

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MASIMO CORPORATION

Petitioner,

v.

APPLE INC.

Patent Owner.

Case No. IPR2024-00071

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

**DECLARATION OF ALAN L. OSLAN IN SUPPORT OF PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 10,076,257**

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I, Alan Oslan, do hereby declare:

I. INTRODUCTION

1. I, Alan L. Oslan, MSBionedEngr, MBA, have been retained by Knobbe, Martens, Olson & Bear, LLP, counsel for Masimo Corporation (“Masimo” or “Petitioner”). I understand that Masimo is petitioning for inter partes review of U.S. Patent No. 10,076,257 (“the ’257 patent”; EX1001) and requests that the United States Patent and Trademark Office cancel Claims 6-7 of the ’257 patent as unpatentable. The following discussion and analysis provide my opinion as to why Claims 6-7 would have been anticipated and/or obvious to a person of ordinary skill in the art (“POSITA”) in November of 2008. This declaration is provided after my review and analysis of the ’257 patent, the prior art, relevant background technology, and is also based on my education and experience, as well as additional materials identified herein.

2. I am being compensated for my work in this matter at my standard hourly rate for consulting services. My compensation in no way depends on the outcome of this proceeding.

3. The opinions set forth in this declaration are my independent opinions, formed after conducting significant analysis, over several days, related to whether the claims of the ’257 patent would have been obvious in view of the prior art discussed in this declaration. I have been assisted by attorneys in preparing my

declaration in writing, based on my input and approval, and identifying the applicable legal standards that I applied in my analysis set forth in this declaration.

4. I understand that Petitioner will cite and rely on significant portions of my testimony and analysis set forth in this declaration in support of its Petition challenging the patentability of the '257 patent.

II. QUALIFICATIONS AND BACKGROUND

5. I am currently president of ElectroSurge LLC. I founded ElectroSurge in 2010 to consult for other companies based on my extensive experience in medical device development projects. As president of ElectroSurge, I have consulted for several medical device companies on device design and testing, NIH grant support, expert witness for medical device patent litigation including wearable monitoring devices, understanding electrical properties of body tissues, and surface electrodes for stimulation. Over the course of my career, I have worked at a variety of medical device companies ranging from small start-ups, to large mature companies, and have been involved with numerous technologies relating to a multitude of anatomical regions (1977 to present).

6. I received a B.S. in the Electrical Engineering program from the University of Connecticut (1975) where I specialized in biomedical engineering principles. As an undergraduate, I worked in a metallurgy research lab on campus as a lab technician, in a United States Army research facility in Washington, D.C.,

on high-current pulsing of semiconductor devices, and in an on campus biobehavioral sciences research lab testing and repairing capacitive-based respiration monitors. Additionally, I did an independent study lab on using miniature electrodes to measure nerve signals of insects.

7. I received my M.S. in Biomedical Engineering from Boston University in Boston, MA on a part-time basis (1980). I took courses including biomaterials, human anatomy, and electrical signal analysis. My thesis topic was measurement and analysis of electromyography signals (EMGs). EMGs are physiological signals produced by the body to cause muscles to contract. EMG signals are similar to ECG signals, except that ECG signals are produced specifically by the heart muscle. The electrodes for this EMG medical device were dry (pasteless) surface electrodes and they interfaced with a biometric device that I designed.

8. I studied towards my Ph.D. in Electrical Engineering at the University of Connecticut with an anticipated thesis topic in medical ultrasound imaging (1980-81). I took courses in digital image processing and taught classes to junior-level electrical engineering undergraduate students in electrical signals and systems analysis. At the end of my first year, my academic advisor started a two-year sabbatical to obtain his M.D. degree, and I therefore decided not to continue my Ph.D. degree studies.

9. I earned an M.B.A. degree, specializing in management of technology enterprises, from Babson College in Wellesley, MA (2013). While doing so, I took a course entitled “Patents and Licensing in the Life Sciences” and learned about analysis and management of manufacturing costs and other issues facing technology companies.

10. I was a Biomedical Equipment Technician at New England Medical Center, a teaching hospital of Tufts University School of Medicine in Boston, MA (1977-78). Some of my responsibilities included performing scheduled maintenance and calibration of medical equipment including electrocardiogram (ECG) and respiratory monitoring equipment. I also responded to and resolved problems with equipment, including issues with ECG surface electrodes and respiration impedance electrodes, used on patients in wards, ICUs, and surgery.

11. I was a Research Engineer in a research lab at Children’s Hospital Medical Center, a teaching hospital of Harvard Medical School in Boston, MA (1978-80). My manager was an adjunct professor at Boston University and my lab project overlapped considerably with my M.S. thesis project discussed above, involving measurement and analysis of EMG signals using dry (pasteless) surface electrodes and designing a biomedical measuring device. At this time, I was also an advisor to a group of Boston University undergraduate students working towards their B.S. degrees in Biomedical Engineering.

12. I was an Electrical Engineer for Corning Medical & Scientific in Medfield, MA (1981-83) where I worked on systems for spectrophotometric-based blood analysis of hemoglobin. I helped designed an ultrasonic driver and power supply used within the system that could accommodate varying worldwide voltages and frequencies.

13. I was a Design Engineer for Zoll Medical Instrument Corp. in Cambridge, MA (1987) where I designed and tested a single package application-specific integrated circuit (ASIC) for a portable ECG/external pacemaker instrument. Additionally, I designed analog drive circuitry for magnetic deflection of a CRT display.

14. I was a Project Engineer developing various medical devices based on microwave energy and sensing techniques at Microwave Medical Systems, a start-up company in Acton, MA (1988-92, 1996-97). As part of my responsibilities, I selected several connectors, with some containing alignment keys, for use with those medical devices. Additionally, I worked with a vacuum mold forming company to fabricate the plastic housing of a medical device.

15. I worked at Boston Scientific, a large and successful medical device company in Natick, MA, as a Sr. Biomedical/Electrical Engineer and Program Manager (1992-96, 2005-06). In this role (1992-96), I led a multidisciplinary team to develop a catheter for diagnosing and treating cardiac arrhythmias that was

eventually released to the market. This catheter contained electrodes for measuring the ECG from within the heart. I explored printing conductive ink on an insulating substrate to reduce manufacturing costs.

16. I was a technical Program Manager at Aurora Imaging Corp. (no longer in business), a start-up company (1997-98, 2000-03). In this role, I was the technical and clinical lead for a breast biopsy system for use on an Aurora MRI machine dedicated to breast imaging that was eventually released to the market. I was also a co-inventor on a patent (US Pat. No. 7,171,256) relating to this device.

17. I was a technical Project Manager at Smith + Nephew (Endoscopy Division) in Andover, MA (1998-2000). In this role, I was the technical lead for an arthroscopic surgery device (used in joints such as shoulders and knees), which was eventually released to the market. The device included ceramic materials.

18. I am a co-inventor of two U.S. patents and one pending U.S. patent application: (a) U.S. Patent No. 7,171,256, directed toward breast magnetic imaging systems; (b) U.S. Patent No. 5,833,688, directed toward sensing temperature with a plurality of catheter sensors; and (c) U.S. Patent Appl. No. 20040030330, directed toward electrosurgery systems.

19. I am a member of Eta Kappa Nu (“HKN”) Electrical Engineering honor society, and the Institute of Electrical and Electronic Engineers (“IEEE”) subgroup Biomedical Engineering. I have been a member of the Medical Development Group

("MDG") and advise medical device start-up companies in Massachusetts Medical Device Development ("M2D2") center accelerator programs.

20. I am qualified to render an opinion regarding the design and development of electronic devices for monitoring or sensing biological parameters. Based on my expertise and qualifications, I am qualified to provide an opinion as to what a person of ordinary skill in the art would have understood, known, or concluded as of November 2008.

21. A copy of my curriculum vitae, attached as Exhibit 1004, contains further details concerning my education, experience, publications, patents, and other qualifications to render an expert opinion in this matter.

III. INFORMATION AND MATERIALS CONSIDERED

22. I have considered the following list of materials in formulating my opinions in this matter:

Exhibit No.	Description
1001	U.S. Patent No. 10,076,257 ("the '257 patent")
1002	File history of the '257 patent
1005	U.S. Pat. Pub. No. 2007/0021677, published January 25, 2007 ("Markel")

Exhibit No.	Description
1006	U.S. Pat. No. 5,351,695, issued Oct. 4, 1994 (“Mills”)
1008	Leslie Cromwell et al., <u>Biomedical Instrumentation and Measurements</u> (1973)
1011	Stejskal et al., <u>Electrically Anisotropic Materials: Polyaniline Particles Organized in a Polyurethane Network</u> (1997)
1015	Carl R. Nave, <i>Conductors and Insulators</i> , HYPERPHYSICS (last visited March 13, 2023), http://hyperphysics.phy-astr.gsu.edu/hbase/electric/conins.html#c1
1016	<u>Merriam-Webster’s Collegiate Dictionary</u> (11 th ed. 2004)
1017	<u>Random House Unabridged Dictionary</u> (2 nd ed. 1993)
1018	<u>The American Heritage Dictionary of the English Language</u> (4 th ed. 2000)
1019	Steven M. Kaplan, <u>Wiley Electrical and Electronics Engineering Dictionary</u> (2004)
1020	<u>Stedman’s Medical Dictionary</u> (28 th ed. 2006)
1022	U.S. Patent No. 5,678,545, issued Oct. 21, 1997 (“Stratbucker”)
1024	U.S. Patent Pub. No. US 2005/0239493 A1, published Oct. 27, 2005 (“Batkin”)
1025	U.S. Patent No. 4,230,127, issued Oct. 28, 1980 (“Larson”)

Exhibit No.	Description
1026	Miller, H. A. et al., <u>Biomedical Electrode Technology Theory & Practice</u> , Academic Press Inc., 1974, pp. 5-93.
1027	U.S. Patent No. 3,568,662, issued Mar. 9, 1971 (“Everett”)
1028	Carl R. Nave, <i>Capacitors</i> , HYPERPHYSICS (last visited October 17, 2023), http://hyperphysics.phy-astr.gsu.edu/hbase/electric/pplate.html#c1

23. In addition to references specifically cited by Petitioner in the Petition, I have also reviewed all other documents and exhibits cited in my declaration, to the extent they are not listed above.

IV. RELEVANT LEGAL STANDARDS

24. I am not a lawyer. Therefore, in formulating my opinions and conclusions in this proceeding, I have been provided with an understanding of the relevant aspects of U.S. patent law that govern the issues of patent validity.

A. **Prior Art**

25. I understand that, in this IPR proceeding, the prior art to the ‘257 patent includes patents and printed publications in the relevant field(s) that predate the ‘257 patent’s priority date.

A. Anticipation

26. I have been informed that a person cannot obtain a patent on an invention if someone else had already made the same invention. I understand that 35 U.S.C. § 102 is the statute that governs the determination of anticipation. I understand that under 35 U.S.C. § 102, a prior art reference anticipates a claim if each and every element of a claim is found, either expressly or inherently, within the single prior art reference. I understand that a reference anticipates a claim if all elements of the claim are disclosed within the four corners of the reference in the same arrangement as in the claim.

B. Obviousness

27. I understand that a claim of a patent may be obvious to a person of ordinary skill in the art if the differences between the subject matter set forth in the patent claim and the prior art are such that the claimed subject matter as a whole would have been obvious at the time of the invention.

28. I understand that obviousness is a determination of law based on various underlying determinations of fact. In particular, these underlying factual determinations include (1) the scope and content of the prior art; (2) the level of ordinary skill in the art at the time the claimed invention was made; (3) the differences between the claimed invention and the prior art; and (4) the extent of any proffered objective “indicia” of non-obviousness. I understand that the objective

indicia, also known as secondary considerations, which may be considered in such an analysis include, among other factors: the commercial success of the patented invention (including evidence of industry recognition or awards), the existence of a long-felt but unmet need in the field satisfied by the invention, the failure of others to arrive at the invention, industry acquiescence and recognition of the invention, initial skepticism of the invention by others in the field, the extent to which the inventors proceeded in a direction contrary to the accepted wisdom of those of ordinary skill in the art, and licensing of the patent.

29. In determining the scope and content of the prior art, I understand a reference is considered prior art for the obviousness analysis if it falls within the inventors' field of endeavor. Additionally, a reference is prior art for the obviousness analysis, even if from a different field of endeavor, if it is reasonably pertinent to the particular problem for which the invention was made. A reference is reasonably pertinent if it is something a person of ordinary skill in the art would have looked to when attempting to solve the problem.

30. While multiple prior art references or elements may be combined to render a patent claim obvious, I understand that a patent claim composed of several elements is not proven obvious merely by demonstrating that each of its elements was, independently, known in the prior art. I understand that I should consider whether there is an "apparent reason" or motivation to combine the prior art

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

B. Claim Construction

31. I have been informed the first step of a validity analysis is to construe the claims. I have been informed that the Patent Trial and Appeal Board construes the claims by giving the claim terms their ordinary and customary meaning, as they would have been understood by a person of ordinary skill in the art (“POSITA”) at the time of the invention in view of the intrinsic record (patent specification and file history). For the purposes of this review, and to the extent necessary, I have interpreted each claim term in accordance with its plain and ordinary meaning as it would have been understood by a POSITA at the time of the invention, in view of the intrinsic record.

32. It is my understanding that an inventor may expressly define certain terms used in a patent, and therefore may give a term a meaning that differs from the term's plain and ordinary meaning. However, I do not believe that the inventors defined any claim terms whose construction is necessary for my analysis in a manner inconsistent with their plain and ordinary meanings in view of the intrinsic record.

33. I have been informed that, under 35 U.S.C. § 112(f), claim limitations written in “means-plus-function” format must be construed as follows: (1) the function specified in the claim, and the structure corresponding to the claimed function, must be identified, (2) to be corresponding structure, the specification must clearly link the structure with performance of the claimed function and the structure must actually be able to perform the claimed function, and (3) once corresponding structure is identified, the claim limitation is construed to cover the corresponding structure and equivalent structures. However, I do not believe that any claim terms whose construction is necessary for my analysis is written in “means-plus-function” format.

C. Perspective of a Person of Ordinary Skill in the Art at the Time of the Claimed Invention

34. I have been informed that claim construction and patent validity is generally analyzed from the perspective of a hypothetical person of ordinary skill in the art of the invention (“POSITA”) as of the effective filing date. I have assumed

for purposes of my analysis that the effective filing date, also referred to herein as the “relevant time,” is November 5, 2008.

35. I have performed my analyses, and expressed my opinions, from the perspective of the POSITA (as further described below) at the relevant time.

D. Prior-Art Status of References

36. I understand that the patent statute defines the requirements for a reference to be considered prior art to the '257 patent. However, while I understand the references I have analyzed were published before November 5, 2008, I have not been asked to assess their prior-art status. Rather, I have assumed, for purposes of my analysis, that the references are prior art to the '257 patent.

V. LEVEL OF ORDINARY SKILL IN THE ART

37. I understand that my opinion must be taken from the perspective of what would have been known or understood by a person of ordinary skill in the art at the time of the invention. I have been informed by counsel and it is my understanding that the '257 Patent claims priority to a provisional application filed on November 5, 2008. I understand that date to be the time of the invention for my analysis. I have been informed that the level of ordinary skill in the art may be determined by various factors including: (a) the type of problems encountered in the art, (b) prior art solutions to those problems, (c) the rapidity with which innovations

are made, (d) the sophistication of the technology, and (e) the educational level of active workers in the field.

38. A POSITA of the '257 patent would have had a B.S. degree in electrical engineering or biomedical engineering or a related field, with at least two years of experience designing patient monitoring systems. A higher level of education may compensate for less work experience and vice versa. My opinions concerning the unpatentability of the '257 patent claims, as set forth herein, are from the perspective of a person of ordinary skill in the art, as set forth above.

VI. THE '257 PATENT

A. Overview of '257 Patent

39. The '257 patent is directed to an electronic device, such as a mobile phone, that includes “a heart sensor having several leads for detecting a user’s cardiac signals.” EX1001, Abstract. Fig. 3¹ (reproduced in part below with annotations) depicts a mobile phone 300 including a bezel 310.

¹ All reproduced figures herein are annotated unless otherwise stated.

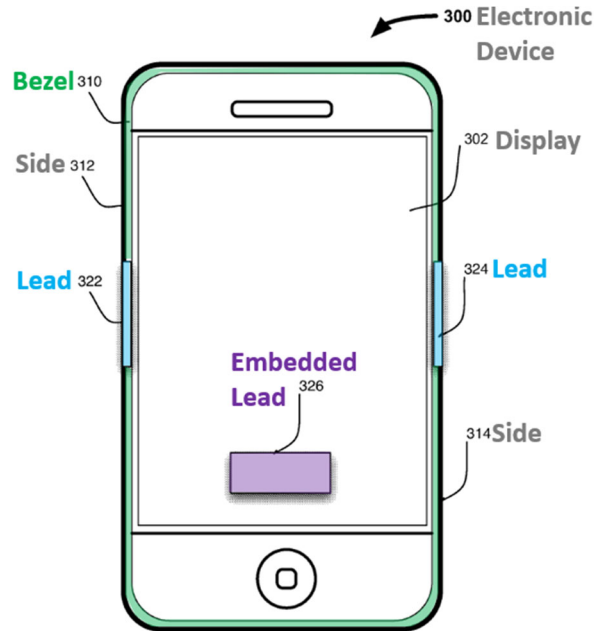


FIG. 3

40. The ‘257 patent touts the improvement of the aesthetic qualities of the electronic device with respect to the positioning of the leads. The ‘257 patent explains this improvement is because the approach of prior art devices placing “the leads ... on the exterior surface” of the housing (or enclosure) of the electronic device “is not aesthetically pleasing.” *Id.*, 1:58-63.

41. Fig. 4B illustrates the lead 472 can be positioned against the back surface of bezel 460 or alternatively “placed in the thickness of bezel 460 (e.g., in a pocket within the bezel wall), but underneath the outer surface of the bezel” where the bezel is part of electronic device 450. EX1001, 9:46-48. According to the ’257 patent, the “short thickness of the bezel can allow electrical signals to propagate from the user to the outer surface of the bezel, through the bezel, and into the lead.”

Id., 9:48-51. In turn, the lead “transmits the signals to a processor.” *Id.*, 9:51-52. The ‘257 patent explains that this results in an “electronic device [450] having a bezel [460] with an embedded heart sensor lead [472].” *Id.*, 3:30-33.

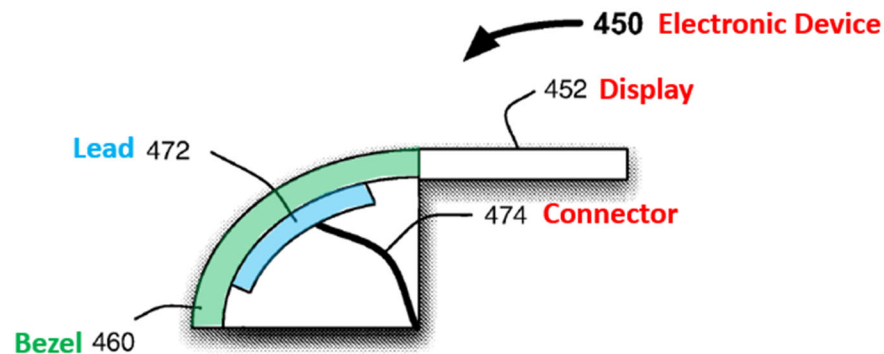


FIG. 4B

B. Prosecution History of the ‘257 Patent

42. The examiner rejected the claims several times before allowing them after Patent Owner made several narrowing amendments to the independent claims. Specifically, Patent Owner added the limitation of an embedded “first pad” and “second pad” in pending claim 29 (issued claim 1), pending claim 34 (issued claim 6), and pending claim 35 (issued claim 7). EX1002 at 77–79. The Examiner provided no reason for allowance of the claims. EX1002 at 33-35.

VII. CLAIM CONSTRUCTION

1. Embedded

43. I assessed the meaning of the term “embedded” which is recited in independent claim 1. More specifically, claim 1 recites “embedded” first and second pads of respective first and second leads. After thoroughly reviewing the ‘257 patent, I have concluded that the ‘257 patent does not provide a definition of “embedded.” As such, to construe these claim terms, I have used the claim language itself, the specification as well as reviewed dictionary definitions to produce a proper definition for “embedded” as would be understood by a POSITA reviewing the ‘257 patent.

44. The ‘275 patent discloses two examples of leads 422, 472 “embedded” into portions of the housing or enclosure 410, 460. EX1001, 9:19-20, 9:37-38. Fig. 4A shows embedded lead 422 “along the outer surface of the bezel 410” and “exposed to the user during use.” *Id.*, 9:22-24. In contrast, Fig. 4B shows embedded lead 472 “positioned against the back surface of the bezel 460” *Id.*, 9:44-45.

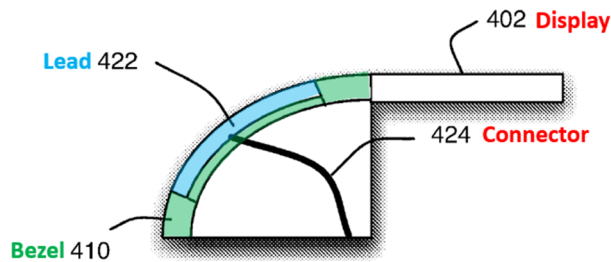


FIG. 4A

"[A] bezel with an embedded heart sensor lead" Ex. 1001 at 9:19-20.

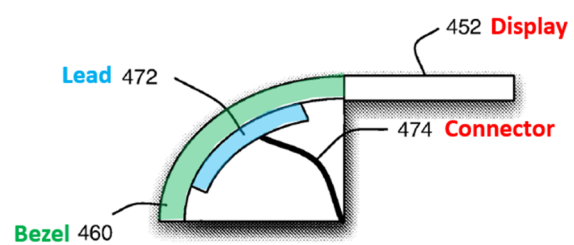


FIG. 4B

"[A]another ... bezel with an embedded heart sensor lead" Ex. 1001 at 9:37-38.

The '257 patent also explains that a lead can be embedded if it is "placed within the thickness of bezel . . . but underneath the outer surface of the bezel." EX1001, 9:45-48.

45. Appropriate dictionary meanings for embedded as used in the '257 patent include "to make something an integral part of" (EX1016, 406); "to be or become fixed or incorporated, as into a surrounding mass" (EX1017, 635); "to cause to be an integral part of a surrounding whole" (EX1018, 583).

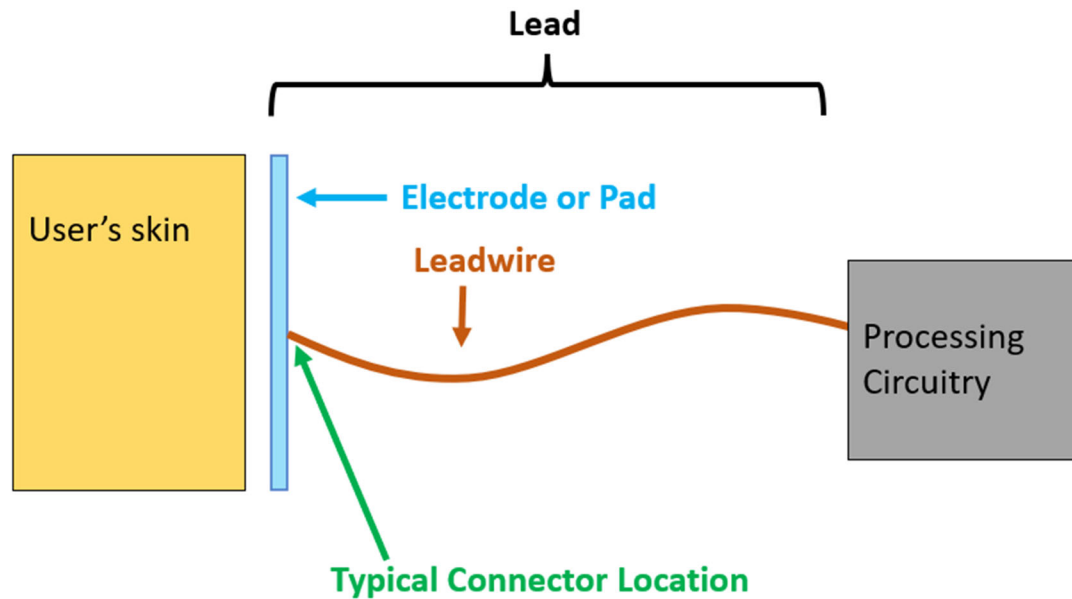
46. Accordingly, a POSITA would understand at the time of the '257 patent disclosure that the ordinary and customary meaning of "**embedded**" means "*an integral part of*" such as, by "*being placed in the thickness of a surrounding material including forming an outer and/or inner surface*" or "*placed underneath an exterior surface and against an inner surface.*"

2. Lead

47. I assessed the meaning of the term “lead” which is recited in independent Claim 1. A person of skill in the art (POSITA) would have understood that a common definition of a lead is a “conductor, usually a wire, by which circuit elements or points are connected to components, devices, equipment, systems, points or materials. Also called a lead wire.” (EX1019, 414). Another technical dictionary defines a lead as an “electrocardiographic cable with connections within the electronics of the machine designated for an electrode placed at a particular point on the body surface.” (EX1020, 1062).

48. A POSITA would understand a common basic electrocardiogram (ECG)² system to include a number of “leads” each typically formed from an “electrode” in contact with the user’s skin (sometimes referred to as a “pad”) and may include a “lead wire”, one or more connectors, and other components to electrically couple a body electrical signal at the electrode to processing circuitry. For example, a typical ECG lead can be graphically illustrated as follows:

² Electrocardiogram is commonly abbreviated as either ECG or EKG. EX1008, 31.



Electric potentials measured by each lead are compared to other leads to determine a voltage (*e.g.*, a difference between two electrical potentials). The measured differential voltage is the ECG signal.

49. The '257 describes an electronic device with a sensor such that “electrical signals generated by the user can be transmitted from the user's skin through the electronic device housing to the leads.” EX1001, Abstract. Accordingly, this device is a type of electrocardiogram (ECG). In the context of an ECG system, an “electrode” is a well-known term of art that a POSITA understands to mean a structure, such as a pad, that contacts the user’s skin to detect the user’s ECG.

50. The '257 patent does not explicitly use the commonly applied term “electrode” in the field of ECG, but does describe a structure a POSITA would

understand to mean an electrode, including a “pad.” EX1001, 6:28-33. For example, the ‘257 patent explains: “to detect a user's heartbeat or heart rhythm, however, the electronic device must provide at least two leads that the user contacts to detect the user's cardiac signals” and “contact is made between the user (e.g., the user's hand or finger) and the leads for cardiac signals to be detected.” EX1001, 1:56-58, 6:27-28.

51. The ‘257 patent states that to “provide an electrical signal from the user to the processing circuitry, the leads can be exposed such that the user may directly contact the leads, or 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).” EX1001, 2:44-50. Consistent with its ordinary meaning as shown in dictionary definitions and based on the claims and disclosure of the ‘257 patent, a POSITA would understand a **“lead”** in context of the ‘257 patent to mean *“one or more conductive components that form at least a part of an electrical path from the user’s skin to the processor.”*

3. Pad

52. I assessed the meaning of the term “pad” which is recited in independent Claim 1 and a number of its dependent claims. The ‘257 patent states that a “lead can include a pad ... placed on the outer or inner surface of an electronic device bezel or housing [which] can then be coupled to a wire or other connector for

providing cardiac signals to a processor for processing.” EX1001, 6:28-33. An electrode is often a conductive pad. The dictionary meaning of pad is “a thin flat mat or cushion.” EX1016, 890. The ‘257 patent states a “pad” as “an extended area placed on the outer or inner surface of an electronic device bezel or housing” and which can then be “coupled to a wire or other connector for providing cardiac signals to a processor for processing.” EX1001, 6:29-33. Consistent with its ordinary meaning to a POSITA, a “**pad**” in the context of the ‘257 patent means “*a thin mat that may be part of the electrical path of a lead, such as an electrode or a connection that is part of the lead.*”

4. Positioned Apart

53. I have assessed the meaning of the term “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” which is recited in dependent Claim 7. The ’257 patent specification does not explicitly define this term nor are there any drawings that illustrate what is meant by being “positioned apart . . . by material having the second conductivity.”

54. Claim 7 recites “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.” EX1001, 13:15-18. Claim 7 depends from claim 6 which recites that “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.”

Id. 13:11-14. Claim 6 depends from Claim 4, which recites separation of the first portion and the second portion by a third material with a first conductivity “insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion.” EX1001, 12:55-62. The ‘257 claims do not recite that the first conductivity and the second conductivity are required to be in two different materials, and the claims also do not require the first and second conductivity to be in the same material. Rather, the claims refer to the first conductivity and second conductivity as having different directional properties (such as in the direction “from the first pad to the second pad” and in the direction through a portion “over a distance larger than the thickness of the second portion”).

55. From my inspection, the ’257 patent specification does not refer to the use of an isolating layer in conjunction with a bezel having a second conductivity. Instead, the ‘257 patent states that “if the material of bezel 410 is not conductive, or insufficiently conductive to cause several distinct leads 422 positioned on bezel 410 from shorting, no isolating layer may be necessary.” EX1001, 32-35. Thus, the ‘257 patent does not require any embodiment incorporating two separate materials, one with a first conductivity and one with a second conductivity.

56. When discussing Figure 4B, having a lead 472 below the bezel 460, the specification states that the electrical conductivity of the bezel is “adapted such that the signal can be transmitted along short distances in bezel 460.” EX1001, 9:40-44. Further, the specification states that “the distance between adjacent leads can be sufficiently large (e.g., substantially larger than the thickness of bezel 460) that different leads of bezel 460 cannot detect the same electrical signal.” EX1001, 9:53-57.

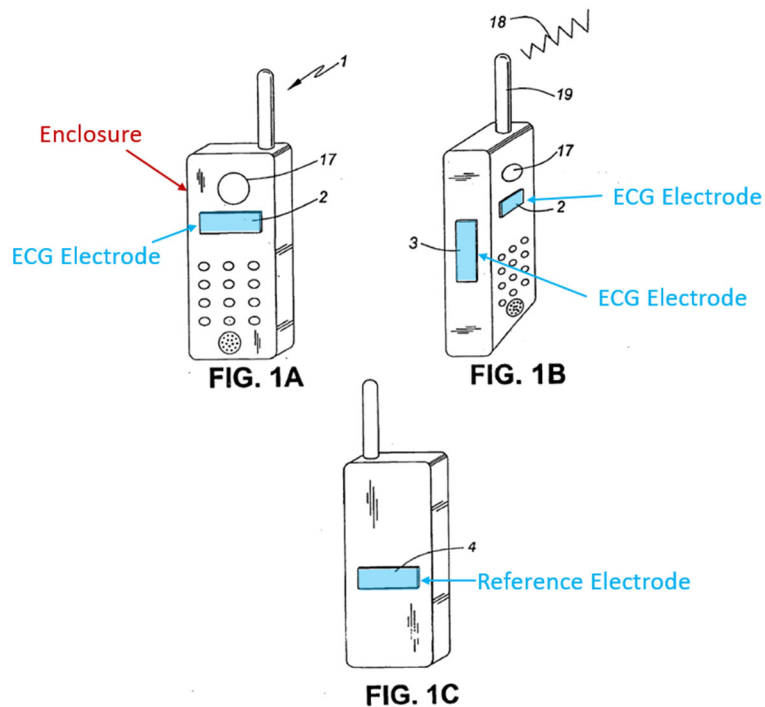
57. Using this description of Figure 4B, “positioned apart from one another . . . by material having the second conductivity” should be interpreted for the purposes of this Declaration as *an electrical separation between two pads such that they “cannot detect the same electrical signal.”* EX1001, 9:53-57. This electrical separation may be accomplished by a material having the first conductivity and the second conductivity or by two or more materials, where a first material has the first conductivity and the second material has the second conductivity.

VIII. OVERVIEW OF THE PRIOR ART

A. Batkin

58. Batkin discloses a bio-monitor built into a telephone handset or cellphone where two sensors (2 and 3) and a reference electrode (4) are configured to obtain bio-signals while the cell phone is in the position for normal use. EX1024, abstract. The sensors may be ECG capacitive electrodes with a forward facing (2)

and side or rear-facing positions. EX1024, [0044]. Batkin explains that the prior art fails to provide a phone with bio-signal monitoring during “normal speaking or communications over a phone handset.” EX1024, [0010]. Thus, Batkin provides “electrode placement . . . for bio-signal pickup during the course of normal communications.” EX1024, [0034].

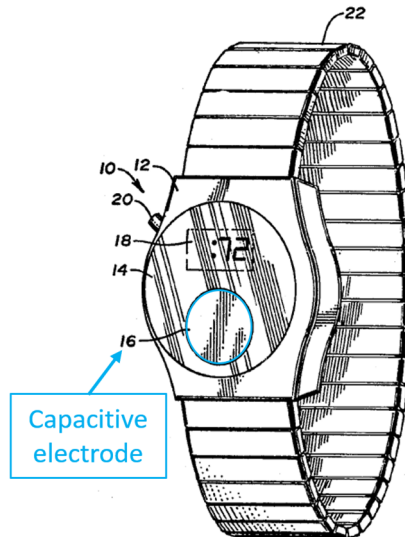


B. Larson

59. Larson discloses a wristwatch size cardiac monitoring apparatus that is worn on the wrist of the user. EX1025, abstract. The cardiac monitoring apparatus contains a capacitive sensor on the top of the device having a metal layer on which is placed a dielectric material such that when the finger is placed on top of the dielectric material, a capacitor is formed and the electric signal (EKG) on the finger

is transferred through the dielectric layer to the metal layer. *Id*; see also *id.* 3:38-57.

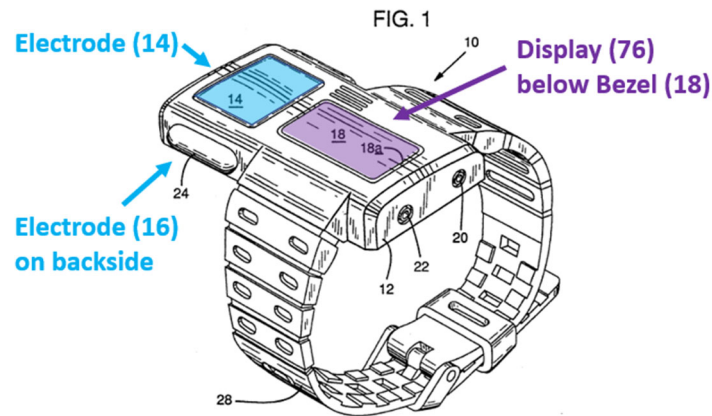
Larson teaches that, in this sensor configuration, when the finger is placed on top of the capacitive electrode it acts as a plate of a capacitor and the metal conductive material acts as a second plate of the capacitor. EX1025, 1:65-67.



C. Mills

60. Mills discloses a “cardiac and data event monitor having dry skin electrodes integral with the monitor’s housing.” EX1006, Abstract. As shown in Fig. 1 (reproduced with annotations below), a wrist-worn ECG monitor 10 includes a first electrode 14 incorporated within housing 12 and a second electrode 16. According to Mills, an “object [of the invention] is to provide such a monitor that reliably detects and records ECG signals without the use of external electrodes or messy gels...” EX1006, 1:39-42. Mills also states that “an object of the invention

[is] to provide an improved dry skin electrode system that is an integral part of the housing of such a monitor.” *Id.*, 1:43-45.



D. Markel

61. Markel discloses a device that comprises one or more electrodes that are “adapted to detect cardiac activity of a user” of the device. EX1005, [0035]. As shown in Fig. 4 below, a mobile communication device 400 includes electrodes placed on or molded into regions 410b, 420b, that are “substantially concealed (or hidden) from a user.” EX1005, [0039], [0040], [0045]. Markel further goes on to provide an example by disclosing that “an electrode may comprise molded conductive plastic with little or no visible indication of the electrode presence.” *Id.*, [0040].

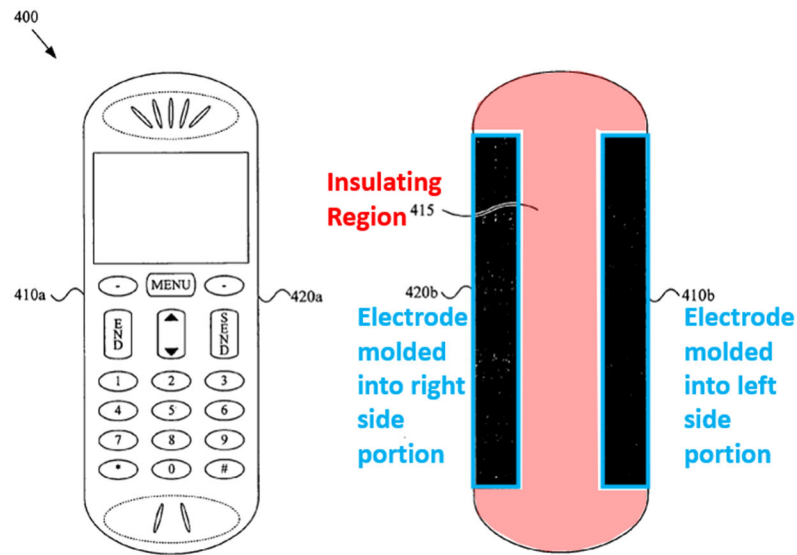


Figure 4

E. Stratbucker

62. Stratbucker discloses a bioelectric interface “which demonstrates electrode isolating anisotropic electrical specific impedance properties simultaneous with isotropic pliability and adhesion mechanical properties” that can be used in ECG systems. EX1022, abstract. During measurement its electrodes are “in a desired spacially [sic] separated pattern, such that in use said electrodes are essentially fixed in location with respect to one another.” EX1022, 5:50-52. Stratbucker teaches that “electrical anisotropy is desirable because it “allows use of higher resolution electrode geometry . . . because lateral current flow is limited.” EX1022, 8:30-32. In particular, Stratbucker teaches that due to the anisotropic properties of the material the “the specific impedance across the sheet is significantly different from that laterally along said sheet.” EX1022, 5:62-63.

F. Stejskal

63. Stejskal (EX1011) teaches a method of manufacturing conductive polyurethane (plastic) which has anisotropic characteristics. EX1011 at 283. Anisotropic characteristics allow for “electrical conductivity several times higher in the direction of the orientation [e.g., thickness] than in the perpendicular one [e.g., lateral].” EX1011 at 287. Stejskal teaches that a polyaniline is distributed in a polyurethane network and solidified (petrified) following polymerization of the polyurethane medium. EX1011 at 287.

IX. GROUND FOR UNPATENTABILITY

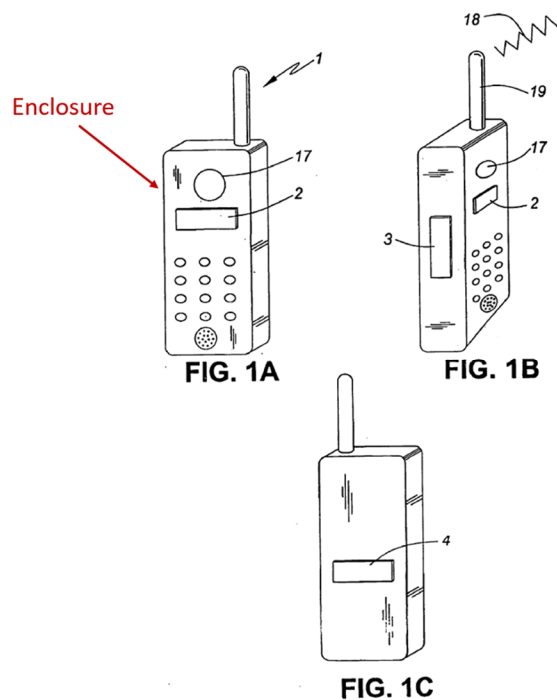
A. Ground 1: Dependent Claims 6-7 are unpatentable as obvious over Batkin in view of Larson.

1. Claim 1: “An electronic device for detecting a user’s cardiac signal, comprising”

64. Batkin (EX1024) discloses, as stated in its title, a “Remote Monitoring of Cardiac Electrical Activity Using A Cell Phone Device.” Batkin also teaches that the “cell phone 1 of the invention is equipped as a cardiac monitoring device.” EX1024, [0043].

a. Limitation 1[a]: “an enclosure;”

65. Batkin discloses a “cell phone 1” which includes an enclosure, and a person having ordinary skill in the art (POSITA) would understand from at least Fig. 1A-C that it includes an enclosure as shown below. EX1024, [0044].

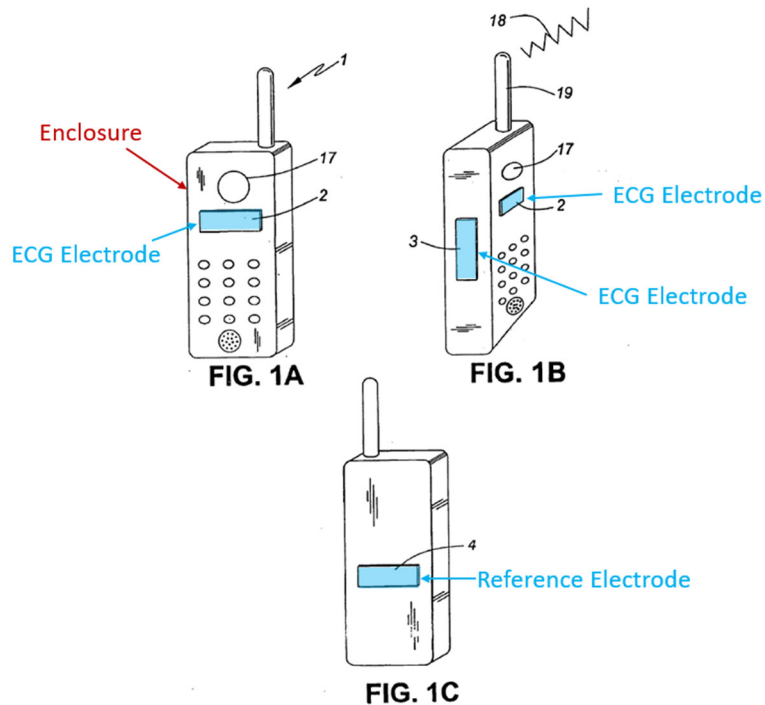


66. Batkin further explains that the cell phone has an enclosure/case as it states that “FIG. 6 illustrates a functional block diagram of the invention removed from the interior of a cell phone, or case.” EX1024; [0049].

b. Limitation 1[b]: “a heart sensor configured to detect the user's cardiac signal, the heart sensor comprising:”

67. Batkin discloses that its “cell phone 1” is equipped with “a cardiac monitoring device.” EX1024, [0044]. This cardiac monitoring device is equipped such that “cardiac signals such as human heart rate, electrocardiogram (ECG) and

other vital signs may be acquired.” EX1024, [0001]. The monitoring device structure includes a forward facing “head-contacting sensor 2,” a second “side or rear-facing, hand-contacting sensor 3,” and a “reference electrode 4,” as shown in the annotated figures below. EX1024, [0044], Fig. 1A-1C.

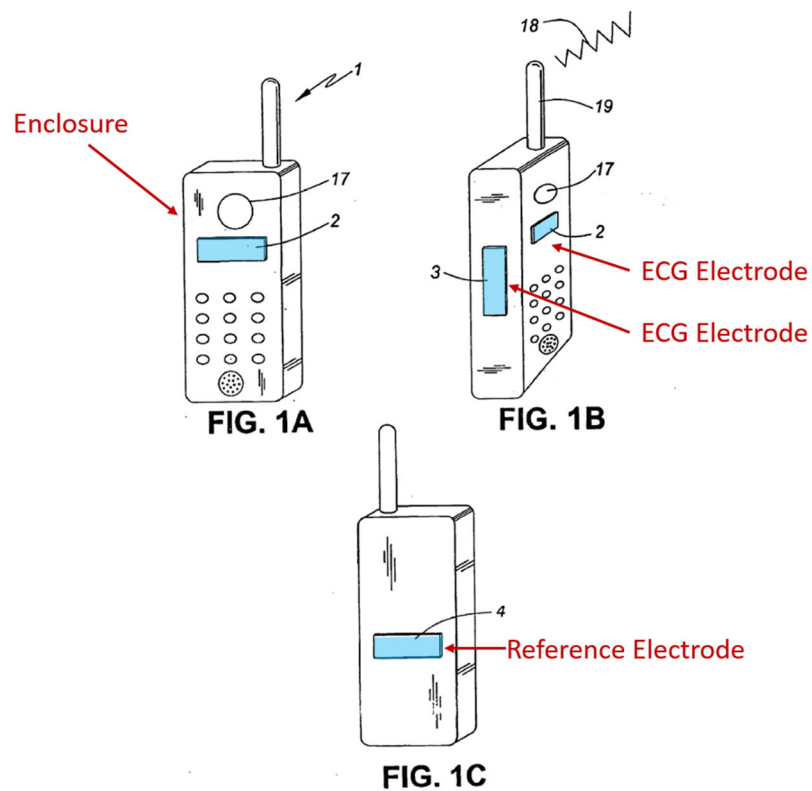


c. Limitation 1[b(i)] “a first lead comprising a first pad that is embedded in a first portion of the enclosure”

68. Batkin shows its electrodes, for example, electrode 2 in Figs. 1A-1C, as integrated in its enclosure. EX1024, Figs. 1A-1C. Further, Batkin teaches that its two electrodes may be capacitive electrodes or ohmic electrodes (i.e. direct contact electrodes), and that there may be an optional reference electrode which is preferably ohmic. EX1024, [0030], [0044]. Although Batkin suggests in one portion that an ohmic *reference* electrode is preferred, Batkin’s teachings nevertheless would have

suggested to a person of skill that a capacitive reference electrode can be used as a known equivalent. EX1024, [0044].

69. Batkin does not provide details of its electrode structure, other than that they can be capacitive or ohmic, but it does illustrate them as rectangular pads on the surface of its enclosure:

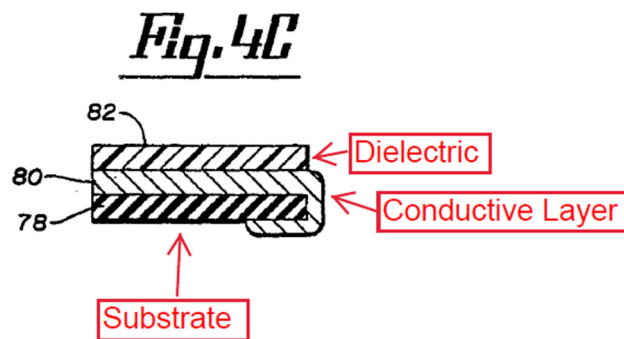


EX1024, Fig. 1A-1C.

70. A person of ordinary skill in the art looking to implement Batkin would have been motivated to look to other references that teach capacitive electrode structures, as explicitly suggested by Batkin. For example, a person of ordinary skill in the art would have looked to Larson for its teaching of capacitive electrodes in a

portable electronic device and would have understood that Larson’s capacitive electrode structure could be used with Batkin’s cell phone device.

71. Larson shows in detail the internal structure of capacitive electrodes in an electronic watch for the detection of “electrocardiac (EKG) signal[s].” EX1025, 1:19-22. Larson provides several configurations of its capacitive electrode, each with an insulating, dielectric layer on the surface (where a finger may be placed), a middle conductive layer of a conductive material such as silver, and a supporting substrate on the bottom. EX1025, Figs. 4A-4C, 4:59-5:34. For example, Figure 4C illustrated below contains an uppermost dielectric layer 82 (where a finger may be placed), a middle conductive layer 80, and support substrate 78 on the bottom. EX1025, 5:24-34.



72. A person having skill in the art would understand that the electrode structure shown above is a typical structure for a capacitive electrode. A capacitor necessarily contains a dielectric layer between two conducting layers, creating capacitance. Larson also explicitly references the 1974 edition of the book

“Biomedical Electrode Technology Theory and Practice” by Miller et al. (EX1026) which states that “The insulated electrode consists of a thin dielectric film on a conducting substrate chip, arranged so that skin contact is made directly to the dielectric thin film layer. The skin acts as one plate of a simple capacitor while the [conducting] substrate acts as the other ... This system is designed as a replacement for the conductive type electrode.” EX1026 at 16-17. Larson similarly states that “when a finger is placed on the dielectric material of receiving means 16 a capacitor is formed with the finger being one plate and the conductive material being the second plate.” EX1025, 3:50-53. Although Larson describes a supporting substrate layer (78) as being non-conductive and Miller describes a substrate layer as being conductive, a person of skill in the art would appreciate that they describe the same capacitive configuration. Thus, Larson’s electrode structure embodies the capacitive electrode structure described in Miller and is typical of capacitive electrode structures.

73. Accordingly, a POSITA would have applied the capacitive electrode structure of Larson to Batkin, which results in a first conductive “pad” that is “embedded” (placed underneath and against) the exterior surface of the enclosure of Larson.

74. A POSITA would have also been motivated to use the capacitive electrode structure of Larson in the system of Batkin for many reasons beyond the

explicit suggestion in Batkin. Capacitive electrodes are known to have many benefits that would have let a POSITA to use capacitive electrodes in the system of Batkin. . As discussed above, Larson cites to Miller et al. (EX1026), which explains some of the benefits of capacitive electrodes compared to ohmic/conductive electrodes. Miller explains that capacitive electrodes 1) “yield good quality ECG signals”; 2) “can be made quite small”; 3) “provides no DC offset voltage at its output;” and 4) where two capacitive electrodes are used, the two capacitive electrodes of “identical design will have closely matched voltage transfer functions” which Miller goes on to explain simplifies implementation of electrodes. EX1026 at 11-17. Further, beyond the clear advantages of capacitive electrodes explained in Miller, a POSITA also would have appreciated that Batkin as modified by Larson’s capacitive electrode design would be aesthetically pleasing by blending in with the surrounding mineral glass. EX1025, Fig. 1-2; 3:66-4:4.

75. Another prior art reference disclosing the benefits of capacitive electrodes is Everett (EX1027, US3568662A), which would have motivated a person having ordinary skill in the art to use a capacitive electrode, as taught in Batkin and Larson.

76. Everett teaches the many benefits of capacitive electrodes, which have been known at least since Everett’s publication as a patent in 1971. EX1027, Abstract. Everett teaches that direct contact electrodes suffer from many issues,

including “polarization, partial rectification, chemical reaction, noise and contact or movement artifacts.” EX1027, 1:29-31. For example, direct contact with the surface of the body can cause variations, due to perspiration or chemical reaction with the contact electrode, that “mask the true body potential sought to be detected,” but capacitive electrodes do not have this problem. EX1027, 1:33-49. As Everett explains, capacitive electrodes are beneficial because a “chemically inert and electrically stable substance” is exposed to the body surface as a non-conducting layer. *Id.*, 1:50-56. A capacitive electrode is also “more efficient than a direct contact electrode because the capacitive electrode cannot cause chemical reactions to occur at the expense of bioelectric energy” and it “does not dissipate any measurable amount of energy in the frequency range of biological signals.” *Id.*, 1:57-60; 2:17-22. Moreover, capacitive electrodes “permit a more accurate determination of ventricular gradient” as they are not subjected to the polarization of contact electrodes, even “so-called ‘nonpolarizable’ direct contact electrodes”. *Id.*, 1:65-2:3. Another advantage of capacitive electrodes is that “less noise is generated in the use thereof than in the use of direct contact electrodes” because “there is no continuous flow of electrons or ions between the skin or other biological tissue.” *Id.*, 2:23-39. One particular advantage is that with capacitive electrodes “no contact artifacts or movement artifacts are produced as is typical in the case of direct contact electrodes” which is “one of the most common difficulties in recording EKG and EEG signals”

and can come from the “change in applied pressure” of the contact electrode. *Id.*, 2:40-52. Finally, capacitive electrodes can cause less skin irritation than contact electrodes because the skin is contacted by an inert dielectric and the inert material also isolates the body from electrical shocks that could occur where there is a sensor malfunction. *Id.*, 2:63-73. As a result, a POSITA would have known at least since 1971 that capacitive electrodes provide a variety of benefits over direct contact electrodes.

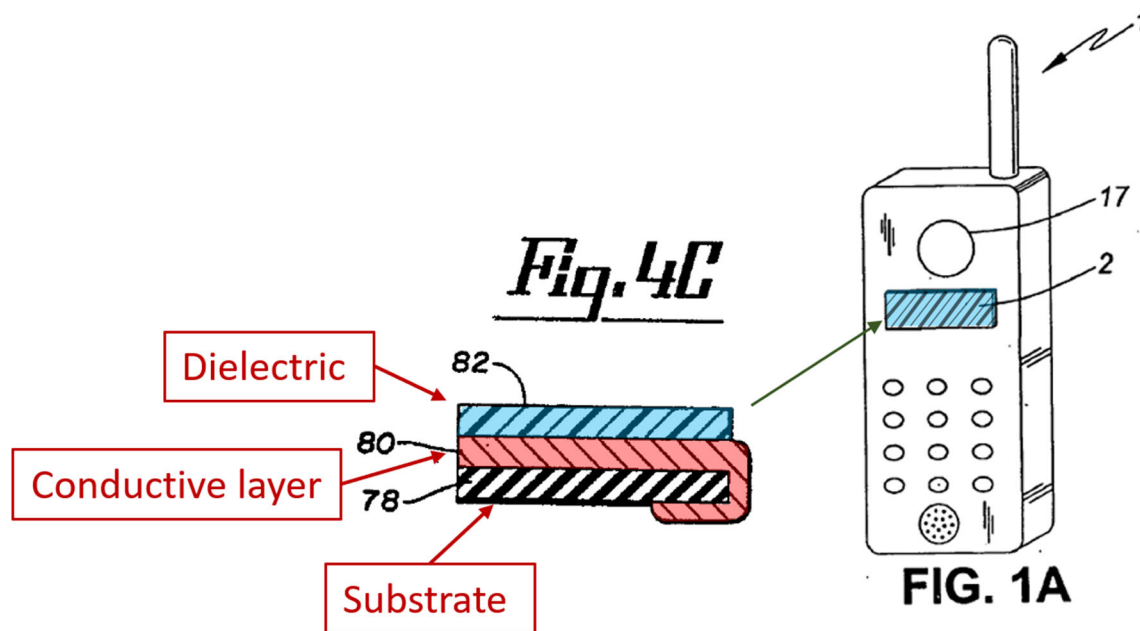
77. Therefore, a POSITA would have been motivated to implement the capacitive electrode structure as taught in Larson at least because Batkin teaches that capacitive electrodes can be used and, separately, because there are many advantages of capacitive electrodes, as explained in the prior art.

d. Limitation 1[b(ii)] “an exterior surface of the enclosure comprises an exterior surface of the first portion”

78. As mentioned above, the electrode 2 of Batkin combined with the structure of Larson places the dielectric on the exterior surface of the first portion of Batkin (electrode 2). Batkin’s sensors have a first portion on an exterior surface as Batkin teaches that the sensors obtain signals when they “contact the user's head,” “contact the left hand or thumb of the user,” or “contact the face or ear of the user.” EX1024, [0044]. Thus, a POSITA would have known the exterior surface of the enclosure comprises a first portion for cardiac measurements.

e. Limitation 1[b(iii)] “the first pad is positioned underneath the exterior surface of the first portion”

79. As stated above, the electrode of Batkin as modified by Larson places the dielectric on the exterior surface of the first portion of Batkin and the first pad (conductive layer 80 of Larson) underneath the exterior surface. This is shown with annotations below. EX1024, Fig. 1A; EX1025, Fig. 4C.



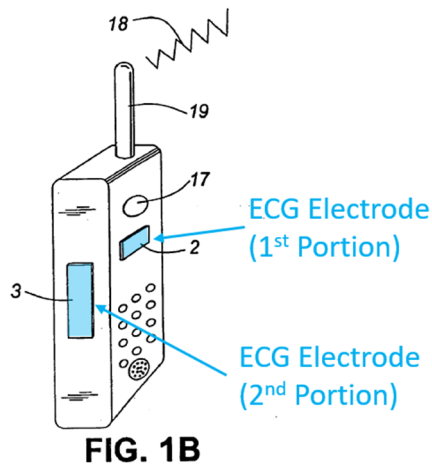
f. Limitation 1[b(iv)] “the first pad detects a first electrical signal of the user’s cardiac signal via the user’s skin’s contact with the exterior surface of the first portion”

80. Batkin explains that its capacitive sensors obtain signals when they “contact the user's head,” “contact the left hand or thumb of the user,” or “contact the face or ear of the user.” EX1024, [0044].

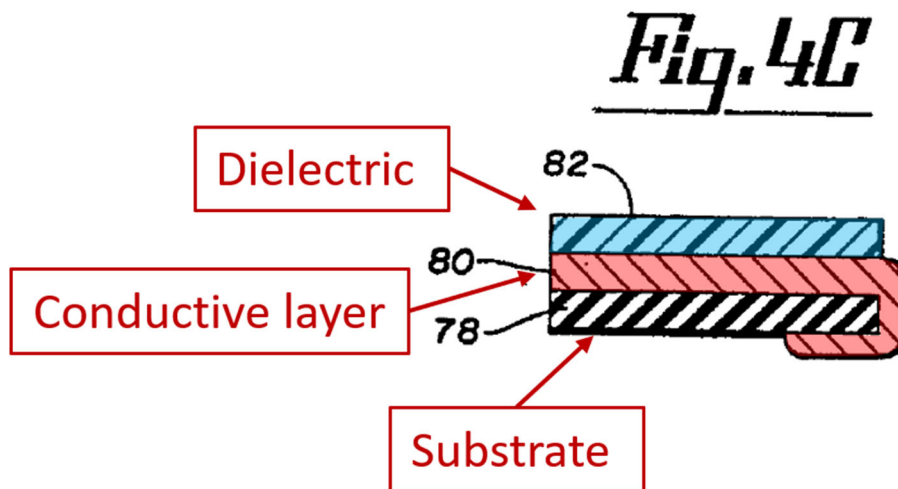
81. Larson likewise explains that its capacitive electrode detects electrical signals from a user's touch. EX1025, 5:1-7. Larson teaches that when a finger is placed on top of the dielectric layer (e.g., layer 82 in Larson), a capacitor is formed with the conductive layer (e.g., conductive layer 80). EX1025, 3:50-57 and 5:1-7. The conductive layer acts as one plate of the capacitor and the finger acts as a second plate of the capacitor. *Id.* The "voltage on the skin of the finger is transferred through the dielectric material to the other plate of the capacitor" (the conductive layer) and the signal is transferred from there to "electrical components of the circuit, where the heart rate is determined." EX1025, 3:50-57, 5:1-7, 5:24-34, Fig. 4C (below). Conversely, Larson explains that with its capacitive electrode "If for some reason the user of the device removes his finger from electrode [16], heartbeat signals will stop being applied through circuit 100 and detected by amplifier 120." EX1025, 11:3-6 (Larson repeatedly refers to a finger with reference to capacitive electrode 16).

g. Limitation 1[b(v)] "a second lead comprises a second pad that is embedded in a second portion of the enclosure"

82. As stated above, Batkin teaches a second electrode, electrode 3 of Fig. 1B of Batkin, which is embedded in a second portion of its enclosure, illustrated below. EX1024, Fig. 1B.



83. Further, as explained above with regard to section 1[b(i)], Batkin teaches that electrode 3 may be a capacitive electrode and would have included or been modified to include the capacitive electrode structure of Larson. EX1024, [0043] (“The electrodes may be ohmic or capacitive”). As explained above, Larson teaches that its capacitive electrode structure comprises an uppermost dielectric layer (e.g. 82), a middle conductive layer (e.g., 80), and support substrate (e.g., 78) on the bottom, as shown in Fig. 4C. EX1025, 5:24-34, Fig. 4C.



84. Accordingly, applying the capacitive electrode of Larson, the conductive layer of Larson (layer 80) constitutes a “second pad” which is embedded (placed underneath and against the outer dielectric surface) of electrode 3 of Batkin. A person having ordinary skill in the art would have been motivated to embed the conductive layer in this way and combine the teachings of Batkin and Larson at least for the reasons discussed in 1[b(i)].

h. Limitation 1[b(vi)] “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”

85. Batkin teaches, as mentioned previously for limitation 1[b(iv)], its capacitive sensors obtain signals when they “contact the user's head,” “contact the left hand or thumb of the user,” or “contact the face or ear of the user.” EX1024, [0044].

86. Similarly, Larson explains that its capacitive electrode detects electrical signals from a user’s touch. Larson explains that when a finger (user’s skin) is placed on top of the dielectric layer (e.g., layer 82 in Larson), a capacitor is formed with the conductive layer (e.g., conductive layer 80). The conductive layer acts as one plate and the finger acts as a second plate. The electric signals from the heart appearing on the skin of the finger are transferred through the dielectric material to the conductive layer. EX1025, 5:1-7, 5:24-34, Fig. 4C. Conversely, by removing the finger “heartbeat signals will stop being applied through circuit 100 and detected

87. Batkin discloses that its electrodes are connected to a processor (“analyser circuit 15” of Fig. 6 of Batkin). EX1024, [0049]. This is illustrated in Batkin’s Fig. 6 annotated below:



88. A POSITA would understand that Fig. 6 shows a first and second “connector” between the electrodes (sensors 2 and 3)³ and the analyser circuit 15. Batkin teaches that its analyser circuit 15 derives key parameters from the bio-signal:

FIG. 6 illustrates a functional block diagram of the invention removed from the interior of a cell phone, or case for clarity. The outputs from the first sensor **1**, the second sensor **2**, and the reference electrode **3**, are connected to the conditioning circuit **5**. Circuit **5** may include analyser means **15** to *partially analyse the bio-signal*. For the purpose of ECG pickup, the analyser circuit 15 preferably includes a differential amplifier. The analyser circuit 15 may also include means to *derive key parameters from the bio-signal*, provide band-pass filters, interference filters and produce outputs based on the correlation of multiple bio-signals.

EX1024, [0049] (emphasis added).

³ A POSITA would have readily understood that Batkin has a typographical error and refers to sensors 2, 3, and 4 in Fig. 6 as sensors 1, 2, and 3, respectively in the description at [0049].

89. On a related note, Batkin shows the resistors, capacitors, amplifiers, and connections associated with the signal reception and transmission from its electrodes, illustrated below. EX1024, Fig. 5.

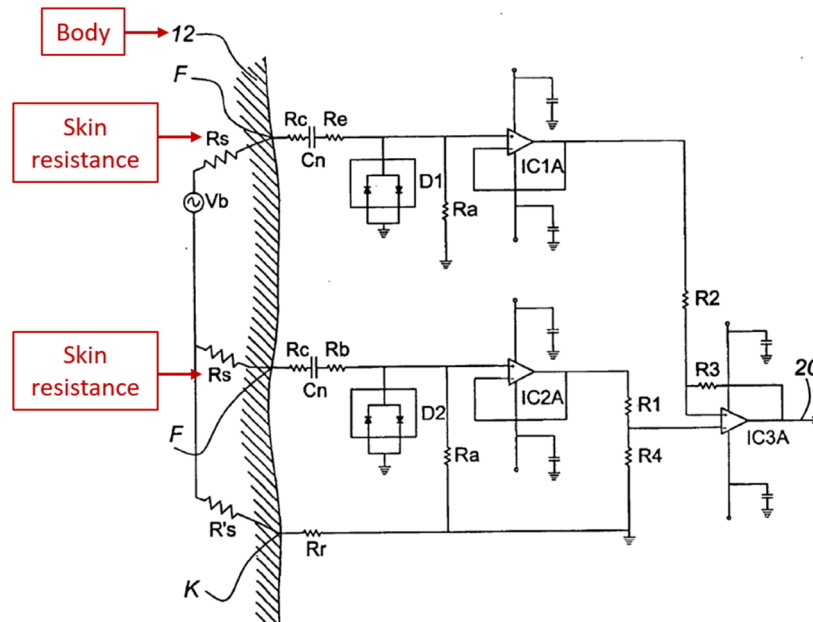


FIG. 5

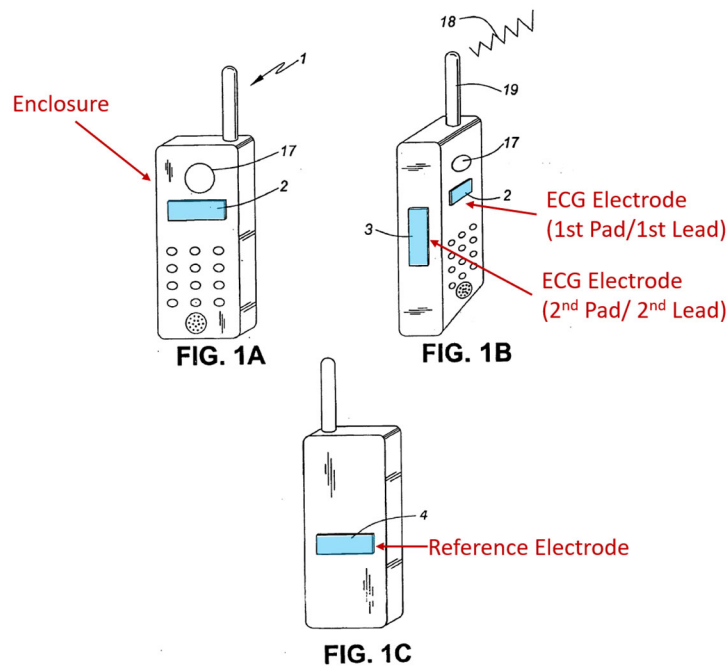
90. Batkin additionally explains that the “handling of bio-signals, once acquired . . . can be performed by known technology in a number of ways.” EX1024, [0017]. Thus, a POSITA would have found the processing and handling of bio-signals as obvious and known in art.

91. Finally, Larson teaches that its capacitive electrodes are configured where an “electrical connection is provided between the conductive material and the electronic components within housing 12.” EX1025, 3:48-50. Larson specifically notes that the “voltage on the skin of the finger is transferred through the dielectric material to the other plate of the capacitor and from there to the electrical

components of the circuit, where the heart rate is determined and displayed on display 18.” EX1025, 3:53-57; *see also* 9:12-22 (showing a formula for calculating and displaying heartbeats). A POSITA would have found it obvious to incorporate the processor of Larson into Batkin in order to provide a heart rate that can be monitored on the display of Batkin. Accordingly, limitation 1[c] is met by both teachings in Batkin and Larson.

2. Claim 4 “the first portion is separated from the second portion by a third portion of the enclosure; at least 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”

92. Batkin shows its cell phone as having a case (white) with embedded ECG electrodes (blue) shown below in Figs. 1A-1C. EX1024, Figs. 1A-1C. A POSITA would have understood that the case of Batkin would have a conductivity insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion. A person of skill would understand that this is required to prevent signals from one electrode being picked up by the other electrodes. For example, Stratbucker (EX1022 discussed below in Ground 2) teaches that “signals which should be present in one electrode in a bioelectric interface, will to some extent be present in other electrodes as well, as a result of [unintentional] lateral current flow” causing an “artifact to (ECG) data as a result” if electrodes lack sufficient electrical separation. EX1022, 8:20-29.



93. Larson also teaches that its capacitive electrode (16) is surrounded by and disposed in mineral glass (14). EX1025, 3:61-68. Glass is an insulator with a conductivity on the order of 10^{-12} S/m. EX1015 at 2. Additionally, a POSITA would have recognized that the glass in Larson is nonconducting at least because a hole (30) is drilled in the glass “in order that electrical contact may be made with the conductive layer of electrode 16 and the remainder of the electronic circuitry.” EX1025, 3:68 to 4:3. Thus, a person having ordinary skill in the art would have known that embedding a capacitive electrode in a non-conducting material would have been desirable to isolate the conductive later of the capacitive electrode from other conducting parts of the electronic device.

3. Claim 6

- a. Limitation 6(a) “The electronic device of claim 4, wherein: the exterior surface of the enclosure further comprises an exterior surface of the second portion”**

94. As described above, with regard to 1[b(v)] the electrode 3 of Batkin as modified by Larson places the dielectric layer of the capacitive electrode on the exterior surface of the first portion of Batkin.

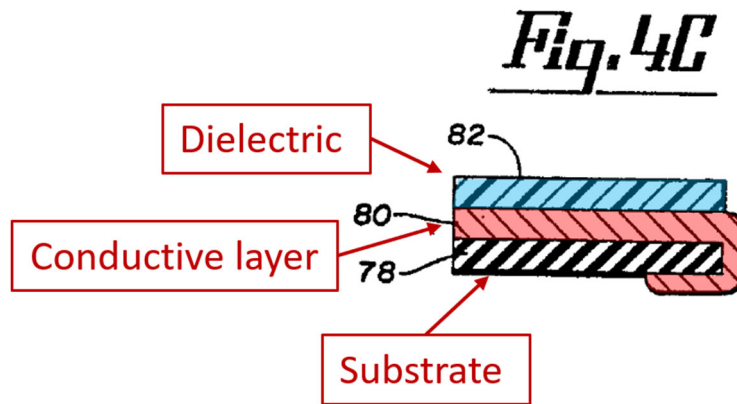
- b. Limitation 6(b) “the second pad is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the exterior surface of the second portion;”**

95. As explained above, Batkin teaches that its capacitive sensors obtain signals when they “contact the user's head,” “contact the left hand or thumb of the user,” or “contact the face or ear of the user.” EX1024, [0044]. Batkins electrodes are configured such that “cardiac signals such as human heart rate, electrocardiogram (ECG) and other vital signs may be acquired.” EX1024, [0001]. Accordingly, the limitations of 6(b) are met by Batkin.

- c. Limitation 6(c) “the second pad is positioned from the exterior surface of the second portion by a thickness of the second portion;”**

96. As explained above for 1[b(v)], Batkin as modified by Larson teaches a pad (conductive layer 80) underneath the dielectric layer 82. Thus, the pad is positioned from the exterior surface of the second portion (the exterior surface of electrode 3) by a thickness of the second portion (dielectric 82). *See* EX1025, Fig.

4C. Accordingly, the second pad (conductive layer 80) would be positioned from the surface by a thickness of the second portion (dielectric 82).



- d. **Limitation 6(d) “at least the thickness of the second portion is constructed from material having a second conductivity; and”**

97. As referenced above for 1[b(v)], Larson teaches an outermost layer composed of a dielectric material pad (dielectric 82) that, when incorporated in electrode 3 of Batkin, constitutes a “second portion.” Necessarily the pad (conductive layer 80), as shown in Figure 4C above, is positioned from the exterior surface of the second portion by a thickness of the dielectric layer. The dielectric 82 of Larson has a second conductivity, as it is an insulating dielectric. EX1024, 5:31-34. A person having skill in the art would have appreciated that the second conductivity of dielectric material is important to the operation of the capacitive electrode as it provides the dielectric material by which capacitance can be achieved.

- e. **Limitation 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”

98. Batkin illustrates in Figure 5, for example, an ECG measurement schematic diagram that would be used to determine the requirements of the capacitive electrode materials necessary to transmit the signal of each electrode across the dielectric material while isolating the signals from each other.⁴ Figure 5 is reproduced below, showing various parameters that may be optimized in order to have a desired electrical reading over a prescribed thickness. EX1024, Fig. 5.

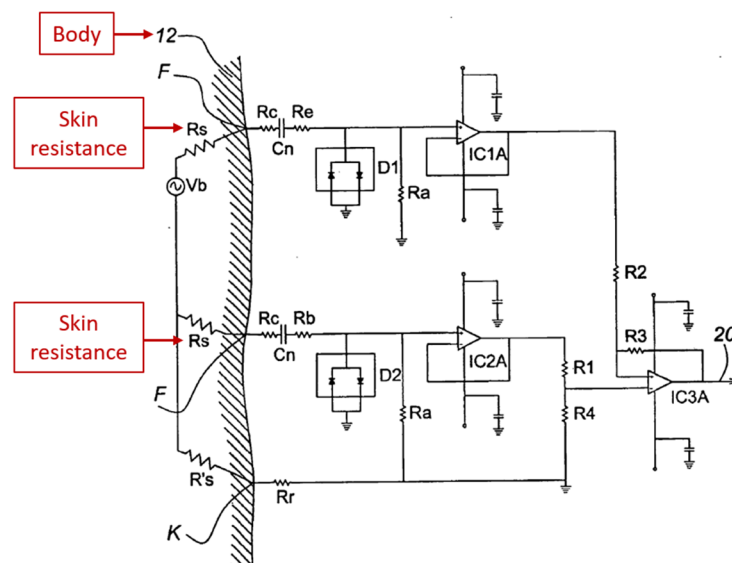


FIG. 5

99. As explained above for 6(d), Batkin as modified by Larson teaches a pad (conductive layer 80) is positioned from the exterior surface of the second

⁴ A POSITA would understand that the schematic diagram could also be used to approximate an ECG signal in an ohmic electrode.

portion by a thickness of the second portion (dielectric 82). The dielectric 82 of Larson has a second conductivity. Dielectrics (insulators) are commonly understood by a POSITA to have a very low conductivity which will not transmit electrical signals over a meaningful distance. However, Larson notes that the “voltage on the skin of the finger is transferred through the dielectric material to the other plate of the capacitor.” EX1025, 3:53-55. Thus, even though an insulating dielectric is used as the skin-facing layer in a capacitive electrode, it is able to transfer signals through its own thickness and possesses insulating characteristics that prevent transmission of signals “over a distance larger than the thickness of the second portion.”⁵

⁵ It is noted that the limitation “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” is a subjective standard. The “257 patent states that if “*the electrical conductivity and size of bezel 460, and the strength or characteristics of the cardiac signal* provided by the user and detected by the heart sensor are adapted such that the signal can be transmitted along short distances in bezel 460, lead 472 of the heart sensor can be positioned against the back surface of bezel 460.” (emphasis added). EX1001, 9:40-44. A POSITA would understand that there are many variables, such as those italicized above, to determine how the sensor

100. This reading is consistent with the teachings of Larson, as the capacitive effect allows the signal to be passed from the exterior surface through the dielectric to the underlying conductive layer (layer 80 of Larson). EX1025, 3:53-55 (“The voltage on the skin of the finger is transferred through the dielectric material to the other plate of the capacitor”). At the same time, the insulating properties of the dielectric layer (82) would be understood by a POSITA to have a conductivity that will not transmit a signal over any meaningful distance, such as “over a distance larger than the thickness of the second portion.” Therefore, a POSITA would understand that the capacitive electrode taught by Larson satisfies the limitations of 6(c). A person of ordinary skill in the art would have been motivated to combine the teachings of Batkin and Larson at least because they both teach capacitive electrodes and for other reasons provided in 1[b(i)] above.

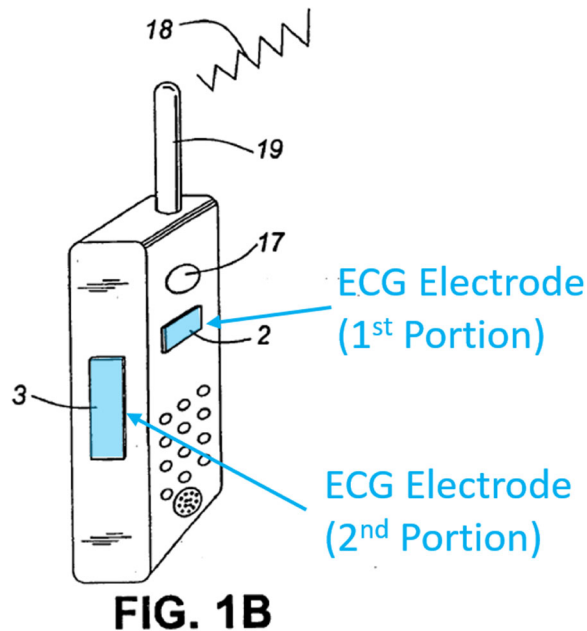
4. Claim 7: “The electronic device of claim 6, wherein the first pad and the second pad are positioned apart from one another at a distance larger than the thickness of the second portion by material having the second conductivity”

101. With regard to the positioning, Batkin as modified by Larson has electrode 2 (first portion with an underlying first pad) and electrode 3 (second

may be positioned with respect to the thickness of the second portion. The '257 patent provides insufficient information regarding these variables.

portion with an underlying second pad) which are separated by a distance and positioned on separate sides of the electronic device, illustrated in Figs. 1B below.

EX1024, Fig. 1B.

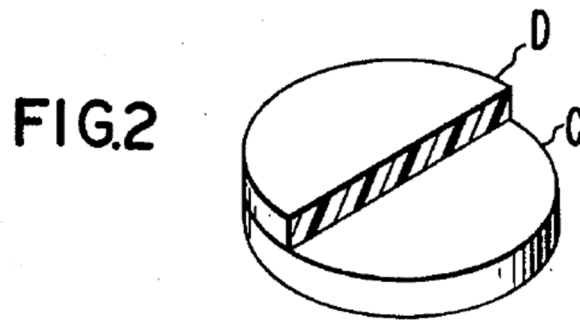


102. Batkin notes that its device (shown above in 1B) is a hand-held device and that “bio-signals are acquired from the same user posture as in ordinary telephonic use.” EX1024, [0020], [0047]. Thus, Batkin’s device has dimensions spanning at least 4-6 cm, the minimum physiological size of a hand-held device. Therefore, Batkin’s electrodes (with underlying electrode pads from Larson) are physically separated by at least several centimeters.

103. Regarding the thickness of the thickness of the “second portion,” a POSITA would understand the thickness of the dielectric of Larson to be very small, on the order of micrometers. For example, Miller (EX1026 referenced in Larson as

discussed above) describes formation of the dielectric layer by a sputtering technique with a resultant thickness of between 5000 (5,000 Angstroms equals 0.5 micrometers) and 50,000 Angstroms (50,000 Angstroms equals 5 micrometers). EX1026, pg. 18. A POSITA would know that the equation governing the capacitance of parallel plates as shown in Larson is: $C = k \cdot \epsilon_0 \cdot \frac{A}{d}$, where C is the capacitance in farads, k is the relative permittivity of the dielectric material between the plates, ϵ_0 is the permittivity of space, A is the area of the plates, and d is the distance between the plates. EX1028 at 1. A POSITA would understand that the signal will pass through the capacitor more readily the higher is the capacitance. Therefore, the thinner the thickness of the dielectric, d , the greater the capacitance will be. Therefore, a POSITA would understand that the physical distance between electrodes 2 and 3 would be on the order of several centimeters and the “thickness of the second portion” (dielectric layer 82) would be on the order of 10^{-4} centimeter.

104. Everett (EX1027 discussed above) corroborates the thicknesses taught in Miller. Figure 2 shows the general structure of Everett’s capacitive electrode, which is functionally equivalent to Larson’s structure, and is shown below:



105. In the figure shown above, the capacitive electrode includes “an electrode member C and a nonconducting region D between the electrode member C and the body A.” EX1027, 3:48-50, Fig. 2. Everett teaches that its non-conducting dielectric layer may be “one one thousandth inch thick and having a dielectric constant of about 3 at frequencies below 10 Hz,” and a POSITA would have known that the dielectric layer of a capacitive electrode is generally a fraction of an inch thick. *Id.*, 4:39-41. Thus, a POSITA would have known that the dielectric layer of the capacitive electrode in Batkin and Larson is, or may be configured to be, on the order of microns ($1/1,000 = 0.001$ inch = 25.4 micrometers).

106. With regard to the separation of the electrodes, Claim 4, discussed above, states that “the first portion is separated from the second portion by a third portion of the enclosure” and that “at least the third portion is constructed from a material having a first conductivity.” Thus, the first portion and second portion are separated by a material having a first conductivity. Claim 7 additionally recites that “first pad and the second pad are positioned apart from one another . . . by material

having the second conductivity.” In the combination of Batkin and Larson, the first portion and the second portion are themselves “constructed from material having a second conductivity,” which is dielectric layer 82. Thus, the “pads” underneath the first portion and second portion are electrically separated “apart” from each other by “a material having the second conductivity” (dielectric layer 82).

107. A POSITA would have found it desirable to physically separate the electrodes, as illustrated in Batkin, so that sensors are in the appropriate physiological positions and can “obtain bio-signals while the . . . phone is in the position for normal speaking use.” EX1024 at abstract. Further, a POSITA would have found it desirable to electrically separate the electrodes “apart” from each other to reduce noise and extraneous cross-coupling of signals that would unintentionally travel from one electrode to another. Stratbucker (discussed in Ground 2 below) illustrates that a POSITA would understand that “signals which should be present in one electrode in a bioelectric interface, will to some extent be present in other electrodes as well, as a result of [unintentional] lateral current flow” causing an “artifact to (ECG) data as a result” if electrodes lack sufficient electrical separation. EX1022, 8:20-29. Therefore, a POSITA would understand that Batkin in view of Larson meets the limitations of Claim 7.

B. Ground 2: Dependent Claims 6-7 are unpatentable as obvious in view of Markel in combination with Mills, Stratbucker, and Stejskal.

1. Claim 1: “An electronic device for detecting a user’s cardiac signal, comprising”

108. Markel discloses “electronic devices with cardiovascular monitoring capability.” *See* EX1005, Abstract, [0035].

a. Limitation 1[a]: “an enclosure”

109. Markel states that the mobile communication device MCD 100 (also referred to as “device 100”) includes a main body portion 110 as shown, for example, in Fig. 1. EX1005, [0034], Fig. 1.

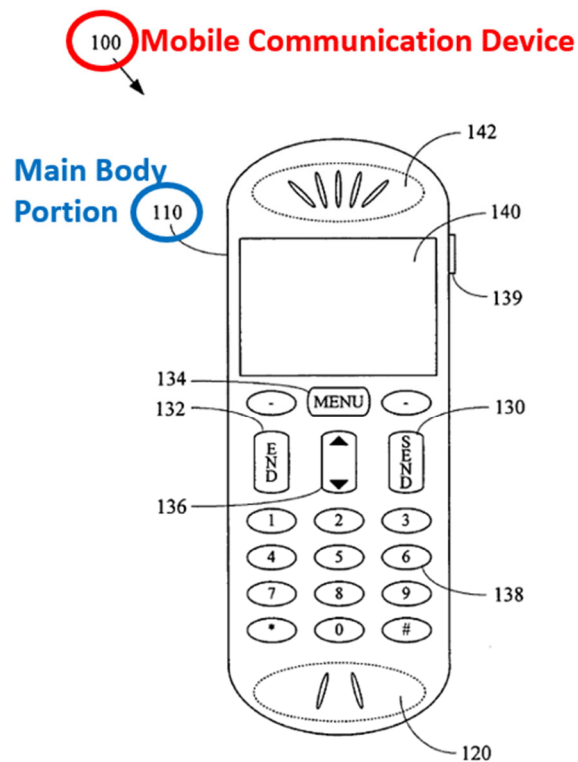


Figure 1

110. As explained in Markel, the main body portion 110 “may comprise the portion of the MCD 100 that is generally held in the hand during normal use of the MCD 100.” EX1005, [0043], [0064]. Additionally, Markel states that the device “may comprise a primary casing or housing for the user interface device.” EX1005, [0064]. A POSITA would understand from this disclosure that Markel discloses an enclosure comprising a main body, a screen 140, and various buttons (130, 132, 134, 136, etc.).

b. Limitation 1[b]: “a heart sensor configured to detect the user's cardiac signal”

111. Markel discloses that the MCD 100 may comprise at least one cardiac sensor “that is adapted to detect cardiac activity of a user of the MCD 100” with the user being “conductively coupled to the electrodes (*e.g.*, by touching the electrodes).” EX1005, [0035]; [0058]; [0082]; [0103].

c. Limitation 1[b(i)] “a first lead comprising a first pad that is embedded in a first portion of the enclosure”

112. Markel states that electrodes for detecting the cardiac signals “may be disposed in any of a variety of locations” on its device including being “generally concealed from a user” such that they are “substantially concealed (or hidden) from a user.” EX1005, [0045], [0039]-[0040]. Such electrodes may be “exposed for user contact” or “may be integrated into various molded components.” *Id.*, [0037].

113. Markel provides an example device 400 in Fig. 4. EX1005, [0045]. A first electrode is “placed on or molded into the region 410b” which is located on the rear side of the phone. *Id.* As such, a POSITA would understand that Markel describes an electrode of conductive plastic (region 410b under a first mapping) embedded in a first portion of the enclosure. *Id.*

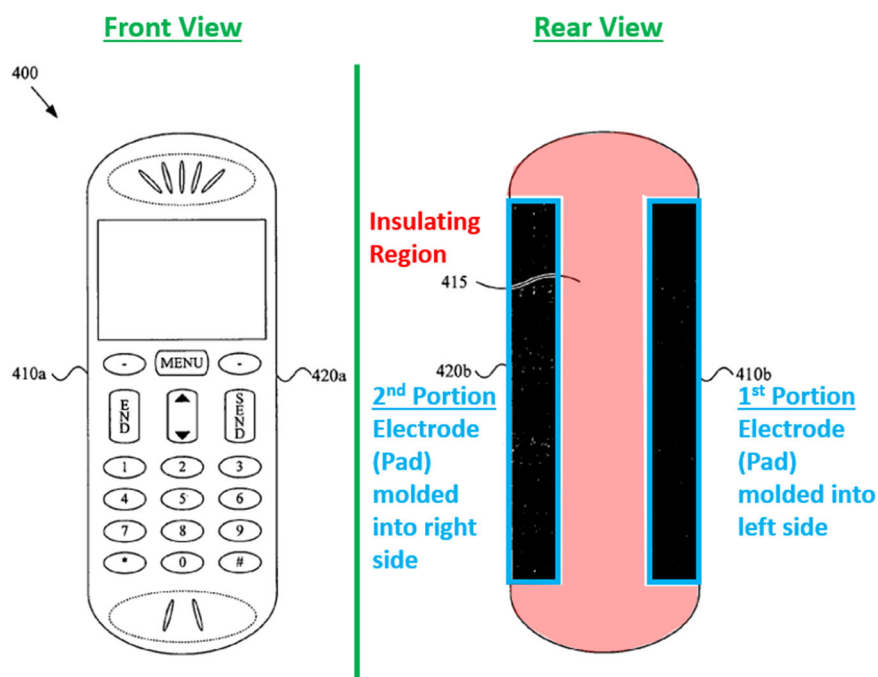
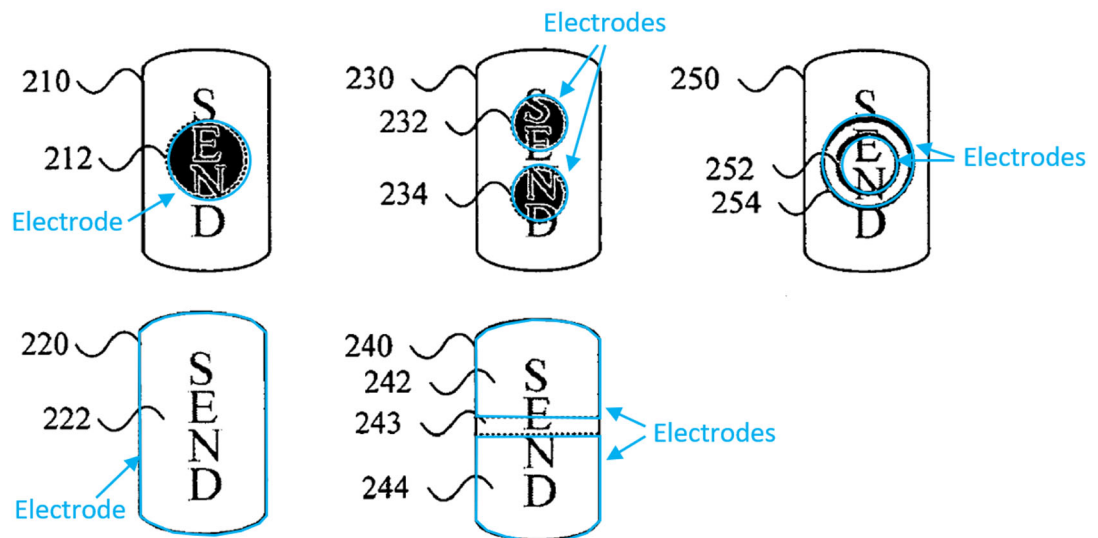


Figure 4

EX1005, Fig. 4, a first mapping of the claims.

114. In other embodiments, Markel teaches that a pushbutton may incorporate one or more ECG electrodes. EX1005, [0047]. Each pushbutton may have a single electrode, such as with pushbutton 210 and 220 reproduced below, or

each pushbutton may have more than one electrode, such as with pushbutton 230, 240, and 250 shown below.



EX1005, Fig. 2, a second mapping of the claims.

115. Similar to the other conductive plastic regions, the pushbutton may be molded from conductive plastic. EX1005, [0047] (“pushbutton 240 comprises a first electrode 242 (e.g., a first conductive plastic region) and a second electrode 244 (e.g., a second conductive plastic region)”). As such, a POSITA would understand that Markel describes a first electrode (such as 242, 232, 252 under a first mapping) of conductive plastic embedded in a first portion of the enclosure.

d. Limitation 1[b(ii)] “an exterior surface of the enclosure comprises an exterior surface of the first portion”

116. As illustrated in Fig. 4 of Markel (shown below), the pad at region 410b is a first portion of the exterior surface of the enclosure of device 400. EX1005, Fig.

4, [0037]. Markel explains that “first and second electrodes may be disposed on a main body portion 110 of the MCD 100” and “an electrode (or all electrodes) or other sensor may be substantially concealed (or hidden) from a user . . . an electrode may comprise molded conductive plastic with little or no visible indication of the electrode presence.” EX1005, [0040], [0045].

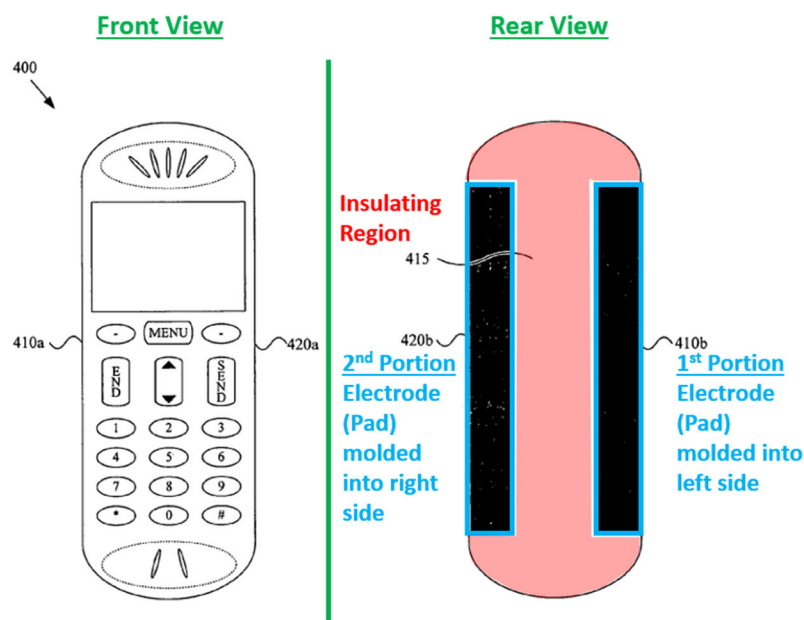
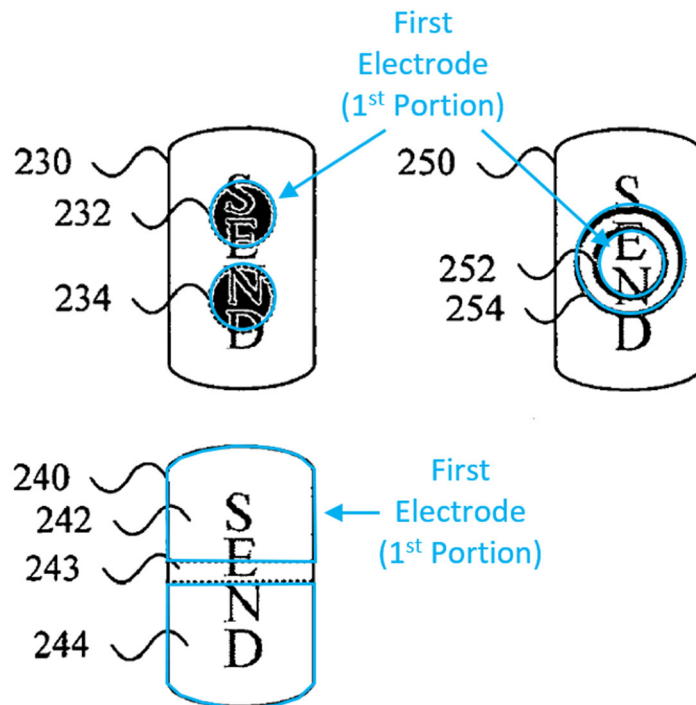


Figure 4

117. Likewise, under a second mapping of the claims, pushbutton electrodes constitute a portion of an exterior surface of the enclosure and contain a “first portion.”



e. Limitation 1[b(iii)] “the first pad is positioned underneath the exterior surface of the first portion”

118. Markel teaches, as shown in Fig. 10 below, “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.” EX1005, [0058], Fig. 10. A POSITA would know that electrodes 1020, 1022 correspond to electrodes 410b and 420b or to pushbutton 210, 220, 230, 240, and 250.

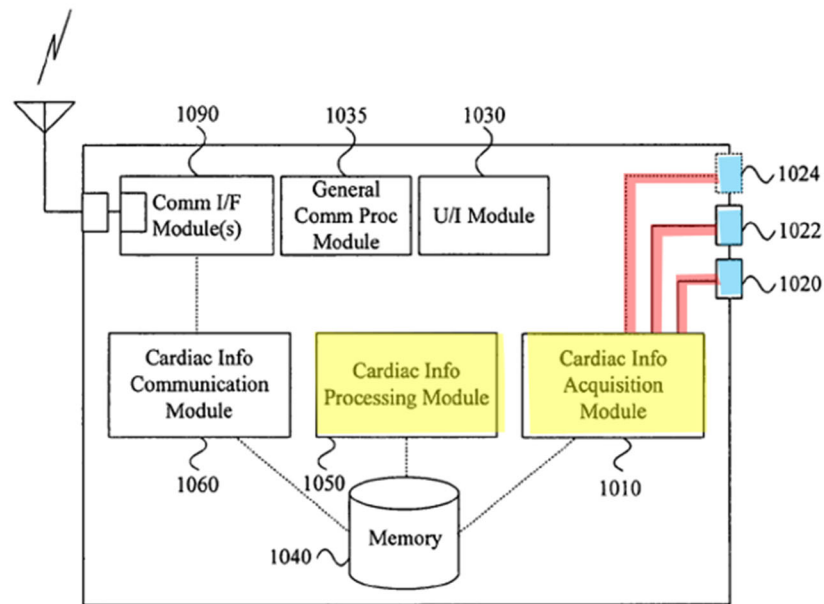
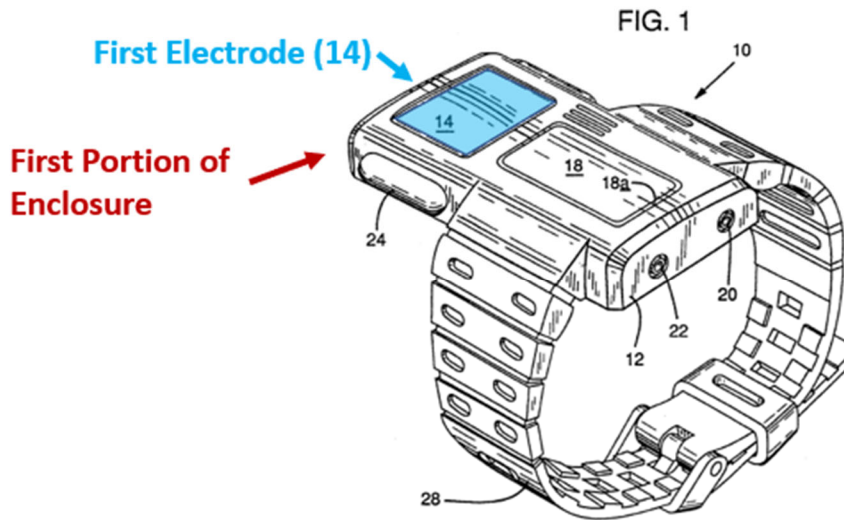
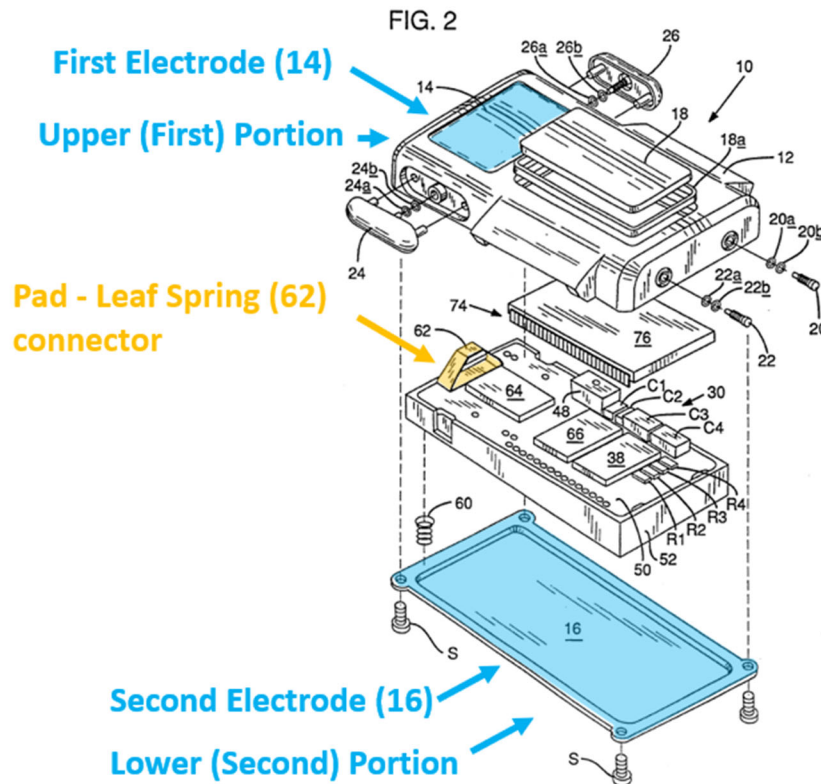


Figure 10

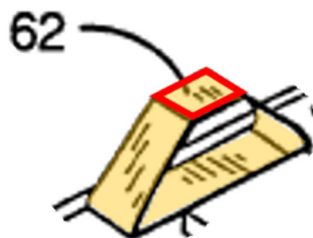
119. Markel does not provide the exact details of the internal components of its device or the underside of its electrodes. *See* EX1005 generally. A POSITA looking to implement Markel would have looked to other references in the same field of disclosure for information on internal components and structures to implement the device of Markel. Mills (EX1006) is one such reference. Mills, for example, discloses an enclosure (housing 12) which includes a first skin electrode 14 “unitarily connected” with the housing of an electronic watch. EX1006, Fig. 1, 3:8-13. Thus, Mills’ electrodes are similar to Markel’s electrodes 410b, 420b.



120. Mills specifies that the electrode 14 is “integrally” connected with the housing 12 by being molded therein, again similar to Markel’s disclosure. EX1006, 3:47-51; EX1005, [0045]. Therefore, Mill’s electrode is integrated with the housing and outer surface of the watch. Mills also discloses that the underside of electrode 14 is physically and electrically connected to processing circuitry by a leaf spring 62 as shown in Fig. 2 (reproduced below with annotations). EX1006, 4:67-5:3.

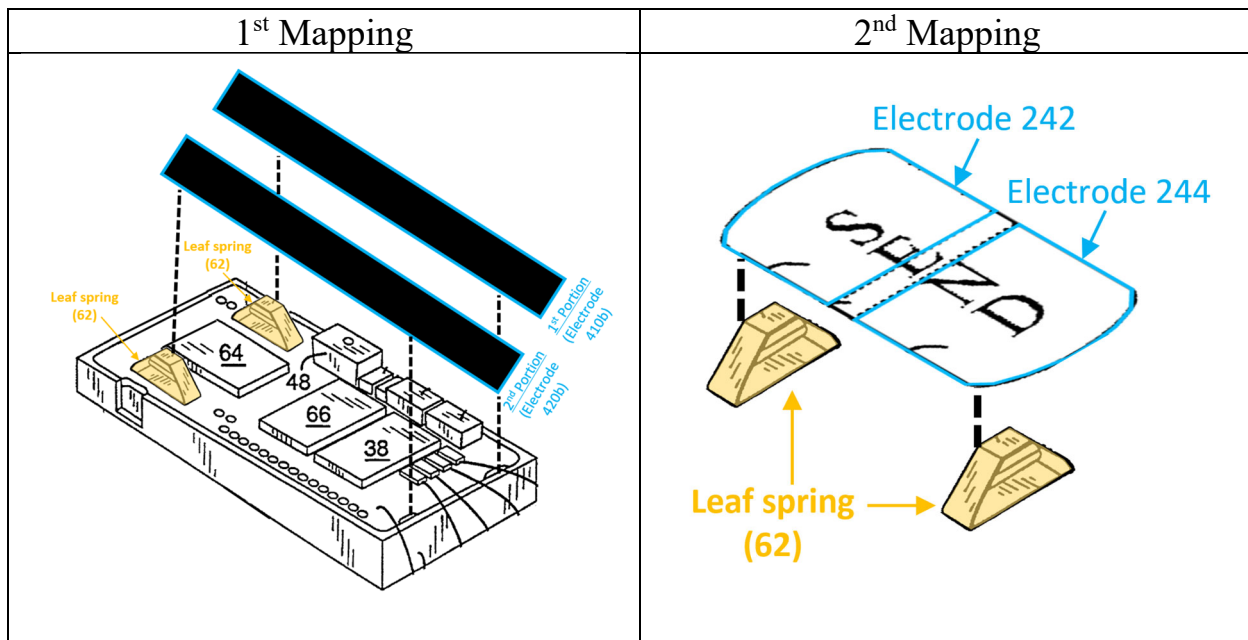


121. Mills explains that “electrode 14 is connected to the ... signal input terminal of ECG amplifier 32 via a generally trapezoid-shaped, split and thus slidably yielding, leaf spring 62 connected to a circuit pad formed on the top side of PCB 50.” EX1006, 4:67-5:3. A person having ordinary skill in the art would appreciate that at least the top of the trapezoid-shaped leaf spring 62 constitutes a “pad.”



122. In order to provide an electrical connection, the pad is pressed against the inner wall of electrode 14 in Mills and surrounded by the housing 12 of Mills and is therefore embedded in the device of Mills. EX1006, Fig. 2. The pad is below the exterior surface, and the pad is configured to detect an ECG signal of the user via its electrical contact with electrode 14 located on the exterior surface.

123. An alignment of a leaf spring with one or more electrodes is shown below in an exploded view showing different arrangements of the leaf spring of Mills aligned with electrodes in Figure 2 and 4 of Markel. EX1005, Fig. 2, 4.



124. A POSITA would have found it obvious to incorporate the pad (leaf spring 62) of Mills into the device of Markel for many reasons. For example, a person of ordinary skill in the art would have looked to Mills as both references teach the integral molding of an ECG electrode. A person of ordinary skill in the art would

have also looked to Mills because Mills teaches that its configuration provides 1) a biological monitor with “an extremely compact, integral housing” 2) “a monitor that reliably detects and records ECG signals” 3) a biological monitor that is lightweight and compact and 4) a “monitor easily manufactured and maintained, and cost effective.” EX1006, 1:36-59.

125. Furthermore, a POSITA would have been motivated to consult Mills to provide details of internal physical connections on which Markel is silent. Markel teaches that its “electrodes may be incorporated into the MCD 100 in any of a variety of manners,” which would include using a pad underneath the exterior surface of the device of its electrodes. EX1005, [0035].

126. A leaf spring would have been desirable to use to a POSITA as leaf springs are well known electrical connectors commonly used in the art. Further, a POSITA would have been motivated to use a leaf spring as leaf springs are commonly employed as electrical connectors because they provide good electromechanical contact between two components. Leaf springs are often placed between two components as an electrical connector (or bridge) and mechanical pressure is applied such that the leaf spring pushes against both components to maintain good contact pressure, such as with battery terminal contacts in some battery operated devices. Leaf springs are also used because they solve manufacturing and assembling complexities by, for example, eliminating the need

to solder a wire between the electrode and a circuit board to electrically connect the two together. A leaf spring would have been apparent to a POSITA in view of Markel as soldering is not a viable solution if the electrode is made of conductive plastic.

127. A POSITA seeking to implement Markel's device would have looked to Mill's disclosure for ways to internally connect the electrodes of Markel to internal electronic components using pads. Thus, a POSITA would utilize the leaf spring 62 taught by Mills to connect electrodes (410b, 420b, 210, 220, 230, 240, or 250) of Markel to internal processing components taught by Markel as a mere rearrangement of familiar mechanical components in known ways in a complementary device. Once incorporated into the internal components of Markel, the leaf spring 62 of Mills would be embedded in the housing of Markel because its top pad portion is placed underneath an exterior surface material and against an inner wall of the exterior surface material. Therefore, a POSITA would have seen the combination of Markel and Mills for all of the reasons stated above.

f. Limitation 1[b(iv)] “the first pad detects 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”

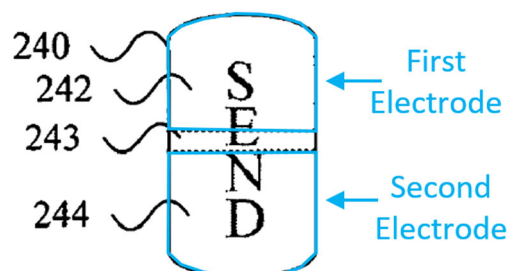
128. Markel explains that its device detects and acquires “various cardiac (i.e. heart-related) signals” from a user's finger or hand in contact with the electrodes (such as electrode 410b, 242, 244) on the exterior of Markel's housing. EX1005,

[0049] and [0058]. Markel also discloses that the electrodes can detect cardiac activity of a user “that is conductively coupled to the electrodes (*e.g.*, by touching the electrodes).” *Id.*, [0035], [0068]. Thus, this limitation would have been obvious in view of Markel and Mills.

g. Limitation 1[b(v)] “a second lead comprises a second pad that is embedded in a second portion of the enclosure”

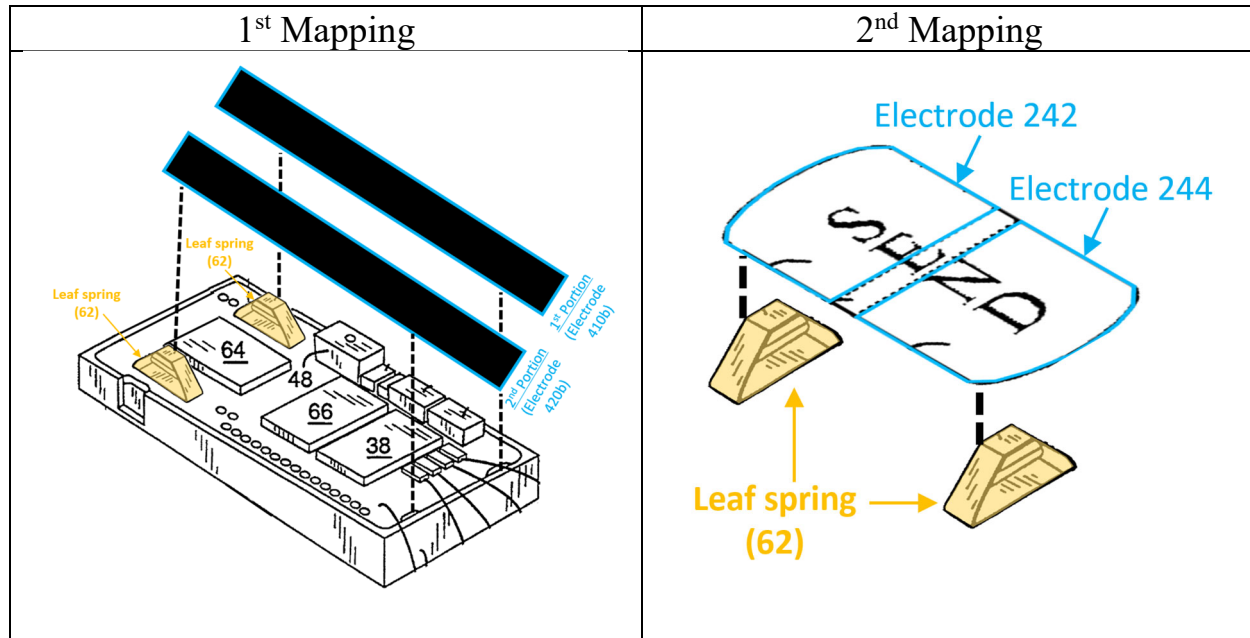
129. Markel teaches that its device is “adapted to detect cardiac activity of a user that is conductively coupled to at least two of a first, second and third (or N) electrodes.” EX1005, [0051]. In one embodiment, Markel discloses a second electrode or region 420b forming a second portion of the enclosure. EX1005, [0045]. Markel states that the second electrode may be molded into the region 420b, which includes conductive plastic. *Id.*

130. As discussed above, in other embodiments Markel discloses pushbuttons formed of conductive plastic that constitute a second portion of the enclosure. Pushbutton 240 contains a first (240) and second (244) electrode on the pushbutton, as shown from Figure 2 below. In a second mapping of the claims, second electrode 244 is a second portion with a leaf spring (second pad) underneath.



131. As discussed above with regard to limitation 1[b(iii)], Mills provides details of internal connections including the use of a leaf spring with a top pad portion. As discussed above, a POSITA would have found it obvious to use the leaf spring of Mills to connect a second electrode of Markel to internal processing arrangements. A POSITA implementing Markel would have found it obvious to use two⁶ leaf springs for all of the reasons discussed above. In addition, because Markel's electrodes (410b/420b or 242/244) are on the same side of the device of Markel instead of opposite sides as shown in Mills, a POSITA would have used the same type of electrical connections for consistency. Further, leaf springs are one of a limited number of commonly used electrical connectors and a person would have found it obvious to use a leaf spring as a known equivalent to other types of electrical connectors, including a wire spring. Thus, a person having ordinary skill in the art would have used the leaf spring of Mills as an application of a known technique to improve a similar device in the same way. A modified implementation of two leaf springs contacting Markel's electrodes (410b/420b or 242/244) is shown in an exploded view below. EX1005, Fig. 2, 4.

⁶ I understand that it is “well settled” that duplication of parts is, by itself, not patentably significant. *In re Harza*, 274 F.2d 669, 124 USPQ 378 (CCPA 1960).



- h. Limitation 1[b(vi)] “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”**

132. As explained for section 1[b(iv)] above, Markel’s device is “adapted to detect cardiac activity of a user that is conductively coupled to the electrodes (e.g., by touching the electrodes).” EX1005, [0035]. For example, by holding the phone (MCD) a user would contact first portion 410b and second portion 420b “during normal use of the MCD”. EX1005, [0043].

133. Moreover, in a second mapping at least where “electrodes may be disposed on a same pushbutton” (such as pushbutton 240 having electrode 242 and 244) a user would “contact both electrodes while operating the pushbutton.”

EX1005, [0047]. Thus, a person having ordinary skill in the art would have understood that Markel meets this limitation.

- i. **Limitation 1[c] “a processor coupled to the heart sensor 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”**

134. Markel discloses “electronic devices” with “cardiovascular monitoring capability” that may “comprise a cardiac sensor (e.g., electrodes)” that may also “acquire, analyze and/or communicate user health-related information” such as derived from electrodes (410b, 420b, 242, 244). EX1005, Abstract. A POSITA would understand from this disclosure that Markel teaches processing elements coupled to a heart sensor that acquire, analyze, and/or communicate heart sensor information. Markel discloses the processor in its disclosure can be any of a number of hardware components including an integrated circuit, processor chip and controller chip. EX1005, [0178].

135. In various embodiments Markel discloses a first and second lead configured as a first and second pad, respectively, on a portion of the housing, and the first and second pads each connected to a processor, as shown in annotated Figs.

4 and 20⁷ below. EX1005, Figs. 4 and 20. Accordingly, Markel teaches a first lead with a first connector coupled to a first pad that provides a first electrical signal from the first pad to the processor, and a second lead with a second connector coupled to a second pad that provides a second electrical signal from the second pad to the processor.

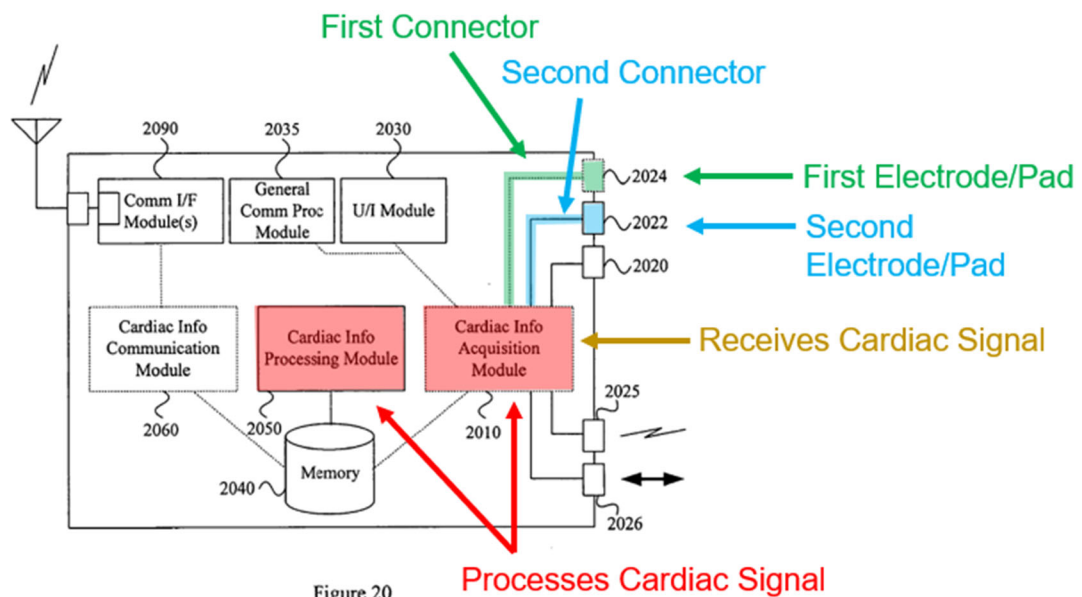
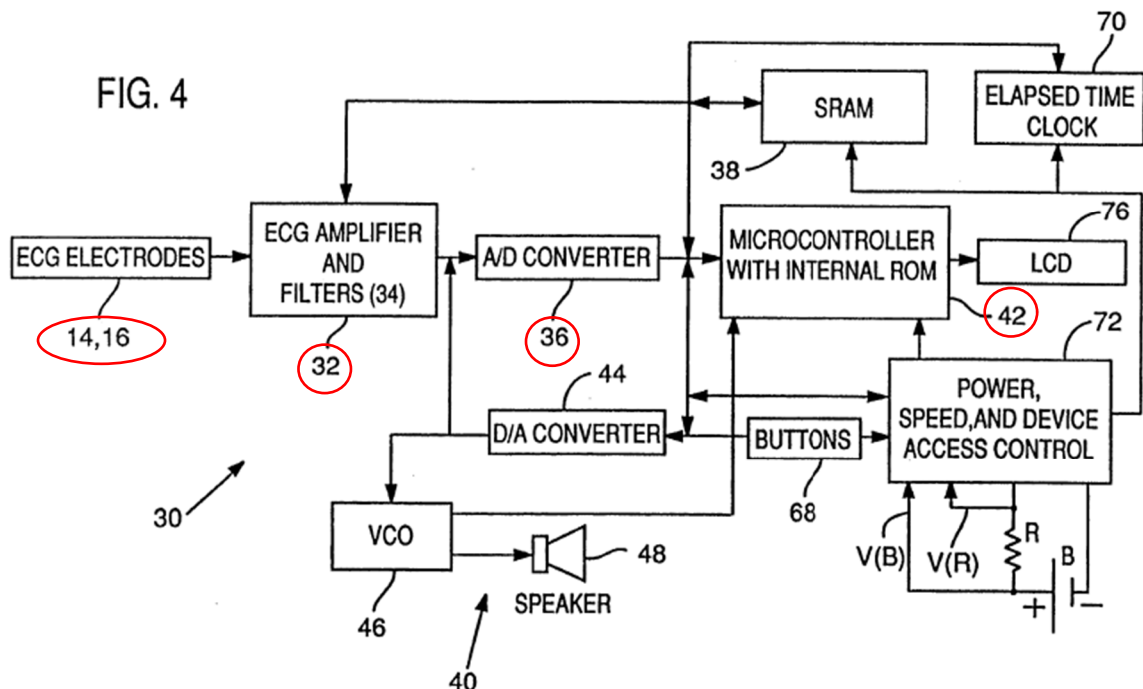


Figure 20

136. Mills likewise discloses its electrodes 14 and 16 are electrically connected to processing circuitry (ECG amplifier 32, A/D converter 36 and microcontroller 42), as shown in annotated Fig. 4 below. EX1006, 4:64-5:3, Fig. 4. As an alternative to the processing disclosed in Markel, it would have been obvious

⁷ Markel Fig. 20 is a block diagram applicable to any of Markel's Figs. 1-19. EX1005, [0108].

to use the internal componentry of Mills as a substitute as Mills provides complimentary implementation details to those taught in Markel.

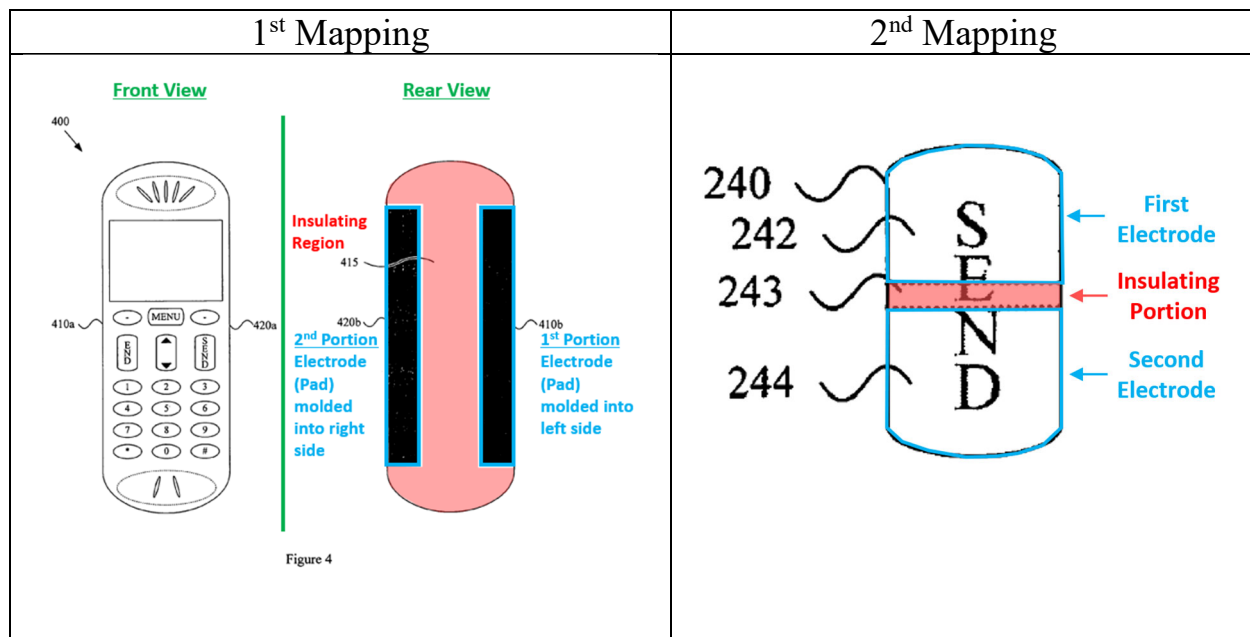


2. **Claim 4 “the first portion is separated from the second portion by a third portion of the enclosure; at least the third portion is constructed from a material having a first conductivity; and the first conductivity is insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion”**

137. For the first mapping, Markel discloses region 410b (first portion) and the region 420b (second portion) may include conductive plastic. EX1005, [0045]. Markel further discloses an “insulating region 415” that electrically isolates the region 410b from the region 420b, as shown in a first mapping with Fig. 4 below.

Id.

138. As an example for the second mapping, Markel discloses a pushbutton 240 where “a first electrode 242 (e.g., a first conductive plastic region) and a second electrode 244 (e.g., a second conductive plastic region) [are] separated by an insulating portion 243 (e.g., non-conductive plastic).” This is shown in the second mapping showing a pushbutton from Figure 2. EX1005, Fig. 2, [0047].



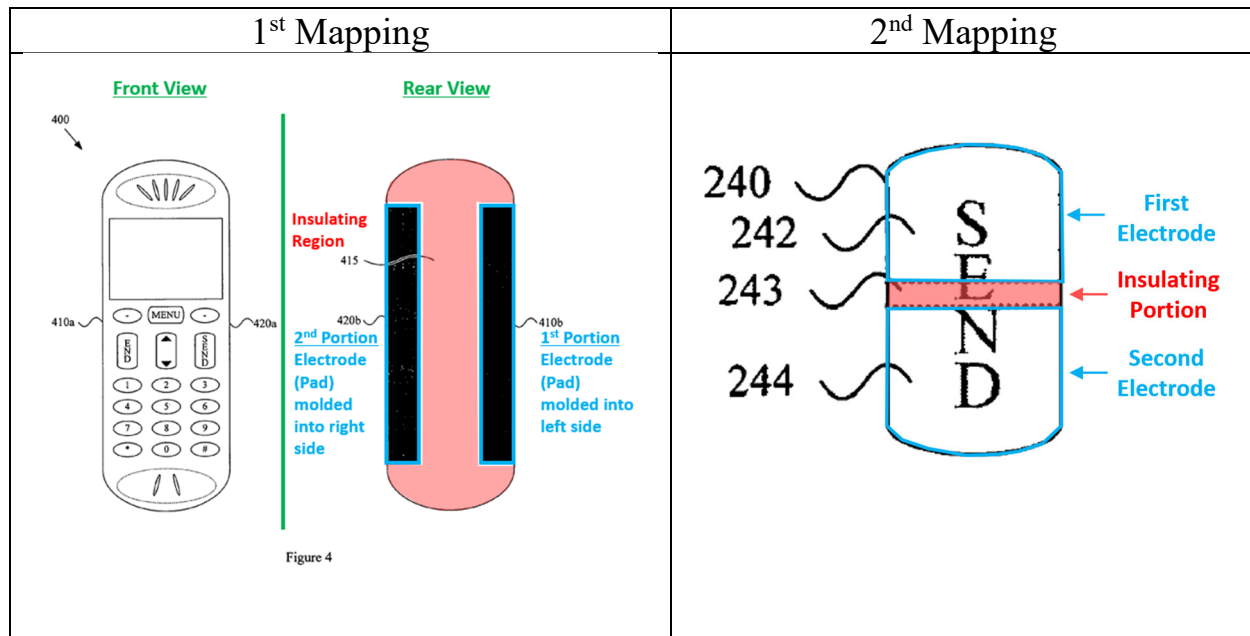
139. A POSITA would have understood that an insulating region, such as the insulating regions discussed above in Markel, is a third portion formed of a material having a first conductivity insufficient to transmit the first electrical signal from the first pad to the second pad via the third portion.

3. Claim 6

- a. Limitation 6(a) “The electronic device of claim 4, wherein: the exterior surface of the enclosure further comprises an exterior surface of the second portion;”**

140. As is shown in Fig. 2 and 4 of Markel illustrated below, the pushbutton second electrode 244, or in an alternative mapping, the pad at region 420b are each a second portion of the exterior surface of the enclosure of device 400. EX1005, Figs. 2 and 4, [0037].

141. Markel notes that “first and second electrodes may be disposed on a main body portion 110 of the MCD 100” and “an electrode (or all electrodes) or other sensor may be substantially concealed (or hidden) from a user an electrode may comprise molded conductive plastic with little or no visible indication of the electrode presence.” Thus, a POSITA would understand that electrode 244 and region 420b each constitute a second portion, meeting the limitation of 6(a). EX1005, [0040], [0045].



EX1005, Fig. 2, 4.

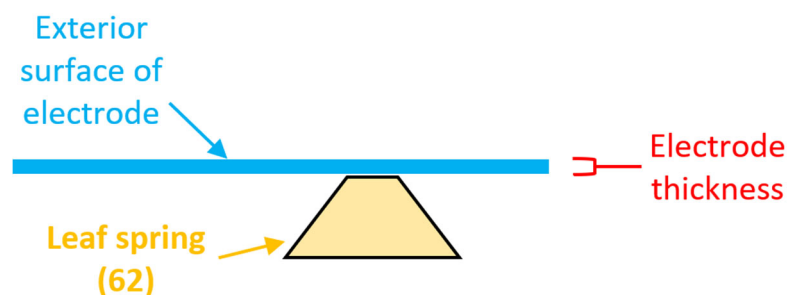
- b. Limitation 6(b) “the second pad is configured to detect the second electrical signal of the user's cardiac signal via the user's contact with the exterior surface of the second portion;”**

142. Electrodes (such as 420b or 244 shown above) detect and acquire various cardiac signals from a user's skin contact with the electrodes on the exterior of Markel's housing. EX1005, [0042]-[0043]. As cited in section 1[b(iv)] above, Markel's device is “adapted to detect cardiac activity of a user that is conductively coupled to the electrodes (e.g., by touching the electrodes).” EX1006 at [0035], [0068]. Using the leaf spring of Mills as discussed above, the electrical signal is then carried from the electrodes (420b or 244) through the leaf spring (second pad) via the leaf spring's top pad to a processor, such as processing module 1050 in Markel or microcontroller chip 42 of Mills. EX1005, [0059] (“processing module 1050 that

processes acquired cardiac information”); EX1006, 4:55-60, 4:68-5:3; EX1005, [0178]-[0179]. Accordingly, this limitation would have been obvious in view of Markel and Mills.

c. Limitation 6(c) “the second pad is positioned from the exterior surface of the second portion by a thickness of the second portion;”

143. As discussed above in 1[b(v)], the combined Markel and Mills combination would include a leaf spring of Mills pressed against the inside of the electrodes 420b or 244 of Markel. Accordingly, the second pad (the leaf spring connector as taught by Mills) is positioned against an inside surface of electrodes 244 or 420b which is a distance from the exterior surface of the second portion (outside surface of electrode 420b or 244) equivalent to a thickness of the second portion. The second pad (leaf spring) would necessarily be spaced from the exterior surface of the second portion by the thickness of the second portion, since the leaf spring abuts the back side of the conductive plastic of the first electrode and the second electrode, as illustrated in a side view below.



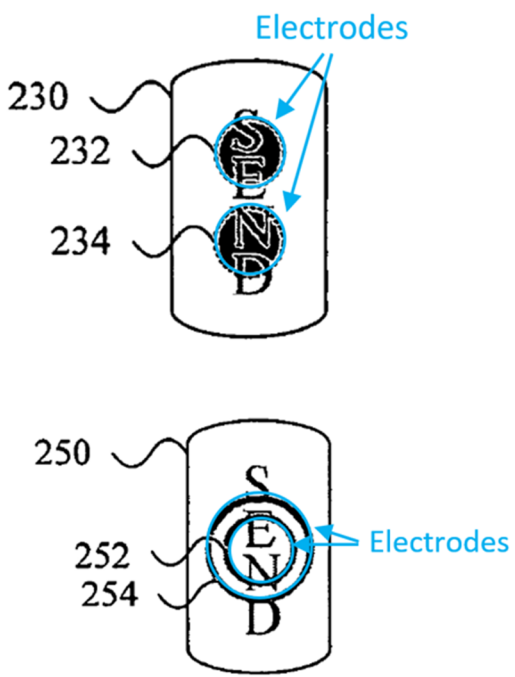
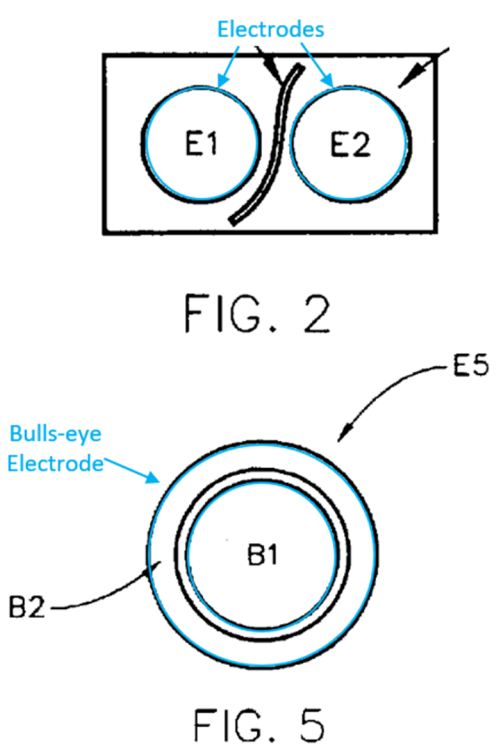
d. Limitation 6(d) “at least the thickness of the second portion is constructed from material having a second conductivity; and”

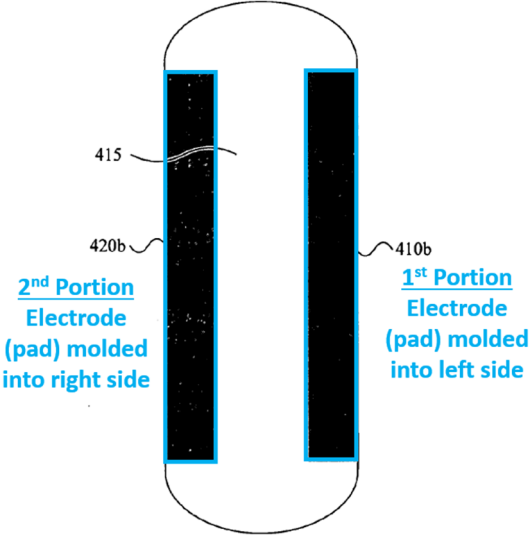
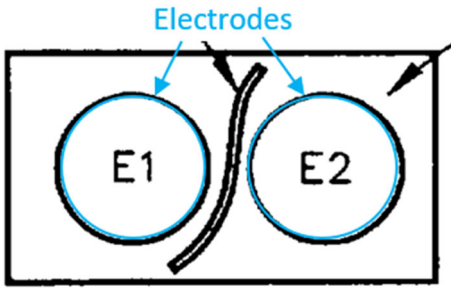
144. The exterior surface at region 420b of Markel is an electrode comprising “molded conductive plastic with little or no visible indication of the electrode presence.” EX1005, [0040], [0045] (“420b include[s] conductive plastic”). Additionally, Markel’s pushbutton is molded from conductive plastic. EX1005, [0047] (“second electrode 244 (e.g., a second conductive plastic region)”). A POSITA would understand that the conductive plastic would have a second conductivity that is different than the conductivity of insulating portions, such as “insulating region 415” and “insulating portion 243 (e.g., non-conductive plastic)”. EX1005, [0045], [0047].

e. Limitation 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”

145. As explained above, Markel teaches electrodes such as 420b and 244 comprising molded conductive plastic. EX1005, [0045], [0047]. A POSITA would look to other references to learn how to make molded conductive plastic and specific properties that would be desirable for ECG electrodes in a device similar to Markel. For example, a person of skill would have looked to Stratbucker (EX1022) and Stejskal (EX1011, “Electrically Anisotropic Materials: Polyaniline particles organized in a Polyurethane Network”).

146. Stratbucker teaches the general principle that anisotropic electrical properties are desirable when two ECG electrodes are “held in essentially constant spacial [sic] separation configurations,” similar to the configuration of Markel’s Figures 2 and 4. EX1022, 1:6-14. A side by side comparison of sample electrode configurations in Stratbucker and Markel is shown below. EX1005, Fig. 2; EX1022, Fig. 2 and 5.

Electrode Configurations in Markel (EX1005, Fig. 2)	Electrode Configurations in Stratbucker (EX1022, Fig. 2 and 5)
	

Electrode Configurations in Markel (EX1005, Fig. 4)	Electrode Configurations in Stratbucker (EX1022, Fig. 2)
<u>Rear View</u> 	 FIG. 2

147. Stratbucker notes that with its anisotropic polymer “the specific impedance across the sheet is significantly different from that laterally along said sheet.” EX1022, 5:61-65. Anisotropic electrical properties, as explained in Stratbucker, allow the electrical signal to propagate through a depth, but not laterally. EX1022, 7:65-8:4. On the other hand, with an isotropic sheet “signals which should be present in one electrode in a bioelectric interface, will to some extent be present in other electrodes as well, as a result of lateral current flow,” producing “artifact[s] to (ECG) data.” EX1022, 8:23-29. Thus, an anisotropic material is desirable as it “allows use of higher resolution electrode geometry . . . because lateral current flow is limited.” EX1022, 8:30-32. This also prevents

electrical shorting between the electrodes. Finally, Stratbucker teaches that anisotropic materials are particularly useful where the dimensions of the electrodes are smaller. EX1022, 5:31-64; 9:21-24.

148. Stratbucker teaches the general application of anisotropic materials to ECG electrodes in the form of an adhesive sheet. EX1022 at 283 (abstract). However, Stejskal teaches a process for making a solid polyaniline conductive polymer with anisotropic properties. EX1011, abstract. The solid structure is composed of polyaniline distributed in a polyurethane network and solidified (petrified) following polymerization of the polyurethane medium. EX1011 at 287 (conclusion). Polyurethane is a plastic (polymer), thus a POSITA would readily understand that Stejskal teaches a process for making solid anisotropic conductive plastic, which is directly applicable to the conductive plastic of Markel and the adhesive anisotropic material of Stratbucker.

149. Stejskal teaches that its conductive plastic has a higher conductivity in one direction and much lower conductivity in directions perpendicular to the first direction. EX1011 at 287, 283 (“The conductivity in the direction parallel to the orientation was several times higher than that in the perpendicular one.”). Thus, a POSITA would have understood that Stejskal and Stratbucker teach a material that limits lateral transmission of an electrical signal while at the same time is configured

to transmit an electrical signal vertically, such as through the thickness of electrodes 410b/420b or 242/244 in Markel.

150. A POSITA would have been motivated by the teachings of Stejskal and Stratbucker to use conductive plastics with anisotropic electrical properties at least because Markel and Stejskal both teach conductive plastics and are in the same field of endeavor. The POSITA would have been further motivated to use an anisotropic material:

- 1) to prevent “artifacts” (noise) from being transmitted in ECG measurements (EX1022, 8:20-29);
- 2) to increase the accuracy of monitored ECG signals where the electrodes are close together, such as with a pushbutton or a Bulls-eye electrode configuration (EX1022; 3:49-58, 9:21-25);
- 3) to provide “higher resolution electrode geometry . . . because lateral current flow is limited” (EX1022, 8:30-32); and

4) in order to reduce the use of mechanical features that prevent lateral current flow, such as slits (EX1022, 8:17-20 with “anisotropic electrical specific impedance⁸ properties, said slit (S) typically becomes unnecessary”).

151. Accordingly, Limitation 6(e) would have been obvious to a POSITA in view of Markel’s teachings of the use of conductive plastics in combination with Stejskal’s general teaching of anisotropic conductive plastic and Stratbucker’s teachings of the desirability of using anisotropic electrical properties in an ECG electrical configuration where two electrodes are collocated on the same substrate as is shown in Markel.

4. Claim 7: “The electronic device of claim 6, 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”

152. A POSITA would have known that electrical signals propagating from one electrode to another electrode would result in inaccuracies in the signal, potentially decreasing the signal to noise ratio. Markel discloses several insulating regions, “insulating region 415” and “insulating portion 243” in order to prevent the

⁸ Stratbucker refers to specific impedance as a bulk property of the adhesive material. EX100, 5:65-6:1. The real part of specific impedance is also referred to as resistivity, and the inverse of resistivity is conductivity.

shortcutting of electrical signals from one electrode to another. EX1005, [0045] and [0047].

153. Stratbucker similarly utilizes an anisotropic material in order to provide “specific impedance properties” between electrodes. Stratbucker specifically notes that the position of its electrodes may be arranged with respect to each other to ensure that the impedance (resistance) between adjacent electrodes is high and the impedance vertically through the electrodes is lower:

Said electrodes (E1) and (E2) are affixed to said adhesive sheet in a manner such that their relative positions with respect to one another are essentially fixed, and such that the *specific impedance from each electrode directly through said adhesive sheet[] is less than that between any said electrodes through said adhesive sheet (AS)*.

EX1022, 7:65-8:4 (emphasis added); *see also* EX1022, claims 1, 11, 22, 25, 8:65-9:2.

154. Thus, a person having ordinary skill in the art would have found it obvious to distance the electrodes (and the electrode pads beneath the electrodes) such that the impedance between the electrodes is high to prevent short circuiting or noise of the ECG signal in the anisotropic material. Therefore, the electrodes are

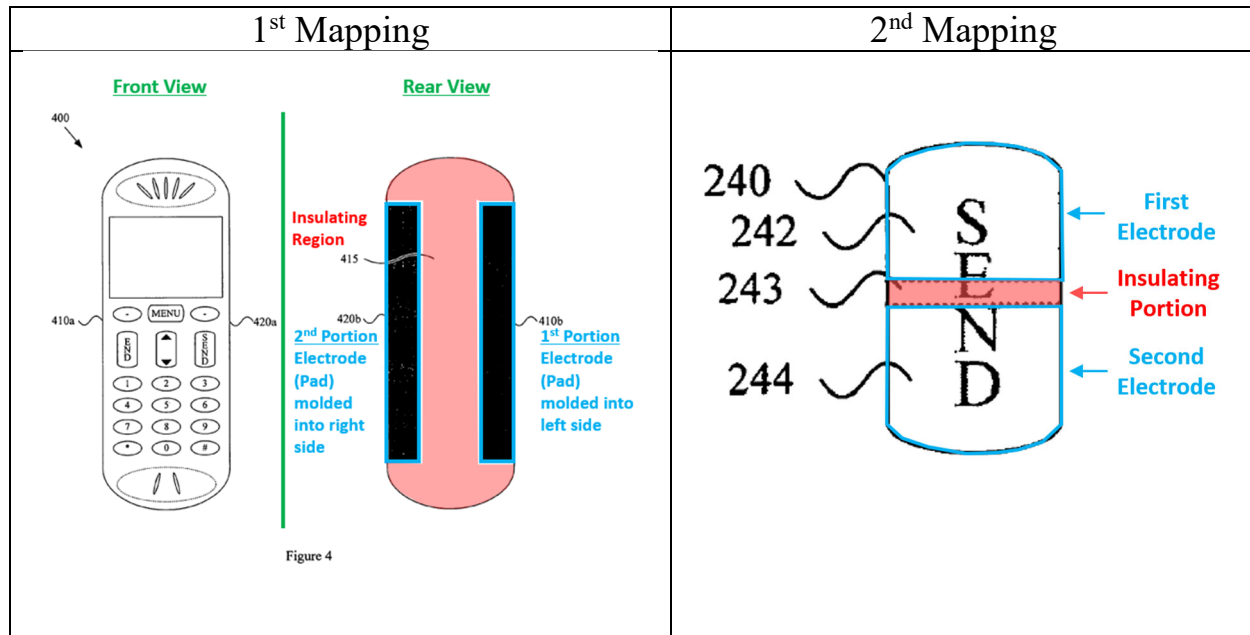
positioned such that they are electrically isolated “apart” by a “material having [a] second conductivity” (anisotropic material).⁹

155. Further, with respect to Figure 4 of Markel, a person having ordinary skill in the art would have known that a mobile phone housing would be on the order of millimeters in thickness and the distance between the 1st portion 410b and the 2nd portion 420b would be on the order of centimeters, an order of magnitude difference. Thus, where the conductive plastic of Markel is replaced with an anisotropic conductive plastic of Stratbucker and Stejskal, the electrodes would be physically distanced from one another at a distance larger than the thickness of the housing of the phone and be separated apart by an anisotropic material having a second conductivity. As discussed above with regard to limitation 6(e) a POSITA would have been motivated to use an anisotropic material for many reasons, many of which are provided in Stratbucker. EX1022, 8:20-29; 3:49-58, 9:21-25; 8:30-32; 8:17-20.

156. With respect to Figure 2 of Markel, a person having ordinary skill in the art would have found it desirable to electrically isolate the two electrodes (242 and 244 for example) at a prescribed distance in order to prevent cross-signal artifacts. Therefore, a POSITA would have made the insulating region 243 wider

⁹ Petitioner reserves the right to challenge the validity of this claim under 35 U.S.C. 112(a) in other parallel proceedings.

than a thickness of the material of the pushbutton in order to provide a signal free of artifacts.



EX1005, Fig. 2, 4.

157. A person having ordinary skill in the art would have been motivated to physically and electrically separate the first and second pads “apart” from one another at least for the reasons discussed above, such as to prevent short circuiting or noise of the ECG signal in the anisotropic material. Therefore, Claim 7 would have been obvious to a POSITA in view of Markel, Mills, Stratbucker, and Stejskal.

X. SECONDARY CONSIDERATIONS

158. I understand that secondary considerations of non-obviousness, such as commercial success, unexpected results, skepticism of others, long-felt-but-unmet need, etc., should be considered when evidence of such factors has been introduced. I am not aware of any evidence of secondary considerations. I reserve the right to respond to any evidence of secondary considerations introduced by Apple.

XI. CONCLUSION

159. For the foregoing reasons, it is my opinion that claims 6-7 of the '257 patent would have been obvious to a POSITA at the relevant time in view of the prior art referenced above.

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

Dated: Oct. 19, 2023

By: Alan L. Oslan

Alan L. Oslan