

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIVECOR, INC.,
Petitioner

v.

APPLE INC.,
Patent Owner

Case No. IPR2023-00950

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

**DECLARATION OF RONALD D. BERGER, M.D., Ph.D., F.H.R.S., IN
SUPPORT OF PETITION FOR INTER PARTES REVIEW OF
UNITED STATES PATENT NO. 10,076,257 B2**

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I, Ronald D. Berger, M.D., Ph.D., F.H.R.S., declare as follows:

I. INTRODUCTION

1. I have been retained by AliveCor, Inc. (“Petitioner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) against Apple, Inc. (“Patent Owner”) regarding U.S. Patent No. 10,076,257 B2 (“the ’257 patent”) (Ex-1001).¹ I have been asked to submit this Declaration on behalf of Petitioner.

2. I have been asked to consider whether certain references disclose or render obvious the features recited in claims 1-22 (“the challenged claims”) of the ’257 patent. My opinions are set forth below. Based on my experience and expertise, it is my opinion that the prior art anticipates and/or renders obvious all limitations of the challenged claims, as I discuss in detail below.

3. I am being compensated at a rate of \$800 per hour for my work in this proceeding. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

4. All of my opinions stated in this Declaration are based on my own

¹ Where appropriate, I refer to exhibits that I understand are to be attached to the petition for *Inter Partes* Review of the ’257 patent.

personal knowledge and professional judgment. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth in this Declaration.

II. BACKGROUND AND QUALIFICATIONS

5. I received a Bachelor of Science degree in Electrical Engineering and a Bachelor of Science degree in Computer Science from Massachusetts Institute of Technology in 1981. I received a Master of Science degree and a Ph.D. in Electrical Engineering and Computer Science from Massachusetts Institute of Technology in 1983 and 1987, respectively. I received a Doctor of Medicine from Harvard Medical School in 1987. A copy of my curriculum vitae is Exhibit 1004 to the petition.

6. I am the Nicholas J. Fortuin, M.D. Professor in Cardiology and a Professor of Biomedical Engineering at Johns Hopkins University. I was a Fellow in Cardiology from 1990 to 1993. I joined the faculty at Johns Hopkins University in 1993 as an Assistant Professor of Medicine, and I was promoted to Associate Professor of Medicine in 1998. I also became an Associate Professor of Biomedical Engineering in 2002. In 2005, I was promoted to Professor. I am the Co-Director of Cardiac Electrophysiology, and I have had this role since 1996.

7. I have certifications in Clinical Cardiac Electrophysiology and Cardiovascular Disease from the American Board of Internal Medicine. My research interests include arrhythmia device development and arrhythmia mechanisms.

8. As a professor, I have taught a variety of undergraduate and graduate courses that include electrocardiography, human pathophysiology, and skeletal muscle physiology.

9. I have trained seventy-seven Cardiac Electrophysiology Fellows, and I have mentored thirteen Research Fellows. The students whom I trained and mentored have gone on to take positions at a variety of academic institutions as well as leading medical centers and clinics.

10. I maintain a clinical practice, and over the past twenty years my clinical practice has occupied approximately half of my schedule. Patients under my care have a variety of cardiac conditions, including coronary artery disease. My practice involves a combination of in-patient and out-patient management and performing various arrhythmia related interventional procedures. I also instruct the interventional electrophysiology fellows at Johns Hopkins who go on to become the thought leaders in the field, both nationally and internationally.

11. I have authored more than 300 peer-reviewed articles, invited articles, reviews, editorials, and letters in the field of cardiology and related topics. These papers have been published in journals such as IEEE Transactions on Biomedical Engineering, ESC Heart Failure Journal, the Heart Rhythm Journal, Frontiers in Physiology, the Journal of Cardiovascular Electrophysiology, , the American Journal of Cardiology, Journals of the American College of Cardiology, and more.

12. I am a member of and have been actively involved in a number of professional organizations, including the American College of Cardiology, the American Heart Association, the Heart Rhythm Society, and the Institute of Electrical and Electronics Engineers.

13. I have also been appointed to the Editorial Boards of Circulation Research, Circulation Arrhythmia and Electrophysiology, Heart Rhythm, the Journal of Cardiovascular Electrophysiology, the Journal of Interventional Cardiac Electrophysiology, and PACE. I have been certified by the American Board of Internal Medicine, including in Cardiovascular Disease and Clinical Cardiac Electrophysiology, and have participated in numerous clinical trials relating to medical devices.

14. I have received several awards over the course of my career, including:

- Whitaker Health Sciences Fellow (1986-1987);
- A.H.A. Massachusetts Affiliate Research Fellow (1989-1990);
- Johns Hopkins University Solo Cup Clinician Scientist (1996-1998);
- N.I.H. FIRST Award Recipient (1996-2001);
- Cudahy Scholar of the Johns Hopkins University (1997-Present);
- Fellow, American College of Cardiology (1998-Present);
- Frank T. McClure Fellow of the Johns Hopkins Applied Physics Lab (2001-2003);
- Fellow, Heart Rhythm Society (2006-Present);
- Abell Foundation Award for Research Translation (2013);
- National Academy of Inventors, Johns Hopkins University chapter (2015); and
- Endowed Chair, Nicholas J. Fortuin Professor in Cardiology (2019).

15. In 2021, I was elected a Fellow of the National Academy of Inventors.

III. MATERIALS REVIEWED

16. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge.

17. In forming my opinions expressed in this Declaration, I also reviewed the following materials and information:

Exhibit	Description
Ex-1001	U.S. Patent No. 10,076,257 B2 (“the ’257 patent”)
Ex-1002	Prosecution History of U.S. Patent No. 10,076,257 B2
Ex-1005	U.S. Patent Appl. No. 11/492,278 (“ <i>Markel</i> ”)
Ex-1006	U.S. Patent No. 6,775,566 (“Nissilä”)
Ex-1007	U.S. Patent No. 5,191,891 (“Righter”)
Ex-1008	U.S. Patent No. 7,502,643 (“Farrington”)
Ex-1009	EUAN A. ASHLEY & JOSEF NIEBAUER, CARDIOLOGY EXPLAINED (2004) (“Cardiology Explained”)
Ex-1010	U.S. Patent No. 5,184,620 (“Cudahy”)
Ex-1011	U.S. Patent No. 6,847,836 (“Sujdak”)
Ex-1012	U.S. Patent No. 4,606,352 (“Geddes”)
Ex-1013	U.S. Patent No. 6,522,915 (“Ceballos”)
Ex-1014	U.S. Patent No. 4,635,646 (“Gilles”)
Ex-1015	U.S. Patent No. 5,623,926 (“Weiss”)
Ex-1016	Complaint, <i>Apple Inc. v. AliveCor, Inc.</i> , Case No. 4:22-cv-07608-HSG, Dkt. No. 1 (N.D. Cal. , Dec. 12, 2022)
Ex-1017	U.S. Patent No. 7,876,274 (“Hobson”)

18. I also reviewed any other materials I refer to in this Declaration in

support of my opinions.

19. My opinions contained in this Declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the state of the art, the prior art, and the claims and the specification of the '257 patent at the time of the alleged invention.

IV. LEGAL STANDARDS

20. AliveCor's attorneys have explained to me the legal standards that apply in this case. My understanding of those standards is described below. I am not an attorney, and I do not have formal training in the law regarding patents. I have used my understanding of the following legal principles set forth in this section in reaching my opinions.

21. I understand that, in this proceeding, AliveCor has the burden of proving that the challenged claims are invalid by a preponderance of the evidence.

A. Anticipation

22. I have been informed that a claim is invalid as anticipated under 35 U.S.C. § 102 (pre-AIA) if a prior art reference discloses, either expressly or inherently, all limitations of a claim as those limitations are arranged in the claim.

23. I have been informed that a limitation is disclosed inherently in a reference if it is necessarily present in the process or product described in the prior

art reference. I understand that probabilities or possibilities are insufficient to show that a prior art reference inherently discloses something beyond what it discloses explicitly.

B. Obviousness

24. I have been informed that a claim is invalid as obvious under 35 U.S.C. § 103 (pre-AIA) if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a person of ordinary skill in the art. I have been informed that the following matters are relevant to determining whether the claimed invention would have been obvious: (1) the scope and content of the prior art, (2) the difference or differences between the patent claim and the prior art, (3) the level of ordinary skill in the art at the time the invention of the patent, and (4) any secondary considerations or objective indicia of non-obviousness.

25. I have been informed that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. When a claim simply arranges prior art elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, then such a combination is obvious. When a patent claims a structure already known in the prior art altered by the mere substitution of one element for another known in the field, the combination is likely

to be obvious unless the combination yields an unpredictable result.

26. I have been informed that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. If a person of ordinary skill in the art can implement a predictable variation, such a variation is likely unpatentable. For the same reason, if a technique has been used to improve one device, and one of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. One question to consider is whether the improvement is more than predictably using prior art elements according to their established functions.

27. I have been informed that it may often be necessary, in a validity analysis, to consider whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. This can be accomplished by looking to interrelated teachings of multiple patents or other publications or pieces of prior art; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by one of ordinary skill in the art.

28. I have been informed that a validity analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim; it is appropriate to take account of the inferences and creative steps that a person of

ordinary skill in the art would employ. I have been informed that a person of ordinary skill in the art is a person of ordinary creativity, not an automaton.

29. I have been informed that a claim composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. I have been informed that it can be important to identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does. I am told that one way that subject matter can be proved obvious is by noting there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. I have been informed that any need or problem known in the field of endeavor at the time of the claimed invention and addressed by the patent can provide a reason for combining the elements in the manner claimed.

30. I have been informed that one should not assume that a person of ordinary skill in the art attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem. Instead, I have been informed that since familiar items may have obvious uses beyond their primary purposes, in many cases a person of ordinary skill in the art will be able to fit the teachings of multiple prior art references together like pieces of a puzzle.

31. I have been informed that, when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable

solutions, persons of ordinary skill in the art have good reason to pursue the known options within their technical grasp. If this leads to the anticipated success, the product was likely not accomplished by innovation but by using ordinary skill and common sense. I have been informed that, in such an instance, the fact that the combination was obvious to try may show that the combination was obvious.

32. I have been informed that, when determining whether a claimed combination would have been obvious, the correct analysis is not whether a person of ordinary skill in the art, writing on a blank slate, would have chosen the particular combination of elements described in the claim. Instead, I have been informed that the correct analysis considers whether one of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to selecting the combination claimed.

33. I have been informed that, when determining whether a claimed invention is obvious, any “secondary considerations” of non-obviousness identified by the patentee should also be considered. These secondary considerations can include:

- commercial success of the invention, causally related to the invention itself rather than to companion factors, such as advertising or attractive packaging;
- the invention taught away from the technical direction followed by those skilled in the art;

- a long-felt but unsatisfied need for the invention while the needed implementing arts and elements had long been available;
- the invention achieves results unexpected to those skilled in the art;
- copying of the invention by competitors as distinguished from their independent development
- unsuccessful attempts by those skilled in the art to make the invention;
- acquiescence by the industry to the patent's validity by honoring the patent through taking licenses or not infringing the patent, or both; and
- skepticism, disbelief in or incredulity by those skilled in the art that the patentee's approach worked.

34. I have been informed that, for the above information to impact the obviousness of a patent claim, there must be a nexus between the alleged secondary considerations and the claims. In addition, I have been informed that the burden of introducing evidence of secondary considerations generally is on the Patent Owner. If the Patent Owner or its expert should assert secondary considerations of non-obviousness, I reserve the right to provide a Declaration addressing assertions of non-obviousness due to secondary considerations.

C. Claim Construction

35. I have been informed that claim terms are typically given their plain and ordinary meanings, as would have been understood by a person of ordinary skill in the art at the time of the earliest alleged priority date. I have further been informed that when considering the meaning of any terms in the challenged claims of the '257 patent, I should apply the plain and ordinary meaning of those terms. I have further been informed that in considering the meaning of the claims, one must consider the language of the claims, the specification, and the prosecution history of record.

36. I have been informed that in general, a preamble limits the invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim. I have further been informed that a preamble is not limiting where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention. I have further been informed that dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention. I have further been informed that clear reliance on the preamble during prosecution to distinguish the claimed invention from the prior art transforms the preamble into a claim limitation because such reliance indicates use of the preamble to define, in part, the claimed invention.

V. PERSON OF ORDINARY SKILL IN THE ART AND THE TIME OF THE ALLEGED INVENTION

37. I have been asked to assume that the '257 patent is entitled to its earliest alleged priority date of November 5, 2008 (*see* Ex-1001, 1 (“Cross-Reference to Related Application” section)). Based on my knowledge and experience, I was a person of ordinary skill in the art as of November 5, 2008 and can provide opinions regarding the knowledge of a person of ordinary skill in the art as of that time. My opinions herein are, where appropriate, based on my understandings as to a person of ordinary skill in the art at that time.

38. Based on the materials and information I have reviewed and based on my experience in the technical areas relevant to the '257 patent, a person of ordinary skill in the art at the time of the alleged invention of the '257 patent would have been a person with a working knowledge of physiological monitoring technologies. That person would have had a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information, including but not limited to physiological monitoring technologies. Alternatively, that person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline. More education can supplement practical experience and *vice versa*. I myself had these capabilities at the

time of the alleged invention of the '257 patent.

VI. TECHNICAL BACKGROUND

39. Below, I present a brief overview of certain technical concepts and features that would have been known to a person of ordinary skill in the art prior to and at the time of the earliest alleged priority date of the '257 patent. The technical concepts and features that I describe in this Technical Background section reflect the state of the art that a person of ordinary skill in the art would have had knowledge of and would have understood prior to and at the time of the alleged invention of the '257 patent. I rely on, and incorporate as applicable (even if not expressly mentioned below in Section VIII.B), the following disclosures to support my opinions in this Declaration, including those opinions relating to how the prior art discloses and/or suggests the challenged claims of the '257 patent and how (and why) a person of ordinary skill in the art would have been motivated to consider and combine the disclosures and suggestions from one or more prior art references.

A. Electrical Activity of the Heart

40. Prior to the '257 patent's earliest alleged priority date, a person of ordinary skill in the art would have known that the heart generates electrical activity that can be picked up on the skin. As an example, *Farrington* (Ex-1008) is based on an application filed on September 13, 2004 (Ex-1008, Face at Item (22)). *Farrington* discloses that "[t]he heart is a muscular pump that is controlled by a natural electrical

system that causes the heart muscle to contract and pump blood throughout the heart to the lungs and the rest of the body, carrying oxygen as well as other nutrients” (Ex-1008, 1:27–30). As another example, *Cardiology Explained* (Ex-1009) was published in 2004 (Ex-1009, Copyright Page). According to *Cardiology Explained*, it was well known that “[t]he electrical activity of the heart transmitted throughout the body can be picked up on the skin” (Ex-1009 at 15). As another example, *Cudahy* (Ex-1010) is based on an application filed on December 26, 1991, and issued February 9, 1993 (Ex-1010, Face at Item (22), (45)). Cudahy discloses that “[e]lectrical signals generated by the human heart appear in a characteristic pattern throughout the body and on its surface” (Ex-1010, 1:13–15).

41. Prior to the ’257 patent’s earliest alleged priority date, a person of ordinary skill in the art would also have known that measuring the electrical activity of the heart could be used to assess the condition of a patient’s heart. For example, *Sujdak* (Ex-1011) is based on an application filed on February 8, 2002 (Ex-1011, Face at Item (22)). *Sujdak* discloses:

It has been long known in the medical community that the current condition, and possibly future state, of a subject patient’s heart muscle can be ascertained by measuring the cardiac electrical activity. The electrical system of the heart not only initiates and controls the rate of heartbeat, but also coordinate to transmission in the most efficient mechanical manner. When such electric signals are irregular, it is a sign of cardiac problems, particularly cardiac arrest, better known as a “heart attack.”

(Ex-1011, 1:16–25.)

B. ECG

42. Prior to the '257 patent's earliest alleged priority date of November 5, 2008, a person of ordinary skill in the art would have been very familiar with the electrocardiogram ("ECG") and ECG machines. For example, the '257 patent's "Background of the Invention" section describes the use of an ECG measurement to authenticate a user of an electronic device (Ex-1001, 1:49–55). As another example, *Cardiology Explained* refers to the electrocardiogram as "the oldest and most enduring tool of the cardiologist," excluding only the stethoscope (Ex-1009 at 15). The first human electrocardiogram was published in the British Medical Journal in 1888 by British physiologist Augustus D. Waller (Ex-1009 at 18). As another example, *Farrington* discloses that "[t]he most well-known and conventional method utilized today for measuring heart-related parameters is the electrocardiogram" (Ex-1008, 1:43–45). Further, person of ordinary skill in the art at the time of the invention would have understood that "ECG" and "EKG" are interchangeable terms.

43. A person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart based on an electrical potential difference. For example, *Farrington* discloses that "[s]ensing the electrical impulses of the heart is a well known method in the art for detecting parameters that describe the state of the heart" (Ex-1008, 1:34–38). *Farrington* further discloses that "[a]n

electrocardiogram, or ECG, signal is a surface measurement of the electrical potential of the heart generated by electrical activity in the cardiac tissue” (Ex-1008, 1:45–50). *Farrington*’s Figure 1 (shown below) discloses “a typical ECG signal generated by one heart beat” (Ex-1008, 1:51–52):

Ex-1008 (Farrington), Fig. 1

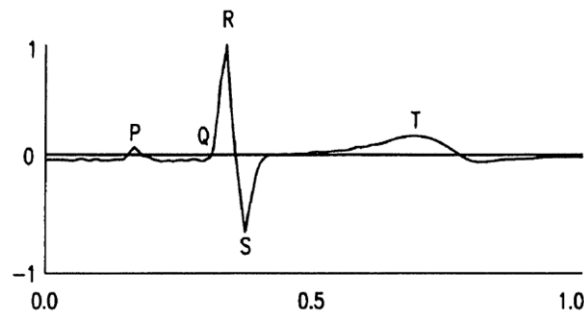
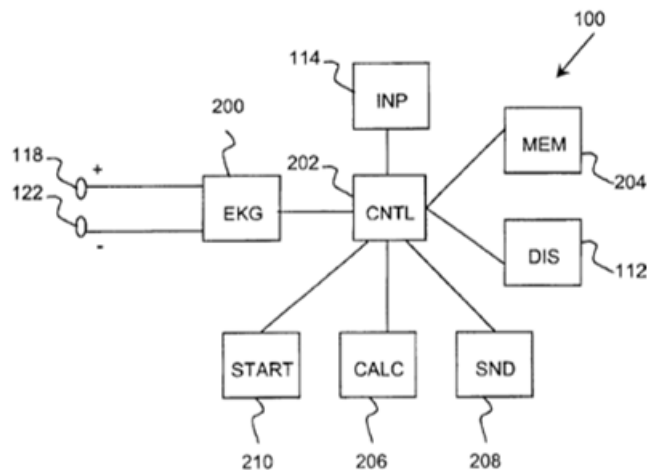


FIG. 1
PRIOR ART

44. As another example, *Nissilä*, based on an application filed on September 13, 2001, discusses processing the ECG signal. (Ex-1006, Face at Item (22)). *Nissilä* discloses, “[t]he heart rate is measured on a person’s skin on the basis of an electrocardiographic [] signal generated by a heart beat” (Ex-1006, 1:20–22). Thus, a person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart.

45. Prior to the ’257 patent’s earliest alleged priority date of November 5, 2008, a person of ordinary skill in the art would also have known that ECG machines and other heart sensors could include a processor to process electrical signals. For example, *Cardiology Explained* states that an “ECG machine processes the signals

picked up from the skin by electrodes and produces a graphic representation of the electrical activity of the patient's heart" (Ex-1009 at 15). As another example, *Sujdak* discloses that "[t]he electrocardiograph receives the signals from the leads, processes them and outputs the resulting waveform patterns These resulting patterns are known as an electrocardiogram (ECG)" (Ex-1011, 1:37–41). As another example, *Nissilä* discloses that "[t]he central unit 202 comprises ECG processing means, by which the potential difference between the first and second electrodes, caused by the ECG signal, is measured, and heart rate information, comprising a heart rate pulse, detection and calculation of heart beat intervals or a heart rate frequency, i.e. the heart rate, is formed from the heart rate signals measured by the electrodes" (Ex-1006, 6:17–23). *Nissilä* further discloses that "the ECG signal to be measured is processed, i.e. filtered, amplified and detected . . . by using known methods such that the heart beat can be detected from the ECG signal." (Ex-1006, 6:39–42). This is illustrated below in *Nissilä*'s Figure 12.



46. A person of ordinary skill in the art would have known that ECG measurements could provide information on heartbeat, heart rate, and other signals generated by the user’s heart. For example, *Farrington* discloses, “ECG measurements may be used to provide information about a number of heart related parameters, including but not limited to, the heart beat rate, or heart rate, for a number of applications, such as medical diagnostic, health awareness and sports performance applications” (Ex-1008,1:61–65).

C. Heart Sensors

47. Prior to the priority date of the ’257 patent, a person of ordinary skill in the art would have known an ECG machine is a heart sensor that uses electrodes on the skin to detect electrical signals on the skin and generate an ECG measurement. For example, the ’257 patent’s “Background of the Invention” section discloses that “[t]o detect a user’s heartbeat or heart rhythm, [an] electronic device must provide

at least two leads that the user contacts to detect the user's cardiac signals.” (Ex-1001, 1:56–58). As another example, *Cardiology Explained* explains that “[a]n ECG machine records [electrical] activity via electrodes on the skin and displays it graphically” (See Ex-1009 at 15). As another example, *Farrington* discloses that “[a]n ECG measurement can be made using electrodes placed on the surface of the skin because the entire body is capable of conducting electricity” (Ex-1008, 1:47–50). As another example, *Cudahy* also discloses “[b]ody surface electrodes are normally employed for non-invasively coupling a patient's intrinsic cardiac electrical activity with various medical diagnostic and therapeutic equipment” (Ex-1010, 1:10–14). Further, *Nissilä* discloses that “[t]he [electrical] signal is measured by means of electrodes, which are in contact with the body at least at two points” (Ex-1006, 1:29–31).

48. A person of ordinary skill in the art would have known that electrodes are attached to leads which transmit the electrical signal to the processor. For example, *Sujdak* discloses that “[t]he electrodes are in turn attached to ‘leads’ or cables which are connected to the [ECG machine]. . . . The [ECG machine] receives the signals from the leads, processes them and outputs the resulting waveform patterns . . .” (Ex-1011, 1:37–39). As another example, *Cardiology Explained* explains that a lead or cable is “used to connect an electrode to the ECG recorder” (Ex-1009 at 15).

49. A person of ordinary skill in the art would have known that an ECG is a measure of the difference in electrical activity between two or more electrodes. For example, *Farrington* discloses “pairs of electrodes are often used to measure the electrical potential difference between two points” (Ex-1008, 2:24–25). *Farrington* further discloses prior art ECG machines that “use several electrodes placed on the chest, arms and legs to measure a number of different ECG signals from selected electrode pairs The different readings together allow a clinician to get a view of the function of the three dimensional electrical activity of the heart from a number of different angles” (Ex-1008, 3:27–36). As another example, *Cudahy* discloses “intrinsic cardiac electrical activity may be measured by placing electrodes on the skin of the individual and measuring the voltage between a particular electrode and a reference potential or between selected bipolar pairs of electrodes” (Ex-1010, 1:15–20). *Cudahy* further discloses that “[i]n heart monitoring and diagnosis, the voltage difference appearing between two such electrodes or between one electrode and the average of a group of other electrodes represents a particular perspective of the heart’s electrical activity and is generally referred to as the ECG” (Ex-1010, 1:25–30).

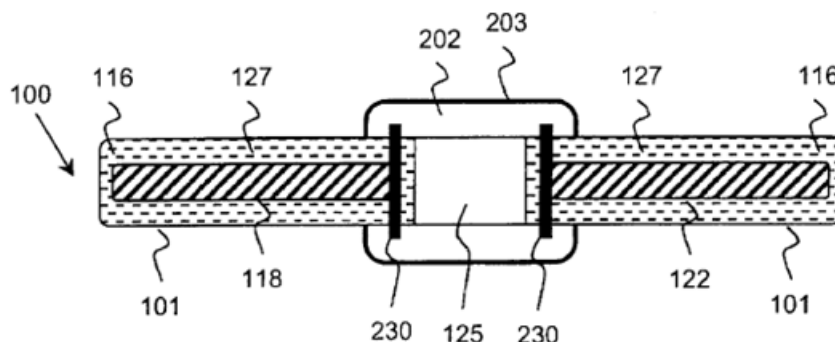
50. As of the priority date of the ’257 patent, a person of ordinary skill in the art would have known that an electrode should be made of a conductive material. For example, *Nissilä* discloses that the electrode “is made of metal, electrically

conductive plastic or a similar conductive material.” (Ex-1006 5:35–37). As another example, *Sujdak* discloses that “[e]lectrodes, generally pads containing conductive material, such as silver chloride and an adhesive are attached to the trunk and limbs of a patient’s body” (Ex-1011, 1:30–31). As another example, *Markel* is based on an application filed on July 25, 2006. (Ex-1005, Face at Item (22)). *Markel* discloses that “[e]lectrodes may generally comprise conductive material” (Ex-1005, [0037]). As another example, *Geddes* (Ex-1012) is based on a patent application filed on July 13, 1984. (Ex-1012, Face at Item (22)). *Geddes* discloses that electrodes “are preferably silver or silver chloride although conductive plastic and other metals are also suitable” (Ex-1012, 3:34–38).

51. A person of ordinary skill in the art would also have known that the electrodes should be electrically insulated from one another. For example, *Cudahy* discloses that “[e]lectrodes 12 are spaced apart with the pad material providing electrical insulation therebetween” (Ex-1010, 5:58–60). *Cudahy* further discloses a pad of electrodes wherein “a plurality of electrodes [is] mounted on the contact surface in a spaced apart relation wherein the base structure supports and electrically insulates the electrodes from the other” (Ex-1010, 3:27–31). As another example, *Nissilä* discloses that “[t]he first and the second electrodes of the electrode structure are electrically separated from one another in order to enable the measurement of the potential difference between the electrodes” (Ex-1006, 3:7–10). *Nissilä* further

discloses a “separating zone 125” that “electrically separate[s]” two electrodes (118 and 122):

Ex-1006 (Nissilä), Fig. 4



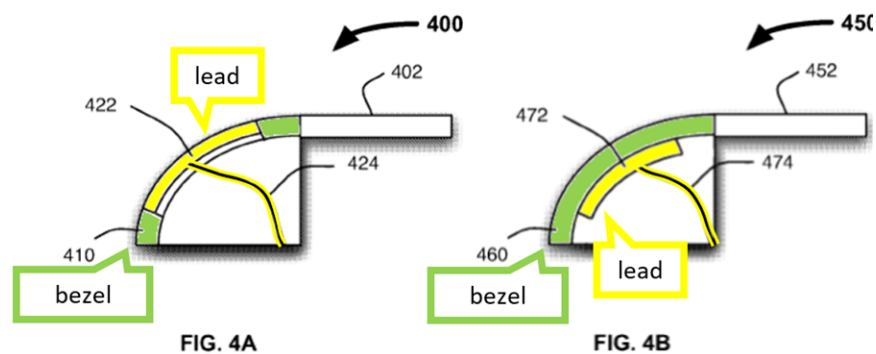
VII. SUMMARY OF THE '257 PATENT

A. The '257 Patent's Specification

52. The '257 patent relates generally to a heart rate monitor in an electronic device (Ex-1001, Abstract). The electronic device includes “at least two leads that the user contacts in order to detect the user’s cardiac signals” (Ex-1001, 1:56–58). The '257 patent purports to identify problems relating to the physical placement of these leads. First, the '257 patent alleges that “[a]lthough the leads can simply be placed on the exterior surface of the device housing, . . . this approach is not aesthetically pleasing, and may cause some prospective buyers to consider other devices” (Ex-1001, 1:58–63). Second, the '257 patent alleges that a lead on the exterior surface of the device “may require the user to perform a specific [] action” which may be “so encumbering that users disable the [] feature” (Ex-1001, 1:63–2:3).

53. The '257 patent purports to solve these alleged problems by disclosing an electronic device with “a seamlessly integrated cardiac sensor” (Ex-1001, 2:7–8). The specification describes an electronic device with one or more sensors embedded in the device (Ex-1001, 2:38–40). As annotated below in the '257 patent's Figures 4A and 4B, the disclosed sensors include leads (highlighted in yellow, 422 and 472) for receiving electrical signals from the user's heart (Ex-1001, 2:40–42). Figure 4A illustrates that the “leads can be exposed such that the user may directly contact the leads” (Ex-1001, 2:45–50). Alternatively, Figure 4B illustrates that the leads “may instead or in addition be coupled to an electrically conductive portion of the device enclosure (e.g., a metallic bezel or housing forming the exterior of the device)” so that the lead is positioned underneath the exterior surface of a bezel (460) (Ex-1001, 2:45–50).

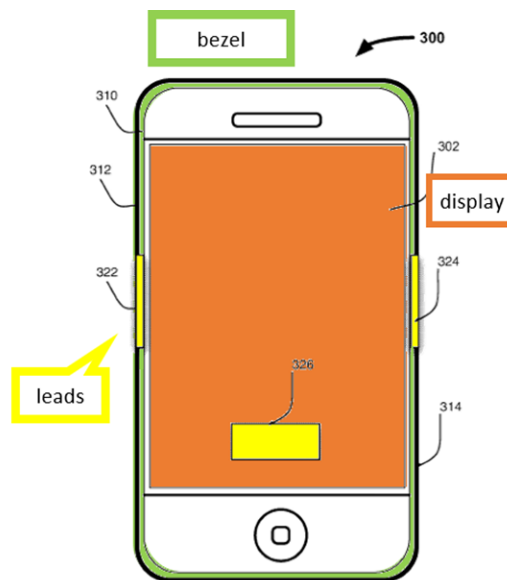
Ex-1001, Fig. 4A (annotated), Fig. 4B (annotated)



54. The '257 patent describes that “[t]he leads can be integrated in any suitable portion of the electronic device” (Ex-1001, 8:11–13). “Leads 322 and 324,

which can include conductive pads, can be coupled to sides 312 and 314 of bezel 310, respectively” and “electronic device 300 can include additional lead 326 embedded in or behind display 302” (Ex-1001, 8:20–21, 8:40–41). A purported embodiment is depicted in annotated Figure 3, below:

Ex-1001, Fig. 3 (annotated)



55. The '257 patent explains that “the leads may be electrically isolated to avoid shorting or interference among leads” (Ex-1001, 2:51–53). “[A]n electrically isolating component can be inserted between adjacent leads. Alternatively, if the electronic device enclosure is constructed from a material having insufficient conductivity for transmitting detected cardiac electrical signals, the distance along the enclosure between adjacent leads can be sufficient to isolate the leads” (Ex-1001, 2:55–59).

B. The '257 Patent's Prosecution History

56. In this Section, I summarize parts of the '257 patent's prosecution history. This summary is not intended to address or summarize the '257 patent's entire prosecution history; rather, it is intended to summarize the parts that are relevant to my analysis below.

57. U.S. Patent App. No. 14/136,658 was filed on December 20, 2013 (Ex-1001, Cover).

58. On February 17, 2015, the Examiner required an election of claims because “the inventions as claimed have different designs and modes of operation. Invention I requires a bezel and wireless heart sensor. Conversely, Invention II does not require a bezel and instead requires a wired heart sensor with two leads” (Ex-1002, 157). In response, the Applicant elected the claims directed to alleged “Invention II” (Ex-1002, 168).

59. On June 19, 2015, the Examiner rejected all pending claims (Ex. 1002, 173). That included a rejection under §§ 102 and 103 in view of U.S. Patent No. 6,522,915 (“*Ceballos*,” Ex-1013) (Ex-1002, 176–180). The Examiner also rejected some claims as indefinite under § 112 (Ex-1002, 175–176).

60. In a response on November 17, 2015, the Applicant amended the claims to address the rejections under §§ 102, 103, and 112 (Ex-1002, 199–205). The Applicant's amendments to the two independent claims are reproduced below.

Ex-1002, 201

29. (Currently Amended) An electronic device for detecting a user's cardiac signal, comprising:

an enclosure;

a heart sensor configured to detect the user's cardiac signal, the heart sensor comprising:

a first lead embedded in a first portion of the enclosure, wherein an exterior surface of the enclosure comprises an exterior surface of the first portion, wherein the first lead is positioned underneath the exterior surface of the first portion, and wherein the first lead is configured to detect a first electrical signal of the user's cardiac signal via the user's contact with ~~at least one of the first lead and~~ the exterior surface of the first portion of the enclosure; and

a second lead embedded in a second portion of the enclosure, wherein the second lead is configured to detect a second electrical signal of the user's cardiac signal via the user's contact with at least one of the second lead and the second portion of the enclosure; and

a processor coupled to the heart sensor and configured to receive and process the detected cardiac signal.

Ex-1002, 204

40. (Currently Amended) An electronic device for detecting a user's cardiac signal, comprising:

a heart sensor configured to detect the user's cardiac signal, the heart sensor comprising:

a first lead embedded in a first portion of the electronic device, wherein the first lead is configured to detect a first electrical signal of the user's cardiac signal via the user's contact with at least one of the first lead and the first portion of the electronic device; and

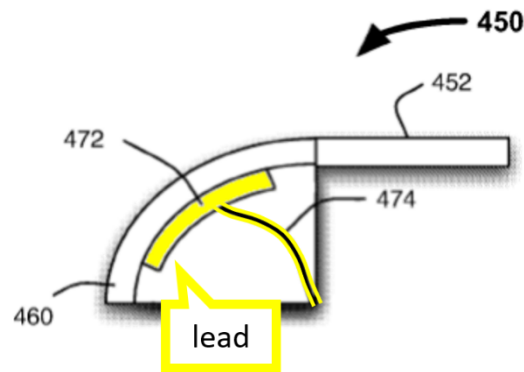
a second lead embedded in a second portion of the electronic device, wherein the second lead is configured to detect a second electrical signal of the user's cardiac signal via the user's contact with at least one of the second lead and the second portion of the electronic device; and

a processor coupled to the heart sensor and configured to process the first and second electrical signals of the user's cardiac signal, wherein:

the first portion of the electronic device comprises an enclosure of the electronic device; and

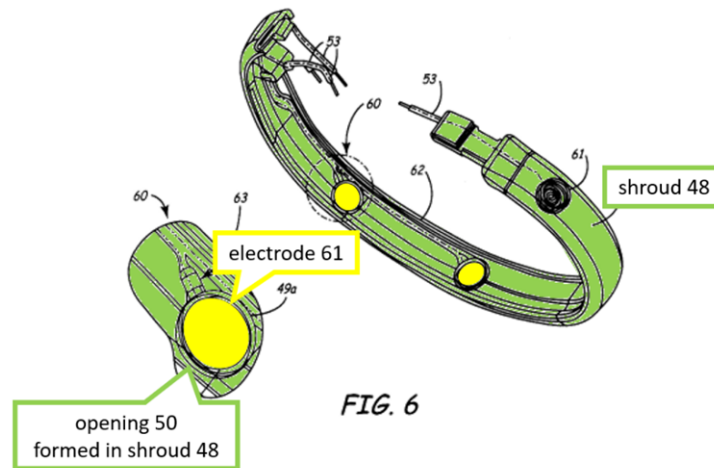
the second portion of the electronic device comprises a display screen exposed to the user through an opening in the enclosure of the electronic device.

61. Next, the Applicant attempted to traverse the rejection to the first independent claim (Ex-1002, 207–210). The Applicant specifically referred to the '257 patent's Figure 4B as an example of the amended claim language in the first independent claim. (Ex-1002, 208–209 ("As a specific example, with respect to [A]pplicants' FIG. 4B . . .")). Figure 4B of the '257 Patent is reproduced and annotated below:



62. Regarding the amended claim language and Figure 4B, the Applicant further explained that the “enclosure of electronic device 450 may include a bezel 460, where . . . lead 472 of the heart sensor can be positioned against the back surface of bezel 460, or . . . underneath the outer surface of the bezel, where a short thickness of bezel 460 can allow electrical signals to propagate from the user to the outer surface of bezel 460, through bezel 460, and into lead 472” (Ex-1002, 208–209 (quotations omitted)).

63. The Applicant then distinguished the amended claim language from *Ceballos*. The Applicant argued that Figures 4–6 of *Ceballos* disclosed “electrode 61 **positioned within an opening 50 formed in shroud 48** through an exterior surface of shroud 48” (Ex-1002, 209 (emphasis added)). Figure 6 of *Ceballos* is reproduced and annotated below:



64. The Applicant also explained that *Ceballos* did not disclose the amended claim language because *Ceballos* disclosed an *exposed* electrode that was *not* “positioned underneath the exterior surface” of the enclosure:

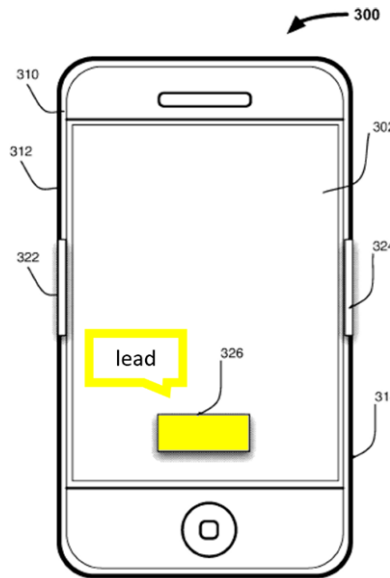
Nowhere does *Ceballos* show or suggest that electrode 61 is positioned underneath the exterior surface of shroud 48 such that electrode 61 detects and electrical signal of a user’s cardiac signal via the user’s contact with the exterior surface of shroud 48[,] underneath which electrode 61 is positioned. Instead, quite to the contrary, ***opening 50 is provided through the exterior surface of shroud 48 for holding and exposing electrode 61.*** Indeed, shroud 48 is insulative and would be unable to enable passage of an electrical signal therethrough for detection by a heart sensor lead.

(Ex-1002, 209–210 (emphasis added)).

65. Next, the Applicant attempted to traverse the rejection to the second independent claim (Ex-1002, 210–212). The applicant pointed to the ’257 patent’s Figure 3 as an example of the amended claim language in the second independent claim (Ex-1002, 211 (“[A]s shown in applicants’ FIG. 3, ‘electronic device 300 can

include additional lead 326 embedded in or behind display 302'”). Figure 3 of the '257 Patent is reproduced and annotated below:

Ex-1001, Fig. 3 (annotated)

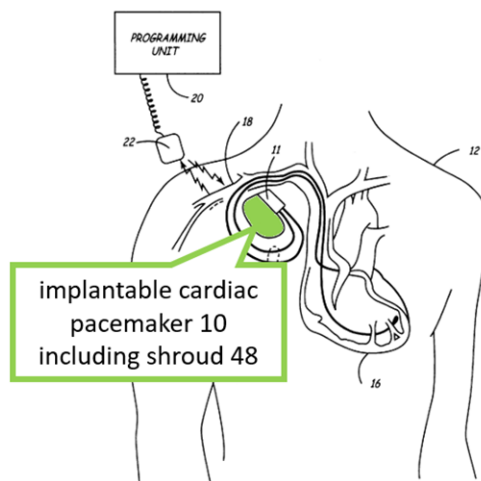


66. Regarding the second independent claim’s amended language and Figure 3, the Applicant further explained that “[l]ead 326 can be operative to detect a user’s heart activity as the user moves a finger across display 302,” and “[u]sing lead 326, the electronic device can detect an electrical signal 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” (Ex-1002, 211).

67. The Applicant then distinguished the second independent claim’s amended language from *Ceballos*. Referring to Figure 1, the Applicant explained

that *Ceballos* did not disclose the amended claim language because *Ceballos* did not “show or suggest any display screen exposed through an opening in shroud 48. Indeed, shroud 48 is only useful when positioned within a patient’s body, thereby teaching away from any need to provide a display screen on shroud 48” (Ex-1002, 211). Figure 1 of *Ceballos* is reproduced and annotated below:

Ex-1013 (*Ceballos*), Fig. 1 (annotated)

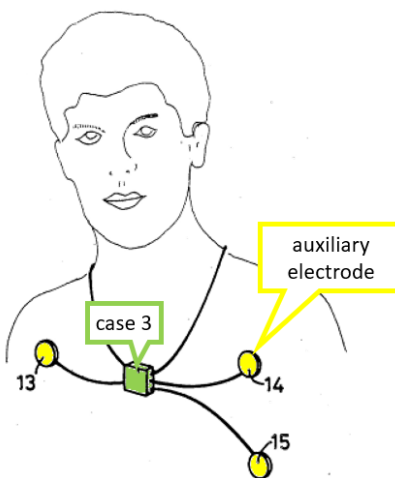


68. Next, on March 2, 2016, the Examiner issued a Final Rejection, rejecting all pending claims under §§ 102 and 103 in view of U.S. Patent No. 4,635,646 (“*Gilles*,” Ex-1014) (Ex-1002, 217–220).

69. In a response on June 30, 2016, the Applicant traversed the rejection and argued that the amended claims avoided the *Gilles* prior art reference. Again, the Applicant specifically referred to the ’257 patent’s Figure 4B as a “specific example” of the amended claim language (Ex-1002, 240). The Applicant then referred to Figure 8 of *Gilles* and argued that this prior art reference did not show or

suggest “any electrode embedded in any portion of [the enclosure 3] Instead, each one of the auxiliary electrodes 13, 14, and 15 of Gilles is distinct and independent from [the enclosure 3] and is remotely coupled to [the enclosure 3] via one or more wires” (Ex-1002, 241). Figure 8 of *Gilles* is reproduced and annotated below:

Ex-1014 (*Gilles*), Fig. 8 (annotated)



70. On August 10, 2016, the Examiner notified Applicant that the application was not in a condition for allowance (Ex-1002, 257). In a response on September 4, 2016, Applicant filed a Request for Continued Examination and amended the claims (Ex-1002, 260–270). As an exemplary amendment, Applicant amended the first independent claim such that the first and second leads comprise a first and second pad, respectively, and such that the first pad is “positioned underneath the exterior surface” of the enclosure (Ex-1002, 264). The Applicant did not make a similar amendment to the second independent claim. The Applicant’s

amendments to the first independent claim are reproduced below.

Ex-1002, 264–265

29. (Currently Amended) An electronic device for detecting a user's cardiac signal, comprising:
an enclosure;
a heart sensor configured to detect the user's cardiac signal, the heart sensor comprising:
a first lead comprising a first pad that is embedded in a first portion of the enclosure, wherein an exterior surface of the enclosure comprises an exterior surface of the first portion, wherein the first ~~lead~~ pad is positioned underneath the exterior surface of the first portion, and wherein the first ~~lead~~ 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; and
a second lead comprising a second pad that is embedded in a second portion of the enclosure, wherein the second ~~lead~~ pad is configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with at least one of the second ~~lead~~ pad and the second portion of the enclosure; and
a processor coupled to the heart sensor and configured to receive and process the detected cardiac signal, wherein the first lead further comprises a first connector coupled to the first pad and configured to provide the first electrical signal detected by the first pad to the processor, and wherein the second lead further comprises a second connector coupled to the second pad and configured to provide the second electrical signal detected by the second pad to the processor.

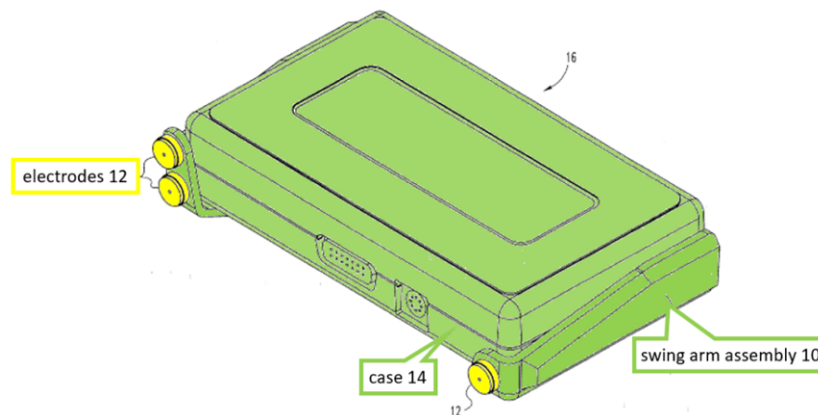
71. Again, the Applicant argued that *Gilles* did not show or suggest an “electrode embedded in any portion of [the enclosure] Instead, each one of the auxiliary electrodes 13, 14, and 15 of *Gilles* is distinct and independent from [the enclosure] and is remotely coupled to [the enclosure] via one or more wires” (Ex-1002, 274).

72. Next, on September 14, 2017, the Examiner issued a Final Rejection,

rejecting all pending claims under §§ 102 and 103 in view of U.S. Patent No. 5,623,926 (“*Weiss*,” Ex-1015) (Ex-1002, 300–301).

73. In a response dated January 15, 2018, the Applicant again traversed the rejection and argued that the amended claims avoided the *Weiss* prior art reference. Yet again, the Applicant specifically referred to the ’257 patent’s Figure 4B as a “specific example” of the amended claim language (Ex-1002, 315). Referring to Figures 1–3, the Applicant argued that *Weiss* did not show or suggest a first or second pad “embedded” in the enclosure where the first pad is “positioned underneath the exterior surface” of the enclosure (Ex-1002, 316). The Applicant argued that “each one of Weiss’[s] electrodes 12 is ‘mounted on’ swing arm assembly 10, where an outermost piece 46 of each one of Weiss’[s] electrodes 12 ‘contacts the skin’ of the user” (Ex-1002, 316 (citations omitted)). Figure 1 of *Weiss* is reproduced and annotated below:

Ex-1015 (*Weiss*), Fig. 1 (annotated)



74. The Examiner issued a Notice of Allowance on May 22, 2018. There, the Examiner did not state any additional reasons for allowance (Ex-1002, 325–331).

C. Claim Construction of the '257 Patent

1. “An electronic device for detecting a user’s cardiac signal” (Elements [1.pre], [15.pre])

75. I have been asked to opine on whether the language “An electronic device for detecting a user’s cardiac signal” in elements [1.pre] and [15.pre] is limiting. Based on my analysis, my opinion is that a person of ordinary skill in the art would have understood that this language is limiting and should receive its plain and ordinary meaning.

76. I have been informed that in general, a preamble limits the invention if it recites essential structure or steps, or if it is necessary to give life, meaning, and vitality to the claim. I have further been informed that dependence on a particular disputed preamble phrase for antecedent basis may limit claim scope because it indicates a reliance on both the preamble and claim body to define the claimed invention.

77. Here, the language “An electronic device for detecting a user’s cardiac signal” in elements [1.pre] and [15.pre] provides antecedent basis that defines language in the claim body. For example, elements [1.pre] and [15.pre] each recite “*a* user’s cardiac signal,” which is referred back to later in the claim bodies as “*the* user’s cardiac signal.” The phrase “a user” in elements [1.pre] and [15.pre] is also

referred back to in the claim bodies as part of “*the* user’s skin’s contact.” As another example, element [15.pre] recites “An electronic device,” which is referred back to later in the claim body as “*the* electronic device.” Consequently, a person of ordinary skill in the art would have understood that the language “An electronic device for detecting a user’s cardiac signal” in elements [1.pre] and [15.pre] is limiting and should receive its plain and ordinary meaning.

VIII. SUMMARY OF THE PRIOR ART

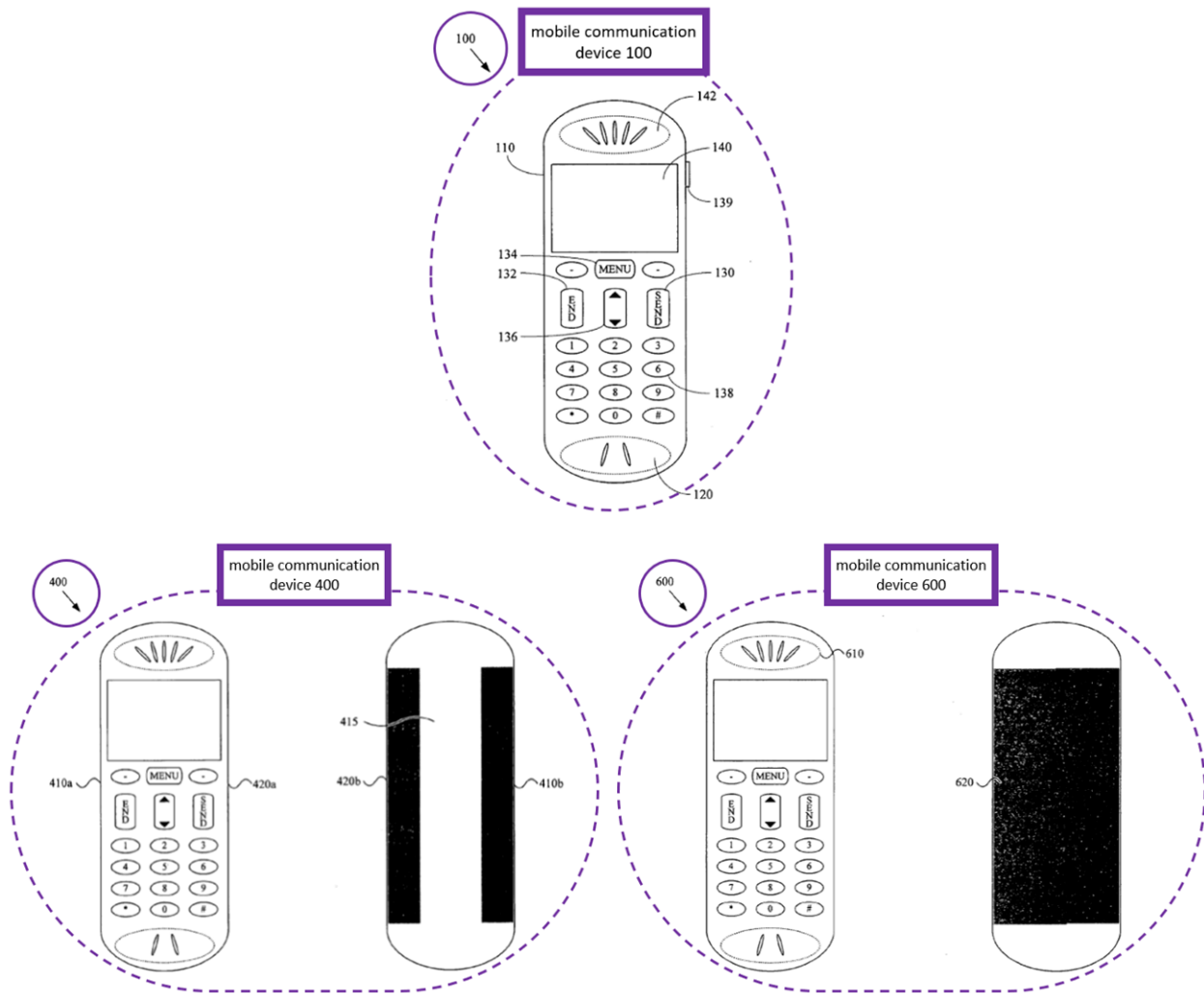
A. *Markel* (Ex-1005)

78. United States Patent Application Publication No. 2007/0021677 (“*Markel*,” Ex-1005) is titled “Mobile Communications Device and Other Devices with Cardiovascular Monitoring Capability.”

79. *Markel* was published on January 25, 2007 (Ex-1005, Cover). Consequently, I have been informed that I should assume *Markel* is prior art under at least 35 U.S.C. §§ 102(a) and 102(b) (pre-AIA).

80. *Markel* discloses an electronic device with cardiovascular monitoring capability (See Ex-1005, Abstract, [0004].) The electronic device, or exemplary mobile communication device, is depicted in Figures 1, 4, and 6, below:

Ex-1005, Fig. 1, Fig. 4, Fig. 6



81. Specifically, *Markel* discloses “at least one cardiac sensor (e.g., one or more electrodes, an audio monitoring or acoustical detection device, etc.) that is adapted to detect cardiac activity of a user of the [electronic device]. Such electrodes may, for example, be adapted to detect cardiac activity of a user that is conductively coupled to the electrodes (e.g., by touching the electrodes)” (Ex-1005, [0035]). *Markel* also teaches that “[s]uch electrodes may be incorporated into the [electronic device] in any of a variety of manners” (Ex-1005, [0035]).

82. For example, *Markel* discloses that electrodes can “be identified for the user in any of a variety of manners” (Ex-1005, [0039]). In some disclosed embodiments, an electrode “may generally comprise conductive material. For example, an electrode may comprise a metallic surface exposed for user contact” (Ex-1005, [0037]).

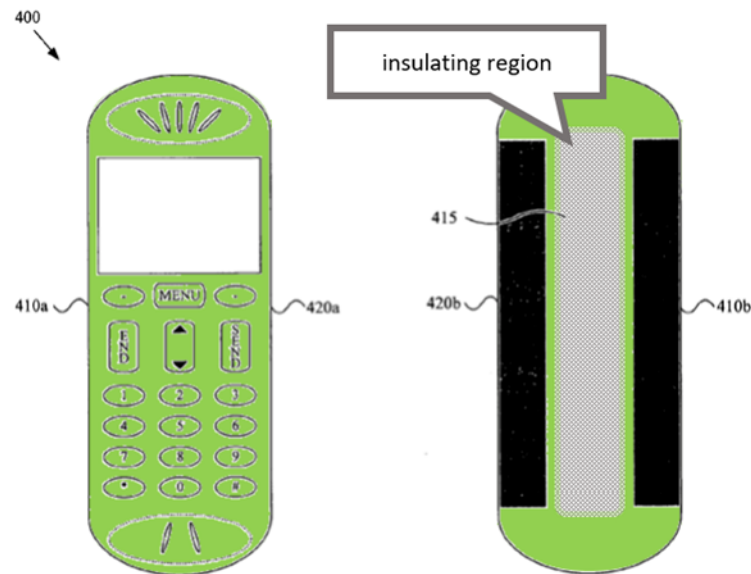
83. As another example, *Markel* discloses that electrodes can “may be generally concealed from the user” (Ex-1005, [0039]). *Markel* further explains that “an electrode (or all electrodes) or other sensor may be substantially concealed (or hidden) from a user” when, for example, it “comprise[s] molded conductive plastic with little or no visible indication of the electrode presence” (Ex-1005, [0040], [0037]). In these disclosed embodiments, “an electrode may be formed from conductive plastic (or another material) that may be integrated into various molded components of the [electronic device]. For example, various conductive plastics (e.g., graphite-impregnated plastic or the like) may provide sufficient conductivity for an electrode to perform adequately” (Ex-1005, [0037]).

84. *Markel* further teaches an insulating region that separates different electrodes:

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 (e.g., placed on or molded into region 420b). In various exemplary configurations (e.g., where regions 410b and 420b include conductive plastic), an insulating region 415 may separate regions 410b and 420b.

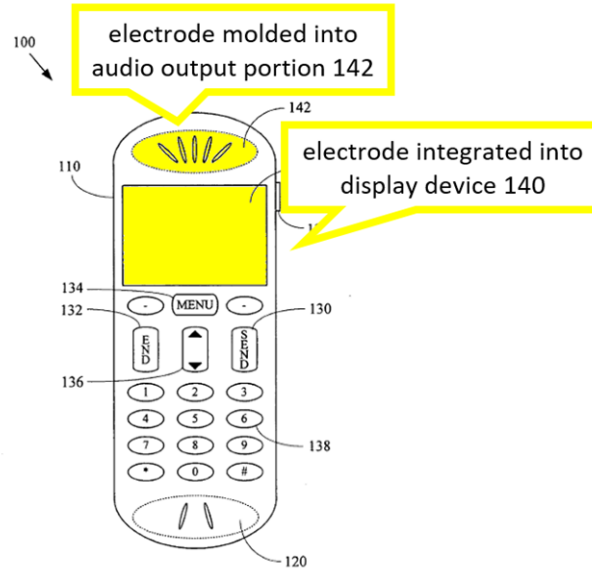
(Ex-1005, [0045].) The insulating region is illustrated below in Markel's Figure 4:

Ex-1005, Fig. 4 (annotated)



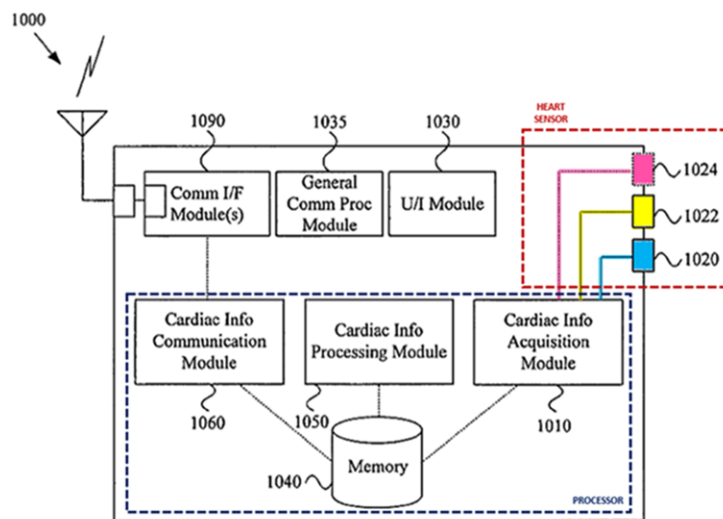
85. *Markel* also discloses that “an electrode (or other sensor) may be placed on (or proximate to) an audio output portion 142 (e.g., a speaker) of the [electronic device]. . . . Also for example, an electrode may be disposed on a video display device 140 (e.g., a border of the display or integrated into a touch screen)” (Ex-1005, [0044]). An exemplary embodiment is depicted in the annotated Figure 1, below:

Ex-1005, Fig. 1 (annotated)



86. *Markel* further teaches a processor with a cardiac information acquisition module and a cardiac information processing module (dark blue) that “processes acquired cardiac information” from the heart sensor (Ex-1005, [0059]). This is illustrated below in *Markel*’s Figure 10:

Ex-1005, Fig. 10 (annotated)



B. *Nissilä* (Ex-1006)

87. United States Patent No. 6,775,566 (“*Nissilä*,” Ex-1006) is titled “Electrode Structure and Heart Rate Measuring Arrangement.”

88. *Nissilä* is based on a patent application dated September 13, 2001, and issued on August 10, 2004 (Ex-1005, Cover). Consequently, I have been informed that I should assume *Nissilä* is prior art under at least 35 U.S.C. §§ 102(a) and 102(b) (pre-AIA).

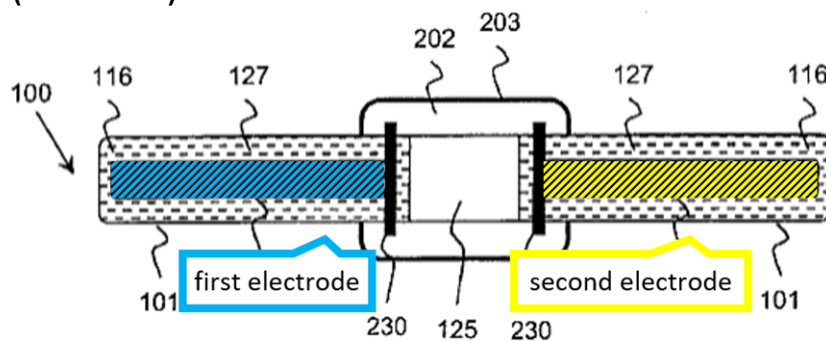
89. *Nissilä* discloses “a device for non-invasive measurement of heart rate information” (Ex-1005, 1:6–9). More specifically, *Nissilä* discloses “an electrode structure and a heart rate measuring arrangement for measuring an ECG signal on the skin of a person’s chest” (Ex-1005, Abstract).

90. According to *Nissilä*, the object of the invention described is “to provide an improved electrode structure and heart rate measuring arrangement for measuring an electrical heart beat signal on a human body” (Ex-1005, 2:17–20). Specifically, *Nissilä* discloses the following arrangement of electrodes:

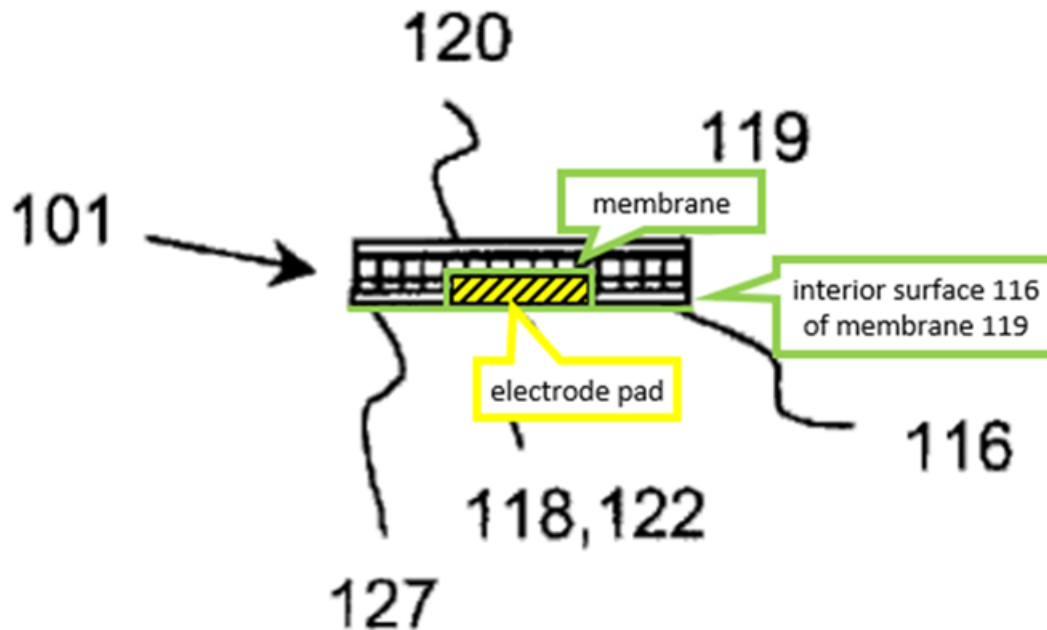
The electrode structure comprises a band-like component having an inner surface to be placed against the skin of the person’s chest and an outer surface opposite thereto, and which electrode structure comprises a first electrode at a first end and a second electrode at a second end of the electrode structure, and the inner surface of the electrode structure is an adhesive surface for attaching the electrode structure to the skin of the person’s chest, and the electrode structure is arranged to measure a potential difference between the first and the second electrodes caused by the ECG signal.

(Ex-1005, 2:22–32). “The first and the second electrodes of the electrode structure are electrically separated from one another in order to enable the measurement of the potential difference between the electrodes” (Ex-1005, 3:7–15). An exemplary embodiment with electrodes highlighted in yellow and blue is depicted in the annotated Figure 4, below:

Ex-1006, Fig. 4 (annotated)



91. *Nissilä* additionally discloses the structure of each electrode. For example, with respect to Figure 5 (which is shown below), *Nissilä* discloses electrodes (yellow) with “an electrically conductive membrane [(green, below)]”:



C. *Righter* (Ex-1007)

92. United States Patent No. 5,191,891 (“*Righter*,” Ex-1007) is titled “Portable ECG Monitor/Recorder.”

93. *Righter* is based on a patent application dated September 10, 1991, and issued on March 9, 1993 (Ex-1007, Cover). Consequently, I have been informed that I should assume *Righter* is prior art under at least 35 U.S.C. §§ 102(a) and 102(b) (pre-AIA).

94. *Righter* discloses “[a] portable apparatus having electronic circuitry for selectively monitoring and recording a user’s ECG signals” (Ex-1007, Abstract).

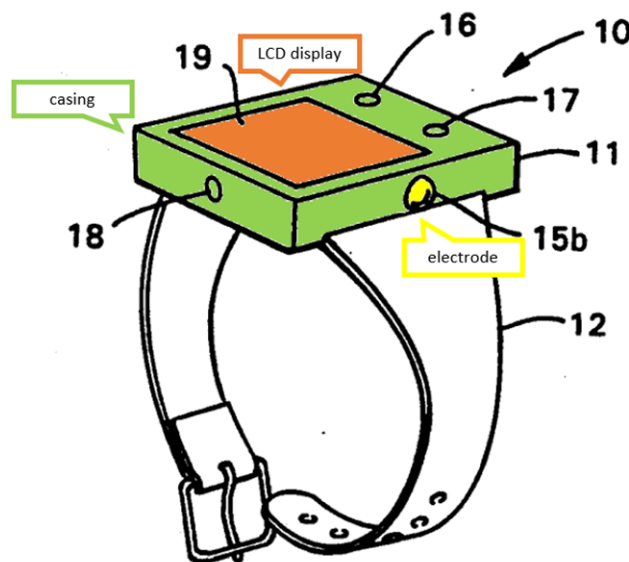
95. *Righter* discloses “an apparatus for monitoring and recording ECG data, and more particularly to a self-contained, portable ECG monitor/recorder”

(Ex-1007, 1:6–9).

96. According to *Righter*, “it is a primary object of the present invention to provide an apparatus that records medical-grade ECG data and yet is convenient and comfortable for a user to wear” (Ex-1007, 1:65–68). Another object of the invention described is “to provide a portable ECG recorder which does not utilize paste-on electrodes” (Ex-1007, 2:1–3).

97. *Righter* discloses a “portable ECG monitor/recorder 10 which is adapted to be worn on the wrist of a user. This unit includes a casing 11 which houses the electronic circuitry” (Ex-1007, 1:51–54). The portable ECG monitor/recorder is depicted in Figure 1A below.

Ex-1007, Fig. 1A (annotated)

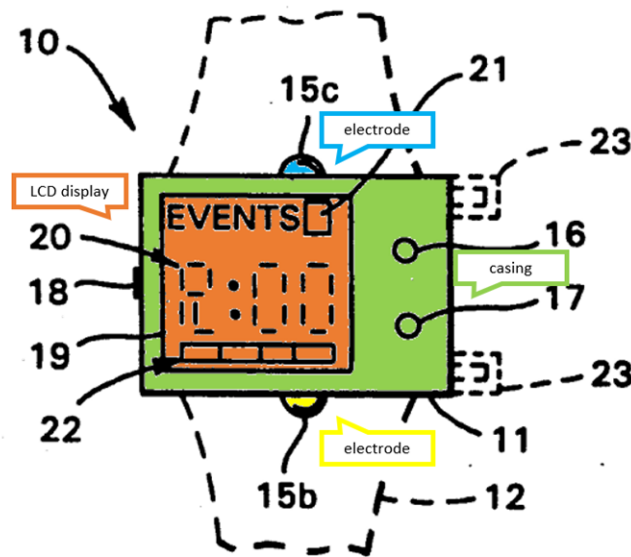


98. To accomplish portable ECG monitoring and recording, *Righter* discloses “surface-mounted electrodes which the user contacts to obtain a

conventional Lead I ECG measurement (i.e., differentially across the user's arms)" (Ex-1007, 2:50–58). First, *Righter* discloses a "first conductive electrode 15a [] provided on the bottom surface of the casing 11, where it is held in constant contact with the user's wrist when the unit is worn" (Ex-1007, 2:63–65) Then, *Righter* discloses "[a]nother 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)" (Ex-1007, 2:65–3:2). The "two electrodes 15b, 15c can [] be easily grasped by the user at the on-set of a cardiac event" (Ex-1007, 3:44–45). *Righter* also teaches that "[a]ll three electrodes are made of a suitable conducting material, preferably silver or silver chloride" (Ex-1007, 3:7–8).

99. *Righter* also discloses that its electronic device "can be easily adapted so that it can be worn by the user as a pendant" or other wearable (Ex-1007, 3:32–37). This embodiment is further depicted in Figure 1B below.

Ex-1007, Fig. 1B (annotated)



100. *Righter* also discloses “an LCD display for visually providing information to the user” (Ex-1007, 2:60–61). For example, “[a]n LCD display 19 is also provided on the top surface of the casing” (Ex-1007, 3:25–26). “This display visually provides information to the user, preferably including an indicator 20 of the time of day, an indicator 21 of the number of cardiac events (e.g., arrhythmias) recorded, and a bar graph 22 which indicates the portion of the total memory that is filled with data.” (Ex-1007, 3:26–31).

IX. THE PRIOR ART RENDERS OBVIOUS CLAIMS 1-22 OF THE '257 PATENT

A. Ground 1: *Markel* Renders Obvious Claims 1-22 of the '257 patent.

101. *Markel* renders obvious claims 1-22 of the '257 patent.

Claim 1, Element [1.pre]: An electronic device for detecting a user's cardiac signal, comprising:

102. To the extent that it is found to be limiting, *Markel* renders obvious claim element [1.pre]. Specifically, *Markel* renders obvious an electronic device for detecting a user's cardiac signal.

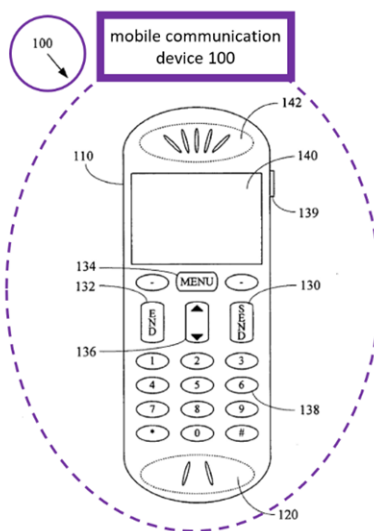
103. For example, *Markel* is titled “***Mobile communications device*** and other devices with ***cardiovascular monitoring capability***” (Ex-1005, Face at Item (54) (emphasis added)). As another example, *Markel*'s Abstract and “Summary of the Invention” disclose “[a] general-purpose ***mobile communication device***, general-purpose ***computer user-interface device***, and other non-health-related ***electronic devices with cardiovascular monitoring capability***” (Ex-1005, Abstract, [0004] (emphasis added)).

104. As another example, *Markel*'s detailed description of the invention teaches “various aspects of the present invention provide a mobile communication device (and other ***electronic devices***) with ***cardiovascular monitoring capability***” (Ex-1005, [0060] (emphasis added)). *Markel* teaches that “various aspects of the present invention may also be applied to other electronic devices” (Ex-1005, [0080], [0099], [0125], [0154]).

105. Figures 1, 4–9, and 12–15 of *Markel* disclose various electronic devices with cardiovascular monitoring capability (Ex-1005, Figs. 1, 4–9). For example, “FIG. 1 is a diagram illustrating an exemplary mobile communication device 100

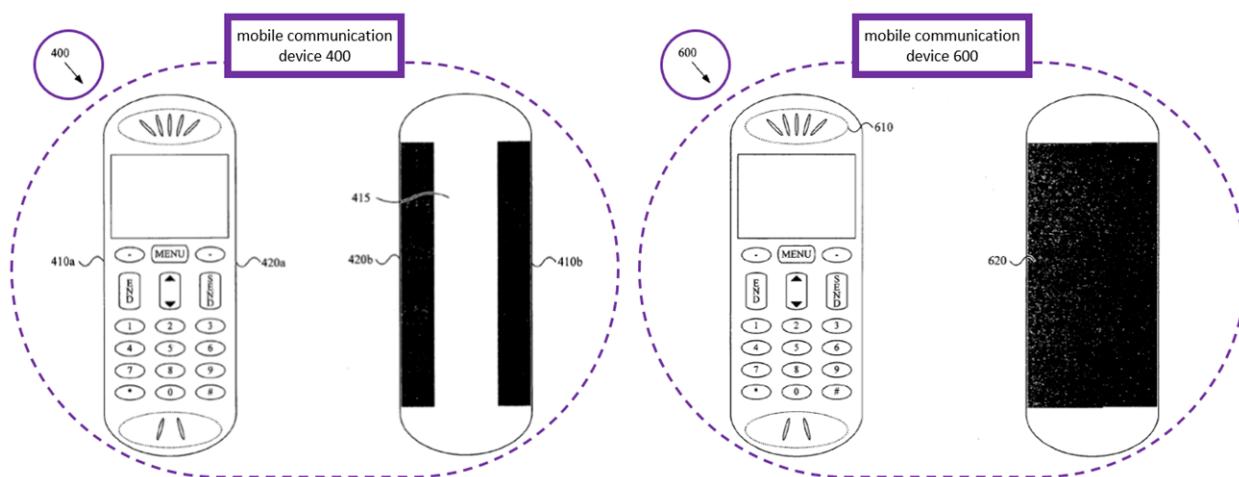
[(annotated below in purple)] in accordance with various aspects of the present invention.” (Ex-1005, [0006], [0033]).

Ex-1005, Fig. 1 (annotated)



106. Similarly, Figures 4 and 6 disclose exemplary “mobile communication device 400” and “mobile communication device 600” respectively.

Ex-1005, Fig. 4 (annotated), Fig. 6 (annotated)

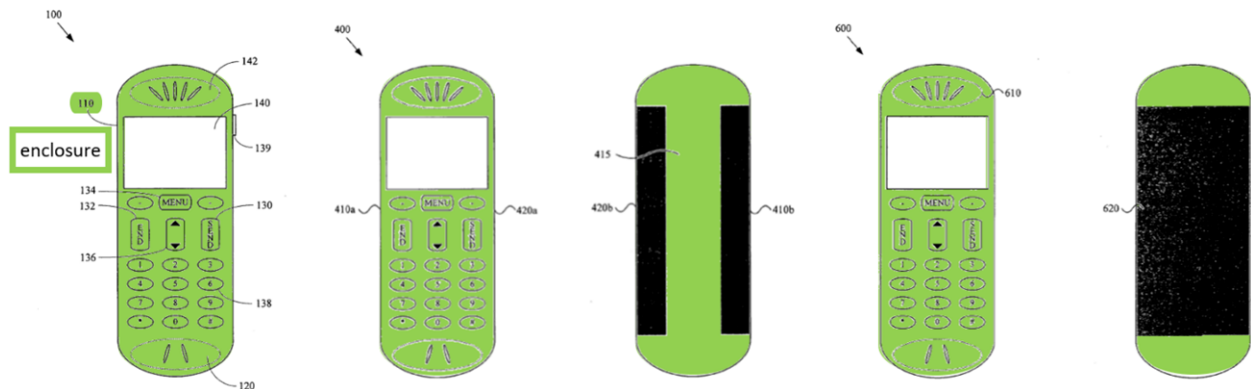


107. Thus, *Markel* renders obvious claim element [1.pre].

Claim 1, Element [1.a]: an enclosure;

108. *Markel* renders obvious claim element [1.a]. Specifically, *Markel* renders obvious an enclosure. This is illustrated in at least *Markel*'s Figures 1, 4, and 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 1 (annotated), Fig. 4 (annotated), Fig. 6 (annotated)



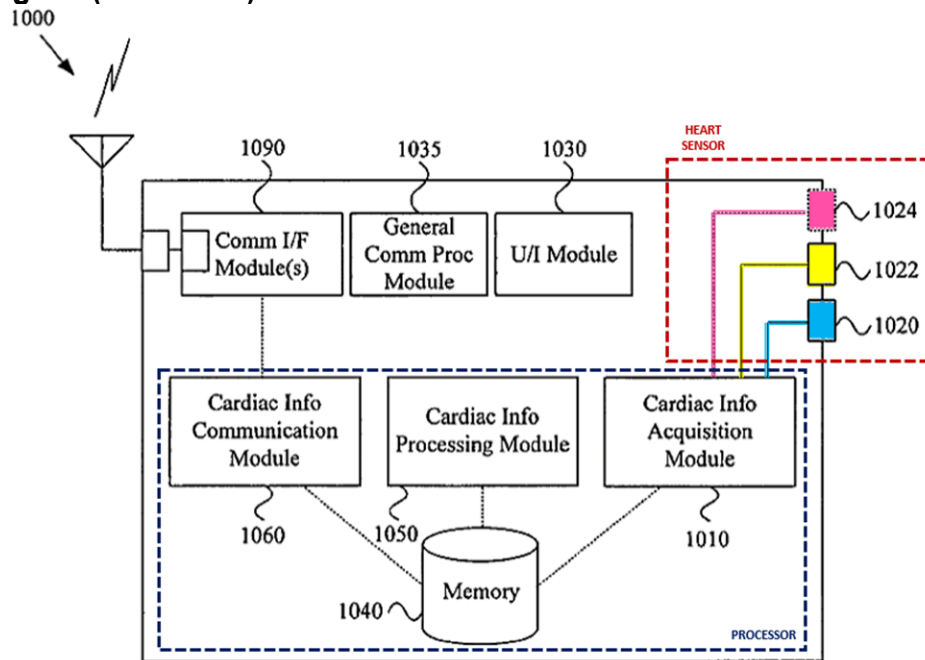
109. *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. For example, *Markel* discloses that “exemplary mobile communication device 100 (‘MCD’) may comprise a **main body portion 110**” (Ex-1005, [0034], Fig. 1; *see also* Ex-1005, [0053], [0054], [0056], [0076], [0077] (emphasis added)). As another example, *Markel* describes the main body portion as “compris[ing] the portion of the [mobile communication device] that is generally held in the hand of the user during normal use of the [mobile communication device]” (Ex-1005, [0043]). As another example, *Markel* refers to a “main body portion” and then states “e.g., a primary **casing or housing** for the user interface device” (Ex-1005, [0064] (emphasis added)).

110. Thus, *Markel* renders obvious claim element [1.a].

Claim 1, Element [1.b]: a heart sensor configured to detect the user’s cardiac signal,

111. *Markel* renders obvious claim element [1.b]. Specifically, *Markel* renders obvious a heart sensor configured to detect the user’s cardiac signal. This is illustrated in at least *Markel*’s Figure 10 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 10 (annotated)



112. *Markel* discloses components (annotated above in red) that correspond to the claimed “a heart sensor configured to detect the user’s cardiac signal” of element [1.a]. For example, *Markel* discloses that “mobile communication device 1000” includes “a first electrode 1020 and a second electrode 1022 (and, for example, a third or Nth electrode 1024)” (Ex-1005, [0058]). *Markel* further discloses

that the “mobile communication device 1000” may “also comprise a cardiac information acquisition module 1010 that is *coupled to the first and second electrodes 1020, 1022* and utilizes the first and second electrodes 1020, 1022 to detect and *acquire various cardiac (i.e., heart-related) signals from a user*” (Ex-1005, [0058] (emphasis added)). As *Markel* summarizes, “various aspects of the present invention provide a mobile communication device (and other electronic devices) with *cardiovascular monitoring capability*” (Ex-1005, [0060] (emphasis added)).

113. Other parts of *Markel* further confirm that it renders obvious “a heart sensor configured to detect the user’s cardiac signal.” For example, *Markel* discloses an electronic device that “comprise[s] a *cardiac sensor* (e.g., electrodes) disposed on the mobile communication device, *which may be utilized to acquire cardiac information during use of the mobile communication device*” (Ex-1005, Abstract (emphasis added)). As another example, *Markel* discloses an electronic device that “comprise[s] at least one *cardiac sensor* (e.g., one or more electrodes, an audio monitoring or acoustical detection device, etc.) that is adapted to *detect cardiac activity of the user* of the [electronic device]” (Ex-1005, [0035]).

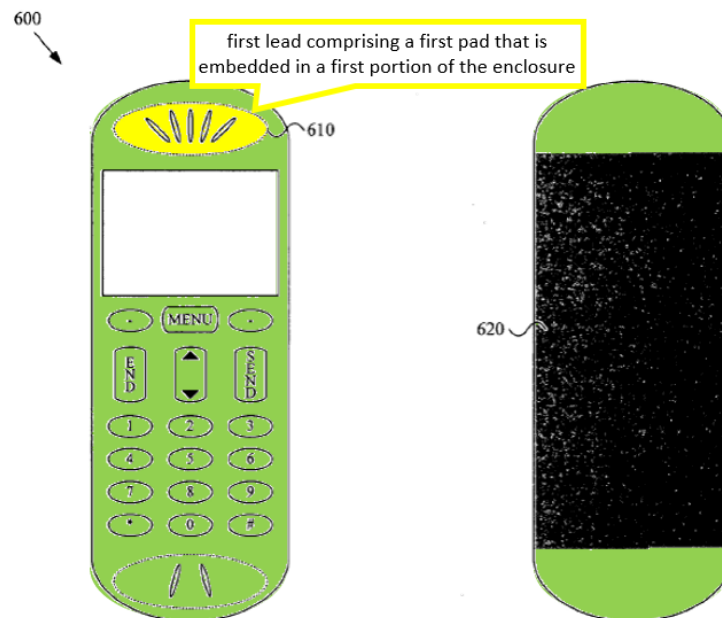
114. Thus, *Markel* renders obvious claim element [1.b].

Claim 1, Element [1.c.i]: the heart sensor comprising: a first lead comprising a first pad that is embedded in a first portion of the enclosure,

115. *Markel* renders obvious claim element [1.c.i]. Specifically, *Markel*

renders obvious a heart sensor comprising a first lead comprising a first pad that is embedded in a first portion of the enclosure. This is illustrated in at least *Markel's* Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)

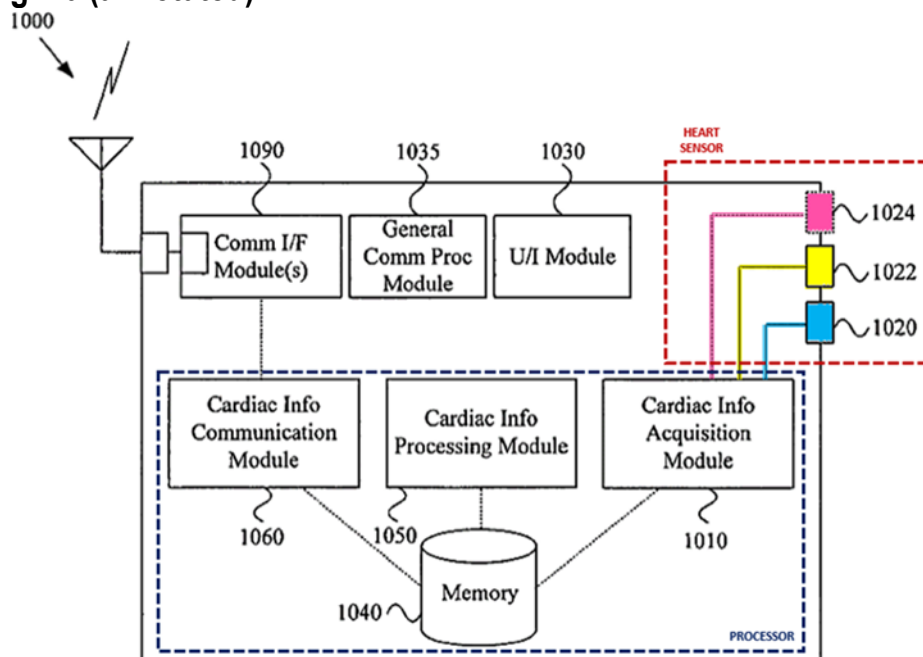


116. In the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “lead” to include (1) an electrode that comes into contact with a user and (2) the electrical connection (*e.g.*, wires) that connects the electrode to additional electronics that implement that ECG signal acquisition. A person of ordinary skill in the art would also have understood that a “pad” is a component of the electrode. This is because the claim language requires that each “lead” comprises a “pad” and “connector” that can “detect” an “electrical signal.” Furthermore, the specification

discloses that “*each lead can include a pad or extended area* placed on the outer or inner surface of an electronic device bezel or housing. The pad or extended area can then be *coupled to a wire or other connector* for providing cardiac signals to a processor for processing” (Ex-1001, 6:29–31 (emphasis added)). I apply this plain and ordinary meaning of “lead” in my analysis below.

117. First, *Markel* renders obvious a heart sensor comprising a first lead. As explained earlier with respect to claim element [1.b] (the discussion of which is incorporated herein), *Markel* discloses components that correspond to the claimed “a heart sensor configured to detect the user’s cardiac signal” of element [1.b]. These components are illustrated in at least *Markel*’s Figure 10 (annotated below):

Ex-1005, Fig. 10 (annotated)

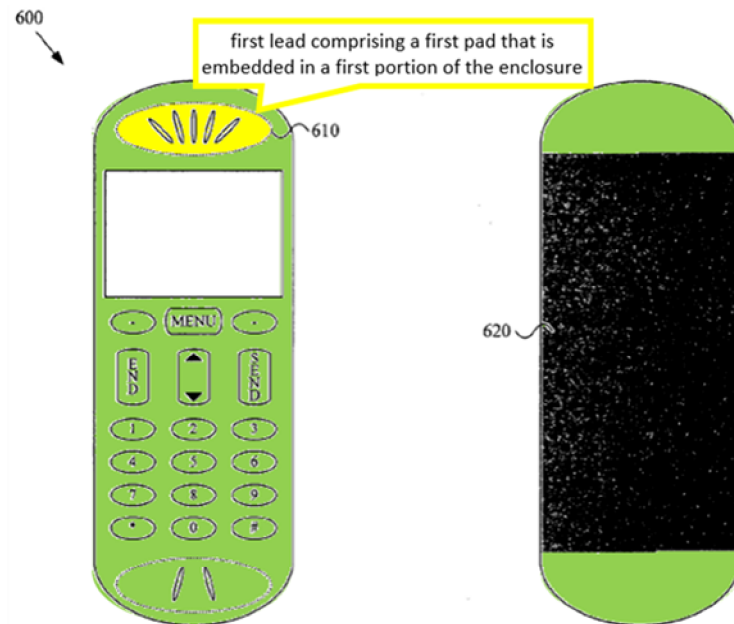


118. One of those components is a “second electrode 1022” and associated

wiring (annotated above in yellow), which correspond to the claimed “first lead” of element [1.c.i]. For example, *Markel* discloses that “mobile communication device 1000” includes “a first electrode 1020 and a ***second electrode 1022*** (and, for example, a third or Nth electrode 1024)” (Ex-1005, [0058] (emphasis added)). *Markel* also discloses that the second electrode is “coupled” to the cardiac information acquisition module (Ex-1005, [0059]). From this, a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” and associated wiring is a “first lead.”

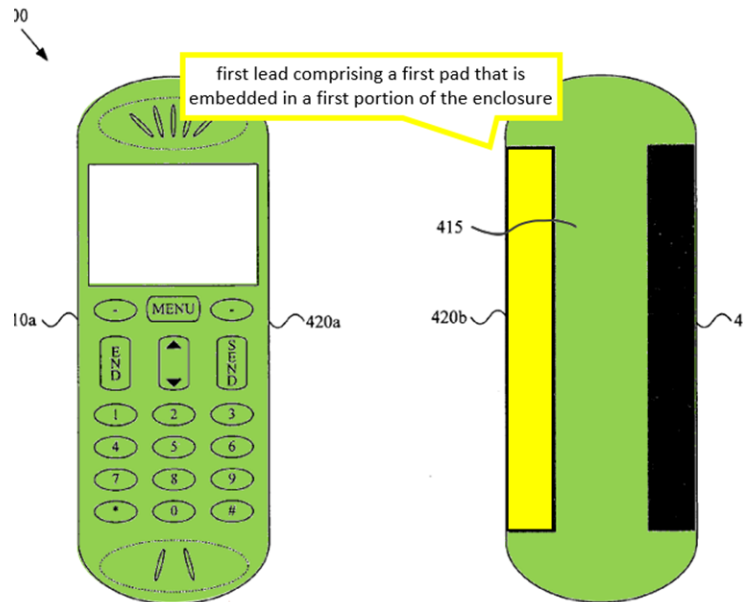
119. Second, *Markel* renders obvious that the first lead comprises a first pad that is embedded in a first portion of the enclosure. For example, *Markel* discloses various configurations for placement of the electrodes, including the configuration illustrated in *Markel*’s Figure 6 (annotated below). In this configuration, the “***second electrode*** [(yellow)] may be . . . ***molded into the audio output portion 610*** or positioned on the main body portion 610” of the electronic device (Ex-1005, [0050] (emphasis added)). From this, a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” comprises a first pad that is “molded into the audio output portion 610” (i.e., embedded in a first portion of the enclosure).

Ex-1005, Fig. 6 (annotated)



120. Additionally, *Markel* discloses another configuration in Figure 4 wherein “[the] *second electrode* may, for example, be placed on the right side portion 420 (e.g., placed on or *molded into region 420b*)” (Ex-1005, [0045] (emphasis added)). From this, a person of ordinary skill in the art would have understood that Figure 4’s “second electrode” would include a first pad that is embedded into the “right side portion 420,” (i.e., a first portion of the enclosure) in the Figure 4 configuration.

Ex-1005, Fig. 4 (annotated)

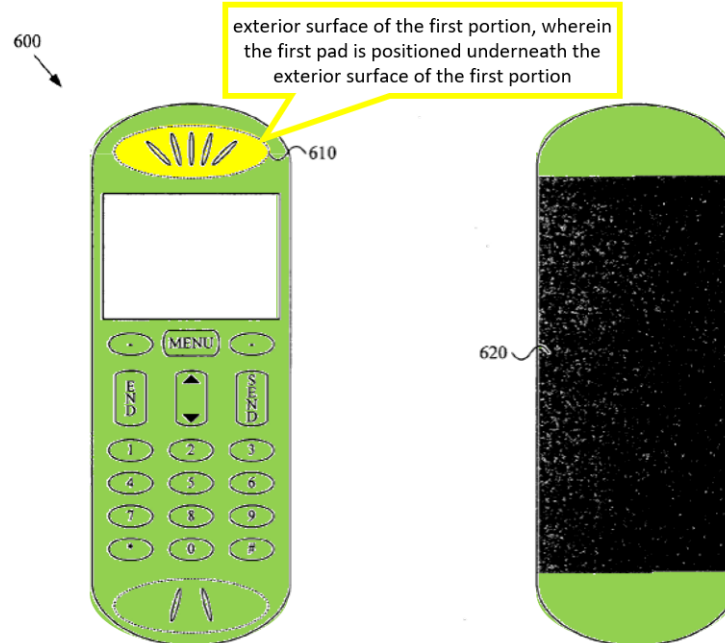


121. Thus, *Markel* renders obvious claim element [1.c.i].

Claim 1, Element [1.c.ii]: wherein an exterior surface of the enclosure comprises an exterior surface of the first portion,

122. *Markel* renders obvious claim element [1.c.ii]. Specifically, *Markel* renders obvious that an exterior surface of the enclosure comprises an exterior surface of the first portion. This is illustrated in at least *Markel*'s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



123. *Markel* renders obvious that an exterior surface of the enclosure comprises an exterior surface of the first portion. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. Furthermore, as explained earlier with respect to claim element [1.c.i], *Markel* discloses a “second electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “first lead comprising a first pad” of element [1.c.i]. As also explained earlier with respect to claim element [1.d.i], a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” comprises a first pad that is embedded in the “audio output portion 610” (i.e., a first portion of the enclosure). Thus, a person of ordinary skill

in the art would have understood that the exterior surface of the “audio output portion 610” corresponds to the “exterior surface of the first portion” of element [1.c.ii].

124. Additionally, as explained with respect to claim element [1.c.i] and *Markel*’s Figure 4, a person of ordinary skill in the art would have understood that Figure 4’s “second electrode” comprises a first pad that is embedded in the “right side portion 420.” A person of ordinary skill in the art would have understood that the exterior surface of the “right side portion 420” corresponds to the “exterior surface of the first portion” of element [1.c.ii] in the Figure 4 configuration.

125. Thus, *Markel* renders obvious claim element [1.c.ii].

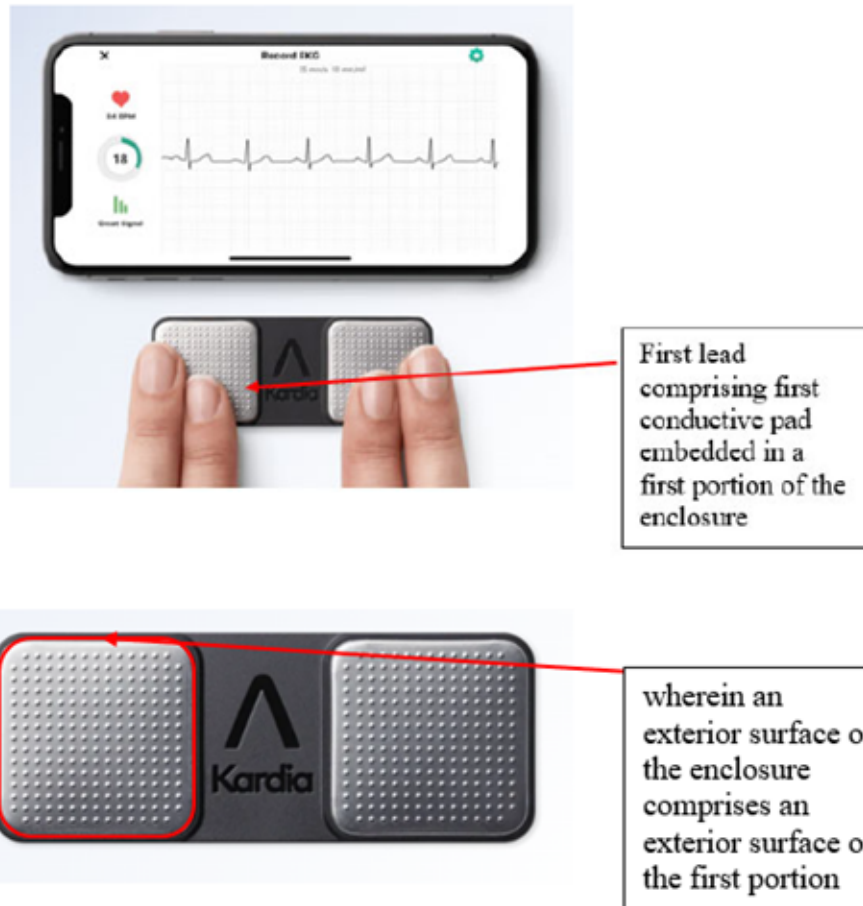
Claim 1, Element [1.c.iii]: wherein the first pad is positioned underneath the exterior surface of the first portion, and wherein the first pad is configured to detect a first electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the first portion of the enclosure;

126. *Markel* renders obvious claim element [1.c.iii]. Specifically, *Markel* renders obvious that the first pad is positioned underneath the exterior surface of the first portion, and that 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. Below, I analyze this claim element under Apple’s interpretation of the claim language (with which I disagree) and under the correct interpretation of the claim language. Each is addressed in turn.

127. ***Apple’s interpretation of claim element [1.c.iii].*** Under Apple’s own

interpretation of claim element [1.c.iii] (with which I disagree), *Markel* discloses that the first pad is positioned underneath the exterior surface of the first portion, and 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. For purposes of showing alleged infringement, Apple appears to have interpreted claim element [1.c.ii] to include the surface of an exposed electrode pad that is configured to detect the user's cardiac signal via direct contact with the user's skin. This is illustrated in at least Apple's Complaint for alleged patent infringement against AliveCor:

Ex-1016 (Apple's Complaint), 11-12 (annotation in original)

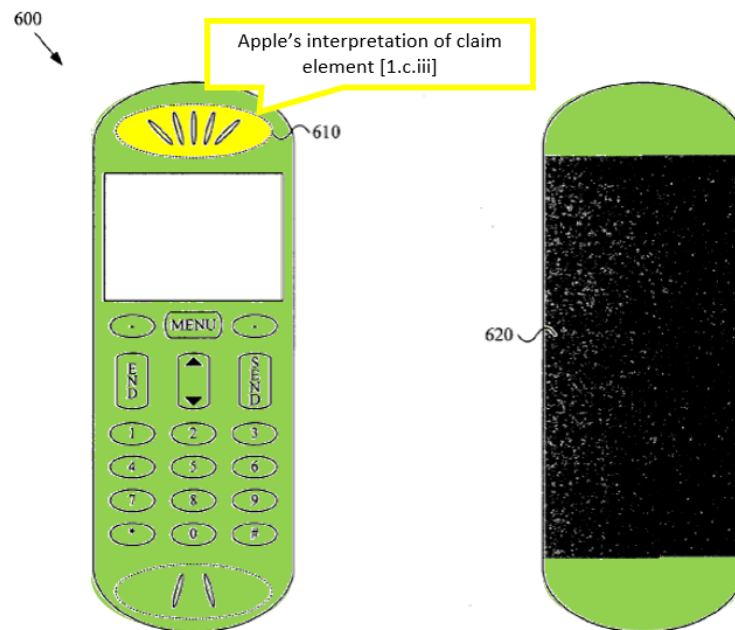


128. This interpretation is incorrect at least because it encompasses prior art that was explicitly distinguished during prosecution, including at least the *Ceballos* and *Weiss* prior art references that I addressed in my overview of the prosecution history. Regardless, Apple's incorrect interpretation is disclosed by *Markel*.

129. *Markel* discloses *Apple's* interpretation of claim element [1.c.iii]. For example, *Markel* teaches that the “*second electrode* may be . . . *positioned on the audio output portion 610*” of the electronic device (Ex-1005, [0050] (emphasis added)). “Such electrode placement may, for example, provide for *user contact*”

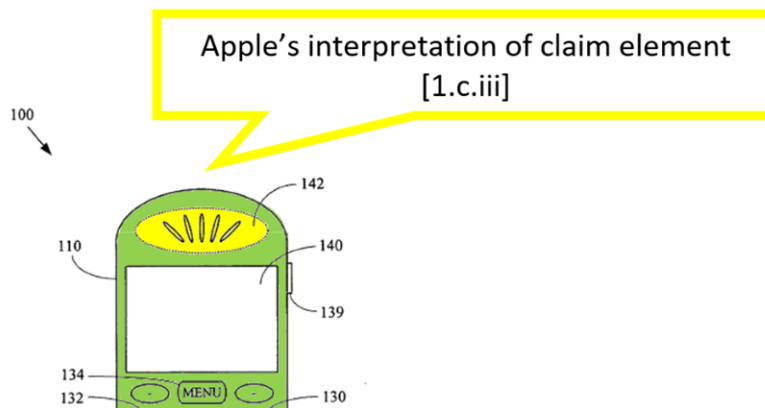
with the second electrode “during the process of listening” to the electronic device (Ex-1005, [0050] (emphasis added)). This is illustrated in at least *Markel*’s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



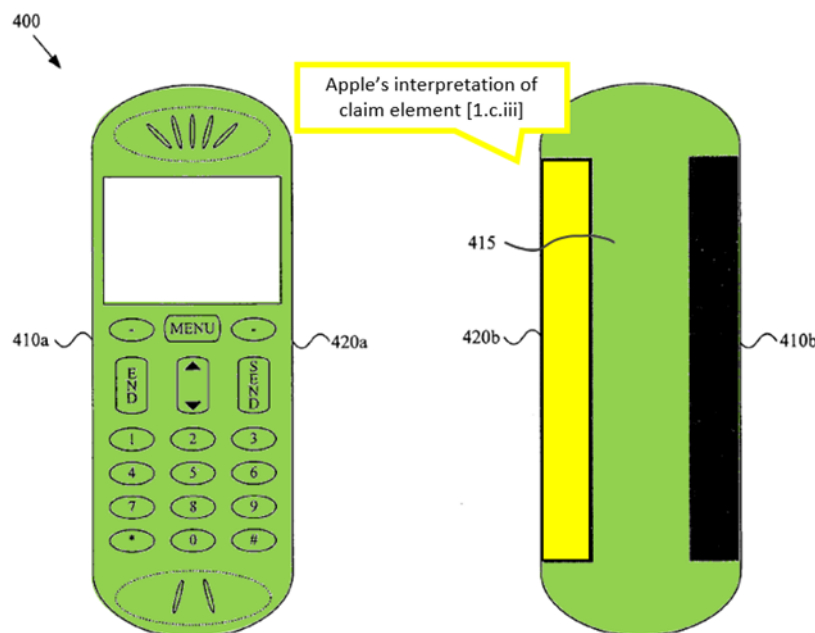
130. Similarly, *Markel*’s Figure 1 (annotated below) discloses that “*an electrode (or other sensor) may be placed on (or proximate to) an audio output portion 142 (e.g., a speaker)*” of the electronic device, which “may, for example, provide for *electrode contact with an ear or cheek* of a user of the [electronic device]” (Ex-1005, [0044] (emphasis added)).

Ex-1005, Fig. 1 (annotated)



131. Also with respect to *Markel*'s Figure 4 configuration, the “*second electrode* may be . . . *placed on the right side portion 420*” of the electronic device (Ex-1005, [0045]). Such electrode placement allows the electrode to “*contact a user* during normal (or typical) use of the [electronic device]” (Ex-1005, [0041] (emphasis added)). This is illustrated in at least *Markel*'s Figure 4 (annotated below):

Ex-1005, Fig. 4



132. *Markel* further discloses that its “electrodes may, for example, be adapted to ***detect cardiac activity of a user that is conductively coupled to the electrodes (e.g., by touching the electrodes)***” (Ex-1005, [0035] (emphasis added)). *Markel*’s electrodes also “may comprise a metallic surface exposed for user contact” (Ex-1005, [0037]). Consequently, *Markel* discloses that its “second electrode” may include an exposed electrode pad that is configured to detect the user’s cardiac signal via direct contact with the user’s skin, which is consistent with Apple’s interpretation of the claim language.

133. Thus, under *Apple*’s interpretation of the claim language (again, with which I disagree), *Markel* renders obvious claim element [1.c.iii].

134. ***Correct interpretation of claim element [1.c.iii]***. In the alternative, and under the correct interpretation of claim element [1.c.iii], *Markel* renders obvious that the first pad is positioned underneath the exterior surface of the first portion, and 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.

135. For example, *Markel* teaches that “an electrode (or all electrodes) . . . may be ***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). As

explained earlier with respect to claim element [1.c.i], a person of ordinary skill in the art would have understood that *Markel*'s "second electrode" comprises a first pad that is embedded in the "audio output portion 610" (i.e., a first portion of the enclosure). When "integrated into various molded components of the mobile communication device," this "electrode may be formed from **conductive plastic** (or another material)" (Ex-1005, [0037] (emphasis added)). From this, a person of ordinary skill in the art would have been motivated to place the pad of the "second electrode" *underneath* the conductive plastic of the "audio output portion." This would have "substantially concealed (or hidden)" the pad of the electrode from the user, which would have been desirable to increase aesthetics of the device while protecting the electrode.

136. *Markel* further teaches that an electrode's pad need not be in direct contact with a user and may be "adapted to detect cardiac activity of a user that is **conductively coupled** to the electrodes (e.g., by touching the electrodes)" (Ex-1005, [0035] (emphasis added)). Specifically, a person of ordinary skill in the art would recognize that the pad of an electrode can be conductively coupled to a user through an intermediate conductive material. Indeed, as discussed earlier, *Markel* teaches that "a **conductive plastic** (or another material) [] 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” (Ex-1005, [0037] (emphasis added)).” This is in contrast to *Markel*’s disclosure that “an electrode may comprise a metallic surface *exposed* for user contact” (Ex-1005, [0037] (emphasis added)).

137. Moreover, a person of ordinary skill in the art would have had a reasonable expectation of success in placing the pad of the electrode underneath and detecting the user’s cardiac signal via the conductive plastic of the “audio output portion” because *Markel* discloses that (1) “electrodes may be *incorporated into the [electronic device] in any of a variety of manners*” and “in any of a *variety of locations*” (Ex-1005, [0035], [0045] (emphasis added)), and (2) electrodes “may, for example, be adapted to detect cardiac activity of a user that is *conductively coupled* to the electrodes” and “various conductive plastics . . . may provide *sufficient conductivity* for an electrode to perform adequately” (Ex-1005, [0037] (emphasis added)).

138. Accordingly, a person of ordinary skill in the art would have been motivated to position the first pad of the “second electrode” underneath the exterior surface of the electronic device’s “audio output portion.” In that configuration, that first pad would have been 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 electronic device’s “audio output portion” (i.e., the first portion of the enclosure).

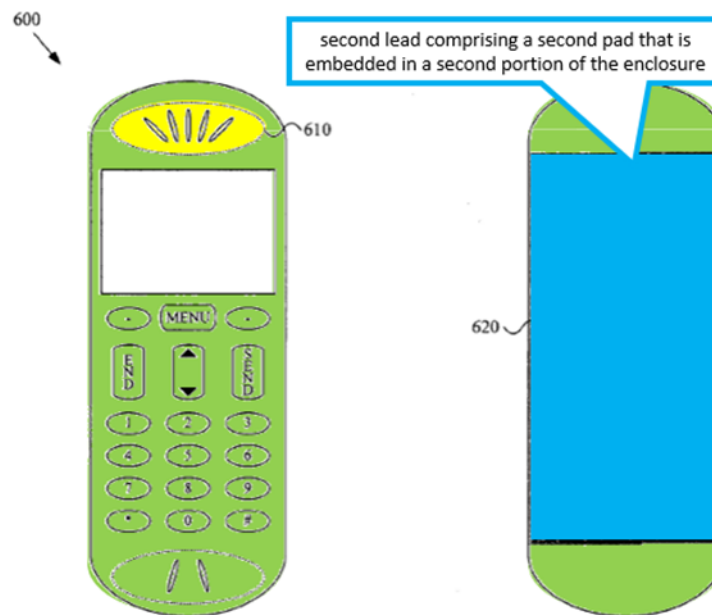
139. As also explained with respect to claim element [1.c.i], a person of ordinary skill in the art would have understood that the “second electrode” in *Markel*’s Figure 4 configuration comprises a first pad that is embedded in the “right side portion 420.” Similarly, a person of ordinary skill in the art would have been motivated to place the pad of the “second electrode” in *Markel*’s Figure 4 *underneath* the conductive plastic of the “right side portion 420.” In that configuration, that first pad would have been 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 electronic device’s “right side portion” (i.e., the first portion of the enclosure).

140. Thus, under the *correct* interpretation of the claim language, *Markel* renders obvious claim element [1.c.iii].

Claim 1, Element [1.d.i]: the heart sensor comprising: . . . a second lead comprising a second pad that is embedded in a second portion of the enclosure,

141. *Markel* renders obvious claim element [1.d.i]. Specifically, *Markel* renders obvious a heart sensor comprising: a second lead comprising a second pad that is embedded in a second portion of the enclosure. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)

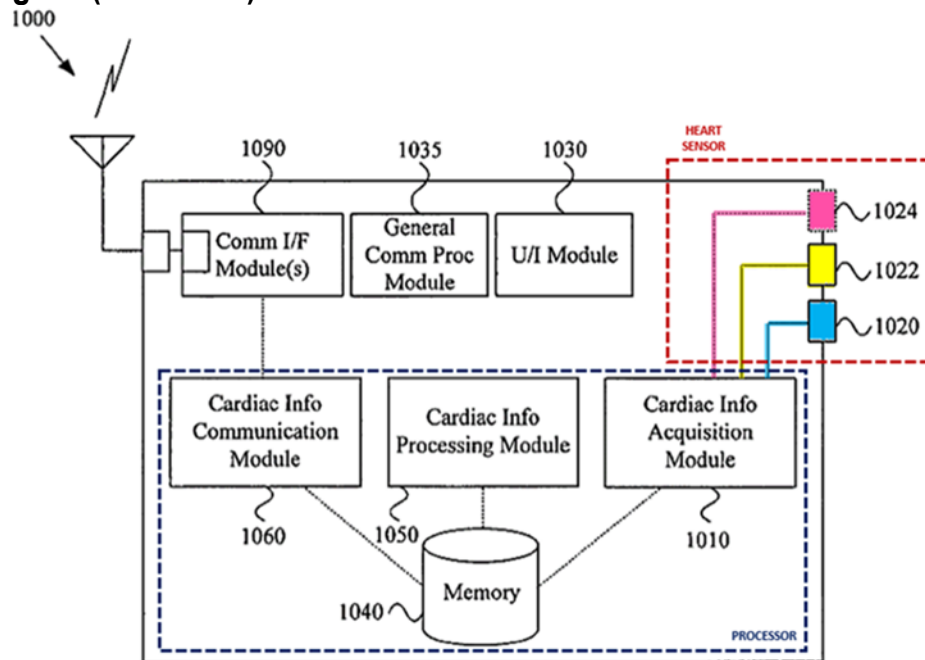


142. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “lead” to include (1) an electrode that comes into contact with a user; and (2) the electrical connection (*e.g.*, wires) that connects the electrode to additional electronics that implement that ECG signal acquisition. A person of ordinary skill in the art would also have understood that a “pad” is a component of the electrode. I again apply this plain and ordinary meaning of “lead” in my analysis below.

143. First, *Markel* renders obvious a heart sensor comprising a second lead. As explained earlier with respect to claim element [1.b] (the discussion of which is

incorporated herein), *Markel* discloses components that correspond to the claimed “a heart sensor configured to detect the user’s cardiac signal” of element [1.b]. These components are illustrated in at least *Markel*’s Figure 10 (annotated below):

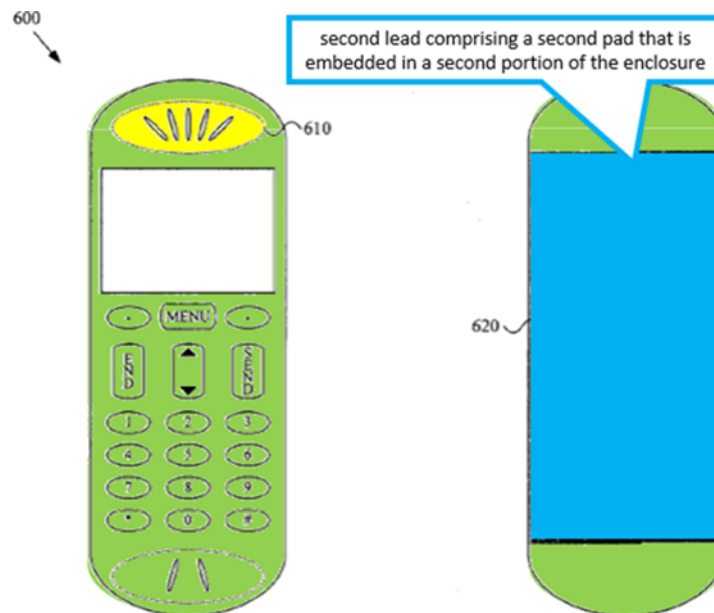
Ex-1005, Fig. 10 (annotated)



144. One of those components is a “first electrode 1020” and associated wiring (annotated above in blue), which correspond to the claimed “second lead” of element [1.c.i]. For example, *Markel* discloses that “mobile communication device 1000” includes “a *first electrode 1020* and a second electrode 1022 (and, for example, a third or Nth electrode 1024)” (Ex-1005, [0058] (emphasis added)). *Markel* also discloses that the first electrode is “coupled” to the cardiac acquisition module (Ex-1005, [0059]). From this, a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” and associated wiring is a “second lead.”

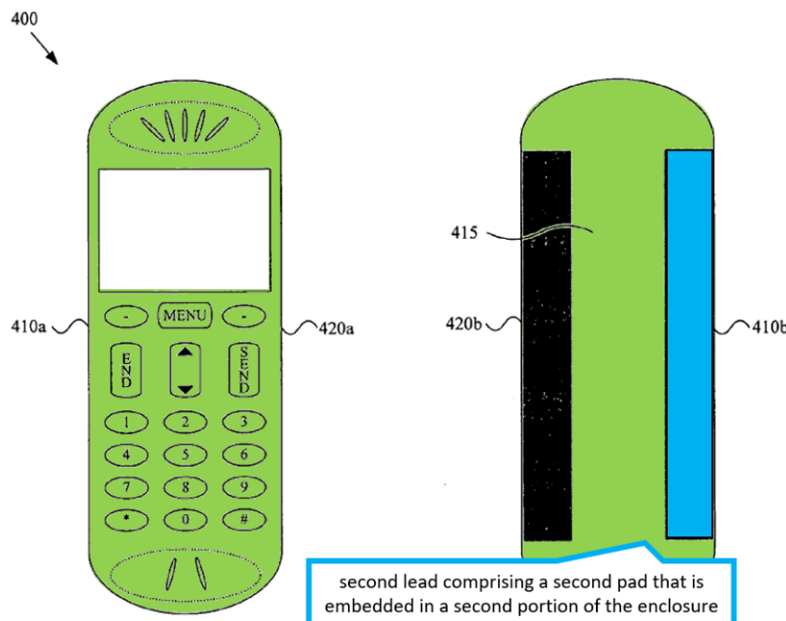
145. Second, *Markel* renders obvious that the second lead comprises a second pad that is embedded in a second portion of the enclosure. For example, *Markel* discloses various configurations for placement of the electrodes, including the configuration illustrated in *Markel*'s Figure 6 (annotated below). In this configuration, the “*first electrode* [(blue)] may be disposed on the main body portion 620 (e.g., *molded into the main body portion 620 or positioned on the main body portion 620*)” (Ex-1005, [0050] (emphasis added)). From this, a person of ordinary skill in the art would have understood that *Markel*'s “first electrode” comprises a second pad that is “molded into the main body portion 620” (i.e., embedded in a second portion of the enclosure).

Ex-1005, Fig. 6 (annotated)



146. Additionally, *Markel* discloses a configuration in Figure 4 wherein “[the] **first electrode** may, for example, be placed on the left side portion 410 (e.g., **placed on or molded into region 410b**)” (Ex-1005, [0045] (emphasis added)). From this, a person of ordinary skill in the art would have understood that Figure 4’s “first electrode” would include a second pad that is embedded into the “left side portion 410,” (i.e., a second portion of the enclosure) in the Figure 4 configuration.

Ex-1005, Fig. 4 (annotated)



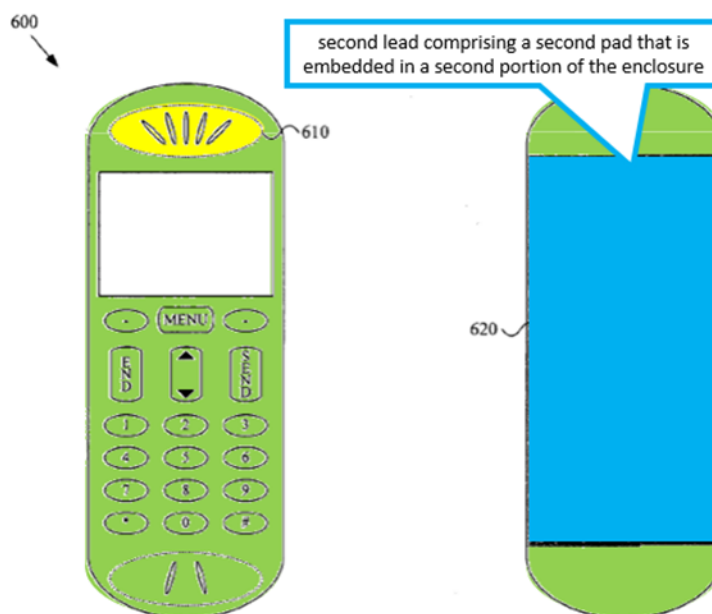
147. Thus, *Markel* renders obvious claim element [1.d.i].

Claim 1, Element [1.d.ii]: wherein the second pad is configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with at least one of the second pad and the second portion of the enclosure;

148. *Markel* renders obvious claim element [1.d.ii]. Specifically, *Markel* renders obvious a second pad configured to detect a second electrical signal of the

user's cardiac signal via the user's skin's contact with at least one of the second pad and the second portion of the enclosure. This is illustrated in at least *Markel's* Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



149. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. Furthermore, as explained earlier with respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “second lead comprising a second pad” of element [1.d.i]. As also explained earlier with respect to claim element [1.d.i], a person of ordinary skill in the art would have

understood that *Markel*'s "first electrode" is embedded in the "main body portion 620" (i.e., a second portion of the enclosure).

150. *Markel* further discloses that the second pad of the "first electrode" is configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with ***at least one of*** (1) the second pad, and (2) the second portion of the enclosure. Each is addressed in turn.

151. First, *Markel* renders obvious that the second pad of the "first electrode" is configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with the second pad. For example, *Markel* discloses that its "electrodes may, for example, be adapted to ***detect cardiac activity of a user*** that is ***conductively coupled to the electrodes (e.g., by touching the electrodes)***" (Ex-1005, [0035] (emphasis added)). *Markel* also discloses that "electrodes contact a user during normal (or typical) use of the [electronic device]. Such normal use may, for example, comprise talking on a telephone, reading messages, perusing a phone book, typing a message, initiating a phone call, sending an email message, entering information in a notepad, etc." (Ex-1005, [0041]). *Markel*'s electrodes also "may comprise a metallic surface exposed for ***user contact***" (Ex-1005, [0037] (emphasis added)). Consequently, *Markel* discloses that the second pad of the "first electrode" is configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with the second pad.

152. Second, and in the alternative, *Markel* renders obvious that the second pad of the “first electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the second portion of the enclosure. For example, *Markel* teaches that “an electrode (or all electrodes) . . . may be *substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). As also explained earlier with respect to claim element [1.d.i], a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” comprises a second pad that is embedded in the “main body portion 620” (i.e., a second portion of the enclosure). When “integrated into various molded components of the mobile communication device,” this “electrode may be formed from *conductive plastic* (or another material)” (Ex-1005, [0037] (emphasis added)). From this, a person of ordinary skill in the art would have been motivated to place the pad of the “first electrode” underneath the conductive plastic of the “main body portion 620.” This would have “substantially concealed (or hidden)” the pad of the electrode from the user, which would have been desirable to increase aesthetics of the device while protecting the electrode.

153. *Markel* further teaches that an electrode’s pad need not be in direct contact with a user and may be “adapted to detect cardiac activity of a user that is

conductively coupled to the electrodes (e.g., by touching the electrodes)” (Ex-1005, [0035] (emphasis added)). Specifically, a person of ordinary skill in the art would recognize that the pad of an electrode can be conductively coupled to a user through an intermediate conductive material. Indeed, as discussed earlier, *Markel* further teaches that “a conductive plastic (or another material) [] 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” (Ex-1005, [0037] (emphasis added)). This is in contrast to *Markel*’s disclosure that “an electrode may comprise a metallic surface *exposed* for user contact” (Ex-1005, [0037] (emphasis added)).

154. Moreover, a person of ordinary skill in the art would have had a reasonable expectation of success in detecting the user’s cardiac signal via the conductive plastic of the “main body portion” because *Markel* discloses that (1) “electrodes may be *incorporated into the [electronic device] in any of a variety of manners*” and “in any of a *variety of locations*” (Ex-1005, [0035], [0045] (emphasis added)), and (2) electrodes “may, for example, be adapted to detect cardiac activity of a user that is *conductively coupled* to the electrodes” and “various conductive plastics . . . may provide *sufficient conductivity* for an electrode to perform adequately” (Ex-1005, [0037] (emphasis added)).

155. Accordingly, a person of ordinary skill in the art would have been motivated to position the second pad of the “first electrode” underneath the exterior surface of the electronic device’s “main body portion.” In that configuration, that second pad would have been configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the electronic device’s “main body portion” (i.e., the second portion of the enclosure). Consequently, *Markel* renders obvious that the second pad of the “first electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the second portion of the enclosure.

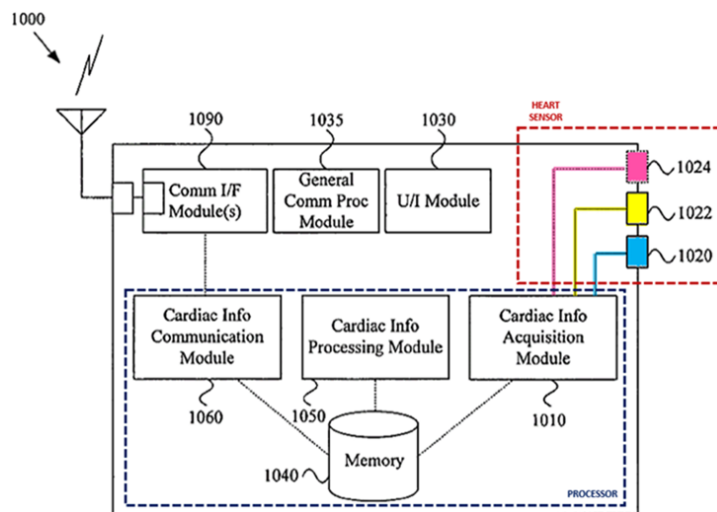
156. As also explained with respect to claim element [1.d.i], a person of ordinary skill in the art would have understood that the “first electrode” in *Markel*’s Figure 4 configuration comprises a second pad that is embedded in the “left side portion 410.” Similarly, a person of ordinary skill in the art would have been motivated to place the pad of the “first electrode” in *Markel*’s Figure 4 underneath the conductive plastic of the “left side portion 410.” In that configuration, that second pad would have been configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the electronic device’s “left side portion” (i.e., the second portion of the enclosure).

157. Thus, *Markel* renders obvious claim element [1.d.ii].

Claim 1, Element [1.e]: a processor coupled to the heart sensor and configured to receive and process the detected cardiac signal, wherein the first lead further comprises a first connector coupled to the first pad and configured to provide the first electrical signal detected by the first pad to the processor, and wherein the second lead further comprises a second connector coupled to the second pad and configured to provide the second electrical signal detected by the second pad to the processor.

158. *Markel* renders obvious claim element [1.e]. Specifically, *Markel* renders obvious a processor coupled to the heart sensor and configured to receive and process the detected cardiac signal, wherein the first lead further comprises a first connector coupled to the first pad and configured to provide the first electrical signal detected by the first pad to the processor, and wherein the second lead further comprises a second connector coupled to the second pad and configured to provide the second electrical signal detected by the second pad to the processor. This is illustrated in at least *Markel*'s Figure 10 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 10 (annotated)



159. First, *Markel* renders obvious a processor coupled to the heart sensor and configured to receive and process the detected cardiac signal. For example, *Markel* teaches a “cardiac information processing module 1050” (annotated above in dark blue) (Ex-1005, [0059]). The “cardiac information processing module 1050” **“processes acquired cardiac information”** from the “cardiac information acquisition module 1010” (Ex-1005, [0058], [0059] (emphasis added)). *Markel* further discloses that such a “module[] . . . may be integrated into a baseband **processor chip or controller chip**” (Ex-1005, [0178] (emphasis added)).

160. Second, *Markel* renders obvious that the first lead further comprises a first connector coupled to the first pad and configured to provide the first electrical signal detected by the first pad to the processor, and wherein the second lead further comprises a second connector coupled to the second pad and configured to provide the second electrical signal detected by the second pad to the processor. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), *Markel* discloses a “second electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “first lead comprising a first pad” of element [1.c.i]. Furthermore, as explained earlier with respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “second lead comprising a second pad” of element [1.d.i].

161. In *Markel*, the first electrode and second electrode are connected to the “cardiac information processing module 1050” through the “cardiac information acquisition module 1010” and a “memory 1040.” As illustrated in *Markel*’s Figure 10 (above), the “cardiac information acquisition module 1010 [] is coupled to the first and second electrodes 1020, 1022” (highlighted above in yellow and blue) and “utilizes the first and second electrodes 1020, 1022 to detect and acquire various cardiac (i.e., heart related) signals from a user” (Ex-1005, [0058], [0059]). *Markel* teaches that “[t]he cardiac information acquisition module 1010 may then, for example, store acquired cardiac information in a memory 1040” (Ex-1005, [0059]). According to Figure 10 (above), the processing module is, in turn, coupled to the memory.

162. Thus, *Markel* renders obvious claim element [1.e].

Claim 2, Element [2.pre]: The electronic device of claim 1,

163. *Markel* renders obvious claim element [2.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

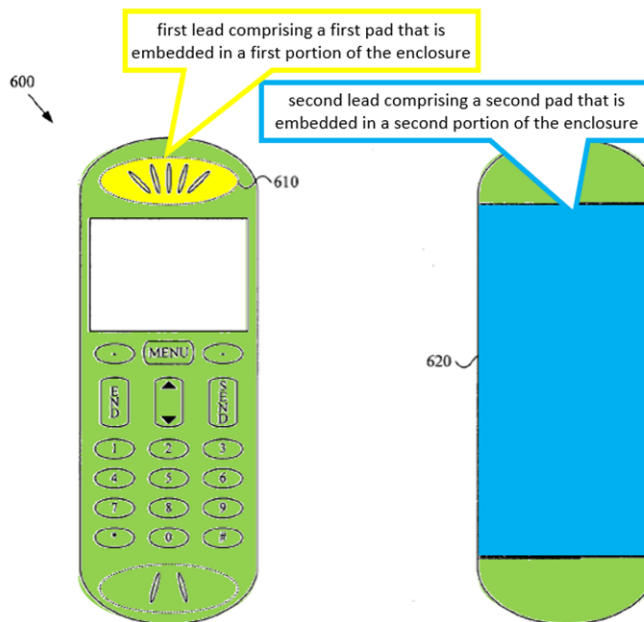
164. Thus, *Markel* renders obvious claim element [2.pre].

Claim 2, Element [2.a]: wherein the first portion and the second portion are located on opposite sides of the electronic device.

165. *Markel* renders obvious claim element [2.a]. Specifically, *Markel* renders obvious wherein the first portion and second portion are located on opposite

sides of the electronic device. This is illustrated in at least *Markel's* Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)

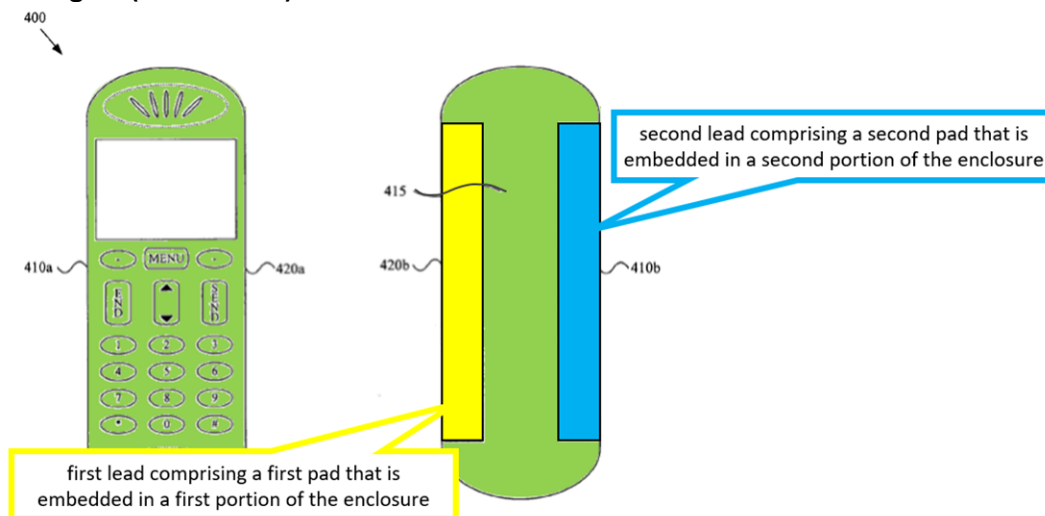


166. As explained above with respect to claim 1, Figure 6 of Markel discloses and “audio output portion 610,” which corresponds to the “first portion of the enclosure,” and a “main body portion 620,” which corresponds to the claimed “second portion of the enclosure” (Ex-1005, [0050]). The “audio output portion 610” and the “main body portion 620” are on opposite sides of the electronic device.

167. Furthermore, *Markel* also discloses the Figure 4 configuration wherein “[the] first electrode may, for example, be placed on the left side portion 410 (e.g., placed on or molded into region 410*b*), and [the] second electrode may, for example, be placed on the right side portion 420 (e.g., placed on or molded into region 420*b*)”

(Ex-1005, [0045]). The “right side portion 420,” which corresponds to the claimed “first portion,” and the “left side portion 410,” which corresponds to the claimed “second portion,” are on opposite sides of the electronic device. This is illustrated in at least *Markel*’s Figure 4 (annotated below).

Ex-1005, Fig. 4 (annotated)



168. Markel further teaches:

[O]ne 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 [electronic device]. Such normal use may, for example, comprise talking on a telephone, reading messages, perusing a phone book, typing a message, initiating a phone call, sending an email message, entering information in a notepad, etc.

(Ex-1005, [0041].) Markel further teaches: “[O]ne or more electrodes may be placed on side or rear portions of the main body portion 100. Such placement may, for example, provide for electrode contact with a user’s hand during use of the [electronic device]” (Ex-1005, [0043] (emphasis added)). A person of ordinary skill

in the art would have a reasonable expectation of success in combining the electrode placement of Figure 4 with the electrode structure described above with respect to Claim 1 because Markel discloses that “electrodes may be *incorporated into the [electronic device] in any of a variety of manners*” and “in any of a *variety of locations*” (Ex-1005, [0035], [0045] (emphasis added)). A person of ordinary skill in the art would have been motivated to implement the electrode placement of Figure 4 because it would have allowed a user to view the display while contacting the electronic device with their left and right hands, allowing the user to observe a real-time ECG measurement.

169. Thus, *Markel* renders obvious claim element [2.a].

Claim 3, Element [3.pre]: The electronic device of claim 1,

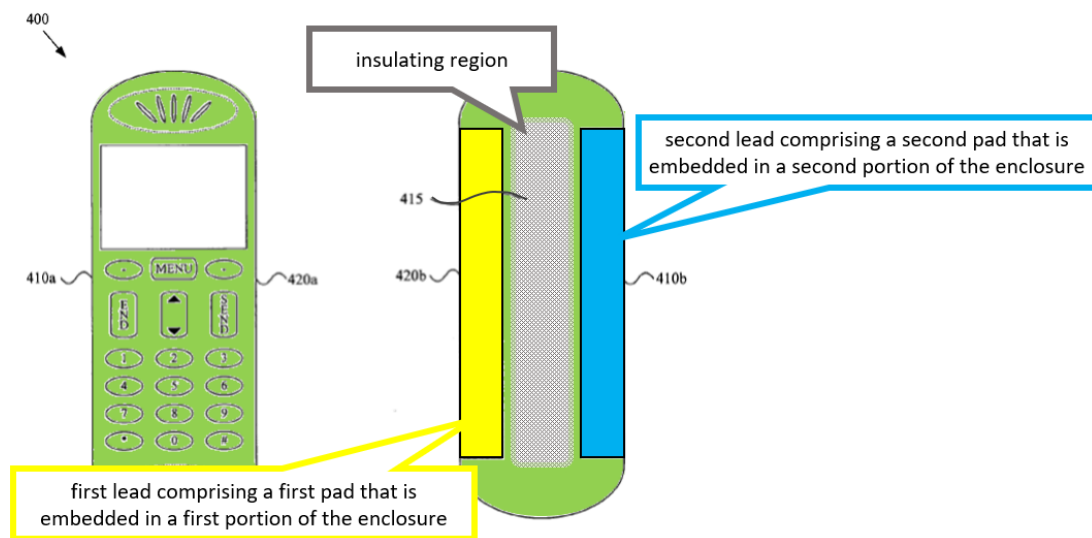
170. *Markel* renders obvious claim element [3.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

171. Thus, *Markel* renders obvious claim element [3.pre].

Claim 3, Element [3.a]: wherein the first portion is electrically isolated from the second portion.

172. *Markel* renders obvious claim element [3.a]. Specifically, *Markel* renders obvious wherein the first portion is electrically isolated from the second portion. This is illustrated in at least *Markel*’s Figure 4 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 4 (annotated)



173. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have understood that the “second electrode” in *Markel*’s Figure 4 is embedded in the “right side portion 420” of the electronic device. The “right side portion 420” corresponds to the claimed “first portion of the enclosure.” As explained earlier with respect to claim element [1.d.i] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have understood that the “first electrode” in *Markel*’s Figure 4 is embedded in the “left side portion 410” of the electronic device. The “left side portion 410” corresponds to the claimed “second portion of the enclosure.”

174. *Markel* further teaches that its electrodes should be electrically isolated. Specifically, *Markel* teaches that an “*insulating region 415* may *separate* regions

410*b* and 420*b*” of the electronic device “where regions 410*b* and 420*b* include conductive plastic” (Ex-1005, [0045] (emphasis added)). The “insulating region 415” electrically isolates “regions 410*b* and 420*b*” (Ex-1005, [0045]).

175. Based on this disclosure, a person of ordinary skill in the art would have also known that *Markel*’s Figure 6 embodiment should similarly include an “insulating region” to electrically isolate the “audio output portion 610” from the “main body portion 620.” As explained in Section VI.B (the discussion of which is incorporated herein), a person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart based on an electrical potential difference. A person of ordinary skill in the art would also have known that in order to measure the potential difference, *Markel*’s electrodes would be electrically isolated as taught in *Markel*’s Figure 4.

176. Thus, *Markel* renders obvious claim element [3.a].

Claim 4, Element [4.pre]: The electronic device of claim 1,

177. *Markel* renders obvious claim element [4.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

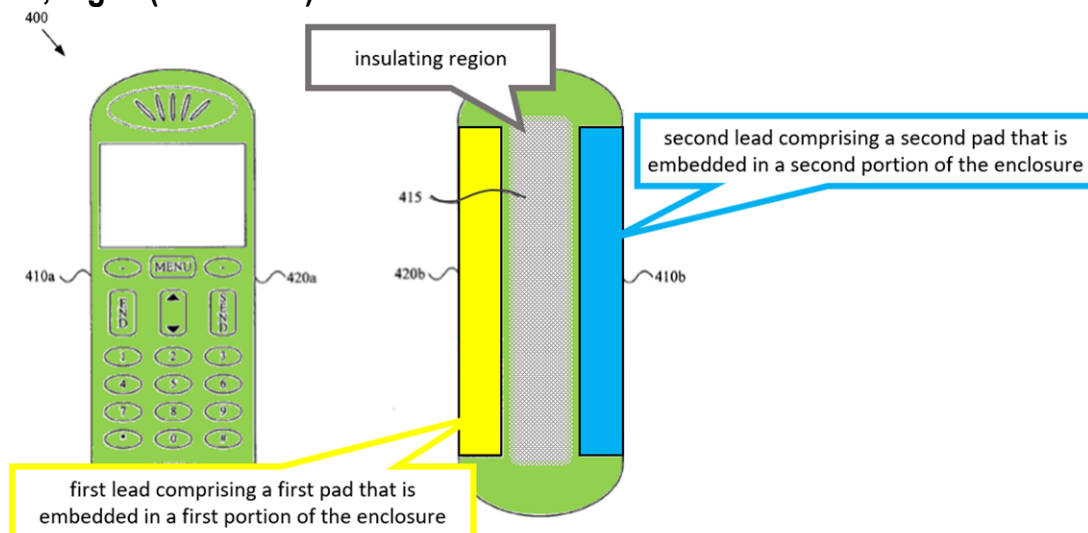
178. Thus, *Markel* renders obvious claim element [4.pre].

Claim 4, Element [4.a]: wherein the first portion is separated from the second portion by a third portion of the enclosure;

179. *Markel* renders obvious claim element [4.a]. Specifically, *Markel*

renders obvious wherein the first portion is separated from the second portion by a third portion of the enclosure. This is illustrated in at least *Markel's* Figure 4 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 4 (annotated)



180. As explained earlier with respect to claim elements [1.c.i]–[1.c.iii] (the discussion of which is incorporated herein), *Markel* discloses a first pad embedded in the electronic device’s “audio output portion” (i.e., the first portion of the enclosure) and 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 “audio output portion.” Furthermore, as explained earlier with respect to claim elements [1.d.i]–[1.d.ii] (the discussion of which is incorporated herein), *Markel* discloses a second pad embedded in a “main body portion” (i.e., the second portion of the enclosure) and configured to detect the user’s cardiac signal via the user’s contact with at least one

of the second pad and the “main body portion.” As also explained earlier with respect to claim 3 (the discussion of which is incorporated herein), a person of ordinary skill in the art would have known to use an “insulating region” to electrically isolate the “audio output portion 610” from the “main body portion 620” because electrodes must be electrically isolated from one another in order to enable the measurement of the potential difference between the “first electrode” and the “second electrode.” The “insulating region” corresponds to the claimed “third portion of the enclosure.”

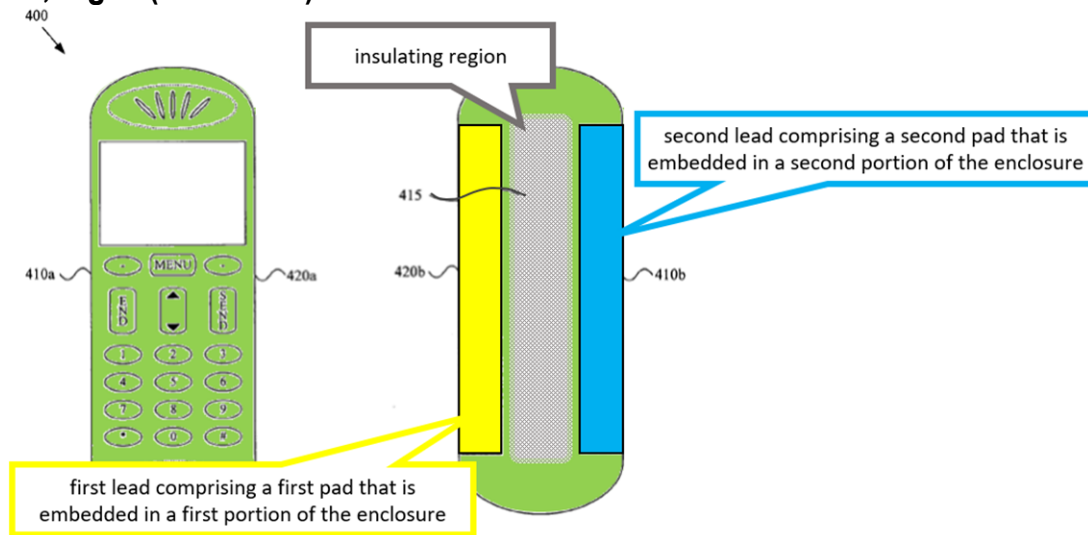
181. Thus, *Markel* renders obvious claim element [4.a].

Claim 4, Element [4.b]: at least the third portion is constructed from a material having a first conductivity; and

Claim 4, Element [4.c]: the first conductivity is insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion.

182. *Markel* renders obvious claim elements [4.b] and [4.c]. Specifically, *Markel* renders obvious that the third portion is constructed from a material having a first conductivity; and the first conductivity is insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion. This is illustrated in at least *Markel*’s Figure 4 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 4 (annotated)



183. As explained earlier with respect to claim element [4.a], *Markel*'s "isolating region" corresponds to the claimed "third portion of the enclosure." Moreover, a person of ordinary skill in the art would have known that one of the simplest ways to implement an "insulating region" would be to use a material having relatively less conductivity (i.e., a conductivity insufficient to transmit an electrical signal).

184. Thus, *Markel* renders obvious claim elements [4.b] and [4.c].

Claim 5, Element [5.pre]: The electronic device of claim 4, wherein:

185. *Markel* renders obvious claim element [5.pre]. Specifically, *Markel* renders obvious the electronic device of claim 4. I incorporate herein my earlier discussion of claim 4.

186. Thus, *Markel* renders obvious claim element [5.pre].

Claim 5, Element [5.a]: the material having the first conductivity comprises one of aluminum or steel; and

187. *Markel* renders obvious claim element [5.a]. Specifically, *Markel* renders obvious a third portion of the enclosure constructed from a material having the first conductivity comprising one of aluminum or steel.

188. As explained earlier with respect to claim 4 (the discussion of which is incorporated herein), *Markel* discloses an “insulating region,” which corresponds to the claimed “third portion” of claim 4. As also explained earlier, a person of ordinary skill in the art would have known that one of the simplest ways to implement an “insulating region” would be to use a material having relatively less conductivity (i.e., a conductivity insufficient to transmit an electrical signal).

189. A person of ordinary skill in the art would further have known that aluminum and steel were used in the construction of mobile devices and were examples of materials having relatively less conductivity (*see, e.g.*, Ex-1017 (“Hobson”), 6:55–60 (“Housing 12 or portions of housing 12 may also be formed from conductive materials such as metal. An illustrative housing material that may be used is anodized aluminum. *Aluminum* is relatively light in weight and, when anodized, has an attractive *insulating* and scratch-resistant surface. If desired, other metals can be used for the housing of device 10, such as *stainless steel . . .*” (emphasis added))). A person of ordinary skill in the art would also have known that stainless steel and aluminum have relatively lower conductivity than silver base

compounds (*see* claim element [5.b] below).

190. Thus, *Markel* renders obvious claim element [5.a].

Claim 5, Element [5.b]: the second pad is constructed from a silver base compound.

191. *Markel* renders obvious claim element [5.b]. Specifically, *Markel* renders obvious that the second pad is constructed from a silver base compound.

192. As explained earlier with respect to claim element [1.d.ii] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” comprising a second pad, which corresponds to the claimed “second pad” of claim 1. As I explained earlier in Section VI.C, a person of ordinary skill in the art would have known electrodes “generally [comprise] pads containing conductive material, such as VI.C chloride” (Ex-1011 1:30–31). Further, electrodes “are preferably silver or silver chloride although conductive plastic and other metals are also suitable . . .” (Ex-1012 3:34–38). Consequently, a person of ordinary skill in the art would have at once envisaged that the second pad would have been comprised of a silver base compound.

193. Thus, *Markel* renders obvious claim element [5.b].

Claim 6, Element [6.pre]: The electronic device of claim 4, wherein:

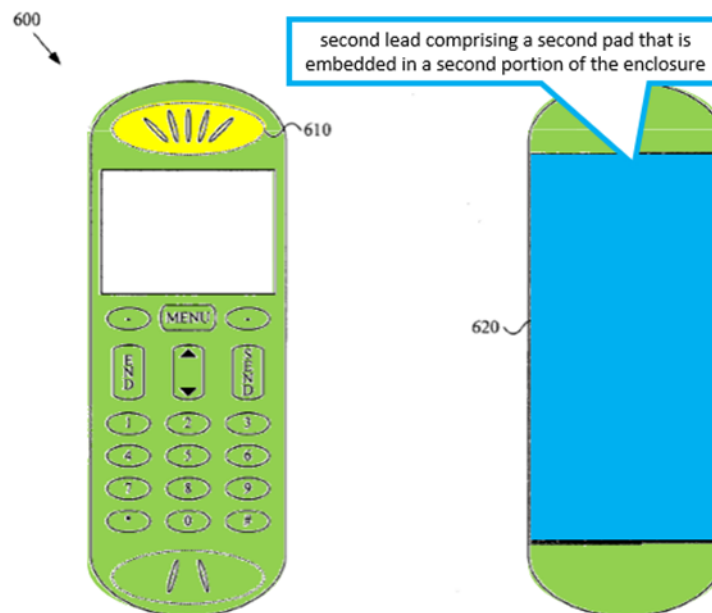
194. *Markel* renders obvious claim element [6.pre]. Specifically, *Markel* renders obvious the electronic device of claim 4. I incorporate herein my earlier discussion of claim 4.

195. Thus, *Markel* renders obvious claim element [6.pre].

Claim 6, Element [6.a]: the exterior surface of the enclosure further comprises an exterior surface of the second portion;

196. *Markel* renders obvious claim element [6.a]. Specifically, *Markel* renders obvious an exterior surface further comprising an exterior surface of the second portion. This is illustrated in at least *Markel*'s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



197. *Markel* renders obvious that an exterior portion of the enclosure comprises an exterior surface of the second portion. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. Furthermore, as explained earlier with

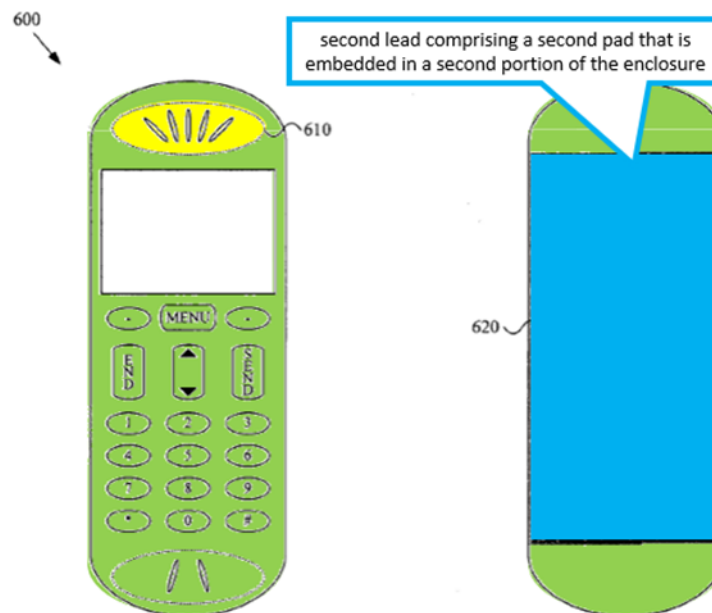
respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “second lead” of element [1.d.i]. As also explained earlier with respect to claim element [1.d.i], a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” comprises a second pad that is embedded in the “main body portion 620” (i.e., a second portion of the enclosure). Thus, a person of ordinary skill in the art would have understood that the exterior surface of the “main body portion 620” corresponds to the claimed “exterior surface of the second portion” of claim element [6.a].

198. Thus, *Markel* renders obvious claim element [6.a].

Claim 6, Element [6.b]: the second pad is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the exterior surface of the second portion;

199. *Markel* renders obvious claim element [6.b]. Specifically, *Markel* renders obvious that the second pad is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the exterior surface of the second portion. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



200. For example, *Markel* teaches that “an electrode (or all electrodes) . . . may be ***substantially concealed (or hidden) from a user*** . . . with ***little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). As explained earlier with respect to claim element [1.d.i] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” comprises a second pad that is embedded in the “main body portion 620” (i.e., a second portion of the enclosure). When “integrated into various molded components of the mobile communication device,” this “electrode may be formed from ***conductive plastic*** (or another material)” (Ex-1005, [0037] (emphasis added)). From this, a person of ordinary skill in the art would have been

motivated to place the pad of the “first electrode” *underneath* the conductive plastic of the “main body portion 620.” This would have “substantially concealed (or hidden)” the pad of the electrode from the user, which would have been desirable to increase aesthetics of the device while protecting the electrode.

201. *Markel* further teaches that an electrode’s pad need not be in direct contact with a user and may be “adapted to detect cardiac activity of a user that is **conductively coupled** to the electrodes (e.g., by touching the electrodes)” (Ex-1005, [0035]). Specifically, a person of ordinary skill in the art would recognize that the pad of an electrode can be conductively coupled to a user through an intermediate conductive material. Indeed, as discussed earlier, *Markel* further teaches that “a conductive plastic (or another material) [] 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” (Ex-1005, [0037] (emphasis added)). This is in contrast to *Markel*’s disclosure that “an electrode may comprise a metallic surface **exposed** for user contact” (Ex-1005, [0037] (emphasis added)).

202. Moreover, a person of ordinary skill in the art would have had a reasonable expectation of success in placing the pad of the electrode underneath and detecting the user’s cardiac signal via the conductive plastic of the “main body portion” because *Markel* discloses that (1) “electrodes may be **incorporated into the**

[electronic device] in any of a variety of manners” and “in any of a *variety of locations*” (Ex-1005, [0035], [0045] (emphasis added)), and (2) electrodes “may, for example, be adapted to detect cardiac activity of a user that is *conductively coupled* to the electrodes” and “various conductive plastics . . . may provide *sufficient conductivity* for an electrode to perform adequately” (Ex-1005, [0037] (emphasis added)).

203. Accordingly, the second pad is configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the electronic device’s “main body portion 620*b*” (i.e., the second portion of the enclosure).

204. Thus, *Markel* renders obvious claim element [6.b].

Claim 6, Element [6.c]: the second pad is positioned from the exterior surface of the second portion by a thickness of the second portion;

205. *Markel* renders obvious claim element [6.c]. Specifically, *Markel* renders obvious that the second pad is positioned from the exterior surface of the second portion by a thickness of the second portion.

206. As explained with respect to claim element [6.b], a person of ordinary skill in the art would have been motivated to place the pad of the electrode *underneath* the conductive plastic of the “main body portion 620” positioned from the exterior surface of the “main body portion 620” by a thickness of the “main body

portion 620” so that the electrode pad is conductively coupled to the user via the conductive plastic of the “main body portion 620.”

207. Thus, *Markel* renders obvious claim element [6.c].

Claim 6, Element [6.d]: at least the thickness of the second portion is constructed from material having a second conductivity; and

Claim 6, Element [6.e]: the second conductivity is defined such that the second electrical signal is not able to be transmitted through material having the second conductivity over a distance larger than the thickness of the second portion.

208. *Markel* renders obvious claim elements [6.d] and [6.e]. Specifically, *Markel* renders obvious that at least the thickness of the second portion is constructed from material having a second conductivity, and the second conductivity is defined such that the second electrical signal is not able to be transmitted through material having the second conductivity over a distance larger than the thickness of the second portion.

209. *Markel* teaches that “various conductive plastics (e.g., graphite-impregnated plastic or the like) may provide ***sufficient conductivity*** for an electrode to perform adequately” (Ex-1005, [0037] (emphasis added)). But as explained earlier with respect to claim element [3.a] (the discussion of which is incorporated herein), *Markel* also renders obvious an “insulating region” to electrically isolate the “audio output portion 610” from the “main body portion 620.”

210. As explained in Section VI.B (the discussion of which is incorporated

herein), a person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart based on an electrical potential difference. A person of ordinary skill in the art would also have known that in order to measure the potential difference, *Markel's* electrodes should be electrically isolated as taught in *Markel's* Figure 4. Consequently, a person of ordinary skill in the art would have been motivated to construct the thickness of the “main body portion 620” from a material with a conductivity sufficient to transmit a signal over a distance of the thickness of the second portion to the second pad but insufficient to transmit the second electrical signal a distance larger than the thickness of the second portion.

211. Thus, *Markel* renders obvious claim elements [6.d] and [6.e].

Claim 7, Element [7.pre]: The electronic device of claim 6,

212. *Markel* renders obvious claim element [7.pre]. Specifically, *Markel* renders obvious the electronic device of claim 6. I incorporate herein my earlier discussion of claim 6.

213. Thus, *Markel* renders obvious claim element [7.pre].

Claim 7, Element [7.a]: wherein the first pad and the second pad are positioned apart from one another at a distance larger than the thickness of the second portion by material having the second conductivity.

214. *Markel* renders obvious claim element [7.a]. Specifically, *Markel* renders obvious wherein the first pad and the second pad are positioned apart from

one another at a distance larger than the thickness of the second portion by material having the second conductivity. I incorporate herein my earlier discussion of claim 6.

215. As explained earlier with respect to claim element [1.c.i], *Markel* discloses a “second electrode” comprising a first pad. Furthermore, as explained earlier with respect to claim element [1.d.i], *Markel* discloses a “first electrode” comprising a second pad.

216. The language of claim element [6.c] defines “the second conductivity” as being “such that the second electrical signal is not able to be transmitted through material having the second conductivity over a distance larger than the thickness of the second portion.” Thus, the plain and ordinary meaning of claim element [7.a] requires positioning “the first pad and the second pad . . . at a distance larger than” the distance that the second electrical signal can be transmitted. Therefore, the plain and ordinary meaning of claim element [7.a] requires positioning “the first pad and the second pad . . . at a distance” that creates electrical isolation.

217. As explained in Section VI.B (the discussion of which is incorporated herein), a person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart based on an electrical potential difference. A person of ordinary skill in the art would also have known that in order to measure the potential difference, *Markel*’s electrodes should be electrically

isolated as taught in *Markel*'s Figure 4. Consequently, a person of ordinary skill in the art would have been motivated to position *Markel*'s "second electrode" and "first electrode" apart from one another at a distance larger than the thickness of the second portion by material having the second conductivity.

218. Thus, *Markel* renders obvious claim element [7.a].

Claim 8, Element [8.pre]: The electronic device of claim 1, wherein:

219. *Markel* renders obvious claim element [8.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

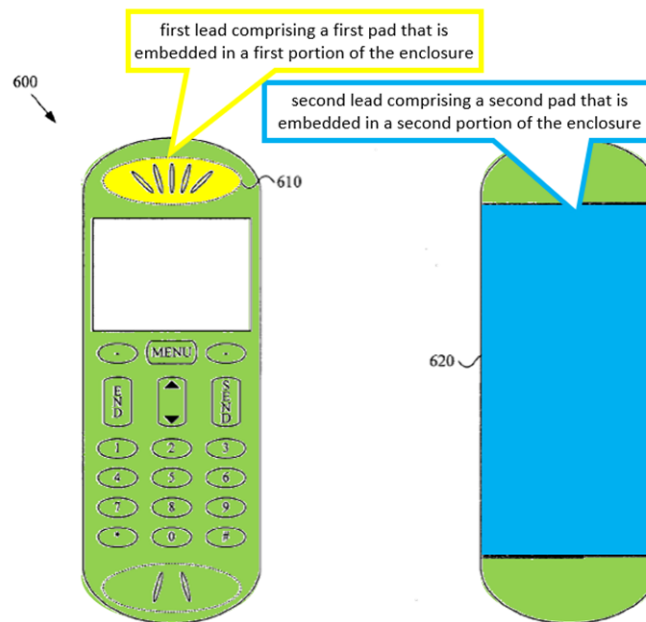
220. Thus, *Markel* discloses claim element [8.pre].

Claim 8, Element [8.a]: the enclosure further comprises at least one pocket underneath the exterior surface of the enclosure; and

Claim 8, Element [8.b]: at least one of the first pad and the second pad is placed within the at least one pocket.

221. *Markel* renders obvious claim elements [8.a] and [8.b]. Specifically, *Markel* renders obvious that the enclosure further comprises at least one pocket underneath the exterior surface of the enclosure; and at least one of the first pad and the second pad is placed within the at least one pocket. This is illustrated in at least *Markel*'s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



222. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. Furthermore, as explained earlier with respect to claim element [1.c.i], a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” comprises a first pad that is embedded in the “audio output portion 610” (i.e., a first portion of the enclosure). Furthermore, as explained earlier with respect to claim element [1.c.ii], *Markel* discloses an exterior surface of the “audio output portion 610,” which corresponds to the claimed “exterior surface of the first portion” of the enclosure.

223. *Markel* further renders obvious a pocket underneath the exterior surface

of the enclosure. *Markel* further teaches that “an electrode (or all electrodes) . . . may be *substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). A person of ordinary skill in the art would have understood that in order to place a pad under “audio output portion 610,” the electronic device would require a pocket underneath the exterior surface of the enclosure. That would allow for placement of the first pad of *Markel*’s “second electrode” within the pocket such that the “first pad” is “conductively coupled” to the user through the exterior surface of the “audio output portion” (see Ex-1005, [0035]). The pocket under “audio output portion 610” corresponds to the “at least one pocket underneath the exterior surface of the enclosure” of elements [8.a] and [8.b].

224. Thus, *Markel* renders obvious claim elements [8.a] and [8.b].

Claim 9, Element [9.pre]: The electronic device of claim 1, further comprising:

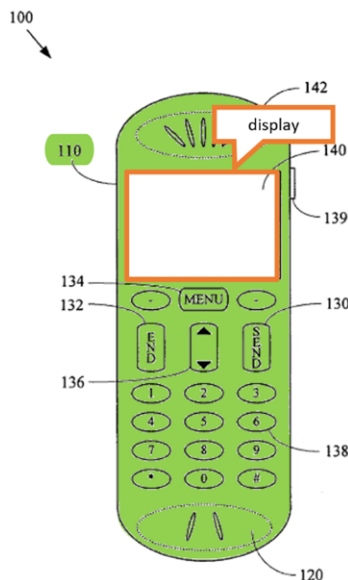
225. *Markel* renders obvious claim element [9.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

226. Thus, *Markel* renders obvious the claim element [9.pre].

Claim 9, Element [9.a]: a display, wherein the enclosure supports the display, and wherein at least a portion of the exterior surface of the enclosure forms at least a portion of an exterior surface of the electronic device behind the display;

227. *Markel* renders obvious claim element [9.a]. Specifically, *Markel* renders obvious a display, wherein the enclosure supports the display, and wherein at least a portion of the exterior surface of the enclosure forms at least a portion of an exterior surface of the electronic device behind the display. This is illustrated in at least *Markel*'s Figure 1 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 1 (annotated)



228. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element

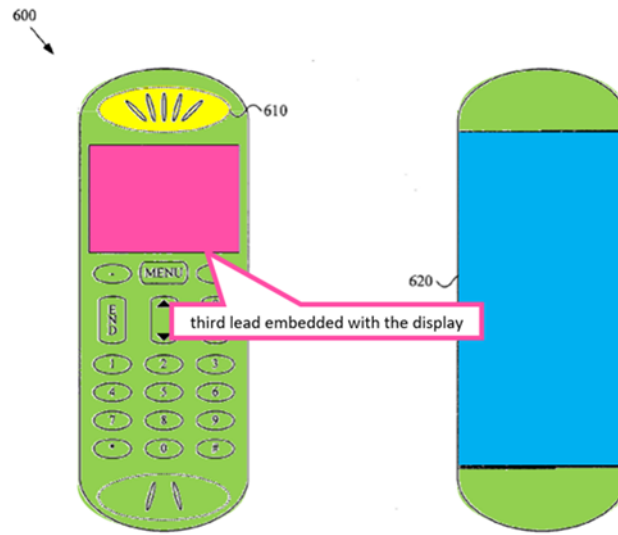
[1.a]. Markel discloses that the electronic device “may also comprise various user output features, for example, a *display 140 (which may also function as a touch screen input feature)* and a speaker 142” (Ex-1005, [0034] (emphasis added)). Figure 1 of *Markel* discloses a “display 140” (orange, above) wherein the “main body portion 110” (green, above) supports the “display 140,” and wherein at least a portion of the exterior surface of the electronic device is behind the “display 140.”

229. Thus, *Markel* renders obvious claim element [9.a].

Claim 9, Element [9.b]: a third lead embedded with the display, wherein the third lead is configured to detect a third electrical signal of the user’s cardiac signal via the user’s contact with at least one of the third lead and the display.

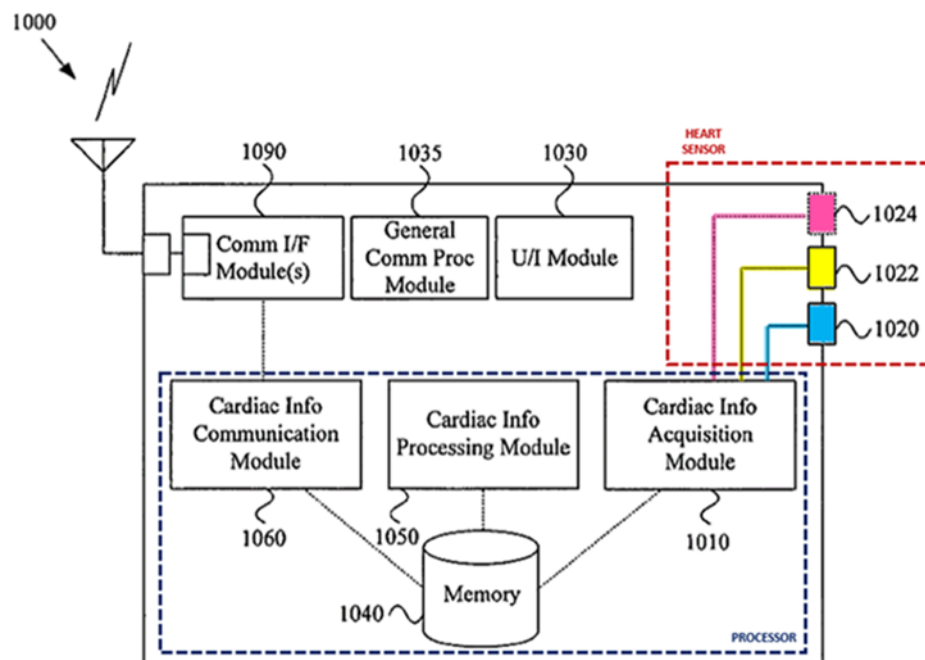
230. *Markel* renders obvious claim element [9.b]. Specifically, *Markel* renders obvious a third lead embedded with the display, wherein the third lead is configured to detect a third electrical signal of the user’s cardiac signal via the user’s contact with at least one of the third lead and the display. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



231. First, *Markel* renders obvious a third lead. As explained earlier with respect to claim element [1.b] (the discussion of which is incorporated herein), *Markel* discloses components that correspond to the claimed “a heart sensor configured to detect the user’s cardiac signal” of element [1.b]. These components are illustrated in at least *Markel*’s Figure 10 (annotated below):

Ex-1005, Fig. 10 (annotated)



232. One of those components is a “third or Nth electrode 1024” and associated wiring (annotated above in pink), which correspond to the claimed “third lead” of element [9.b]. For example, *Markel* discloses that “mobile communication device 1000” includes “a first electrode 1020 and a second electrode 1022 (and, for example, a **third or Nth electrode 1024**)” (Ex-1005, [0058] (emphasis added)). *Markel* further discloses that “[t]hough the [] exemplary illustrations generally discuss one or two electrodes, it should be recognized that more than two electrodes might also be utilized” (Ex-1005, [0051]). *Markel* also discloses that the third electrode is “coupled” to the cardiac information acquisition module (Ex-1005, [0059]). From this, a person of ordinary skill in the art would have understood that *Markel*’s “third or Nth electrode” and associated wiring is a “third lead.”

233. Second, *Markel* renders obvious that the third lead is embedded in the display. As explained earlier with respect to claim element [9.a], *Markel* discloses “a display 140 (***which may also function as a touch screen input feature***),” which corresponds to the claimed “display” of element [9.a]. *Markel* further discloses that “an electrode may be disposed on ***a video display device 140*** (e.g., a border of the display or ***integrated into a touch screen***).” (Ex-1005, [0044] (emphasis added)). A person of ordinary skill in the art would have known that an electrode pad that is “integrated into a touch screen” is *embedded* in “display 140.” From this, a person of ordinary skill in the art would have understood that *Markel*’s “third or Nth electrode” may be embedded with the “display 140.”

234. Third, *Markel* renders obvious that the third lead is configured to detect a third electrical signal of the user’s cardiac signal via the user’s contact with at least one of the third lead and the display. *Markel* discloses that “electrodes may, for example, be adapted to ***detect cardiac activity of a user*** that is ***conductively coupled to the electrodes (e.g., by touching the electrodes)***” (Ex-1005, [0035] (emphasis added)). *Markel* also discloses that “electrodes contact a user during normal (or typical) use of the [electronic device]. Such normal use may, for example, comprise talking on a telephone, reading messages, perusing a phone book, typing a message, initiating a phone call, sending an email message, entering information in a notepad, etc.” (Ex-1005, [0041]). Consequently, *Markel* discloses that a user may contact the

“third or Nth electrode” during normal use of the “display 140 (which may also function as a touch screen input feature).”

235. Thus, *Markel* renders obvious claim element [9.b].

Claim 10, Element [10.pre]: The electronic device of claim 1,

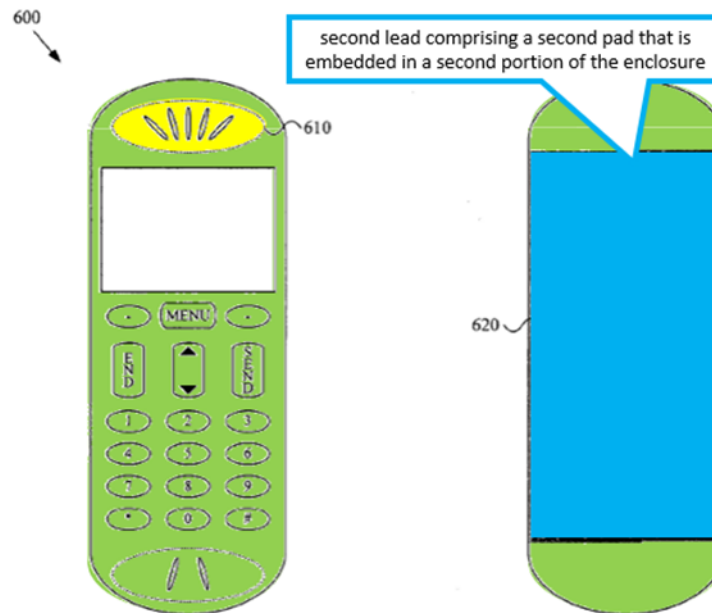
236. *Markel* renders obvious claim element [10.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

237. Thus, *Markel* renders obvious claim element [10.pre].

Claim 10, Element [10.a]: wherein the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the second portion of the enclosure.

238. *Markel* renders obvious claim element [10.a]. Specifically, *Markel* renders obvious wherein a lead is configured to detect the electrical signal of the user’s cardiac signal via the user’s contact with a portion of the enclosure. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



239. This claim is substantially similar to claim element [6.b]. I incorporate herein my earlier discussion of claim 1 and claim elements [6.a] and [6.b].

240. Thus, *Markel* renders obvious claim element [10.a].

Claim 11, Element [11.pre]: The electronic device of claim 1,

241. *Markel* renders obvious claim element [11.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

242. Thus, *Markel* renders obvious claim element [11.pre].

Claim 11, Element [11.a]: wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second lead.

243. *Markel* renders obvious claim element [11.a]. Specifically, *Markel* renders obvious wherein the second lead is configured to detect the second electrical

signal of the user's cardiac signal via the user's contact with the second lead.

244. As explained with respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “second lead comprising a second pad” of element [1.d.i]. Furthermore, as explained with respect to claim element [1.d.ii] (the discussion of which is incorporated herein), *Markel* discloses that the second pad may be configured to detect the user's cardiac signal via direct contact with the user's skin. Consequently, the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second lead.

245. Thus, *Markel* renders obvious claim element [11.a].

Claim 12, Element [12.pre]: The electronic device of claim 1,

246. *Markel* renders obvious claim element [12.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

247. Thus, *Markel* renders obvious claim element [12.pre].

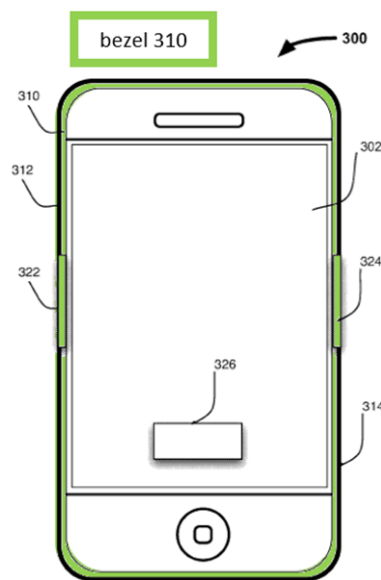
Claim 12, Element [12.a]: wherein the first portion of the enclosure is a bezel.

248. *Markel* renders obvious claim element [12.a]. Specifically, *Markel* renders obvious wherein the first portion of the enclosure is a bezel.

249. In the context of the '257 patent and the claim language, a person of

ordinary skill in the art would have understood the plain and ordinary meaning of “bezel” to include a rim that encircles an electronic device. For example, the ’257 patent’s Figure 3 discloses an “[e]lectronic device 300 [that] can include display 302 and bezel 310” (shown below). I apply this plain and ordinary meaning of “bezel” in my analysis below.

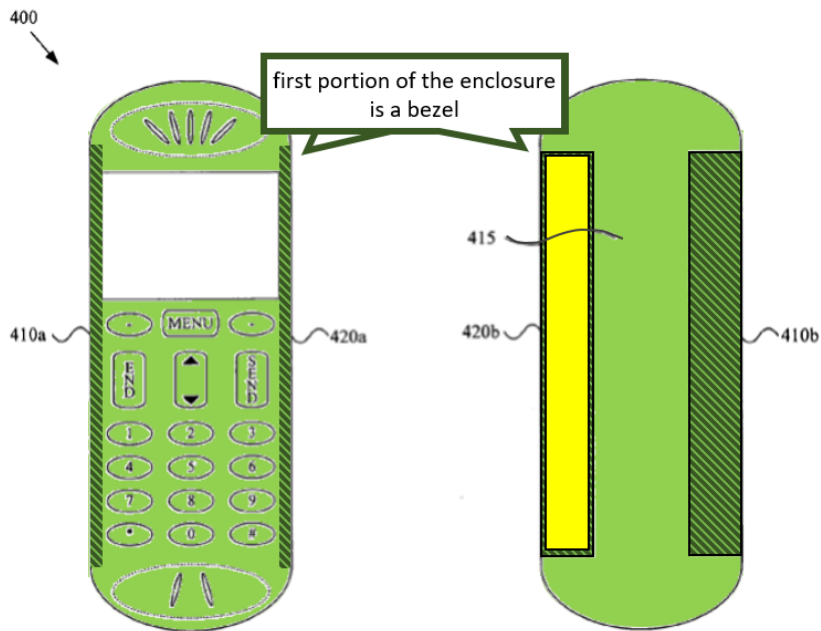
Ex-1001, Fig. 3 (annotated)



250. Based on this plain and ordinary meaning, *Markel* renders obvious wherein the first portion of the enclosure is a bezel. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), *Markel* discloses a “second electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “first lead” of element [1.c.i]. That first lead comprises a first pad that is embedded in a first portion of the enclosure.

251. As explained earlier with respect to claim element [1.c.i], a person of ordinary skill in the art would have understood that the “second electrode” in *Markel*’s Figure 4 is embedded in the “right side portion 420” of the electronic device. The “right side portion 420” corresponds to the claimed “first portion of the enclosure.” According to Figure 4 of *Markel*, the “side portions” (dark green, below) wrap around the front and back of the device, like a bezel. Both the front and back view of *Markel*’s electronic device have labels corresponding to the “right side portion 420” (Ex-1005, Fig. 4). As illustrated below, furthermore, the second electrode extends to the rim that encircles *Markel*’s electronic device. *Markel* also discloses that an electrode may be disposed in “a **border** of the display” (Ex-1005, [0044] (emphasis added)). From this, a person of ordinary skill in the art would have understood that the first pad of *Markel*’s “second electrode” is embedded in 420*b* (i.e., the “first portion of the enclosure”) which includes the “bezel.”

Ex-1005, Fig. 4 (annotated)



252. To the extent that *Markel*'s Figure 4 is not found to disclose that the "first portion of the enclosure" includes the "bezel," this would have been a trivial modification that would have been well-within the general knowledge of a person of ordinary skill in the art. *Markel* discloses "a display 140 (which may also function as a touch screen input feature)" and that "an electrode may be disposed on a video display device 140 (e.g., a ***border of the display*** or integrated into a touch screen)" (Ex-1005, [0044] (emphasis added)). A person of ordinary skill in the art would have been motivated to extend the edges of *Markel*'s "second electrode" in 420b so that they reached the border of the "display 140" (i.e., bezel) because this would have created additional contact area. The additional contact area would have enhanced the ability of the "second electrode" to detect a signal from a user's hand and make it

more likely that a user would interact with the second electrode so as to have a successful test.

253. Thus, *Markel* renders obvious claim element [12.a].

Claim 13, Element [13.pre]: The electronic device of claim 1,

254. *Markel* renders obvious claim element [13.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

255. Thus, *Markel* renders obvious claim element [13.pre].

Claim 13, Element [13.a]: wherein the second portion of the enclosure is a bezel.

256. *Markel* renders obvious claim element [13.a]. Specifically, *Markel* renders obvious wherein the second portion of the enclosure is a bezel.

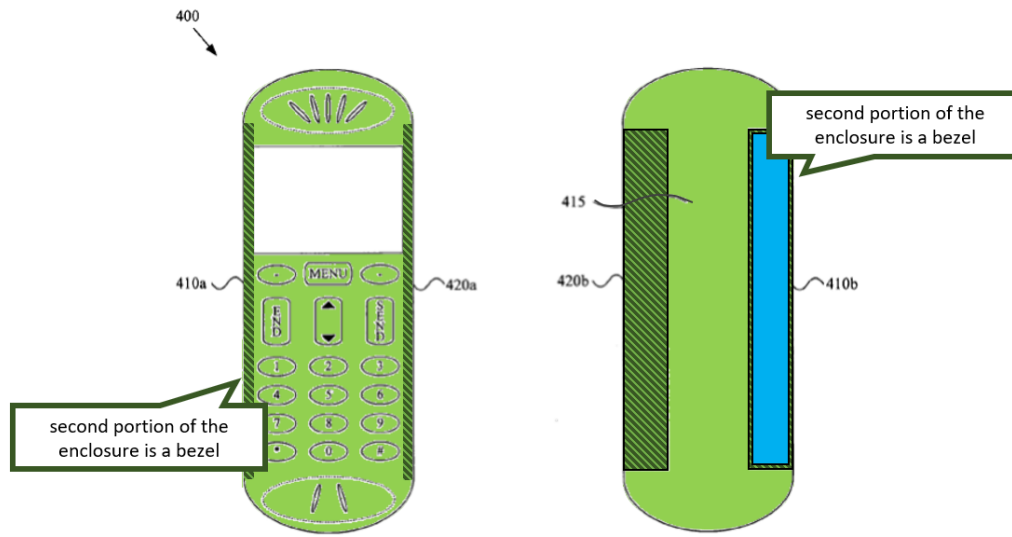
257. As explained earlier with respect to claim element [12.a] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “bezel” to include a rim that encircles an electronic device. I again apply this plain and ordinary meaning of “bezel” in my analysis below.

258. Based on this plain and ordinary meaning, *Markel* renders obvious wherein the second portion of the enclosure is a bezel. As explained earlier with respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which

corresponds to the claimed “second lead” of element [1.d.i]. That second lead comprises a second pad that is embedded in a second portion of the enclosure.

259. As explained earlier with respect to claim element [1.d.i], a person of ordinary skill in the art would have understood that the “first electrode” in *Markel*’s Figure 4 is embedded in the “left side portion 410” of the electronic device. The “left side portion 410” corresponds to the claimed “second portion of the enclosure.” According to Figure 4 of *Markel*, the “side portions” (dark green, below) wrap around the front and back of the device, like a bezel. Both the front and back view of *Markel*’s electronic device have labels corresponding to the “left side portion 410” (Ex-1005, Fig. 4). As illustrated below, furthermore, the first electrode extends to the rim that encircles *Markel*’s electronic device. *Markel* also discloses that an electrode may be disposed in “a **border** of the display” (Ex-1005, [0044] (emphasis added)). From this, a person of ordinary skill in the art would have understood that the second pad of *Markel*’s “first electrode” is embedded in 410*b* (i.e., the “second portion of the enclosure”) which includes the “bezel.”

Ex-1005, Fig. 4 (annotated)



260. To the extent that *Markel*’s Figure 4 is not found to disclose that the “second portion of the enclosure” includes the “bezel,” this would have been a trivial modification that would have been well-within the general knowledge of a person of ordinary skill in the art. *Markel* discloses “a display 140 (which may also function as a touch screen input feature)” and that “an electrode may be disposed on a video display device 140 (e.g., a ***border of the display*** or integrated into a touch screen)” (Ex-1005, [0044] (emphasis added)). A person of ordinary skill in the art would have been motivated to extend the edges of *Markel*’s “second electrode” in 420b so that they reached the border of the “display 140” (i.e., bezel) because this would have created additional contact area. The additional contact area would have enhanced the ability of the “first electrode” to detect a signal from a user’s hand and make it more likely that a user would interact with the second electrode so as to have a successful

test.

261. Thus, *Markel* renders obvious claim element [13.a].

Claim 14, Element [14.pre]: The electronic device of claim 1,

262. *Markel* renders obvious claim element [14.pre]. Specifically, *Markel* renders obvious the electronic device of claim 1. I incorporate herein my earlier discussion of claim 1.

263. Thus, *Markel* renders obvious claim element [14.pre].

Claim 14, Element [14.a]: wherein an interior surface of the enclosure comprises an interior surface of the first portion, wherein the first pad is positioned on the interior surface of the first portion.

264. *Markel* renders obvious claim element [14.a]. Specifically, *Markel* renders obvious the electronic device of claim 1, wherein an interior surface of the enclosure comprises an interior surface of the first portion, wherein the first pad is positioned on the interior surface of the first portion. I incorporate herein my earlier discussion of claim 1.

265. As explained earlier with respect to claim element [1.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element [1.a]. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” comprises a first pad that is embedded

in the “audio output portion 610” (i.e., a first portion of the enclosure). As explained earlier with respect to claim element [1.c.iii], a person of ordinary skill in the art would have been motivated to place the pad of the “second electrode” underneath the conductive plastic of the “audio output portion 610” so that the electrode pad is conductively coupled to the user via the conductive plastic of the “audio output portion 610.” Thus, in order to detect a user’s cardiac activity through a molded component of the electronic device, a person of ordinary skill in the art would have known to position the first pad of the “second electrode” inside the “main body portion” on an interior surface of the “audio output portion” so as to conductively couple the first pad, the “audio output portion,” and the user’s skin (*see* Ex-1005, [0035]).

266. Thus, *Markel* renders obvious claim element [14.a].

Claim 15, Element [15.pre]: An electronic device for detecting a user’s cardiac signal, comprising:

267. To the extent that it is found to be limiting, *Markel* renders obvious claim element [15.pre]. Specifically, *Markel* renders obvious an electronic device for detecting a user’s cardiac signal. I incorporate herein my earlier discussion of element [1.pre].

268. Thus, *Markel* renders obvious claim element [15.pre].

Claim 15, Element [15.a]: an enclosure;

269. *Markel* renders obvious claim element [15.a]. Specifically, *Markel*

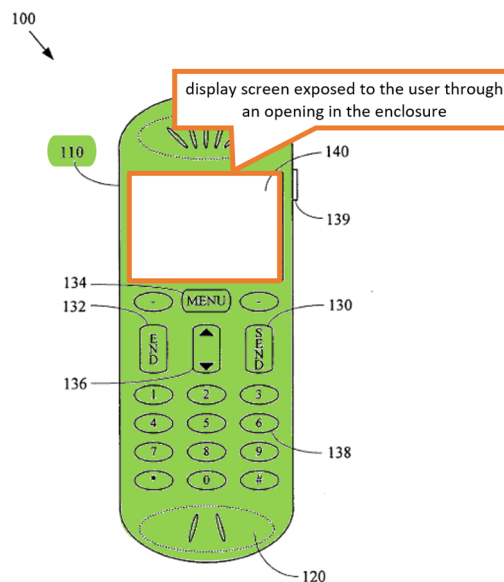
renders obvious an enclosure. I incorporate herein my earlier discussion of element [1.a].

270. Thus, *Markel* renders obvious claim element [15.a].

Claim 15, Element [15.b]: a display screen exposed to the user through an opening in the enclosure;

271. *Markel* renders obvious claim element [15.b]. Specifically, *Markel* renders obvious a display screen exposed to the user through an opening in the enclosure. This is illustrated in at least *Markel*'s Figure 1 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 1 (annotated)



272. As explained earlier with respect to claim element [15.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110” (annotated above in green), which corresponds to the claimed “enclosure” of element

[15.a]. *Markel* further discloses that the electronic device “may also comprise various user output features, for example, a ***display 140 (which may also function as a touch screen input feature)*** and a speaker 142” (Ex-1005, [0034] (emphasis added)). Figure 1 of *Markel* discloses a “display 140” (orange, above) exposed to the user through an opening in the enclosure (green, above).

273. Thus, *Markel* renders obvious claim element [15.b].

Claim 15, Element [15.c]: a heart sensor configured to detect the user’s cardiac signal,

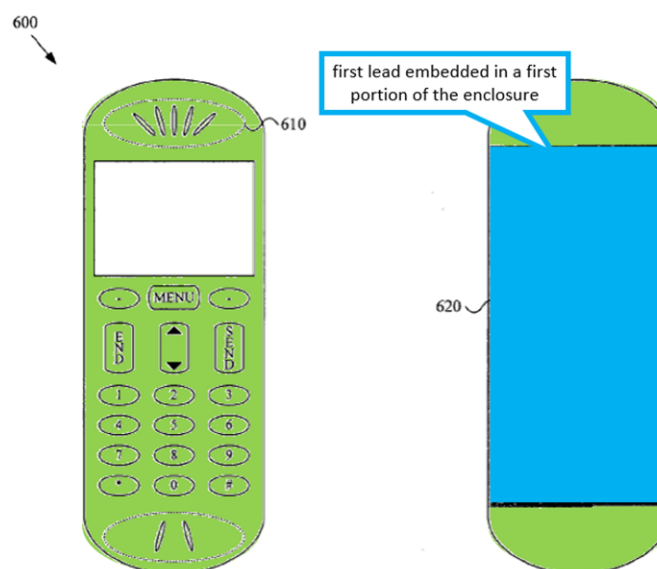
274. *Markel* renders obvious claim element [15.c]. Specifically, *Markel* renders obvious a heart sensor configured to detect the user’s cardiac signal. I incorporate herein my earlier discussion of element [1.b].

275. Thus, *Markel* renders obvious claim element [15.c].

Claim 15, Element [15.d.i]: the heart sensor comprising: a first lead embedded in a first portion of the enclosure of the electronic device,

276. *Markel* renders obvious claim element [15.d.i]. Specifically, *Markel* renders obvious a heart sensor comprising a first lead embedded in a first portion of the enclosure of the electronic device. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

1005, Fig. 6 (annotated)

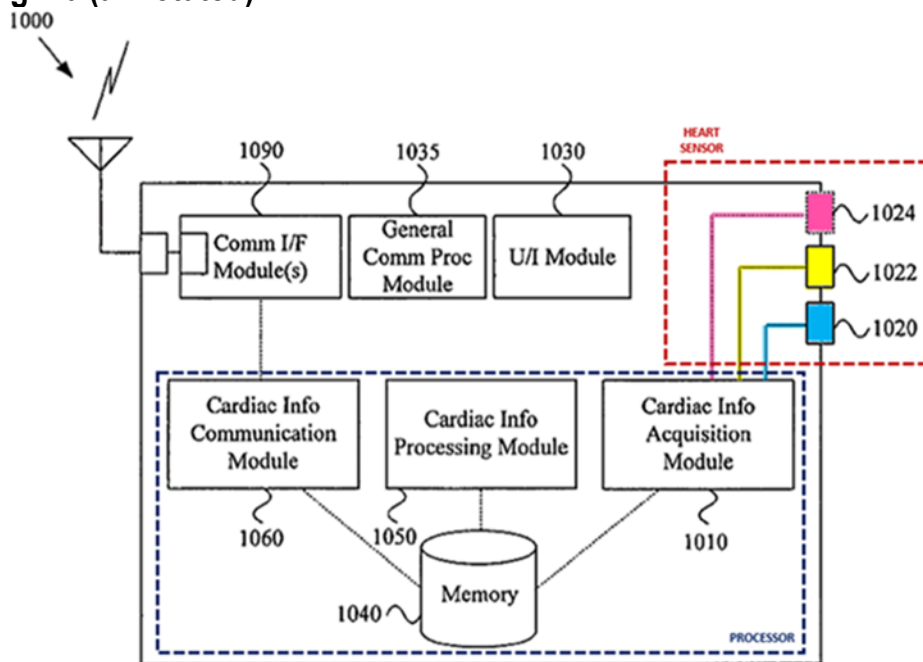


277. As explained earlier with respect to claim element [1.c.i] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “lead” to include (1) an electrode that comes into contact with a the user; and (2) the electrical connection (e.g., wires) that connects the electrode to additional electronics that implement that ECG signal acquisition. A person of ordinary skill in the art would also have understood that a “pad” is a component of the electrode. I again apply this plain and ordinary meaning of “lead” in my analysis below.

278. First, *Markel* renders obvious a first lead. As explained earlier with respect to claim elements [1.b] and [15.c] (the discussion of which is incorporated herein), *Markel* discloses components that correspond to the claimed “a heart sensor

configured to detect the user's cardiac signal" of elements [1.b] and [15.c]. These components are illustrated in at least *Markel's* Figure 10 (annotated below):

Ex-1005, Fig. 10 (annotated)

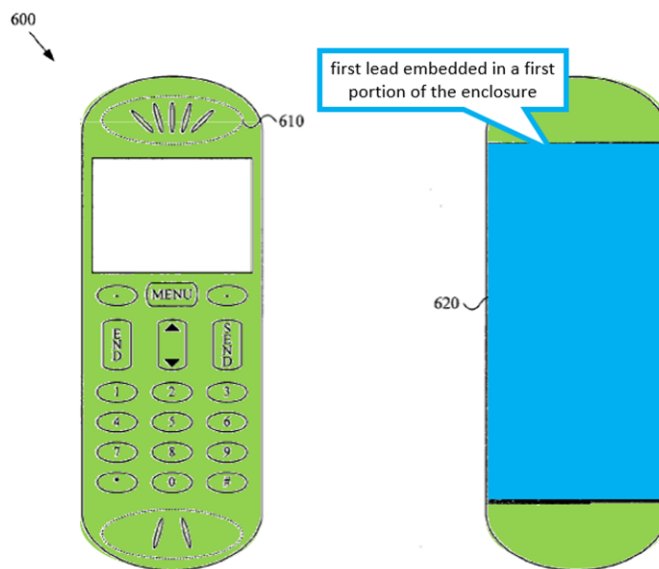


279. One of those components is a “first electrode 1020” and associated wiring (annotated above in blue), which correspond to the claimed “first lead” of element [15.d.i]. For example, *Markel* discloses that “mobile communication device 1000” includes “a **first electrode 1020** and a second electrode 1022 (and, for example, a third or Nth electrode 1024)” (Ex-1005, [0058] (emphasis added)). *Markel* also discloses that the first electrode is “coupled” to the cardiac acquisition module (Ex-1005, [0059]). From this, a person of ordinary skill in the art would have understood that *Markel's* “first electrode” and associated wiring is a “first lead.”

280. Second, *Markel* renders obvious that the first lead is embedded in a first

portion of the enclosure. For example, *Markel* discloses various configurations for placement of the electrodes, including the configuration illustrated in *Markel*'s Figure 6 (annotated below). In this configuration, the “*first electrode* [(blue)] may be disposed on the main body portion 620 (e.g., *molded into the main body portion 620 or positioned on the main body portion 620*)” (Ex-1005, [0050] (emphasis added)). From this, a person of ordinary skill in the art would have understood that *Markel*'s “first electrode” is “molded into the main body portion 620” (i.e., embedded in a first portion of the enclosure).

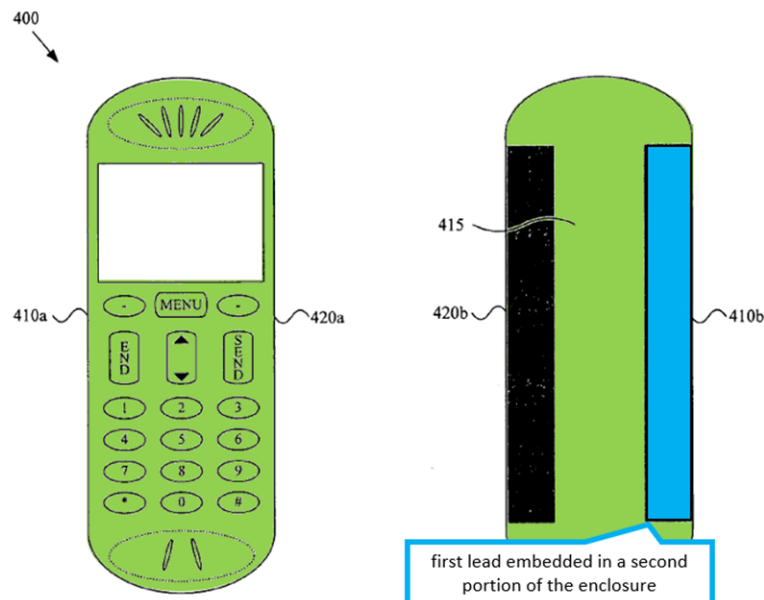
Ex-1005, Fig. 6 (annotated)



281. Additionally, *Markel* discloses a configuration in Figure 4 wherein “[the] *first electrode* may, for example, be placed on the left side portion 410 (e.g., *placed on or molded into region 410b*)” (Ex-1005, [0045] (emphasis added)). From this, a person of ordinary skill in the art would have understood that Figure 4’s “first

electrode” is embedded into the “left side portion 410,” (i.e., a second portion of the enclosure) in the Figure 4 configuration.

Ex-1005, Fig. 4 (annotated)

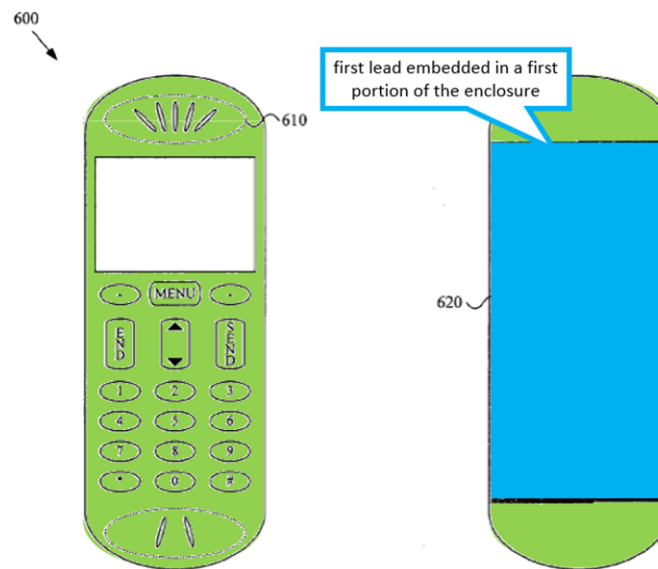


282. Thus, *Markel* renders obvious claim element [15.d.i].

Claim 15, Element [15.d.ii]: wherein the first lead is configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with at least one of the first lead and the first portion of the enclosure of the electronic device; and

283. *Markel* renders obvious claim element [15.d.ii]. Specifically, *Markel* renders obvious a first lead configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with at least one of the first lead and the first portion of the enclosure of the electronic device. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



284. As explained earlier with respect to claim element [15.a] (the discussion of which is incorporated herein), *Markel* discloses a “main body portion 110.” which corresponds to the claimed “enclosure” of element [15.a]. Furthermore, as explained earlier with respect to claim element [15.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “first lead” of element [15.d.i]. As also explained earlier with respect to claim element [15.d.i], a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” is embedded in the “main body portion 620” (i.e., a first portion of the enclosure).

285. *Markel* further discloses that the “first electrode” is configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with ***at least one of*** (1) the first lead, and (2) the first portion of the enclosure of the electronic

device. Each is addressed in turn.

286. First, *Markel* renders obvious that the “first electrode” is configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with the first lead. For example, *Markel* discloses that its “electrodes may, for example, be adapted to *detect cardiac activity of a user* that is *conductively coupled to the electrodes (e.g., by touching the electrodes)*” (Ex-1005, [0035] (emphasis added)). *Markel* also discloses that “electrodes contact a user during normal (or typical) use of the [electronic device]. Such normal use may, for example, comprise talking on a telephone, reading messages, perusing a phone book, typing a message, initiating a phone call, sending an email message, entering information in a notepad, etc.” (Ex-1005, [0041]). *Markel*’s electrodes also “may comprise a metallic surface exposed for *user contact*” (Ex-1005, [0037] (emphasis added)). Consequently, *Markel* discloses that the “first electrode” is configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with the first lead.

287. Second, and in the alternative, *Markel* renders obvious that the “first electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with the first portion of the enclosure of the electronic device. For example, *Markel* teaches that “an electrode (or all electrodes) . . . may be *substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the

presence of the electrode” (Ex-1005, [0040] (emphasis added)). As also explained earlier with respect to claim element [15.d.i], a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” is embedded in the “main body portion 620” (i.e., a first portion of the enclosure). When “integrated into various molded components of the mobile communication device,” this “electrode may be formed from **conductive plastic** (or another material)” (Ex-1005, [0037] (emphasis added)). From this, a person of ordinary skill in the art would have been motivated to place the pad of the “first electrode” underneath the conductive plastic of the “main body portion 620.” This would have “substantially concealed (or hidden)” the pad of the electrode from the user, which would have been desirable to increase aesthetics of the device while protecting the electrode.

288. *Markel* further teaches that an electrode’s pad need not be in direct contact with a user and may be “adapted to detect cardiac activity of a user that is **conductively coupled** to the electrodes (e.g., by touching the electrodes)” (Ex-1005, [0035] (emphasis added)). Specifically, a person of ordinary skill in the art would recognize that the pad of an electrode can be conductively coupled to a user through an intermediate conductive material. Indeed, as discussed earlier, *Markel* further teaches that “a conductive plastic (or another material) [] 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” (Ex-1005, [0037] (emphasis added)). This is in contrast to *Markel*’s disclosure that “an electrode may comprise a metallic surface *exposed* for user contact” (Ex-1005, [0037] (emphasis added)).

289. Moreover, a person of ordinary skill in the art would have had a reasonable expectation of success in detecting the user’s cardiac signal via the conductive plastic of the “main body portion” because *Markel* discloses that (1) “electrodes may be *incorporated into the [electronic device] in any of a variety of manners*” and “in any of a *variety of locations*” (Ex-1005, [0035], [0045] (emphasis added)), and (2) electrodes “may, for example, be adapted to detect cardiac activity of a user that is *conductively coupled* to the electrodes” and “various conductive plastics . . . may provide *sufficient conductivity* for an electrode to perform adequately” (Ex-1005, [0037] (emphasis added)).

290. Accordingly, a person of ordinary skill in the art would have been motivated to position the second pad of the “first electrode” underneath the exterior surface of the electronic device’s “main body portion.” In that configuration, that second pad would have been configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the electronic device’s “main body portion” (i.e., the second portion of the enclosure). Consequently, *Markel* renders obvious that the second pad of the “first electrode” is

configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with the second portion of the enclosure.

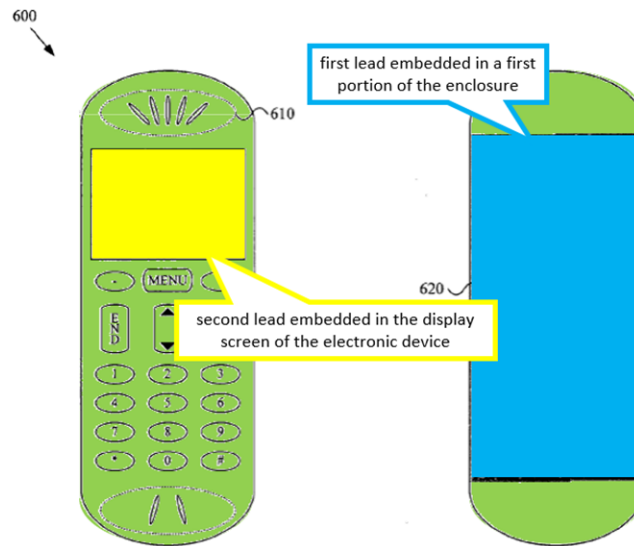
291. As also explained with respect to claim element [15.d.i], a person of ordinary skill in the art would have understood that the “first electrode” in *Markel*'s Figure 4 configuration is embedded in the “left side portion 410.” Similarly, a person of ordinary skill in the art would have been motivated to place the pad of the “first electrode” in *Markel*'s Figure 4 underneath the conductive plastic of the “left side portion 410.” In that configuration, that second pad would have been configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with the exterior surface of the electronic device's “left side portion” (i.e., the second portion of the enclosure).

292. Thus, *Markel* renders obvious claim element [15.d.ii].

Claim 15, Element [15.e.i]: the heart sensor comprising: . . . a second lead embedded in the display screen of the electronic device,

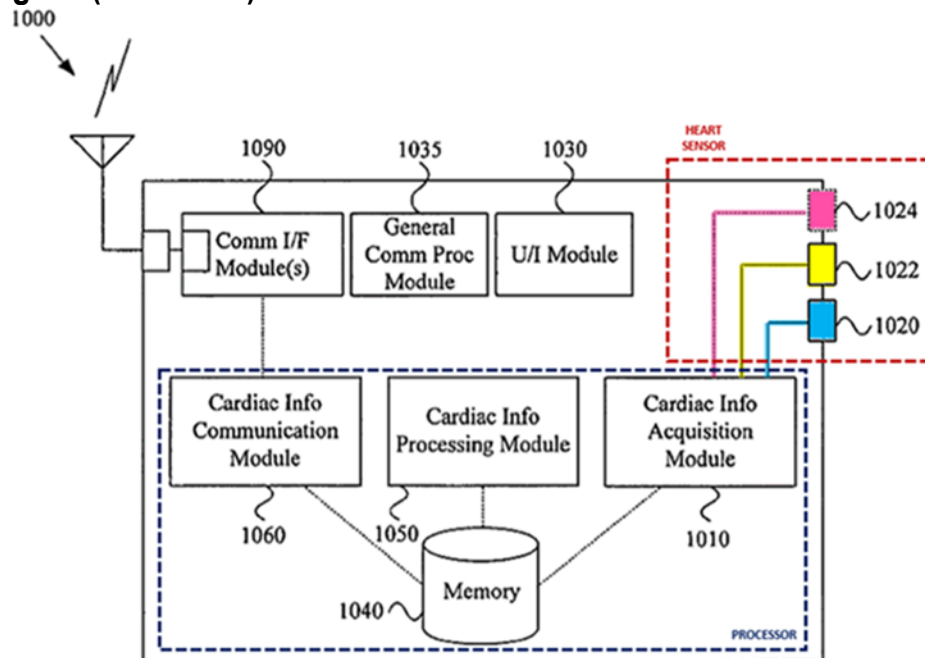
293. *Markel* renders obvious claim element [15.e.i]. Specifically, *Markel* renders obvious a heart sensor comprising a second lead embedded in the display screen of the electronic device. This is illustrated in at least *Markel*'s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



294. First, *Markel* renders obvious a second lead. As explained earlier with respect to claim elements [1.b] and [15.b] (the discussion of which is incorporated herein), *Markel* discloses components that correspond to the claimed “a heart sensor configured to detect the user’s cardiac signal” of elements [1.b] and [15.c]. These components are illustrated in at least *Markel*’s Figure 10 (annotated below):

Ex-1005, Fig. 10 (annotated)

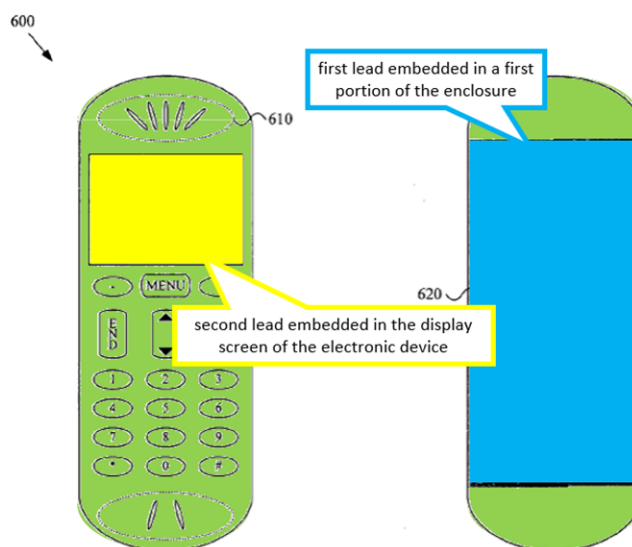


295. One of those components is a “second electrode 1022” and associated wiring (annotated above in yellow), which corresponds to the claimed “second lead” of element [15.e.i]. For example, *Markel* discloses that “mobile communication device 1000” includes “a first electrode 1020 and a **second electrode 1022** (and, for example, a third or Nth electrode 1024)” (Ex-1005, [0058] (emphasis added)). *Markel* also discloses that the second electrode is “coupled” to the cardiac information acquisition module (Ex-1005, [0059]). From this, a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” and associated wiring is a “second lead.”

296. Second, *Markel* renders obvious that the second lead is embedded in the display screen of the electronic device. As explained earlier with respect to claim

element [15.b], *Markel* discloses “a display 140 (*which may also function as a touch screen input feature*),” which corresponds to the claimed display of element [15.b]. As illustrated in *Markel*’s Figure 1 (annotated below), *Markel* discloses that “an electrode may be *disposed on a video display device* 140 (e.g., a border of the display or *integrated into a touch screen*).” (Ex-1005, [0044] (emphasis added)). A person of ordinary skill in the art would have known that an electrode pad that is “integrated into a touch screen” is *embedded* in “display 140.” From this, a person of ordinary skill in the art would have understood that *Markel*’s “second electrode” may be embedded in the “display 140.”

Ex-1005, Fig. 6 (annotated)



297. A person of ordinary skill in the art would have been motivated to implement the electrode placement embedded in the display because it would have allowed a user to use the touch screen with one hand while contacting the electronic

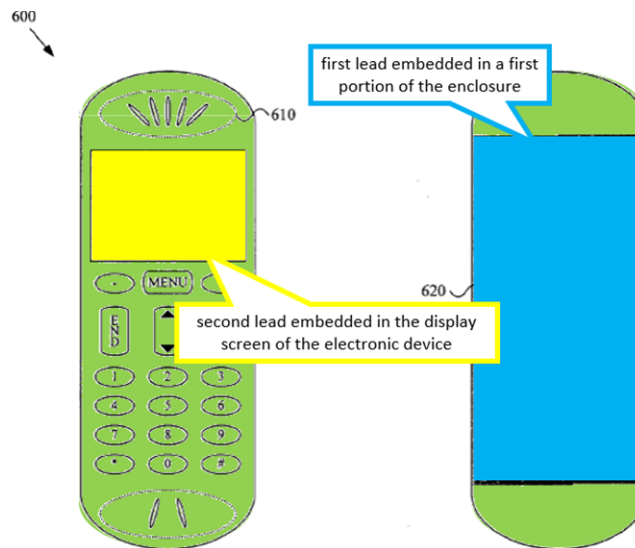
device with their other hand, allowing the device to record a real-time ECG measurement. Because *Markel* teaches that “[a] plurality of electrodes (or other sensors) may be disposed in any of a variety of locations” (Ex-1005, [0045]), a person of ordinary skill in the art would be motivated to combine *Markel*’s teaching of an electrode embedded in “display 140” with the placement of the first electrode in the either of the Figure 4 and Figure 6 configurations.

298. Thus, *Markel* renders obvious claim element [15.e.i].

Claim 15, Element [15.e.ii]: wherein the second lead is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with at least one of the second lead and the display screen of the electronic device; and

299. *Markel* renders obvious claim element [15.e.ii]. Specifically, *Markel* renders obvious a second lead embedded in the display screen of the electronic device, wherein the second lead is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with at least one of the second lead and the display screen of the electronic device. This is illustrated in at least *Markel*’s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 6 (annotated)



300. As explained earlier with respect to claim element [15.e.i] (the discussion of which is incorporated herein), *Markel* discloses a “second electrode” that is “*disposed on a video display device 140*” (Ex-1005, [0044]), which corresponds to the claimed “second lead embedded in the display screen of the electronic device” of element [15.e.i].

301. *Markel* renders obvious that its “second electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with *at least one of* (1) the second lead and (2) the display screen of the electronic device. Each is addressed in turn.

302. First, *Markel* renders obvious that “second electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with the second lead. For example, *Markel* discloses that its “electrodes may, for

example, be adapted to *detect cardiac activity of a user* that is *conductively coupled to the electrodes (e.g., by touching the electrodes)*” (Ex-1005, [0035] (emphasis added)). *Markel* also discloses that “electrodes contact a user during normal (or typical) use of the [electronic device]. Such normal use may, for example, comprise talking on a telephone, reading messages, perusing a phone book, typing a message, initiating a phone call, sending an email message, entering information in a notepad, etc.” (Ex-1005, [0041]). *Markel*’s electrodes also “may comprise a metallic surface exposed for *user contact*” (Ex-1005, [0037]). Consequently, *Markel* discloses that the “second electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with the second electrode.

303. Second, and in the alternative, *Markel* renders obvious that the “second electrode” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with the display screen of the electronic device. For example, *Markel* teaches that an electrode’s pad need not be in direct contact with a user and may be “adapted to detect cardiac activity of a user that is *conductively coupled* to the electrodes (e.g., by touching the electrodes)” (Ex-1005, [0035] (emphasis added)). Specifically, a person of ordinary skill in the art would recognize that the pad of an electrode can be conductively coupled to a user through an intermediate conductive material. *Markel* further teaches that the “second electrode” may be “*integrated into a touch screen*” (Ex-1005, [0044] (emphasis added)).

Consequently, *Markel* renders obvious that the “second electrode” that is “integrated into a touch screen” is configured to detect a second electrical signal of the user’s cardiac signal via the user’s contact with the display screen of the electronic device.

304. Thus, *Markel* renders obvious claim element [15.e.ii].

Claim 15, Element [15.f]: a processor coupled to the heart sensor and configured to process the first and second electrical signals of the user’s cardiac signal.

305. *Markel* renders obvious claim element [15.f]. Specifically, *Markel* renders obvious a processor coupled to the heart sensor and configured to process the first and second electrical signals of the user’s cardiac signal. I incorporate herein my earlier discussion of element [1.e].

306. Thus, *Markel* renders obvious claim element [15.f].

Claim 16, Element [16.pre]: The electronic device of claim 15,

307. *Markel* renders obvious claim element [16.pre]. Specifically, *Markel* renders obvious the electronic device of claim 15. I incorporate herein my earlier discussion of claim 15.

308. Thus, *Markel* renders obvious claim element [16.pre].

Claim 16, Element [16.a]: wherein the first lead is configured to detect the first electrical signal of the user’s cardiac signal via the user’s contact with the first lead.

309. *Markel* renders obvious claim element [16.a]. Specifically, *Markel* renders obvious wherein the first lead is configured to detect the first electrical signal of the user’s cardiac signal via the user’s contact with the first lead.

310. As explained with respect to claim element [15.d.i], *Markel* discloses a “first electrode” embedded in the “main body portion 620,” which corresponds to the claimed “first lead” of element [15.d.i]. Furthermore, as explained with respect to claim element [15.d.ii], the “first electrode” may be configured to detect the user’s cardiac signal via direct contact with the user’s skin. Consequently, the first lead is configured to detect the first electrical signal of the user’s cardiac signal via the user’s contact with the first lead.

311. Thus, *Markel* renders obvious claim element [16.a].

Claim 17, Element [17.pre]: The electronic device of claim 16,

312. *Markel* renders obvious claim element [17.pre]. Specifically, *Markel* renders obvious the electronic device of claim 16. I incorporate herein my earlier discussion of claim 16.

313. Thus, *Markel* renders obvious claim element [17.pre].

Claim 17, Element [17.a]: wherein the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the second lead.

314. *Markel* renders obvious claim element [17.pre]. Specifically, *Markel* renders obvious wherein the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the second lead.

315. As explained with respect to claim element [15.e.i], *Markel* discloses a “second electrode” embedded in the “display 140,” which corresponds to the

claimed “second lead” of element [15.e.i]. Furthermore, as explained with respect to claim element [15.e.ii], the “second electrode” may be configured to detect the user’s cardiac signal via direct contact with the user’s skin. Consequently, the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the second lead.

316. Thus, *Markel* renders obvious claim element [17.a].

Claim 18, Element [18.pre]: The electronic device of claim 16,

317. *Markel* renders obvious claim element [18.pre]. Specifically, *Markel* renders obvious the electronic device of claim 16. I incorporate herein my earlier discussion of claim 16.

318. Thus, *Markel* renders obvious claim element [18.pre].

Claim 18, Element [18.a]: wherein the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the display screen.

319. *Markel* renders obvious claim element [18.a]. Specifically, *Markel* renders obvious wherein the second lead is configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the display screen.

320. As explained with respect to claim element [15.e.i], *Markel* discloses a “second electrode” embedded in the “display 140,” which corresponds to the claimed “second lead” of element [15.e.i]. Furthermore, as explained with respect to claim element [15.e.ii], the “second electrode” may be configured to detect the user’s

cardiac signal via the user's contact with "display 140." Consequently, the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the display screen of the electronic device.

321. Thus, *Markel* renders obvious claim element [18.a].

Claim 19, Element [19.pre]: The electronic device of claim 15, wherein:

322. *Markel* renders obvious claim element [19.pre]. Specifically, *Markel* renders obvious the electronic device of claim 15. I incorporate herein my earlier discussion of claim 15.

323. Thus, *Markel* renders obvious claim element [19.pre].

Claim 19, Element [19.a]: the first portion of the electronic device comprises a bezel of the enclosure;

324. *Markel* renders obvious claim element [19.a]. Specifically, *Markel* renders obvious a first portion of the electric device comprising a bezel of the enclosure.

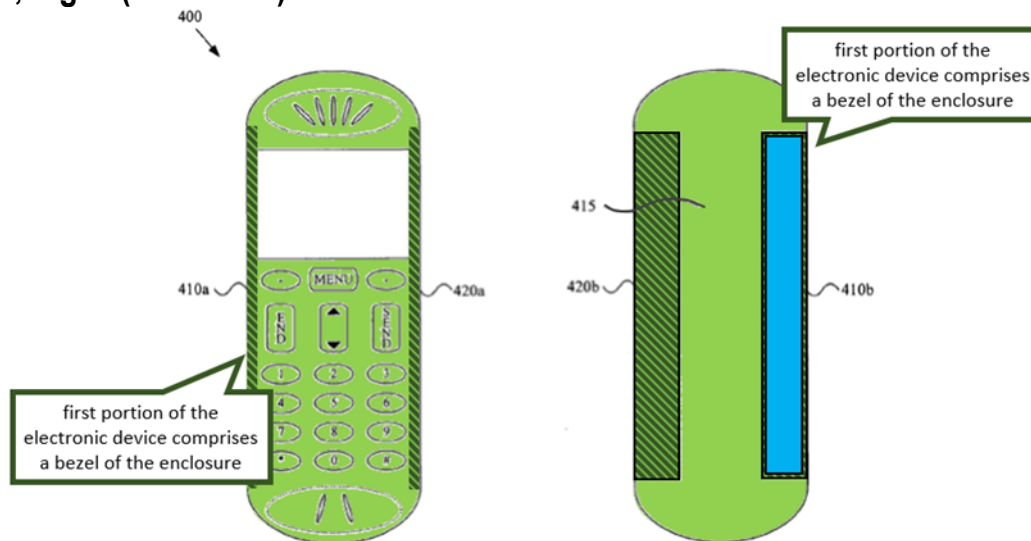
325. As explained earlier with respect to claim element [12.a] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of "bezel" to include a rim that encircles an electronic device. I again apply this plain and ordinary meaning of "bezel" in my analysis below.

326. Based on this plain and ordinary meaning, *Markel* renders obvious a first portion of the electronic device comprising a bezel of the enclosure. As

explained earlier with respect to claim element [15.d.i] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” coupled to a cardiac acquisition module, which corresponds to the claimed “first lead” of element [15.d.i]. That lead is embedded in a first portion of the enclosure.

327. As explained earlier with respect to claim element [15.d.i], a person of ordinary skill in the art would have understood that the “first electrode” in *Markel*’s Figure 4 is embedded in the “left side portion 410” of the electronic device. The “left side portion 410” corresponds to the claimed “first portion of the enclosure.” According to Figure 4 of *Markel*, the “side portions” (dark green, below) wrap around the front and back of the device, like a bezel. Both the front and back view of *Markel*’s electronic device have labels corresponding to the “left side portion 410” (Ex-1005, Fig. 4). As illustrated below, furthermore, the first electrode extends to the rim that encircles *Markel*’s electronic device. *Markel* also discloses that an electrode may be disposed in “a ***border*** of the display” (Ex-1005, [0044] (emphasis added)). From this, a person of ordinary skill in the art would have understood that *Markel*’s “first electrode” is embedded in 410*b* (i.e., the “first portion of the enclosure”) includes the “bezel.”

Ex-1005, Fig. 4 (annotated)



328. To the extent that *Markel*'s Figure 4 is not found to disclose that the "first portion of the enclosure" comprises a "bezel," this would have been a trivial modification that would have been well-within the knowledge of a person of ordinary skill in the art. A person of ordinary skill in the art would have been motivated to extend the edges of *Markel*'s "first electrode" in 410b so that they reached the device's bezel (i.e., rim) because this would have created additional contact area. The additional contact area would have enhanced the ability of the "first electrode" to detect a signal from a user's hand and make it more likely that a user would interact with the second electrode so as to have a successful test.

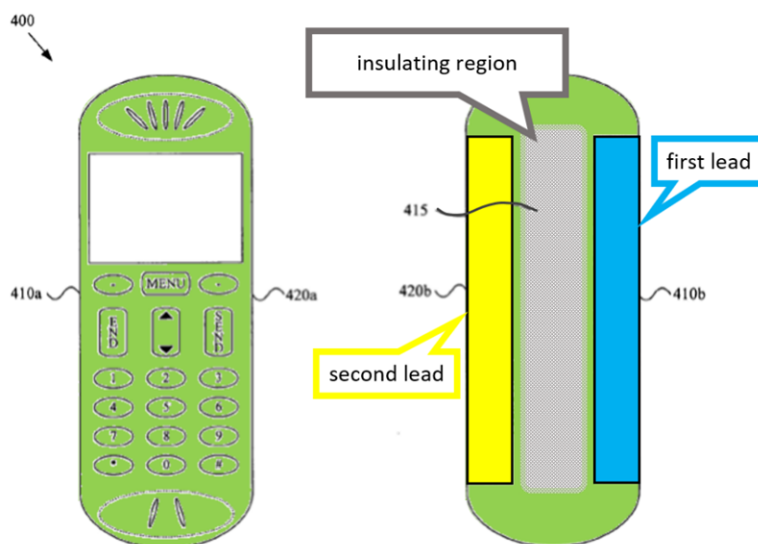
329. Thus, *Markel* renders obvious claim element [19.a].

Claim 19, Element [19.b]: the electronic device further comprises a non-conductive component positioned between the bezel and the display screen for electrically isolating the first lead from the second lead.

330. *Markel* renders obvious claim element [19.b]. Specifically, *Markel*

renders obvious a non-conductive component positioned between the bezel and the display screen for electrically isolating the first lead from the second lead. This is illustrated in at least *Markel*'s Figure 6 (annotated below) and is described in further detail as follows.

Ex-1005, Fig. 4 (annotated)



331. As explained earlier with respect to claim element [19.a] (the discussion of which is incorporated herein), *Markel* discloses a “first electrode” embedded in a “left side portion 410,” which corresponds to the claimed “bezel” of element [19.a]. Furthermore, as explained earlier with respect to claim element [15.e.i] (the discussion of which is incorporated herein), *Markel* discloses a “second electrode” embedded in the “display 140,” which corresponds to the claimed “second lead” of element [15.e.i].

332. *Markel* further teaches that its electrodes should be electrically isolated.

Markel teaches that, in its Figure 4 configuration, an “**insulating region 415** may **separate** regions 410*b* and 420*b*” of the electronic device “where regions 410*b* and 420*b* include conductive plastic” (Ex-1005, [0045] (emphasis added)). The “insulating region 415” electrically isolates “regions 410*b* and 420*b*” (Ex-1005, [0045]).

333. Based on this disclosure, a person of ordinary skill in the art would have also known that an “insulating region” should electrically isolate the “bezel” from the “display 140.” As explained in Section VI.B (the discussion of which is incorporated herein), a person of ordinary skill in the art would have known that an ECG is a measure of the electrical activity of the heart based on an electrical potential difference. A person of ordinary skill in the art would also have known that in order to measure the potential difference, *Markel*’s electrodes should be electrically isolated as taught in *Markel*’s Figure 4.

334. Thus, *Markel* renders obvious claim element [19.b].

Claim 20, Element [20.pre]: The electronic device of claim 15,

335. *Markel* renders obvious claim element [20.pre]. Specifically, *Markel* renders obvious the electronic device of claim 15. I incorporate herein my earlier discussion of claim 15.

336. Thus, *Markel* renders obvious claim element [20.pre].

Claim 20, Element [20.a]: wherein the first lead is configured to detect the first electrical signal of the user's cardiac signal via the user's contact with the first portion of the enclosure.

337. *Markel* renders obvious claim element [20.a]. Specifically, *Markel* renders obvious wherein the first lead is configured to detect the first electrical signal of the user's cardiac signal via the user's contact with the first portion of the enclosure.

338. As explained with respect to claim element [15.d.i], *Markel* discloses a "first electrode" embedded in the "main body portion 620," which corresponds to the claimed "first lead" of element [15.d.i]. Furthermore, as explained with respect to claim element [15.d.ii], the "first electrode" may be configured to detect the user's cardiac signal via the user's contact with the "main body portion 620." Consequently, the first lead is configured to detect the first electrical signal of the user's cardiac signal via the user's contact with the first portion of the enclosure.

339. Thus, *Markel* renders obvious claim element [20.a].

Claim 21, Element [21.pre]: The electronic device of claim 20,

340. *Markel* renders obvious claim element [21.pre]. Specifically, *Markel* renders obvious the electronic device of claim 20. I incorporate herein my earlier discussion of claim 20.

341. Thus, *Markel* renders obvious claim element [21.pre].

Claim 21, Element [21.a]: wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second lead.

342. *Markel* renders obvious claim element [21.a]. Specifically, *Markel* renders obvious wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second lead.

343. As explained with respect to claim element [15.e.i], *Markel* discloses a “second electrode” embedded in the “display 140,” which corresponds to the claimed “second lead” of element [15.e.i]. Furthermore, as explained with respect to claim element [15.e.ii], the “second electrode” may be configured to detect the user's cardiac signal via direct contact with the user's skin. Consequently, the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second lead.

344. Thus, *Markel* renders obvious claim element [21.a].

Claim 22, Element [22.pre]: The electronic device of claim 20,

345. *Markel* renders obvious claim element [22.pre]. Specifically, *Markel* renders obvious the electronic device of claim 20. I incorporate herein my earlier discussion of claim 20.

346. Thus, *Markel* renders obvious claim element [22.pre].

Claim 22, Element [22.a]: wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the display screen.

347. *Markel* renders obvious claim element [22.a]. Specifically, *Markel*

renders obvious wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the display screen.

348. As explained with respect to claim element [15.e.i], *Markel* discloses a “second electrode” embedded in the “display 140,” which corresponds to the claimed “second lead” of element [15.e.i]. Furthermore, as explained with respect to claim element [15.e.ii], the “second electrode” may be configured to detect the user's cardiac signal via direct contact with the user's skin. Consequently, the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with “display 140.” Consequently, the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the display screen of the electronic device.

349. Thus, *Markel* renders obvious claim element [22.a].

B. Ground 2: *Markel* in View of *Nissilä* Renders Obvious Claims 1-22 of the '257 patent.

350. *Markel* in view of *Nissilä* further renders obvious claims 1-22 of the '257 patent. I incorporate herein Section IX.A, which analyzes how *Markel* renders obvious claims 1-22 of the '257 patent. For brevity, below I address only the limitations that are further rendered obvious by *Nissilä*. Any limitation not specifically addressed below is rendered obvious for at least the reasons outlined in Section IX.A.

Motivation to Combine Markel and Nissilä

351. There are multiple reasons why a person of ordinary skill in the art would have been specifically motivated to combine *Markel* and *Nissilä*.

352. First, a person of ordinary skill in the art would have been motivated to combine *Markel* and *Nissilä* at least because these references are generally directed to the same technical field of personal heart sensors. *Markel* is directed to “mobile communication device[s], general-purpose computer user interface device[s], and other electronic devices with cardiovascular monitoring capability” (Ex-1005, [0004]). And *Nissilä* is directed to “a device for non-invasive measurement of heart rate information” (Ex-1006, 1:7–10). *Nissilä* contemplates a personal heart sensor to be used “in connection with exercise” (Ex-1006, 1:14–15). *Nissilä*’s stated goal “is to provide an improved electrode structure and heart rate measuring arrangement for measuring an electrical heart beat signal on a human body” (Ex-1006, 2:17–20).

353. Second, *Markel* and *Nissilä* share similar goals. *Markel* is directed to an electrode that is “substantially concealed (or hidden) from a user,” such that there is “little or no visible indication of the electrode presence” (Ex-1005, [0040]). And *Nissilä* is directed to accomplishing an “inconspicuous” electrode structure (Ex-1006, 4:21–24).

354. Third, *Markel* and *Nissilä* share relevant similarities in electrode structure. *Nissilä*’s electrode structure having an external layer of “metal, electrically

conductive plastic or a similar conductive material” (Ex-1006, 5:32–37) is similar to *Markel*’s “hidden” electrode, which includes a “main body portion 110” that “may be formed from conductive plastic (or another material)” (Ex-1005, [0037]). A person of ordinary skill in the art would therefore have understood that the teachings of *Nissilä* were specifically applicable to the teachings of *Markel*.

355. A person of ordinary skill in the art would be motivated to combine *Nissilä*’s electrode structure with *Markel*’s electronic device in order to accomplish *Markel*’s stated goal of an electrode that is “***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). *Markel*’s hidden electrode is desirable because it increases aesthetics of the device while protecting the electrode from bumps or other damage. Indeed, by concealing the electrode from the user, the user is able to obtain the benefits of having an ECG capability without a ***visible indication*** of the electrode presence that takes away from the device’s appearance. A person of ordinary skill in the art would have reasonable expectation of success in combining *Markel* and *Nissilä* because both references disclose an intermediate conductive material made of conductive plastic.

Claim 1, Element [1.c.i]: the heart sensor comprising: a first lead comprising a first pad that is embedded in a first portion of the enclosure,

Claim 1, Element [1.c.ii]: wherein an exterior surface of the enclosure comprises an exterior surface of the first portion, wherein the first pad is positioned underneath the exterior surface of the first portion, and

Claim 1, Element [1.c.iii]: 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;

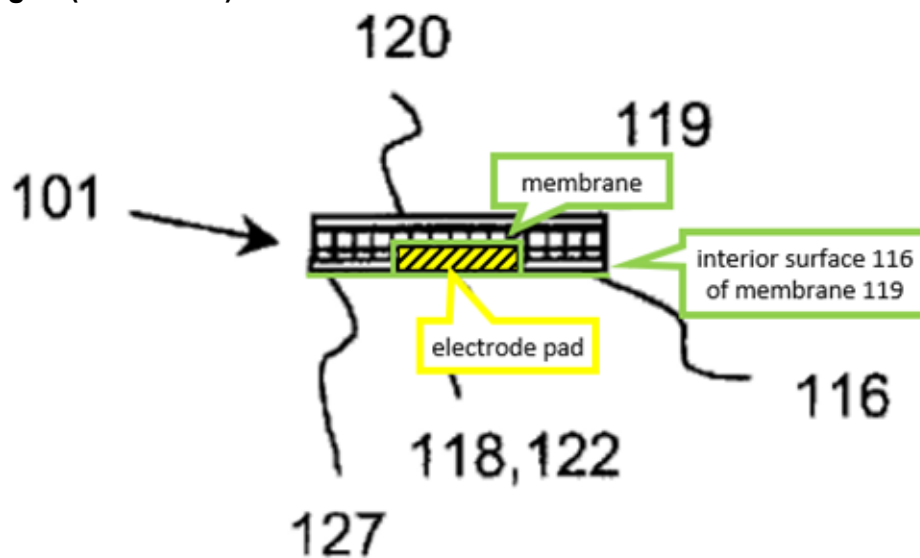
356. *Markel* in view of *Nissilä* renders obvious claim elements [1.c.i], [1.c.ii], and [1.c.iii] under the correct interpretation of the claim language.

357. As explained earlier in Ground 1 with respect to claim elements [1.c.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device that includes “a second electrode 1022” embedded in the “audio output portion 610.” *Markel* also discloses that “an electrode (or all electrodes) or other sensor may be ***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). To the extent that a person of ordinary skill in the art sought additional detail on how to implement *Markel*'s “hidden” electrode, that person of ordinary skill in the art would have turned to *Nissilä*, which expressly teaches a cross-sectional view of an “improved electrode structure” having a pad that is positioned underneath the exterior surface of an enclosure (Ex-1006, 2: 17–20, Fig. 5). A person of ordinary skill would have been motivated to combine the teachings of these references in order to accomplish

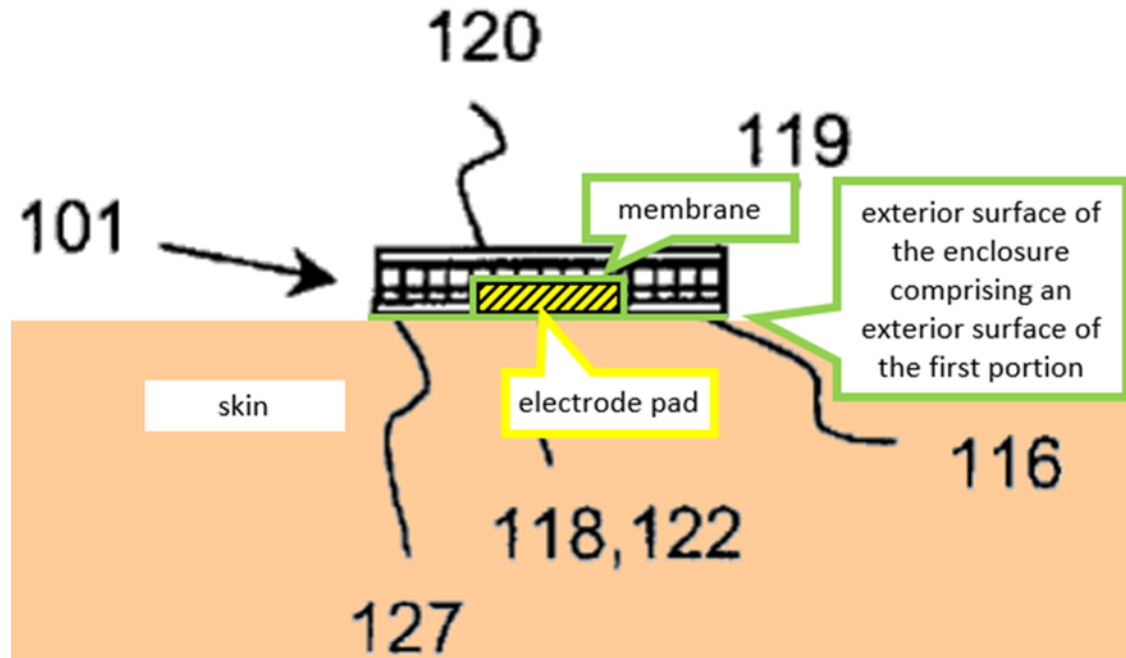
construction of *Markel*'s "hidden" electrode.

358. First, *Nissilä* discloses a first lead comprising a first pad that is embedded in a first portion of the enclosure, wherein an exterior surface of the enclosure comprises an exterior surface of the first portion, and wherein the first pad is positioned underneath the exterior surface of the first portion. *Nissilä* discloses "[a]t 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***" (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode comprising a "membrane 119" that "is made of metal, electrically conductive plastic or a similar conductive material" (Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by "membrane 119." Thus, the electrode pad is *underneath* the "membrane 119," which includes an "exterior surface of the enclosure" and "exterior surface of the first portion" as recited in claim element [1.c.ii]. This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

Ex-1006, Fig. 5 (annotated)

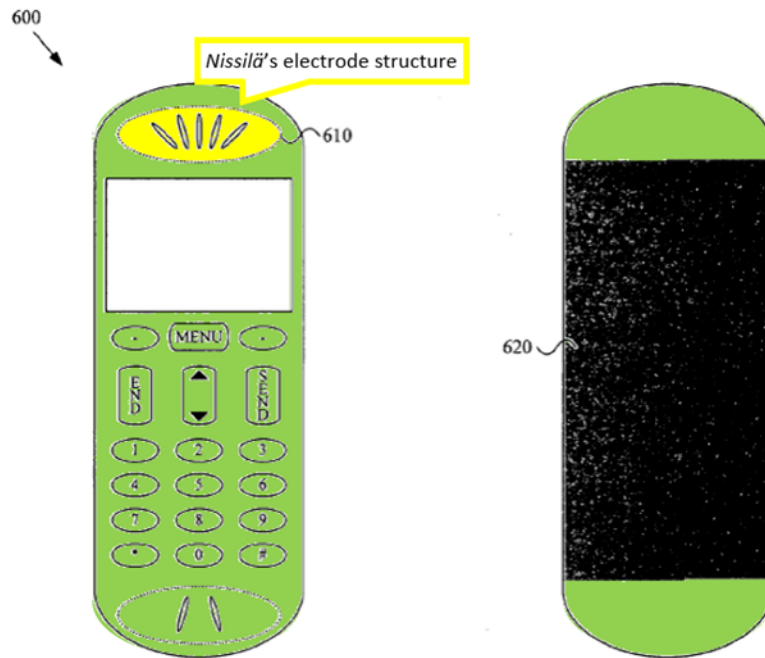


359. Second, *Nissilä* renders obvious a first pad configured to detect a first electrical signal of the user's cardiac signal via the user's skin's contact with the exterior surface of the first portion of the enclosure. *Nissilä* discloses that the "membrane 119 can [] come into contact with the person's skin surface 102" (Ex-1006, 5:39–40). Then *Nissilä* teaches that "on the inner surface 116 of the membrane 119 which is against the person's skin[,] there can be an electrically conductive adhesive" (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to "detect a first electrical signal of the user's cardiac signal" via the user's contact with the "membrane 119" (i.e., via the user's skin's contact with the exterior surface of the first portion of the enclosure). This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.



360. From this, a person of ordinary skill in the art would have been motivated to implement *Nissilä*'s electrode structure in at least the “audio output portion 610” of *Markel*'s Figure 6. This construction would have accomplished *Markel*'s stated goal of an electrode that is “*substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). This is illustrated in at least *Markel*'s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



361. Thus, *Markel* in view of *Nissilä* renders obvious claim elements [1.c.i], [1.c.ii], and [1.c.iii].

Claim 1, Element [1.d.i]: the heart sensor comprising: . . . a second lead comprising a second pad that is embedded in a second portion of the enclosure,

Claim 1, Element [1.d.ii]: wherein the second pad is configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with at least one of the second pad and the second portion of the enclosure;

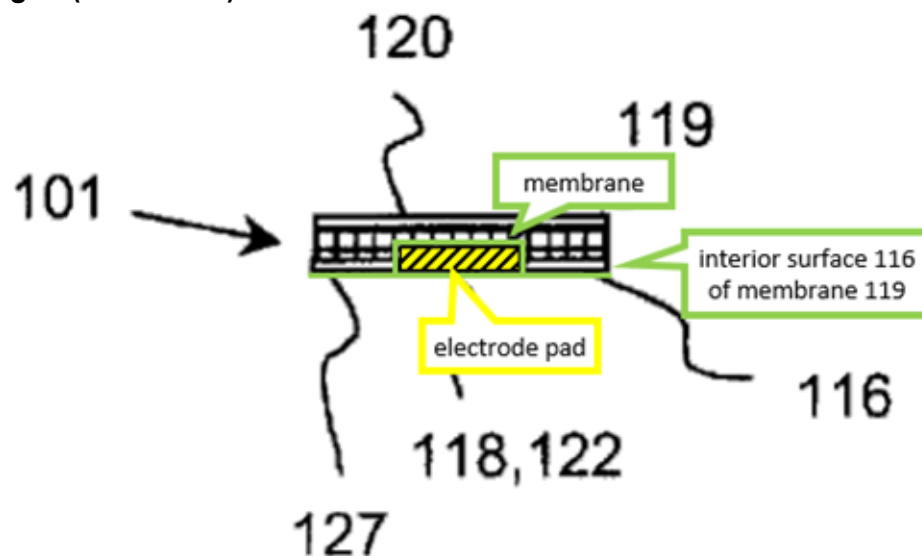
362. *Markel* in view of *Nissilä* renders obvious claim element [1.d.ii]. Specifically, *Markel* in view of *Nissilä* renders obvious a second pad configured to detect a second electrical signal of the user's cardiac signal via the user's skin's contact with the second portion of the enclosure.

363. As explained in Ground 1 with respect to claim elements [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device that includes “a first electrode 1020” embedded in the “main body portion 620.” *Markel* also discloses that “an electrode (or all electrodes) or other sensor may be *substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). To the extent that a person of ordinary skill in the art sought additional detail on how to implement *Markel*’s “hidden” electrode, that person of ordinary skill in the art would have turned to *Nissilä*, which expressly teaches a cross-sectional view of an “improved electrode structure” having a pad that is positioned underneath the exterior surface of the electrode (Ex-1006, 2: 17–20, Fig. 5). A person of ordinary skill would have been motivated to combine the teachings of these references in order to accomplish construction of *Markel*’s “hidden” electrode.

364. First, *Nissilä* discloses a second lead comprising a second pad that is embedded in a second portion of the enclosure. *Nissilä* discloses “[a]t 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” (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode comprising a “membrane 119” that “is made of metal, electrically conductive plastic or a similar conductive material”

(Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by “membrane 119.” This is illustrated in at least *Nissilä*’s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

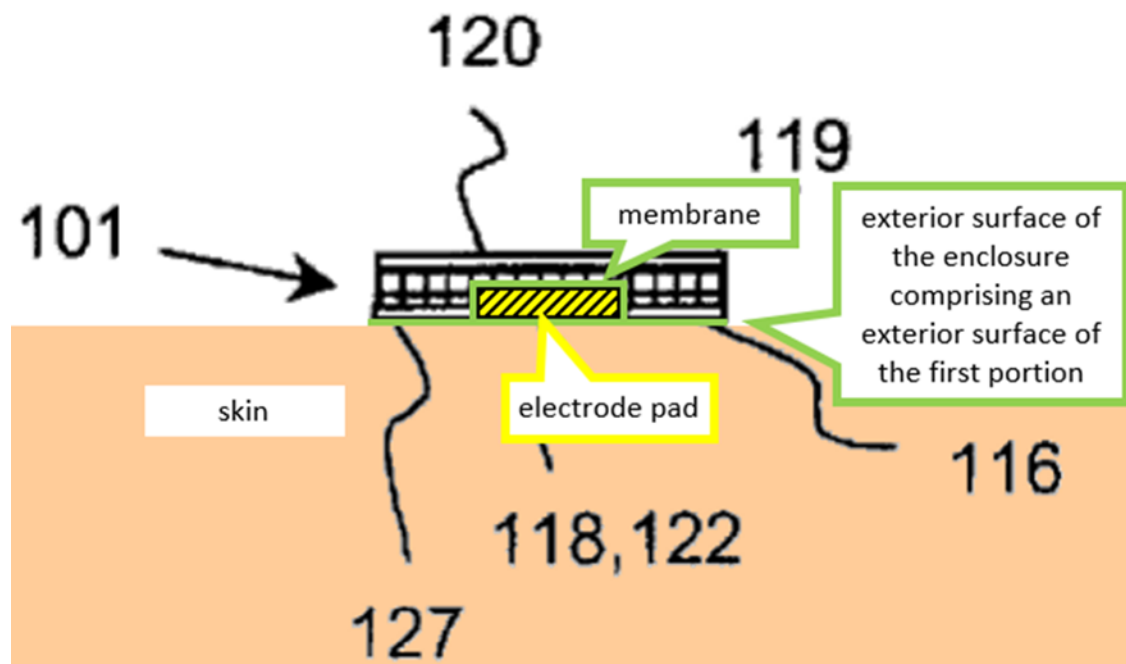
Ex-1006, Fig. 5 (annotated)



365. Second, *Nissilä* renders obvious a second pad configured to detect a second electrical signal of the user’s cardiac signal via the user’s skin’s contact with the second portion of the enclosure. *Nissilä* discloses that its electrode pad is placed underneath the “membrane 119,” which includes a “second portion of the enclosure” as recited in claim element [1.d.ii]. *Nissilä* further discloses that the “membrane 119 can [] come into contact with the person’s skin surface 102” (Ex-1006, 5:39–40). Then *Nissilä* teaches that “on the inner surface 116 of the membrane 119 which is against the person’s skin[,] there can be an electrically conductive adhesive” (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to

“detect a first electrical signal of the user’s cardiac signal” via the user’s contact with the “membrane 119” (i.e., via the user’s skin’s contact with . . . the second portion of the enclosure). This is illustrated in at least *Nissilä*’s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

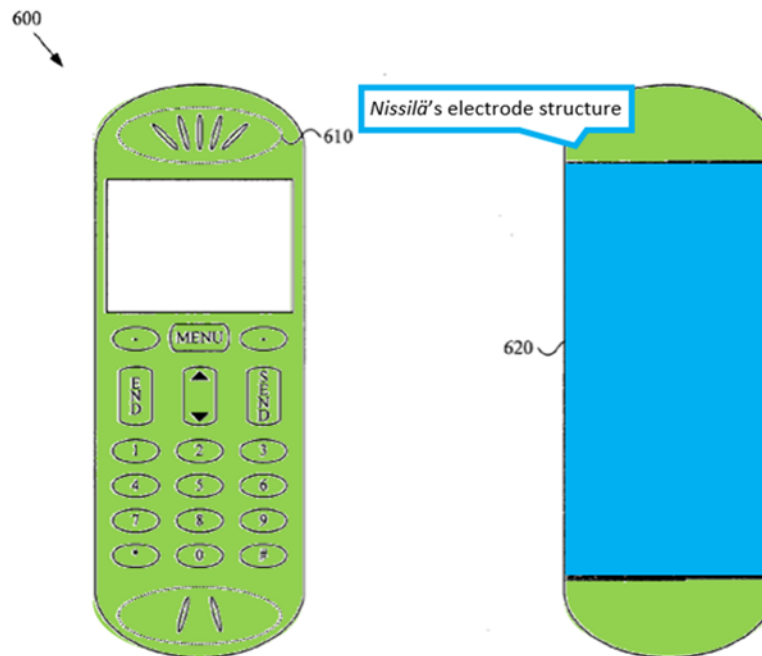
Ex-1006, Fig. 5 (annotated)



366. From this, a person of ordinary skill in the art would have been motivated to implement *Nissilä*’s electrode structure in at least the “main body portion 620” of *Markel*’s Figure 6. This construction would have accomplished *Markel*’s stated goal of an electrode that is “*substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040])

(emphasis added)). This is illustrated in at least *Markel*'s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



367. Thus, *Markel* in view of *Nissilä* renders obvious claim elements [1.d.i] and [1.d.ii].

Claim 6, Element [6.a]: the exterior surface of the enclosure further comprises an exterior surface of the second portion;

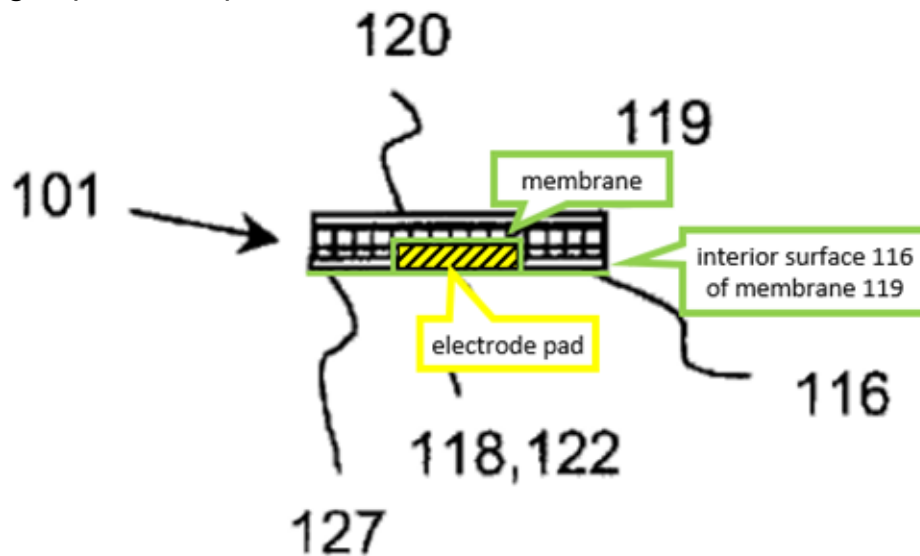
Claim 6, Element [6.b]: the second pad is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the exterior surface of the second portion;

368. *Markel* in view of *Nissilä* renders obvious claim elements [6.a] and [6.b].

369. As explained in Ground 1 with respect to claim elements [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device

that includes “a first electrode 1020” embedded in the “main body portion 620.” As explained earlier in Ground 2 with respect to claim elements [1.d.i] and [1.d.ii] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have been motivated to combine the teachings of *Markel* and *Nissilä* in order to accomplish construction of *Markel*’s “hidden” electrode.

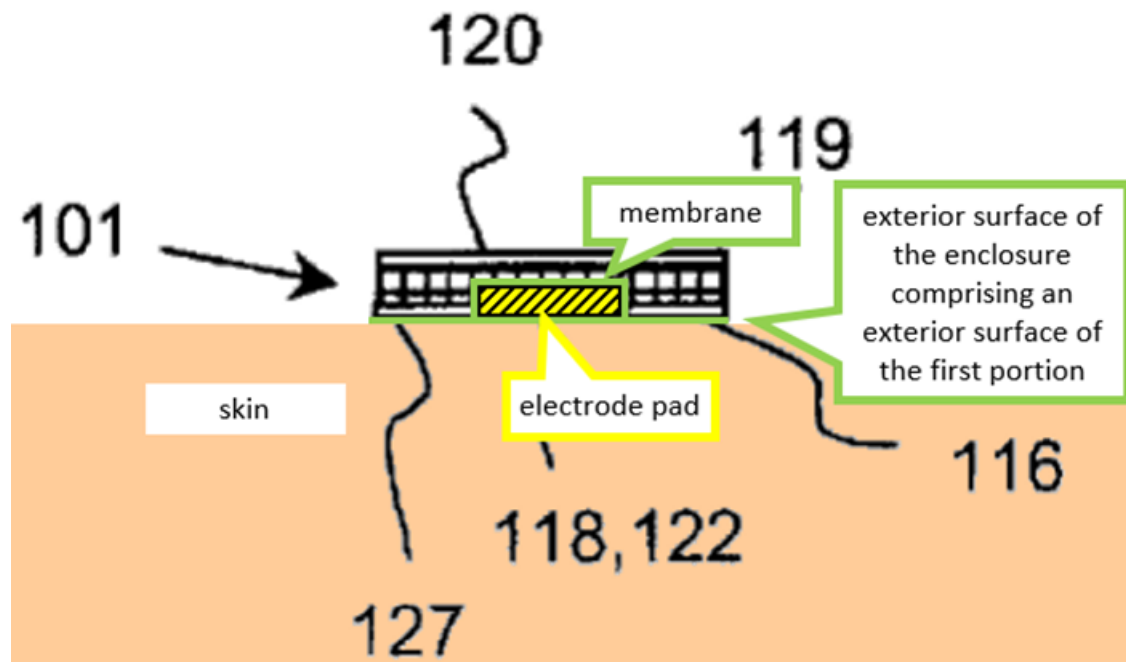
370. First, *Nissilä* discloses a second lead comprising a second pad that is embedded in a second portion of the enclosure. *Nissilä* discloses “[a]t a first end of the electrode structure 100 there is a **first electrode 118** and at a second end of the electrode structure 100 there is a second electrode 122” (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode comprising a “membrane 119” that “is made of metal, electrically conductive plastic or a similar conductive material” (Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by “membrane 119.” The “membrane 119” corresponds to the “exterior surface of the enclosure” that “further comprises an exterior surface of the second portion” of claim element [6.a]. This is illustrated in at least *Nissilä*’s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.



371. Second, *Nissilä* renders obvious a second pad configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the exterior surface of the second portion. For example, *Nissilä* discloses that its electrode pad is placed underneath the “membrane 119,” which includes an “exterior surface of the enclosure” and “exterior surface of the second portion” as recited in claim elements [6.a] and [6.b]. *Nissilä* further discloses that the “membrane 119 can [] come into contact with the person’s skin surface 102” (Ex-1006, 5:39–40). Then *Nissilä* teaches that “on the inner surface 116 of the membrane 119 which is against the person’s skin[,] there can be an electrically conductive adhesive” (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to “detect the second electrical signal of the user’s cardiac signal” via the user’s contact with the “membrane 119” (i.e., via the user’s contact with the exterior surface of the second

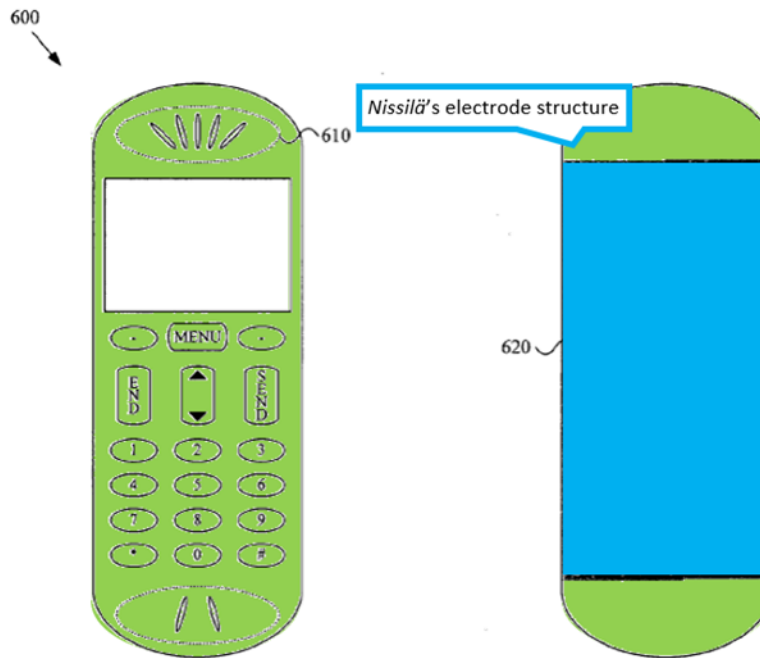
portion). This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

Ex-1006, Fig. 5 (annotated)



372. From this, a person of ordinary skill in the art would have been motivated to implement *Nissilä*'s electrode structure in at least the “main body portion 620” of *Markel*'s Figure 6. This construction would have accomplished *Markel*'s stated goal of an electrode that is “***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). This is illustrated in at least *Markel*'s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



373. Thus, *Markel* in view of *Nissilä* renders obvious claim elements [6.a] and [6.b].

Claim 8, Element [8.a]: the enclosure further comprises at least one pocket underneath the exterior surface of the enclosure; and

Claim 8, Element [8.b]: at least one of the first pad and the second pad is placed within the at least one pocket.

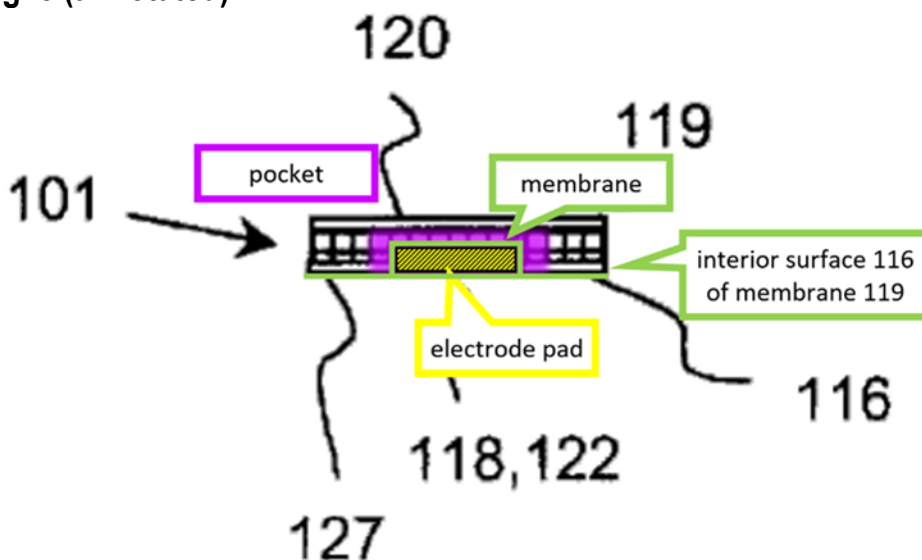
374. *Markel* in view of *Nissilä* renders obvious claim elements [8.a] and [8.b].

375. As explained earlier in Ground 1 with respect to claim elements [1.c.i], [1.c.ii], and [1.c.iii] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have been motivated to implement *Nissilä*'s electrode structure in at least the "audio output portion 610" of *Markel*'s Figure 6. That

implementation would have further rendered obvious claim elements [8.a] and [8.b].

376. For example, *Nissilä* discloses a pad placed within a pocket underneath the exterior surface of the enclosure. This is illustrated in at least *Nissilä*'s Figure 5 (annotated below).

Ex-1006, Fig. 5 (annotated)



377. Thus, *Markel* in view of *Nissilä* renders obvious claim elements [8.a] and [8.b].

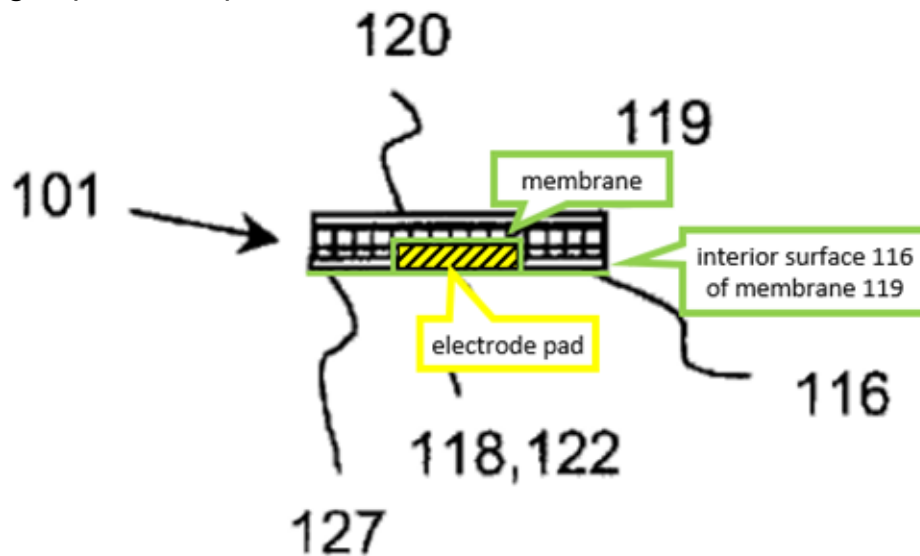
Claim 10, Element [10.a]: wherein the second lead is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the second portion of the enclosure.

378. *Markel* in view of *Nissilä* renders obvious claim element [10.a].

379. As explained in Ground 1 with respect to claim element [1.d.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device that includes “a first electrode 1020” embedded in the “main body portion 620.” As

explained in Ground 2 with respect to claim elements [1.d.i]-[1.d.ii] (the discussion of which is incorporated herein), a person of ordinary skill in the art would have been motivated to combine the teachings of *Markel* and *Nissilä* in order to accomplish construction of *Markel*'s "hidden" electrode.

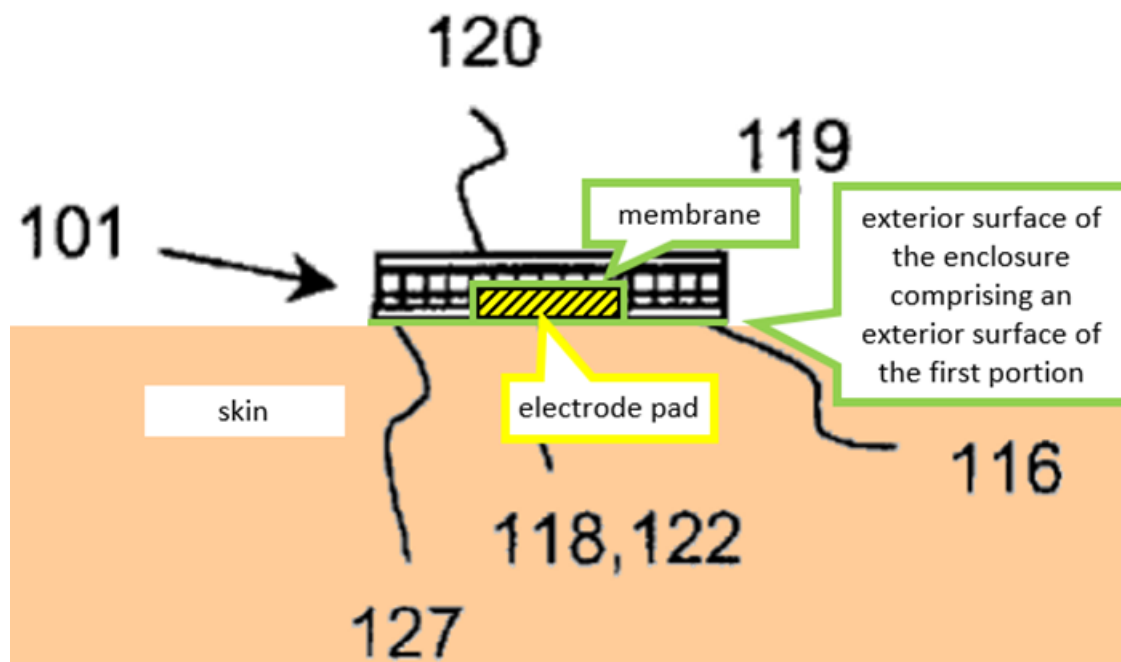
380. First, *Nissilä* discloses a second lead comprising a second pad that is embedded in a second portion of the enclosure. *Nissilä* discloses "[a]t a first end of the electrode structure 100 there is a ***first electrode 118*** and at a second end of the electrode structure 100 there is a second electrode 122" (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode structure comprising a "membrane 119" that "is made of metal, electrically conductive plastic or a similar conductive material" (Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by "membrane 119." The "membrane 119" corresponds to the "second portion of the enclosure" of claim element [10.a]. This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.



381. Second, *Nissilä* renders obvious a second lead configured to detect the second electrical signal of the user’s cardiac signal via the user’s contact with the second portion of the enclosure. For example, *Nissilä* discloses that its electrode pad is placed underneath the “membrane 119,” which includes the “second portion of the enclosure” as recited in claim element [10.a]. *Nissilä* further discloses that the “membrane 119 can [] come into contact with the person’s skin surface 102” (Ex-1006, 5:39–40). Then *Nissilä* teaches that “on the inner surface 116 of the membrane 119 which is against the person’s skin[,], there can be an electrically conductive adhesive” (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to “detect the second electrical signal of the user’s cardiac signal” via the user’s contact with the “membrane 119” (i.e., via the user’s contact with the

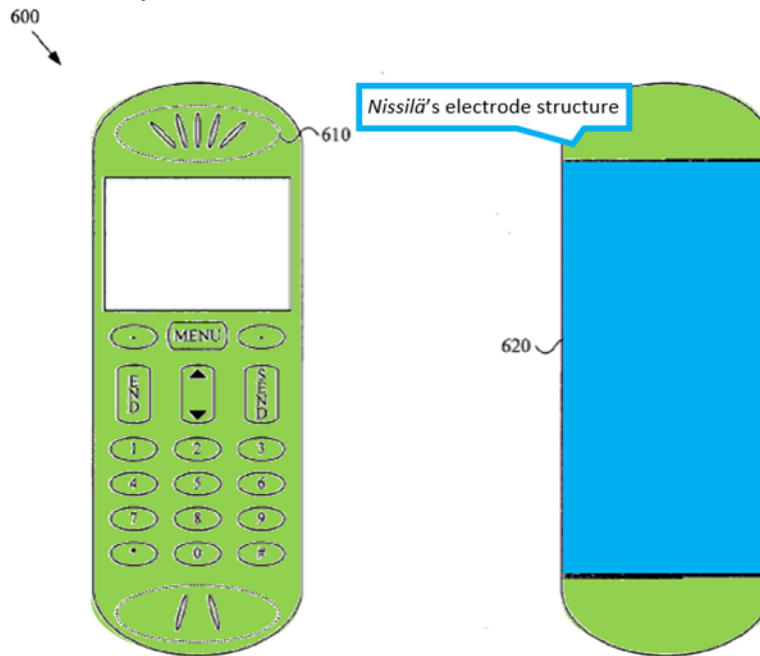
second portion of the enclosure). This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

Ex-1006, Fig. 5 (annotated)



382. From this, a person of ordinary skill in the art would have been motivated to implement *Nissilä*'s electrode structure in at least the “main body portion 620” of *Markel*'s Figure 6. This construction would have accomplished *Markel*'s stated goal of an electrode that is “*substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). This is illustrated in at least *Markel*'s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



383. Thus, *Markel* in view of *Nissilä* renders obvious claim element [10.a].

Claim 15, Element [15.d.i]: the heart sensor comprising: a first lead embedded in a first portion of the enclosure of the electronic device,

Claim 15, Element [15.d.ii]: wherein the first lead is configured to detect a first electrical signal of the user's cardiac signal via the user's contact with at least one of the first lead and the first portion of the enclosure of the electronic device; and

384. *Markel* in view of *Nissilä* renders obvious claim element [15.d.ii].

Specifically, *Markel* in view of *Nissilä* renders obvious a first lead configured to detect a first electrical signal of the user's cardiac signal via the user's skin's contact with the first portion of the enclosure of the electronic device.

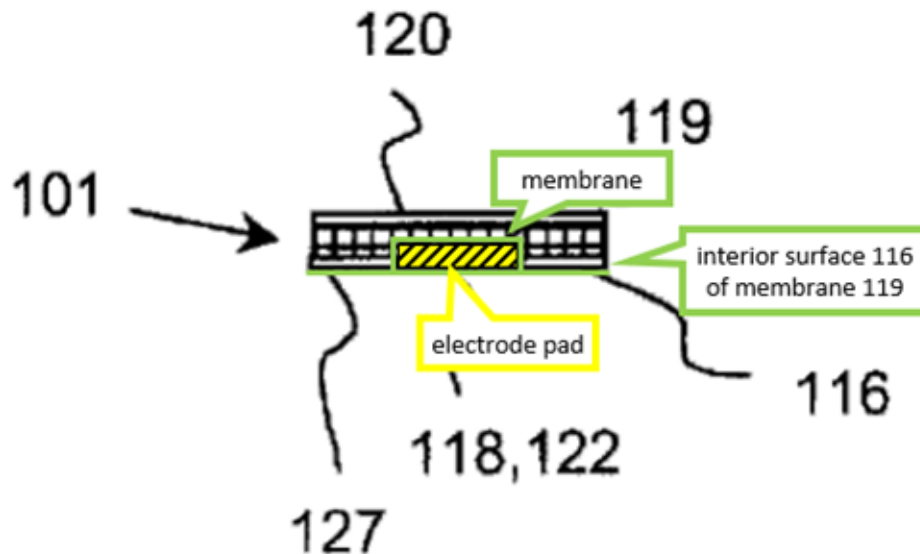
385. As explained in Ground 1 with respect to claim element [15.d.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device

that includes “a first electrode 1020” embedded in “the main body portion 620.” *Markel* also discloses that “an electrode (or all electrodes) or other sensor may be ***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). To the extent that a person of ordinary skill in the art sought additional detail on how to implement *Markel*’s “hidden” electrode, that person of ordinary skill in the art would have turned to *Nissilä*, which expressly teaches a cross-sectional view of an “improved electrode structure” having a pad that is positioned underneath the exterior surface of the electrode (Ex-1006, 2: 17–20, Fig. 5). A person of ordinary skill would have been motivated to combine the teachings of these references in order to accomplish construction of *Markel*’s “hidden” electrode.

386. First, *Nissilä* renders obvious a first lead embedded in a first portion of the electronic device. *Nissilä* discloses “[a]t 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” (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode comprising a “membrane 119” that “is made of metal, electrically conductive plastic or a similar conductive material” (Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by “membrane 119.” This is illustrated in at least *Nissilä*’s Figure 5 (annotated below) which shows a cross

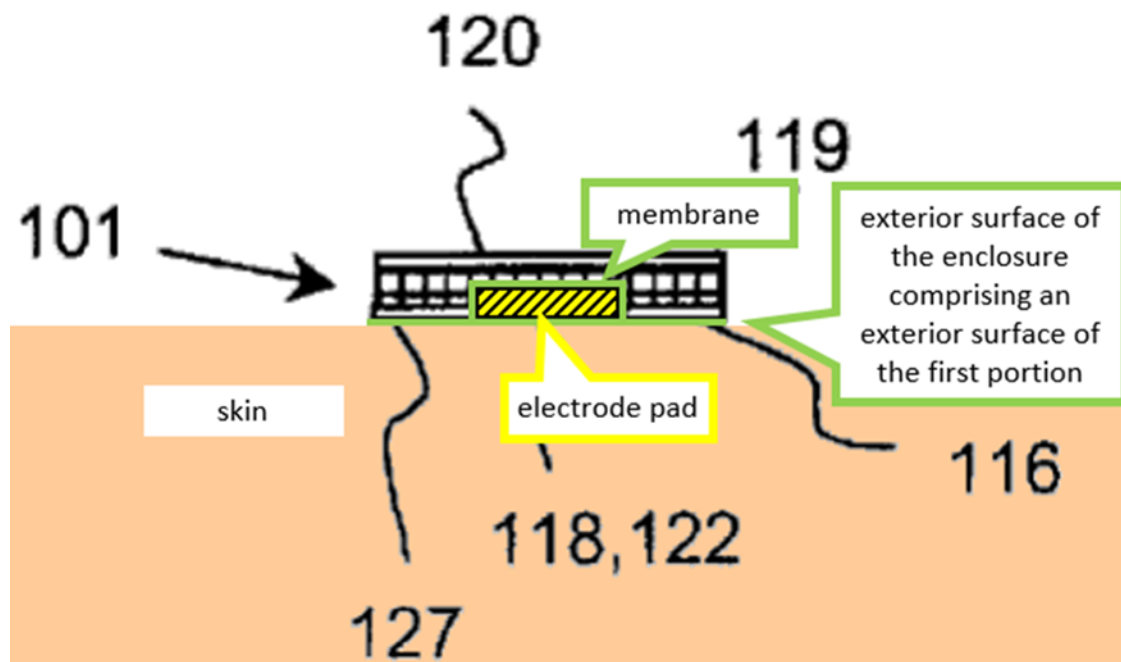
section of the disclosed electrode structure.

Ex-1006, Fig. 5 (annotated)

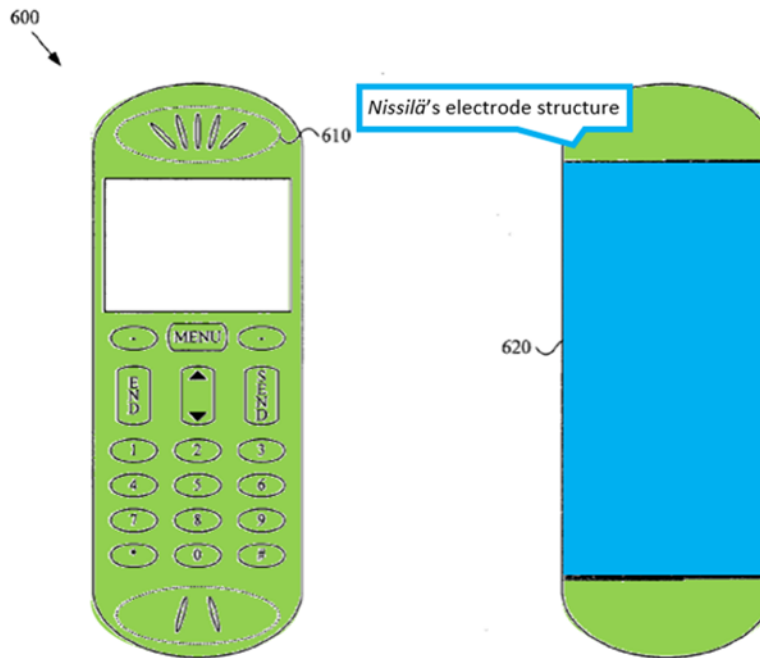


387. Second, *Nissilä* renders obvious that the first lead is configured to detect a first electrical signal of the user’s cardiac signal via the user’s contact with the first portion of the enclosure. *Nissilä* discloses that its electrode pad is placed underneath the “membrane 119,” which includes a “first portion of the enclosure” as recited in claim element [15.d.ii]. *Nissilä* further discloses that the “membrane 119 can [] come into contact with the person’s skin surface 102” (Ex-1006, 5:39–40). Then *Nissilä* teaches that “on the inner surface 116 of the membrane 119 which is against the person’s skin[,] there can be an electrically conductive adhesive” (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to “detect a first electrical signal of the user’s cardiac signal” via the user’s contact with the “membrane 119” (i.e., via the user’s skin’s contact with . . . the second portion

of the enclosure). This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.



Ex-1005, Fig. 6 (annotated)



389. Thus, *Markel* in view of *Nissilä* renders obvious claim element [15.d.ii].

Claim 20, Element [20.a]: wherein the first lead is configured to detect the first electrical signal of the user's cardiac signal via the user's contact with the first portion of the enclosure.

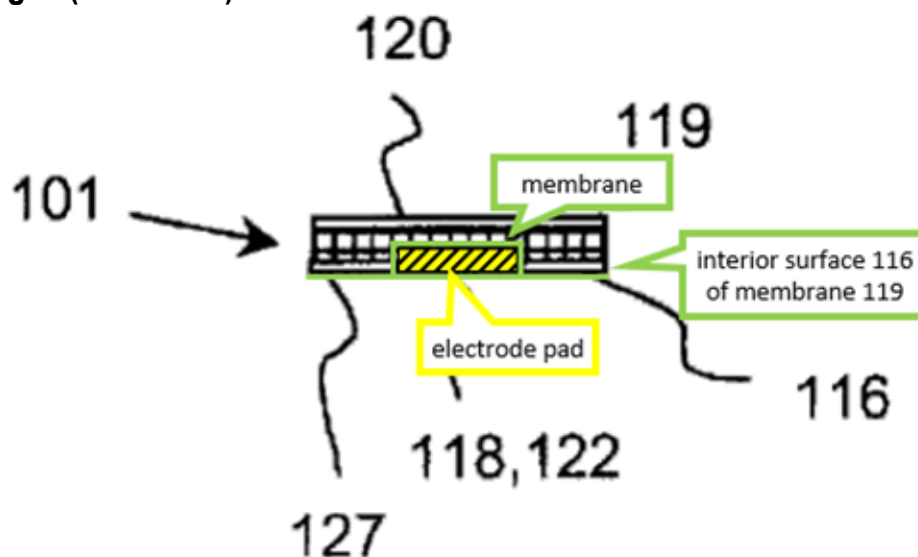
390. *Markle* in view of *Nissilä* renders obvious claim element [20.a].

391. As explained in Ground 1 with respect to claim element [15.d.i] (the discussion of which is incorporated herein), *Markel* discloses an electronic device that includes a “first electrode 1020” embedded in the “main body portion 620.” As explained in Ground 2 with respect to claim elements [15.d.i]-[15.d.ii] (the discussion of which is incorporated herein), a person of ordinary skill in the art

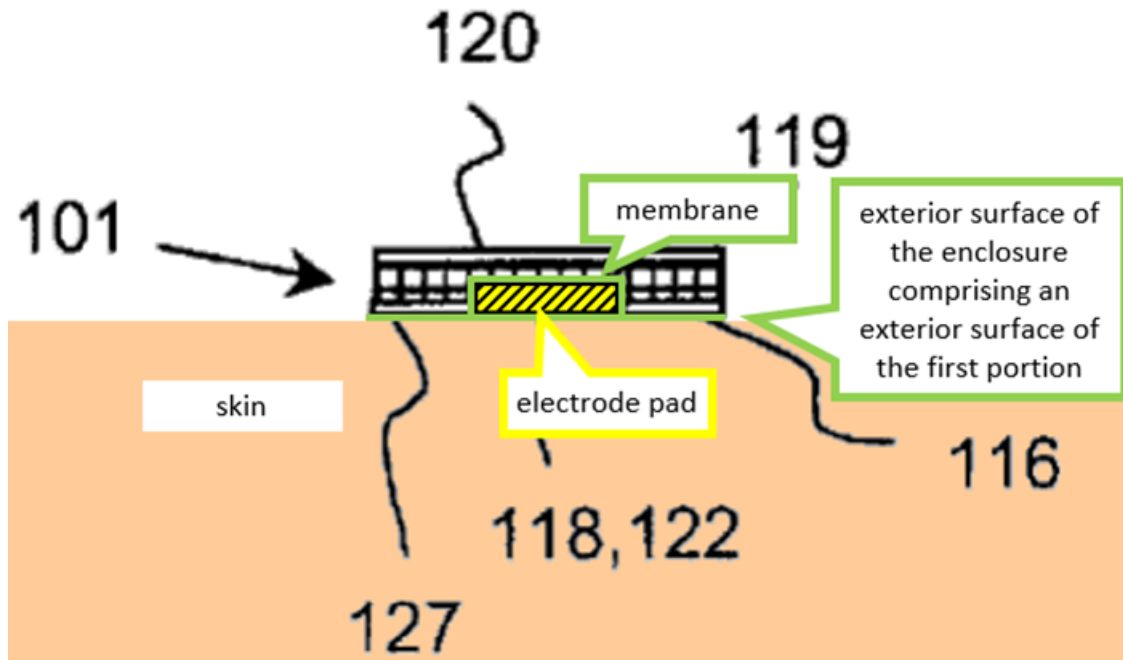
would have been motivated to combine the teachings of *Markel* and *Nissilä* in order to accomplish construction of *Markel*'s "hidden" electrode.

392. First, *Nissilä* renders obvious a first lead embedded in a first portion of the electronic device. *Nissilä* discloses "[a]t 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" (Ex-1006, 5:6–9 (emphasis added)). *Nissilä* further discloses an electrode comprising a "membrane 119" that "is made of metal, electrically conductive plastic or a similar conductive material" (Ex-1006, 5:32–37). The electrode pad is embedded in and enclosed by "membrane 119." The "membrane 119" corresponds to the claimed "first portion of the enclosure" of claim element [20.a]. This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.

Ex-1006, Fig. 5 (annotated)

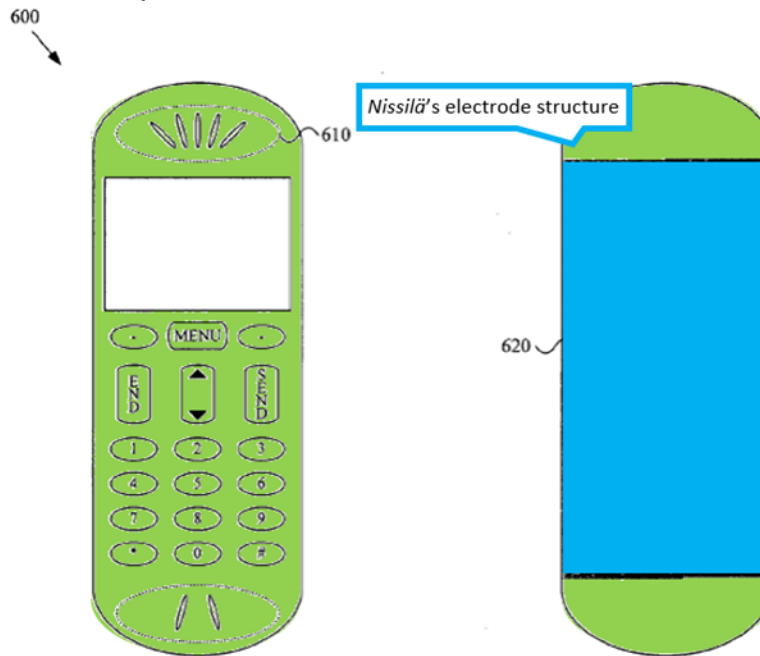


393. Second, *Nissilä* renders obvious a first lead configured to detect the first electrical signal of the user's cardiac signal via the user's contact with the first portion of the enclosure. For example, *Nissilä* discloses that its electrode pad is placed underneath the "membrane 119," which includes the "first portion of the enclosure" as recited in claim element [20.a]. *Nissilä* further discloses that the "membrane 119 can [] come into contact with the person's skin surface 102" (Ex-1006, 5:39–40). Then *Nissilä* teaches that "on the inner surface 116 of the membrane 119 which is against the person's skin[,] there can be an electrically conductive adhesive" (Ex-1006, 5:40–43). Thus, *Nissilä* discloses an electrode pad that is configured to "detect the first electrical signal of the user's cardiac signal" via the user's contact with the "membrane 119" (i.e., via the user's contact with the first portion of the enclosure). This is illustrated in at least *Nissilä*'s Figure 5 (annotated below) which shows a cross section of the disclosed electrode structure.



394. From this, a person of ordinary skill in the art would have been motivated to implement *Nissilä*'s electrode structure in at least the “main body portion 620” of *Markel*'s Figure 6. This construction would have accomplished *Markel*'s stated goal of an electrode that is “*substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence,” such that “a user need not be aware of the presence of the electrode” (Ex-1005, [0040] (emphasis added)). This is illustrated in at least *Markel*'s Figure 6 (annotated below):

Ex-1005, Fig. 6 (annotated)



395. Thus, *Markel* in view of *Nissilä* renders obvious claim element [20.a].

C. Ground 3: *Markel* in View of *Righter* Renders Obvious Claims 12-13 and 19 of the '257 patent.

396. *Markel* in view of *Nissilä* and/or *Righter* further renders obvious claims 12-13 and 19 of the '257 patent. I incorporate herein Section IX.A, which analyzes how *Markel* renders obvious claims 1-22 of the '257 patent. I incorporate herein Section IX.B, which analyzes how *Nissilä* further renders obvious certain limitations. For brevity, below I address only the limitations that are further rendered obvious by *Righter*. Any limitation not specifically addressed below is rendered obvious for at least the reasons outlined in Sections IX.A and IX.B.

Motivation to Combine Markel and Righter

397. There are multiple reasons why a person of ordinary skill in the art would have been specifically motivated to combine *Markel*, *Nissilä*, and *Righter*. The reasons for combining *Markel* and *Nissilä* are set forth in Section IX.B. Furthermore, a person of ordinary skill in the art would have been further motivated to combine these references with *Righter* for the reasons below.

398. First, *Righter* is also directed to the same technical field of personal heart sensors (Ex-1005, [0004]; Ex-1006, 1:7-10, 2:17-20). For example, *Righter* is directed to “an apparatus for monitoring and recording ECG data, and more particularly to a self-contained, portable ECG monitor/recorder” (Ex-1007, 1:6–9). Specifically, *Righter* discloses a “portable ECG monitor/recorder 10 which is adapted to be worn on the wrist of a user” (Ex-1007, 1:51–53).

399. Second, *Righter* is directed to solving a similar problem as *Markel* and *Nissilä* (i.e., monitoring of ECG signals in a mobile device) (Ex-1005, [0002]; Ex-1006, 1:6-9). For example, *Righter* is directed to “an apparatus that records medical-grade ECG data” (Ex-1007, 1:65–68).

400. Third, as discussed in further detail below, a person of ordinary skill in the art would have been motivated to combine the electrode placement of *Righter* with the electronic device of *Markel* in order to make heart monitoring more convenient and comfortable for the user. For example, *Righter* is directed to “an

apparatus that records medical-grade ECG data and yet is convenient and comfortable for a user to wear” (Ex-1007, 1:65-68). Furthermore, the electronic device disclosed in *Righter* can be a watch or “can be easily adapted so that it can be worn by the user as a pendant” or other wearable (Ex-1007, 3:32–37). One of *Righter*’s stated goals is that the “two electrodes 15*b*, 15*c* can [] be easily grasped by the user at the on-set of a cardiac event” (Ex-1007, 3:44–45). Thus, a person of ordinary skill in the art would be motivated to implement the convenient placement of the electrodes on *Righter* on the electronic device of *Markel* so as to encourage user use and to further make it easier and more likely that a user will successfully use the device to provide ECG data.

401. A person of ordinary skill in the art would have reasonable expectation of success in combining the electrode placement in *Righter* with *Markel* and/or *Nissilä* because (1) *Markel* discloses that “electrodes may be *incorporated into the [electronic device] in any of a variety of manners*” and “in any of a *variety of locations*,” (Ex-1005, [0035], [0045]), and (2) the watch in *Righter* “can be easily adapted” (Ex-1007, 3:32–37).

Claim 12, Element [12.a]: wherein the first portion of the enclosure is a bezel.

402. *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [12.a].

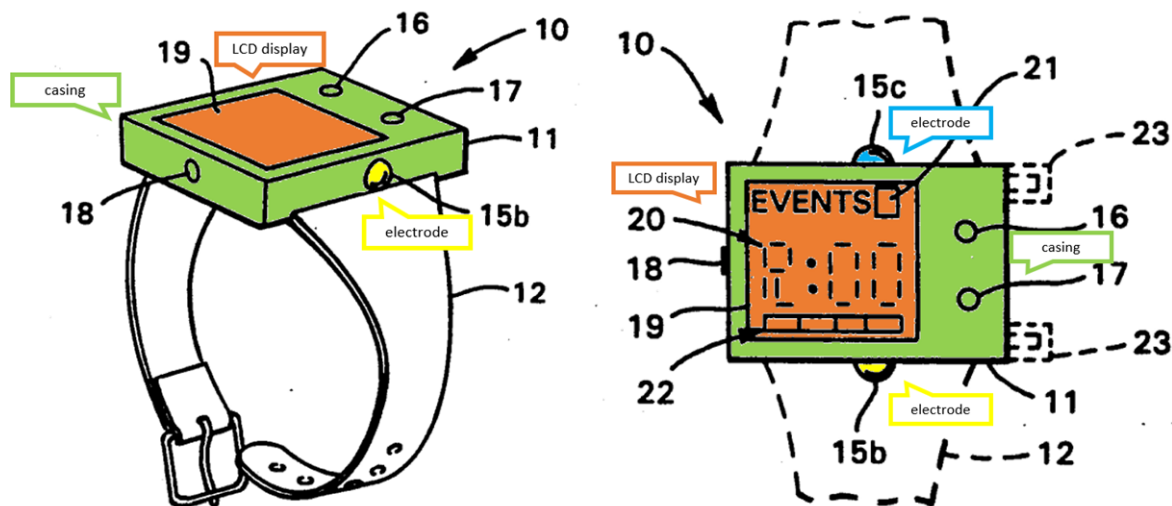
403. As explained earlier in Ground 1 with respect to claim element [1.c.i] (the discussion of which is incorporated herein), *Markel*'s Figure 4 configuration discloses an electronic device that includes "a second electrode 1022" embedded in the "right side portion 420." As further explained earlier in Ground 1 with respect to claim element [1.c.iii], *Markel* also discloses that "an electrode (or all electrodes) or other sensor may be *substantially concealed (or hidden) from a user . . . with little or no visible indication* of the electrode presence," such that "a user need not be aware of the presence of the electrode" (Ex-1005, [0040] (emphasis added)). *Righter* discloses "an apparatus that records medical-grade ECG data and yet is *convenient and comfortable* for a user to wear" (Ex-1007, 1:65–68 (emphasis added)). A person of ordinary skill in the art would have been motivated to combine the electrode placement teachings of *Righter* on the electronic device of *Markel* because the electrode placement in *Righter* is convenient and comfortable.

404. First, *Righter* renders obvious a first lead comprising a first pad embedded in a first portion of the enclosure. *Righter* discloses 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)" (Ex-1007, 2:65–3:2). Although a person of ordinary skill in the art would know contact with the thumb and forefinger alone are not sufficient detect an electrical signal, this is consistent

with the disclosures of the '257 patent (Ex-1001, 8:20–24 (“Leads 322 and 324, which can include conductive pads, can be coupled to sides 312 and 314 of the bezel 310, respectively, such that when the user holds the device, the user’s thumb and forefingers are placed in contact with leads 322 and 324.”)). Thus, *Righter* discloses a first lead comprising a first pad embedded in a “side surface[] of the casing 11” (i.e., the first portion of the enclosure).

405. Second, *Righter* renders obvious that the first portion of the enclosure is a bezel. As explained earlier in Ground 1 with respect to claim element [12.a] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “bezel” to include a rim that encircles an electronic device. I again apply this plain and ordinary meaning of “bezel” in my analysis below. *Righter* discloses that “[a]n LCD display 19 is also provided on the top surface of the casing” (Ex-1007, 3:25–26). Because the “side surfaces of the casing 11” encircle the top surface of the casing, including an LCD display, the “side surfaces” are a bezel. Thus, *Righter* renders obvious an electrode pad embedded in a “side surface[] of the casing 11” (i.e., the first portion of the enclosure) which is a bezel. This is illustrated in at least *Righter*’s Figures 1A and 1B below:

Ex-1007, Fig. 1A (annotated), Fig. 1B (annotated)



406. Thus, *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [12.a].

Claim 13, Element [13.a]: wherein the second portion of the enclosure is a bezel.

407. *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [13.a].

408. As explained in Ground 1 with respect to claim elements [1.d.i] (the discussion of which is incorporated herein), *Markel*'s Figure 4 configuration discloses an electronic device that includes "a first electrode 1020" embedded in the "left side portion 410." As further explained earlier in Ground 1 with respect to claim element [1.d.ii], *Markel* also discloses that "an electrode (or all electrodes) or other sensor may be ***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence," such that "a user need not be aware of

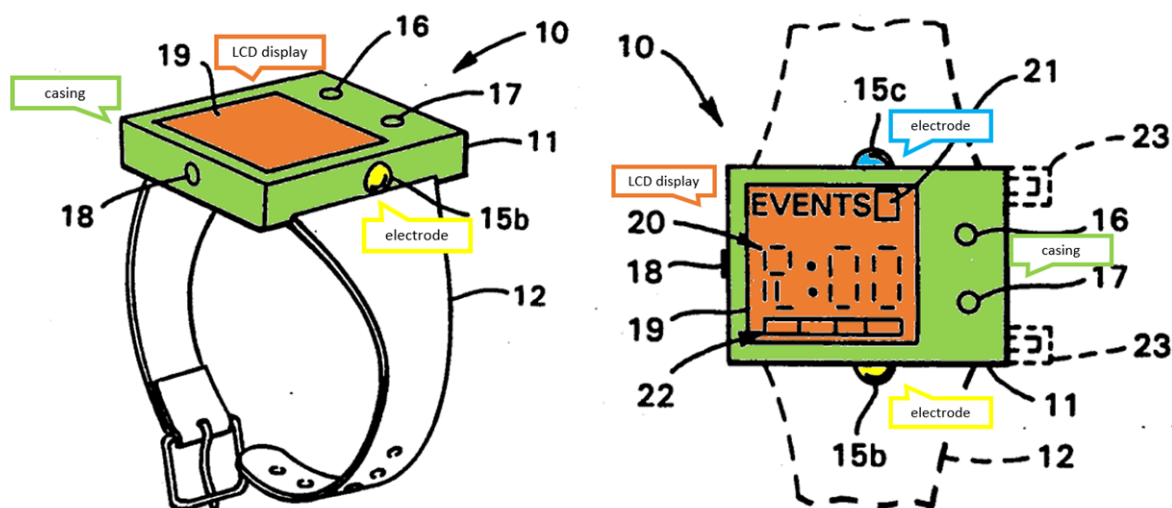
the presence of the electrode” (Ex-1005, [0040] (emphasis added)). *Righter* discloses “an apparatus that records medical-grade ECG data and yet is convenient and comfortable for a user to wear” (Ex-1007, 1:65–68). A person of ordinary skill in the art would have been motivated to combine electrode placement teachings of *Righter* on the electronic device of *Markel* because the electrode placement in *Righter* is convenient and comfortable.

409. First, *Righter* renders obvious a second lead comprising a second pad embedded in a second portion of the enclosure. *Righter* discloses 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)” (Ex-1007, 2:65–3:2). Although a person of ordinary skill in the art would know contact with the thumb and forefinger alone are not sufficient detect an electrical signal, this is consistent with the disclosures of the ’267 patent (Ex-1001, 8:20–24 (“Leads 322 and 324, which can include conductive pads, can be coupled to sides 312 and 314 of the bezel 310, respectively, such that when the user holds the device, the user’s thumb and forefingers are placed in contact with leads 322 and 324.”)). Thus, *Righter* discloses a second lead comprising a second pad embedded in a “side surface[] of the casing 11” (i.e., the second portion of the enclosure).

410. Second, *Righter* renders obvious that the second portion of the

enclosure is a bezel. As explained earlier in Ground 1 with respect to claim element [12.a] (the discussion of which is incorporated herein), in the context of the '257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “bezel” to include a rim that encircles an electronic device. I again apply this plain and ordinary meaning of “bezel” in my analysis below. *Righter* discloses that “[a]n LCD display 19 is also provided on the top surface of the casing ” (Ex-1007, 3:25–26). Because the “side surfaces of the casing 11” encircle the top surface of the casing, including an LCD display, the “side surfaces” are a bezel. Thus, *Righter* renders obvious an electrode pad embedded in a “side surface[] of the casing 11” (i.e., the second portion of the enclosure) which is a bezel. This is illustrated in at least *Righter*’s Figures 1A and 1B below:

Ex-1007, Fig. 1A (annotated), Fig. 1B (annotated)



411. Thus, *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [13.a].

Claim 19, Element [19.a]: the first portion of the electronic device comprises a bezel of the enclosure;

412. *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [19.a].

413. As explained earlier in Ground 1 with respect to claim element [15.d.i] (the discussion of which is incorporated herein), *Markel*'s Figure 4 configuration discloses "a first electrode 1020" embedded in the "left side portion 410." As further explained earlier in Ground 1 with respect to claim element [15.d.ii], *Markel* also discloses that "an electrode (or all electrodes) or other sensor may be ***substantially concealed (or hidden) from a user . . . with little or no visible indication*** of the electrode presence," such that "a user need not be aware of the presence of the electrode" (Ex-1005, [0040] (emphasis added)). *Righter* discloses "an apparatus that records medical-grade ECG data and yet is convenient and comfortable for a user to wear" (Ex-1007, 1:65–68). Furthermore, as explained earlier in Ground 1 with respect to claim element [15.e.i]–[15.e.ii] (the discussion of which is incorporated herein), *Markel* discloses that "an electrode may be ***disposed on a video display device*** 140 (e.g., a border of the display or ***integrated into a touch screen***)." (Ex-1005, [0044] (emphasis added)), and *Righter* discloses an "LCD display 19" (Ex-1007, 3:25–31). A person of ordinary skill in the art would have been motivated

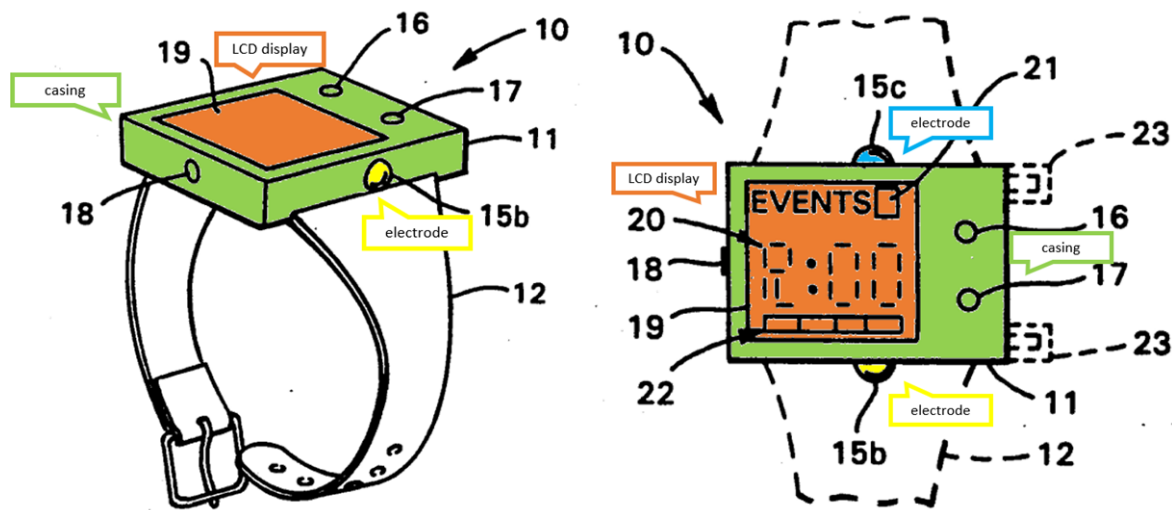
to combine electrode placement teachings of *Righter* on the electronic device of *Markel* because the electrode placement in *Righter* is convenient and comfortable.

414. First, *Righter* renders obvious a first lead embedded in a first portion of the enclosure of the electronic device. *Righter* discloses 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)” (Ex-1007, 2:65–3:2). Although a person of ordinary skill in the art would know contact with the thumb and forefinger alone are not sufficient detect an electrical signal, this is consistent with the disclosures of the ’267 patent (Ex-1001, 8:20–24 (“Leads 322 and 324, which can include conductive pads, can be coupled to sides 312 and 314 of the bezel 310, respectively, such that when the user holds the device, the user’s thumb and forefingers are placed in contact with leads 322 and 324.”)). Thus, *Righter* discloses a first lead embedded in a “side surface[] of the casing 11” (i.e., the first portion of the enclosure of the electronic device).

415. Second, *Righter* renders obvious that the first portion of the device comprises a bezel of the enclosure. As explained earlier in Ground 1 with respect to claim element [12.a] (the discussion of which is incorporated herein), in the context of the ’257 patent and the claim language, a person of ordinary skill in the art would have understood the plain and ordinary meaning of “bezel” to include a rim that

encircles an electronic device. I again apply this plain and ordinary meaning of “bezel” in my analysis below. *Righter* discloses that “[a]n LCD display 19 is also provided on the top surface of the casing ” (Ex-1007, 3:25–26). Because the “side surfaces of the casing 11” encircle the top surface of the casing, including an LCD display, the “side surfaces” are a bezel. Thus, *Righter* renders obvious an electrode embedded in a “side surface[] of the casing 11” (i.e., the first portion of the enclosure) which is a bezel. This is illustrated in at least *Righter*’s Figures 1A and 1B below:

Ex-1007, Fig. 1A (annotated), Fig. 1B (annotated)



416. Thus, *Markel* in view of *Nissilä* and/or *Righter* renders obvious claim element [19.a].

X. CONCLUSION

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and 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.

Dated: June 6, 2023



Ronald D. Berger, M.D., Ph.D., F.H.R.S.