” of “the electronic device of *Markel* because the electrode placement in *Righter* is convenient and comfortable.” Pet., 87. However, AliveCor’s purported motivation is unnecessary and reeks of impermissible hindsight because the configuration shown in FIG. 4 of Markel (which AliveCor uses to assert its combination theory with Righter) already accounts for the user’s touching of both electrodes by one hand. This is because the electrodes in that configuration are

“placed on” the right and left side portions 410/420, respectively, of the mobile device 400. EX1005, [0044]. Such placement of the electrodes “provide for electrode contact with a user’s hand during use of [device 400].” *Id.*, [0043].

Therefore, a POSITA would not seek to combine Markel with Righter for adding this feature, which is already accounted for in Markel.

98. AliveCor also notes that “*Righter* is directed to ‘an apparatus that records medical-grade ECG data and yet is convenient and comfortable *for a user to wear*’” to promote the comfort and convenience that Righter would provide. Pet., 85-87 (emphasis in original). However, AliveCor does not explain how the wearability of Righter’s device would motivate a POSITA to modify the electrode placement of Markel based on Righter, and how such electrode placement would be any different from the side electrode placement that Markel already disclosed (in its FIG. 4).

99. AliveCor asserts a similar motivation to combine Markel and Righter for claim 19. Pet., 90 (referring to arguments made under “Ground 3, [12.a]”). For the same reasons discussed above, AliveCor’s asserted theory fails for not providing a reason to motivate a POSITA to look into Righter for implementing Markel’s device.

VIII. CONCLUSION

100. I reserve the right to supplement my opinions to address any information obtained, or positions taken, based on any new information introduced throughout this proceeding.

101. I declare under penalty of perjury that the foregoing is true and accurate to the best of my ability.