

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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GARMIN INTERNATIONAL, INC.  
Petitioner

v.

CARDIACSENSE LTD.  
Patent Owner

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Case No. IPR2025-00195  
U.S. Patent No. 7,980,998

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**DECLARATION OF DR. ROBERT T. STONE**

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## I. INTRODUCTION

1. I, Dr. Robert T. Stone, have been retained by counsel for Petitioner as a technical expert in the above-captioned case. Specifically, I have been asked to render certain opinions in support of Garmin International's IPR petition, which challenges all claims of U.S. Patent No. 7,980,998 (the "'998 Patent").

2. My compensation in this matter is not based on the substance of my opinions or the outcome of this matter. I have no financial interest in Petitioner.

3. In writing this declaration, I have considered my own knowledge and experience, including my work experience in the fields of Electrical Engineering and biological telemetry; my experience in teaching those subjects; and my experience in working with others involved in those fields. In reaching my opinions in this matter, I have also reviewed the following references and materials:

- Petition for *Inter Partes* Review of U.S. Patent No. 7,980,998 (the "Petition")
- U.S. Patent No. 7,980,998 (Ex. 1001, the "'998 Patent")
- File History for the '998 Patent (Ex. 1002)
- U.S. Provisional Application No. 60/843,422 (Ex. 1004, "'422 Application")
- Continuation-in-Part of Application No. PCT/IL07/01121 (Ex. 1005, the "'121 Application")
- U.S. Patent No. 7,889,085 to Downey et al. (Ex. 1006, "*Downey*")
- U.S. Patent Application Publication No. 2008/0284650 to MacIntosh et

al. (Ex. 1007, “*MacIntosh*”)

- U.S. Patent No. 8,330,611 to Burton et. al (Ex. 1008, “*Burton*”)
- U.S. Provisional Application No. 61/205,146 (Ex. 1009, “*Burton-Provisional*”)
- “An Innovation for Swimming Stroke Monitoring Tri-axial Accelerometer and Gyroscope Data Logger for Stroke Analysis” to Ohgi et al. (Ex. 1010, “*Ohgi*”)
- U.S. Patent Application Publication No. 20030018274 (Ex. 1011, “*Takahashi*”)

#### **A. Background and Qualifications**

4. I have summarized in this section my educational background, career history, and other qualifications relevant to this matter. I have also included a current version of my curriculum vitae attached to this Declaration.

5. I received a B.S. degree in Electrical Engineering from Virginia Tech in 1977, followed by a corresponding M.S. in 1979. In 1981, I received a Ph.D., in Electrical Engineering from Stanford.

6. I have over thirty-eight years of academic and industry experience in the field of medical electronics systems and instrumentation, including devices that employ linear and angular accelerometers, measure signals corresponding to a human’s movement, and communicate wirelessly. As Chief Executive Officer and founder of Medical Design Solutions, Inc, I am responsible for all phases of product development including concept definition, prototyping, design, and evaluation.

7. I have contributed to several marked advances in pulse Oximetry signal processing (two US patents issued), and developed an Oximetry telemetry system. Two of the patents were vital to market growth of Pulse Oximetry. One of the patents allowed the positioning of the second-generation product in awake, agitated, or ambulatory patients, while the second patent significantly improved the product performance during physiologic transients, and is currently in use in as many as 50% of the pulse Oximeters in the world. The Oximetry marketplace expanded from critical care facilities to step down wards and general wards with the introduction of the OXINET telemetry system that was a sole contributor definition, design, and development.

## **II. LEGAL FRAMEWORK**

8. I am a technical expert and do not offer any legal opinions. However, counsel has informed me as to certain legal principles regarding patentability and related matters under United States patent law, which I have applied in performing my analysis and arriving at my technical opinions in this matter.

9. I have been informed that the Patent Trial and Appeal Board (“PTAB”) now applies the claim construction standard applied by Article III courts (i.e., the *Phillips* standard) regardless of whether a patent has expired. I have been informed that under the *Phillips* standard, claim terms are to be given the meaning they would have to a person having ordinary skill in the art at the time of the invention, taking

into consideration the patent, its file history, and, secondarily, any applicable extrinsic evidence (e.g., dictionary definitions).

10. I have also been informed that a person cannot obtain a patent on an invention if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. I have been informed that a conclusion of obviousness may be founded upon more than a single item of prior art. I have been further informed that obviousness is determined by evaluating the following factors: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim at issue, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations of non-obviousness. In addition, the obviousness inquiry should not be done in hindsight. Instead, the obviousness inquiry should be done through the eyes of a person having ordinary skill in the relevant art at the time the patent was filed.

11. In considering whether certain prior art renders a particular patent claim obvious, counsel has informed me that I can consider the scope and content of the prior art, including the fact that one of skill in the art would regularly look to the disclosures in patents, trade publications, journal articles, industry standards, product literature and documentation, texts describing competitive technologies, requests for comment published by standard setting organizations, and materials

from industry conferences, as examples. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be “analogous art” to the claimed invention. I have been informed that a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be “reasonably pertinent” to the problem, it must logically have commended itself to an inventor’s attention in considering his problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

12. I have been informed that, in order to establish that a claimed invention was obvious based on a combination of prior art elements, a clear articulation of the reason(s) why a claimed invention would have been obvious must be provided. Specifically, I am informed that, under the U.S. Supreme Court’s *KSR* decision, a combination of multiple items of prior art renders a patent claim obvious when there was an apparent reason for one of ordinary skill in the art, at the time of the invention,

to combine the prior art, which can include, but is not limited to, any of the following rationales: (A) combining prior art methods according to known methods to yield predictable results; (B) substituting one known element for another to obtain predictable results; (C) using a known technique to improve a similar device in the same way; (D) applying a known technique to a known device ready for improvement to yield predictable results; (E) trying a finite number of identified, predictable potential solutions, with a reasonable expectation of success; (F) identifying that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; or (G) identifying an explicit teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art references to arrive at the claimed invention.

13. I am informed that the existence of an explicit teaching, suggestion, or motivation to combine known elements of the prior art is a sufficient, but not a necessary, condition to a finding of obviousness. This so-called “teaching suggestion-motivation” test is not the exclusive test and is not to be applied rigidly in an obviousness analysis. In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. Instead, the important consideration is the objective reach of the

claim. In other words, if the claim extends to what is obvious, then the claim is invalid. I am further informed that the obviousness analysis often necessitates consideration of the interrelated teachings of multiple patents, the effects of demands known to the technological community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art. All of these issues may be considered to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent.

14. I also am informed that in conducting an obviousness analysis, a precise teaching directed to the specific subject matter of the challenged claim need not be sought out because it is appropriate to take account of the inferences and creative steps that a person of ordinary skill in the art would employ. The prior art considered can be directed to any need or problem known in the field of endeavor at the time of invention and can provide a reason for combining the elements of the prior art in the manner claimed. In other words, the prior art need not be directed towards solving the same specific problem as the problem addressed by the patent. Further, the individual prior art references themselves need not all be directed towards solving the same problem. I am informed that, under the *KSR* obviousness standard, common sense is important and should be considered. Common sense teaches that familiar items may have obvious uses beyond their primary purposes.

15. I also am informed that the fact that a particular combination of prior art elements was “obvious to try” may indicate that the combination was obvious even if no one attempted the combination. If the combination was obvious to try (regardless of whether it was actually tried) or leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than innovation. I am further informed that in many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature or knowledge, will drive the design of an invention. I am informed that an invention that is a combination of prior art must do more than yield predictable results to be non-obvious.

16. I am informed that for a patent claim to be obvious, the claim must be obvious to a person of ordinary skill in the art at the time of the invention. I am informed that the factors to consider in determining the level of ordinary skill in the art include (1) the educational level and experience of people working in the field at the time the invention was made, (2) the types of problems faced in the art and the solutions found to those problems, and (3) the sophistication of the technology in the field.

17. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, upon reading

the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.

18. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider "secondary considerations" if presented. In most instances, the patentee raises these secondary considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the

invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; (h) teaching away from the invention in the prior art.

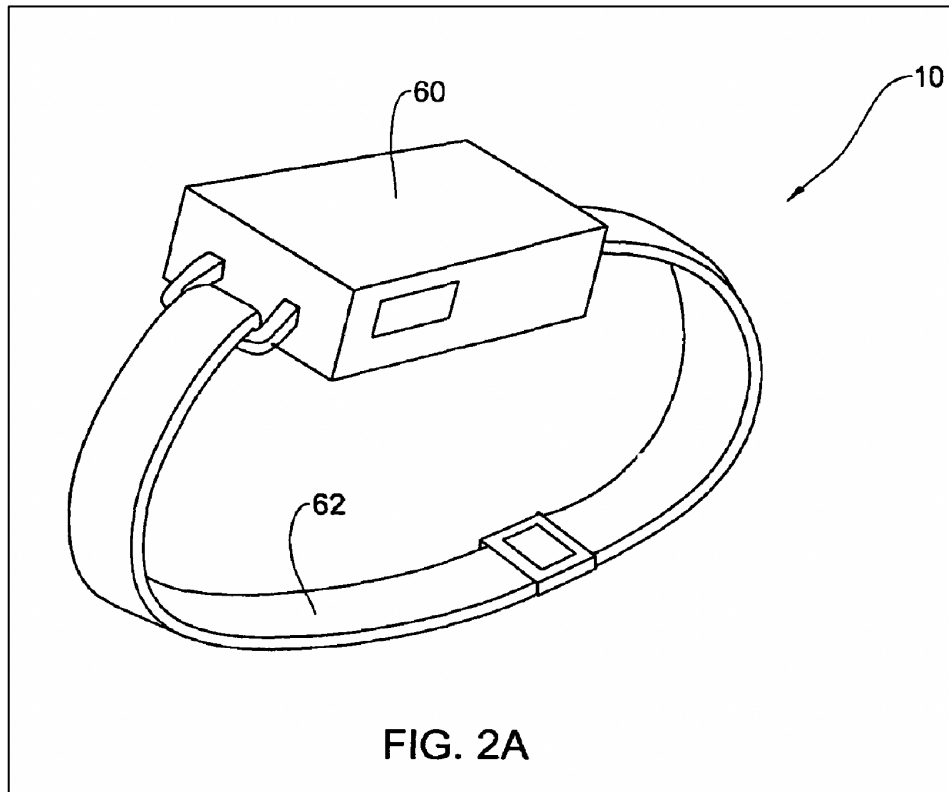
19. I am further informed that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. The establishment of a nexus is a question of fact. While I understand that the Patent Owner here has not offered any secondary considerations at this time, I will supplement my opinions in the event that the Patent Owner raises secondary considerations during the course of this proceeding.

### **III. CLAIM CONSTRUCTION**

20. I have been informed by counsel that the first step in an unpatentability analysis involves construing the claims, as necessary, to determine their scope. Second, the construed claim language is then compared to the disclosures of the prior art. I am informed that claims are generally given their ordinary and customary meaning as understood by one of ordinary skill in the art at the time of the invention in light of the patent specification and prosecution history, i.e., the intrinsic record. I understand the Petition proposes two claim constructions as outlined below. Otherwise, I have applied the ordinary and customary meaning of remaining claim language in my analyses.

21. Claims 1 and 8 recite “each of the measurements,” which may be interpreted in two ways. Ground 2 adopts a broader definition, requiring each of the accelerometer and the gyroscope to determine the location and orientation of the body part. Ground 4 addresses a narrower construction, requiring each sensor reading to be used to calculate/update location and orientation.

22. I have been informed that the appropriate construction of “means for attaching” includes a band of material similar to a watch, an elastic or adjustable band, a headband, goggles, shoes, wet socks, or any other clothing or accessory that is attached to, or worn by, the participant that attaches via a clamp, Velcro patch, adhesive patch, pocket, strap, restraining enclosure, or other equivalent device. Specifically, the “means for attaching” includes at least the watch band illustrated below in the '998 Patent's Figure 2.



'998 Patent, Figure 2.

#### IV. A PERSON HAVING ORDINARY SKILL IN THE ART

23. I was asked to provide my opinion as to the level of skill of a person having ordinary skill in the art ("POSITA") of the '998 Patent at the time of the claimed invention, which I have been instructed to assume is March 11, 2009.<sup>1</sup> In determining the characteristics of a hypothetical person of ordinary skill in the art of

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<sup>1</sup> My opinions provided in this Declaration are made as of the priority date of the '998 Patent unless expressly stated otherwise. To the extent that any verb tense used in this Declaration or any deposition or testimony provided in this matter is a present tense, e.g., "would understand," such verb tense should be understood to be my opinion as of the '998 Patent's priority date.

the '998 Patent at the time of the claimed invention, I was told to consider several factors, including the type of problems encountered in the art, the solutions to those problems, the rapidity with which innovations are made in the field, the sophistication of the technology, and the education level of active workers in the field. I also placed myself back in the time frame of the claimed invention and considered the colleagues with whom I had worked at that time.

24. A person of ordinary skill in the art at the time of the alleged invention of the '998 Patent ("POSITA") would have had a bachelor's degree in Electrical Engineering, Mechanical Engineering, or a similar discipline with at least one year of experience with portable electronic devices. More education can substitute for practical experience and vice versa. Such a person of ordinary skill in the art would have been capable of understanding the '998 Patent and the prior art references discussed herein.

25. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. Additionally, I met at least these minimum qualifications to be a person having ordinary skill in the art at least as of March 11, 2009. Further, although my qualifications may exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis

and opinions regarding the '998 Patent have been rendered from the perspective of a person having ordinary skill in the art at the time of the invention.

## V. OVERVIEW OF THE TECHNOLOGY

26. I was asked to briefly summarize the background of the prior art from the standpoint of the knowledge of a person of ordinary skill in the art (which I have expressly defined in Section IV) prior to March 2009.

### A. Athletic Training Devices

27. Athletic tacking and monitoring systems have been in use since at least the early 1970s. As an example, U.S. Patent No. 3,797,010 to Adler et al. (Ex. 1026, “*Adler*”) provides a system utilizing an accelerometer “capable of sensing each step taken by an exerciser while walking, running or jogging either in place or over a distance course.” *Adler*, 2:57-61. The exercise measuring and indicating device is worn on a belt, situated on the user’s hips, but Adler also contemplates that the device may “be carried equally well on the person of the exerciser 6 by other conventional means.” *Adler*, 4:30-36. Even at this early date, *Adler* expresses a desire for an on-body tracking device that provides “a continuous or periodic indication that an exerciser is moving above a threshold rate[.]” *Adler*, 2:17-18.

28. By the late 1980s, sports related monitoring devices were capable of being attached on a wrist. This is seen in U.S. Patent No. 4,699,379 to Chateau et al. (Ex. 1027, “*Chateau*”) disclosing a wrist mounted athletic monitoring device for

“sensing the acceleration of the body or equipment portion while in motion.” *Chateau*, 2:46-48. Acceleration is measured in “three orthogonal axes of motion” and is subsequently used to determine if a bowling ball is “thrown too hard, too soft, or within the pre-determined range[.]” *Chateau*, 2:37-38, 4:41-44. Like *Adler*, *Chateau* compares an athletic event to predetermined metrics providing feedback to an athlete and allowing “learning efficiency of the user [to be] increased[.]” *Chateau*, 2:36-40.

29. A similar athletic tracking device is disclosed in 1996. U.S. Patent No. 5,524,637 to Erickson (Ex. 1030, “*Erickson*”), which teaches a sensor 10, “attached to the user” and comprising of “an accelerometer, a pressure sensor, a blood pressure sensor, a pulse rate detector or other types of sensing mechanisms.” *Erickson*, 7:41-46. *Erickson* considers that one sensor may be enough “for normal monitoring purposes[.]” but also states that more complex exercises may require attaching sensors to “each of the user’s limbs to monitor arm and leg motion[.]” *Erickson*, 7:50-57. Overall, this system provides an estimated exertion level based on the measure acceleration and may even “display heart rate 18, along with the target range[.]” while also providing a visual or auditory alarm if “the heart beat were too fast or irregular.” *Erickson*, 8:19-30, 9:7-11.

30. With the turn of the century, wearable athletic devices continued to evolve and include more functionality. U.S. Patent Application Publication No.

2004/0102931 to Ellis et al. (Ex. 1023, “*Ellis*”) describes a multifunctional device, or a modular personal network (MPN), with athletic functions that may “measure distance, speed, heart rate, cadence, stride length, and other athletic data.” *Ellis*, [0024]. The MPN also contemplates providing “lap counts, workout logging, and other lap swimming functions” and “form feedback to an athlete.” *Ellis*, [0024]. As contemplated by *Adler*, *Chateau*, and *Erickson* years before, *Ellis* builds on the concept of providing performance metrics to an athlete by incorporating more granular data. For instance, “if the system is being used for athletic monitoring, audio feedback may be used to prompt the user to work out harder or easier, to provide performance information, or to inform the user what workout zone he or she is in.” *Ellis*, [0049].

**B. Linear and Angular Accelerometers, Compasses and Dead Reckoning**

31. As I noted in *Chateau*, accelerometers have been used in athletic tracking devices since at least as early as the early 1980s. U.S. Patent No. 6,122,960 to Hutchings et al. (Ex. 1029, “*Hutchings*”), issued in September 2000, follows suit and discloses a system using accelerometers measuring the movement of objects, specifically the movements found when running or walking. *Hutchings*, Abstract. In addition to accelerometers, rotational rate sensors or rotational accelerometers are utilized “along with linear accelerometers and magnetometers, leading to a system with 9 degrees of freedom[,]” meaning that both linear and rotational acceleration

are measured in three dimensions. *Hutchings*, 5:12-16. *Hutchings* also provides a swimming related embodiment where “the motion of swimmer’s hand (wrist) during one swimming stroke” is measured and used to determine the “position, velocity, or acceleration of the device” attached to the swimmer’s wrist. *Hutchings*, 20:38-60, Figure 12.

32. Similarly taking advantage of accelerometers for athletic tracking, International Publication No. WO 01/42809 to Muendel (Ex. 1021, “*Muendel*”) teaches an athletic performance monitor with accelerometers and gyroscopes (angular accelerometers). In one specific embodiment, “dead reckoning devices 108 includes an accelerometer or other inertial sensor that is adapted to sense the rhythmic motion associated with a user’s athletic performance[.]” *Muendel*, 20:1-4. In addition to utilizing accelerometers, *Muendel* implements a magnetic compass or a gyroscope, enabling “a runner’s stride length to be monitored and analyzed[.]” *Muendel*, 20:17-23. These sensing devices allow dead reckoning devices 108 to “provide direction information or change of location information.” *Muendel*, 10:21-23. I note that dead reckoning, which is a method of calculating the current position of a moving object by using a previously determined position, has been known since at least as early as the fifteenth century. See Ex. 1015 (“*Sobel*”).

33. Swimming specific monitoring devices were also apparent within the early 2000s timeframe. For example, U.S. Patent Application Publication No. US

2003/138763 to Roncalez et al. (Ex. 1022, “*Roncalez*”) teaches a system focused on swimming, which detects, tracks, displays, and identifies repetitive movement. *Roncalez*, Abstract. To accomplish these tasks, *Roncalez* relies on accelerometers, where “a sensor assembly mounted to the human body comprising at least one acceleration sensor” is used to determine “movement identification, movement pattern, and breathing pattern.” *Roncalez*, [0010]. *Roncalez* discusses that “human skeletal components cooperate by hinged movement about rotational axes, their motion tends to be rotational instead of linear” and as such, “rotational movement of the swimmer about the Y and X axes, is captured by the sensor assembly” highlighting the importance of measuring both linear and angular acceleration for swimming related motion. *Roncalez*, [0030], [0057].

34. Around the same timeframe, another swimming monitor is described in Australian Patent Publication No. AU 2006222730 to Davey et al. (Ex. 1024, “*Davey*”). Davey describes a data logger utilizing an accelerometer to sense a user’s position and velocity when used in swimming activities. *Davey*, Abstract. *Davey* acknowledges advances in micro-electromechanical systems (MEMS) technology, leading to “new avenues for the use of high precision lightweight accelerometers and gyroscopes for new and challenging sports applications (eg. characterise rate and length of rowing stroke and stride).” *Davey*, 6:23-26. *Davey* further explains that “[a]ccelerometers measure linear acceleration and gyroscopes measure angular

acceleration (pitch, yaw and roll)[,]" distinguishing the measurement differences that accelerometers and gyroscopes have. *Davey*, 7:1-2.

**C. Feedback Devices – Screens, Haptics, Earphones**

35. Since at least as early as the late 1980s technology for sending wireless audio instruction to a single swimmer or an entire group of athletes was envisioned. Specifically, International Publication No. WO 87/03501 to Leather et al. (Ex. 1020, "*Leather*") teaches a system allowing an instructor to "give instructions to whichever individual he selects . . . and/or the entire group." *Leather*, 1:36–2:2. This system includes a microphone 46, speech encoding circuit 24, audio transducer 88, and wireless components such as aerials (antennae) 26 and 30. *Leather*, 5:1-14, 6:2-14, Figures 1 and 3. It is also disclosed that the audio transducer 88 may be fitted to a bathcap 82 for use while swimming. *Leather*, 8:9-21, Figure 7. *Leather* contemplates the need to address alternate ways of conveying coaching instructions, since "[s]wimming pools especially when indoors are noisy places and it is difficult for any swimmer to understand [] shouted instructions." *Leather*, 1:7-9. *Leather's* desire to effectively communicate with swimmer athletes, would provide inspiration for other sports monitoring inventions to provide feedback to their corresponding athletes.

36. In one specific case, athletic tracking systems with displays started to appear at least as early as the late 1990s. For example, U.S. Patent No. 5,812,049 to Uzi (Ex. 1019, "*Uzi*") discloses a system used for "monitoring the time and location

of a participant in a competitive activity[.]” *Uzi*, Abstract. Athlete timing results may be displayed, for instance, using a “remote display unit 400, for displaying the results . . . of each swimmer[.]” *Uzi*, 7:46-49. Furthermore, the display unit 400 wirelessly receives results to be displayed, containing a “suitable RF antenna 408 and receiver 410 for transferring data received[.]” *Uzi*, 7:56-61. More than a decade before March 2009, *Uzi* understood the need to display performance metrics for a plurality of athletes. Specifically, display 105 may display various parameters such as “lap times; accumulated or remaining laps; swimming speed; average lap times; accumulated distances; energy consumption; and elapsed and accumulated workout time[.]” and also being able to identify which swimmer the metrics belong to. *Uzi*, 8:36-51. The displays within *Uzi*’s tracking system also operate with wireless capabilities. See *Uzi*, Figure 3A (depicting wireless communication between antennae of various subsystems).

37. In yet another example of providing outputs to a user, U.S. Patent No. 6,241,684 to Amano et al. (Ex. 1028, “*Amano*”), issued in the early 2000s, disclosing a wrist worn device that measures heart rate and contains “a body motion detector 104 for detecting body motion when the test subject is running[.]” *Amano*, Abstract, Figure 16. *Amano* contemplates that the device may also be adjusted to be used in swimming activities. *Amano*, 41:61-42:4. The device also includes a vibration alarm “conventionally known” to “communicate[] a vibration to the user s [sic] body[.]”

*Amano*, 42:62-65. The vibration alarm is used to convey to a user if their pitch (the number of steps per unit time) is “in the appropriate range, is too low or is too high, rather than simply being notified of the pitch.” *Amano*, 43:14-17.

38. *Roncalez*’s previously discussed system also provides insight to various athlete communication methodologies. In one instance, “information may also be provided audibly, such as through an earpiece or a speaker.” *Roncalez*, [0012]. Alternatively, a display device is “provided for displaying a real-time, continuous signal of the swimmer's stroke pattern, . . .the swimmer's stroke identification, stroke pattern, kick identification, kick pattern, and breathing pattern.” *Roncalez*, [0012].

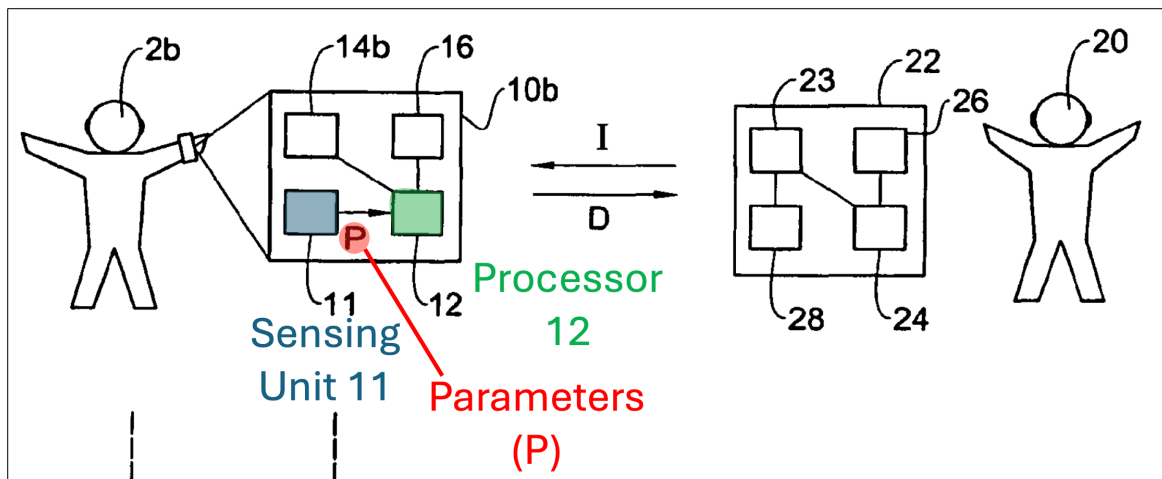
39. In one final example, U.S. Patent Application Publication No. US 2008/0319279 to Ramsay et al. (Ex. 1025, “*Ramsay*”) discloses a haptic feedback device which may monitor an athlete’s heart rate and notify them of being in specific heart rate zones. *Ramsay*, [0017]. Within *Ramsay*’s disclosure, a health parameter (heart rate) is compared to a “predetermined level” which may trigger “haptic feedback “to a user. *Ramsay*, [0005]. It is discussed that haptic feedback is “tactile feedback (such as vibration[.]” and may “enhance and simplify the user interface.” *Ramsay*, [0009].

40. A person having ordinary skill on the art (“POSITA”) would have been well aware of the above-described state of the art as of March 2009.

## VI. THE '998 PATENT AND ITS PROSECUTION

### A. The '998 Patent's Alleged Invention

41. The '998 Patent describes a device “measuring a training activity[,]” including a sensing unit 11 adapted to measure parameters “related to [a] participant’s movement[.]” *'998 Patent*, Abstract, 7:56-60. Sensing unit 11 includes an “accelerometer module 70 adapted to measure linear acceleration . . . along three orthogonal axes,” a “gyroscope module 80 adapted to measure angular acceleration . . . around the three orthogonal axes,” and a compass. *Id.*, 10:32-36, 10:54-59. Linear and angular acceleration measurements made by the accelerometer and gyroscope are provided to processor 12 that may “determine various data D from the measured parameters P.” *Id.*, 7:66-8:2.



*'998 Patent*, Figure 1 excerpt, annotated.

42. The personal measuring device 10 “also comprises a presentation unit 14 that is adapted to present information,” including data D and instructions I sent from an instructor to participant(s). *Id.*, 8:3-6.

**B. The '998 Patent's Prosecution**

43. I have been informed that the '998 Patent issued from U.S. Application Serial No. 12/382,214. I have been asked to assume that March 11, 2009 is the priority date for the Challenged Claims.

**VII. OVERVIEW OF THE PRIOR ART**

**A. Overview of *Downey***

44. *Downey* describes “[a] watch device for use by a swimmer while swimming” “coupled to the user’s wrist via a wristband 104.” *Downey*, 2:36-39. This watch includes a display 106, a user interface 108, and “a processing system 110, a location determining component 112, a memory, an inertial sensor 114, [and] wireless transmission components[.]” *Id.*, 2:66-67, 3:35-38. The display has options to be a touch-sensitive display or function with mechanical buttons, and “can display data and information” relevant to menu items or sensor data. *Id.*, at 2:47-50; 3:12-27. Additionally, the watch can be “coupled with a heads-up display 118 for use by the user while swimming.” *Id.*, Figure 5, 4:48-50.

45. To track an athlete’s swimming metrics, “[t]he inertial sensor 114 may detect movement of the watch device 100 and therefore movement of the user’s right

arm” by “generat[ing] acceleration signals that may be analyzed by the inertial sensor 114 itself and/or by the processing system 110 to identify acceleration signatures generally unique to each part of the user’s swimming stroke.” *Id.*, 5:36-49, 6:4-6. Using this method, the watch device repeatedly measures user generated data represented by movement of the device to determine swimming performance. The device then communicates “feedback to a user while swimming[,]” including “average speed, pace, stroke count, [and] distance traveled” *Id.*, 2:30-35, 7:21-44.

46. Because *Downey*, like the ’998 Patent, discloses a wearable swimming device that measures athletic performance, *Downey* is in the same field of endeavor as the ’998 Patent. *Compare* ’998 Patent, Abstract, 1:12-15, *with Downey*, Abstract, 1:5-7, 7:48-50. Further, both relate to a wrist-worn sensor that provides sensor data taken during a swimming activity. Additionally, both contain figures, shown below, depicting a swimmer with wrist-worn sensors.



FIG. 6

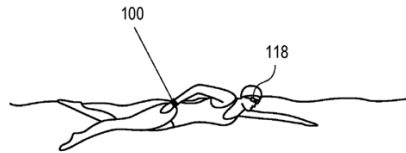


FIG. 7

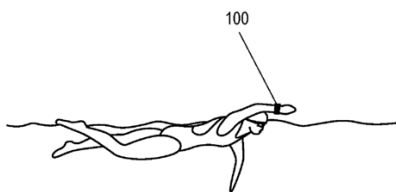


FIG. 8

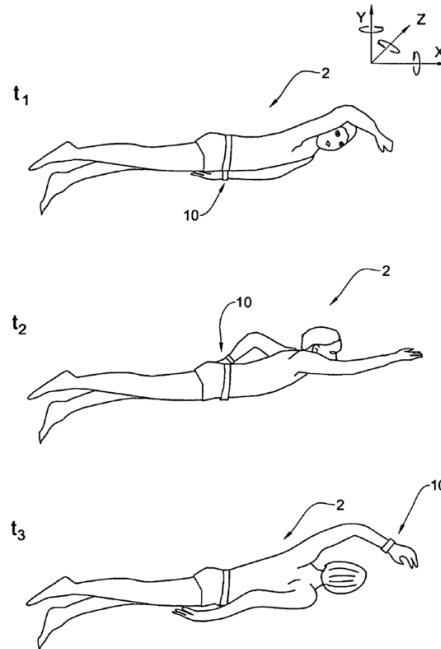


FIG. 4A

*Downey*, Ex. 1006

'998 Patent, Ex. 1001

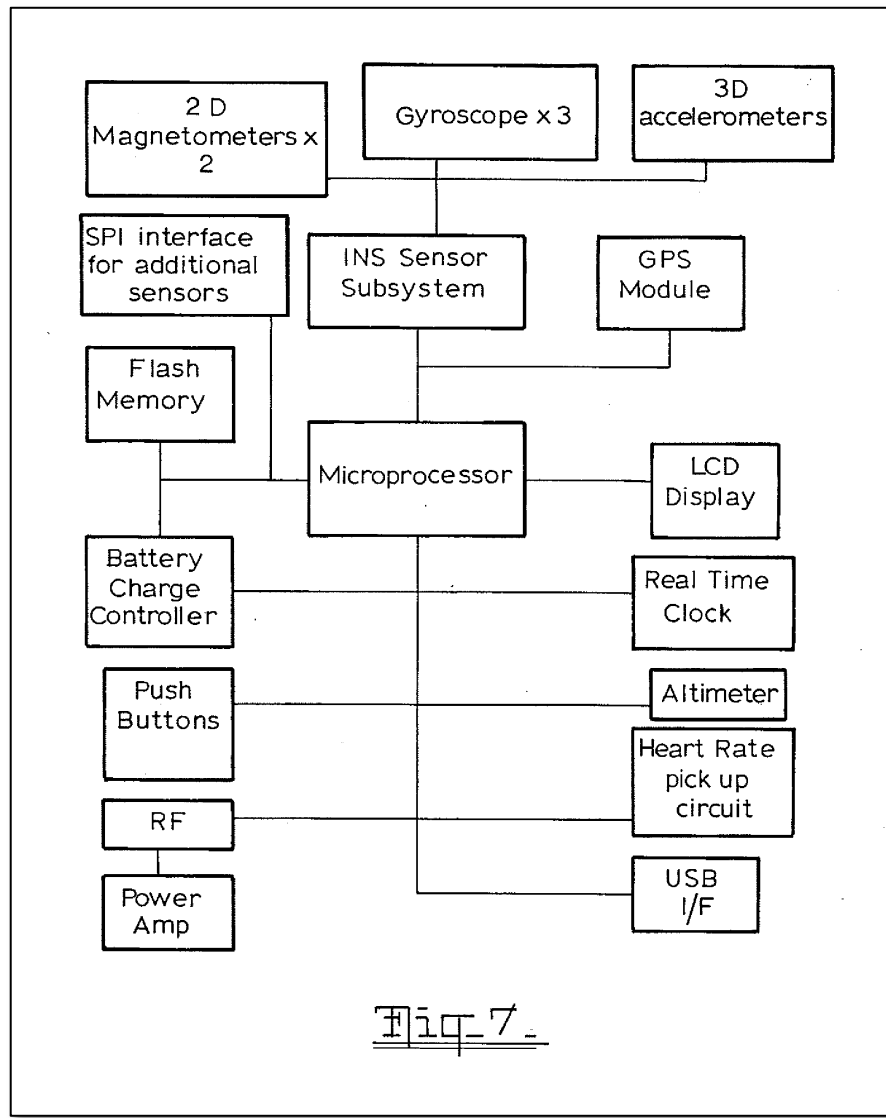
Both *Downey* and the '998 Patent use similar sensor hardware to capture data. For example, both use accelerometers, gyroscopes, and a compass. *Compare* '998 Patent, Abstract, 4:2-7, 10:23-29, with *Downey*, 4:38-47. Since *Downey* is attached to a swimmer in a similar manner, contains the same sensors and hardware, and is directed to the same activity of tracking a swimmer as the claimed device of the '998 Patent, *Downey* is in a same field of endeavor as the '998 Patent.

47. Further, the '998 Patent and *Downey* are both directed to the problem of communicating athletic performance data to an athlete during an athletic activity. *Compare* '998 Patent, (57) with *Downey*, 6:53-64, 7:56-59. *Downey* is reasonably pertinent to a problem described in the '998 Patent. Specifically, the '998 Patent

discloses a solution for communicating data to an athlete or group of athletes. '998 Patent, 3:57-68. Similarly, *Downey* discloses communicating swimming data to a swimmer. *Downey*, 7:56-59.

**B. Overview of *MacIntosh***

48. *MacIntosh* is directed to a method and system of a sport sensor containing “an accelerometer, [and] a gyro sensor to sense angular displacement[.]” *MacIntosh*, Abstract. The accelerometers used in *MacIntosh*’s device “measure linear acceleration and [the] gyroscopes measure angular acceleration (pitch, yaw and roll).” *Id.*, [0038]. Varying discloses in *MacIntosh* contain a 3-axis accelerometer, three gyroscopes, which measure rotation in 3 different planes, and a 3-axis electronic compass in the form of two, 2-D magnetometers. *Id.*, [0073]-[0076], Figure 7.



*Id.*, Figure 7. These components cooperatively function to “form an inertial or dead reckoning system. The deviation from a known starting point is determined by integration of acceleration in each axis over time.” *Id.*, [0039].

49. Because *MacIntosh*, like the '998 Patent, discloses wearable devices including accelerometers and gyroscopes for measuring athlete data during athletic events such as swimming, *MacIntosh* is in the same field of endeavor as the '998

Patent. *Compare* '998 Patent, 1:12-15, 1:41-59 (describing a system for monitoring sporting activities, including swimming, where a sensing unit including an accelerometer and gyroscope is used to determine data indicative of the training activity (e.g., swimming)), 4:2-7, *with MacIntosh*, [0001], [0010], [0024] (describing an improved method and system for real-time monitoring of athlete performance using angular acceleration sensor or gyrosensor measurement to sense movements like strokes and turns in swimming). It is widely understood that gyrosensor and gyroscopes are identical and interchangeable terms. Both the sports sensor in *MacIntosh* and the claimed device of the '998 Patent are used for capturing swimming metrics by utilizing accelerometers and gyroscopes. Therefore, *MacIntosh* is in a same field of endeavor as the '998 Patent.

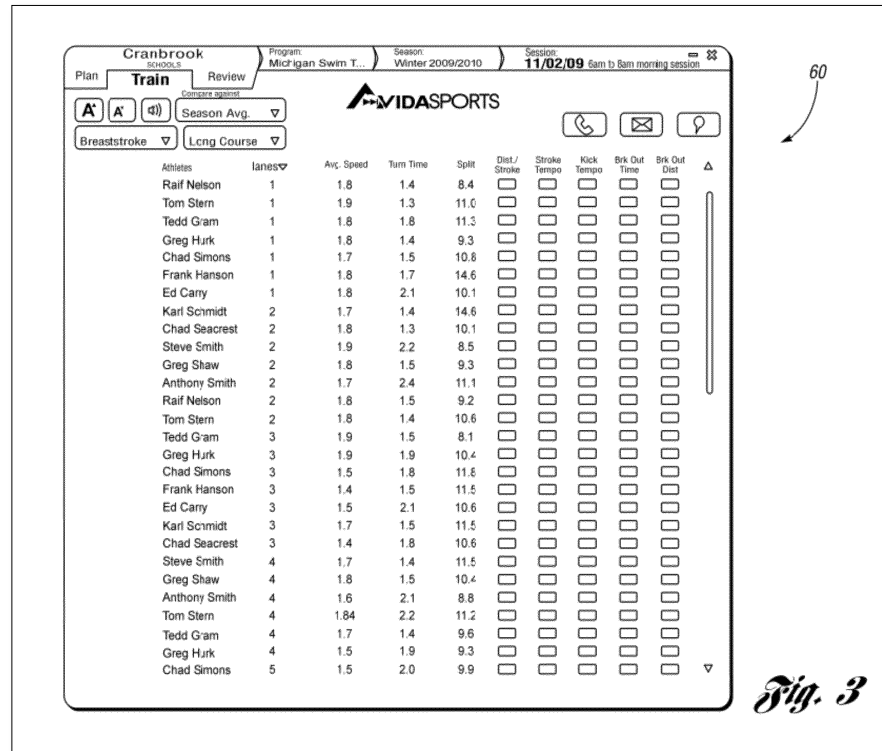
50. Further, the '998 Patent and *MacIntosh* are both directed to the problem of wirelessly providing real-time swimming data to coaches or instructors. *Compare* '998 Patent, 6:5-15 (describing presenting a trainer with data relating to a real-time activity of trainees and discussing wirelessly sending instructions back to the trainees) *with MacIntosh*, [0064] (describing real-time data being transmitted to a Coach's wireless PC). While the '998 Patent contemplates wirelessly sending instructions to the trainees (i.e., swimmers), it is also understood that data received from the swimmers would be done following wireless methods. In fact, the '998

Patent describes a “communication module 16 adapted to wirelessly transmit the data D” to instructor 20. ’998 Patent, 8:17-20.

**C. Overview of *Burton***

51. *Burton* is directed to a locating system 10 that is “attached to an athlete engaging in an athletic event.” *Burton*, Abstract. In one embodiment relevant to my opinion, *Burton* discloses a locating system utilizing limb devices that may “include accelerometers or other devices configured to monitor and report movements of the swimmer to the master station 16, such as through wireless communications.” *Burton*, 3:53-56. As part of *Burton*’s system, the limb devices include sensors that are “attached to arms and legs of the swimmers[.]” *Id.*, 3:49-53, Figs. 1, 5. Further, the overall system uses a master station 16, in communication with the locating system 10, such that “real-time analysis of the swimmers [sic] actions, i.e., stroke rate, stoke style, speed, splits, etc.” can be conducted. *Id.*, 3:59-60. A coach’s tablet computer wirelessly receives the real-time data for evaluation of a swimmer’s performance. *Id.*, 3:61-65. The evaluation results of a swimmer or a group of swimmers can be displayed on the tablet computer. *Burton* does not disclose upon which device display 60 is part of. A POSITA would have understood that the performance metrics would be shown on graphical user interface 70 of hand-held user device 66. It would have been otherwise obvious that this be the situation as this is the device the coach uses to monitor performance. *See Id.*, 3:61-65 (describing

that a coach uses hand-held device 66 to monitor real-time telemetry of the swimmers).



*Burton*, Figure 3, 3:47-52. The communicated data is not limited to only being viewed post activity, but includes the “ability to provide real-time feedback during practice[.]” *Id.*, 4:27. The system further includes a head device 14, including an ear bud 100 “to facilitate audio communications with the s[w]immer.” *Id.*, 6:1-3. This enables “transmitting verbal instructions from the coach to the swimmers, such as through a microphone[.]” *Id.*, 6:5-6.

52. Because *Burton*, like the ’998 Patent, discloses a wearable device that monitors an athlete during an athletic activity, including swimming, *Burton* is in the same field of endeavor as the ’998 Patent. Compare ’998 Patent, 2:39-43 (describing

a personal measurement device that repeatedly measures body movement of a user during an activity), with *Burton*, Abstract (describing an object attached to an athlete engaging in an athletic event that generates positional information of said object). Both the sports sensor in *Burton* and the claimed device of the '998 Patent are used for monitoring an athlete during an athletic performance. Therefore, *Burton* is in a same field of endeavor as the '998 Patent.

53. Further, the '998 Patent and *Burton* are both directed to the problem of wirelessly providing instructions to swimmers in real-time. Compare '998 Patent, 6:11-14, 13:45-48 (describing that instructions may be wirelessly presented to the participant in real-time) with *Burton*, 4:25-27, 4:54-56 (describing wirelessly providing real-time feedback during practice). *Burton* is reasonably pertinent to a problem described by the '998 Patent because it provides coaching instructions or other feedback to an athlete that would be difficult to hear in a swimming environment. Swimming environments have lots of ambient noise – the noise of splashing made by other swimmers and the fact that being underwater will attenuate what a swimmer will be able to hear. Accordingly, *Burton* is analogous art to the '998 Patent.

#### **D. Overview of *Ohgi***

54. *Ohgi* is directed to a wrist-mounted “tri-axial acceleration and tri-axial gyroscope sensor data logger device” that can measure and quantify a “swimmer’s

stroke motion using both the acceleration and the angular velocity.”. *Ohgi*, 1-2. *Ohgi* discloses that a “whole time series” of acceleration and angular velocity data is used in conjunction with “stroke distinctive acceleration” methodology previously introduced by the author to analyze a swimmer’s stroke. *Id.*, 3.

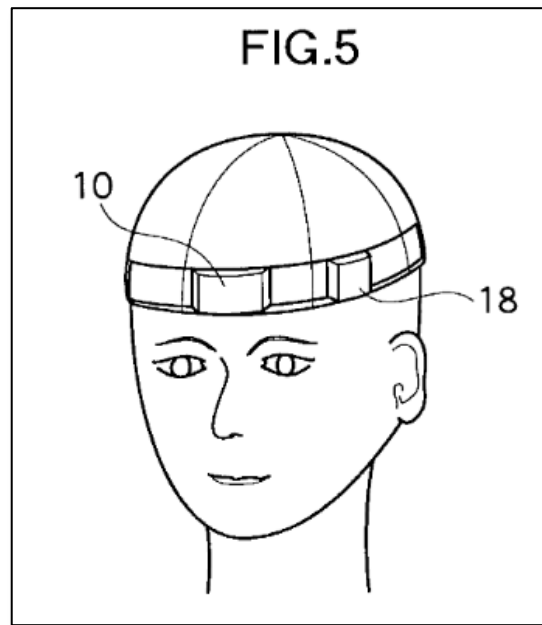
55. Because *Ohgi*, like the ’998 Patent discloses a device for monitoring data taken while swimming, *Ohgi* is in the same field of endeavor as the ’998 Patent. Compare ’998 Patent, 1:12-15, 2:39-43 (describing a personal measurement device that repeatedly measures body movement of a user during an activity, where the activity is swimming), with *Ohgi*, 1-2 (describing the purpose of the study to, in part, quantify a swimmer’s stroke motion). Both devices are swimming related and monitor and collect data during swimming activities. As such *Ohgi* is in a same field of endeavor as the ’998 Patent.

56. Further, the ’998 Patent and *Ohgi* are both directed to the problem of providing swimmer metrics using repeated data analysis. Compare ’998 Patent, 3:67-4:7, 7:56-60 (describing repeatedly measuring a swimmer’s movement) with *Ohgi*, 1, 3 (describing using the whole time series of acceleration and angular velocity data). A POSITA would understand that using the whole time series of a data set requires repeatedly measuring. For example, using the whole time series of collected acceleration data from a swimmer requires that measurements be repeatedly taken to create the time series. It would be further understood that

utilizing the whole time series entails using every collected data point provided by the sensors, at whatever sampling frequency they are set to. Accordingly, *Ohgi* is analogous art to the '998 Patent.

**E. Overview of *Takahashi***

57. *Takahashi* is directed to a heart rate monitor within a swimming cap. The head was chosen because it is “the most stable spot in a human body during exercise[.]” *Takahashi*, [0058], [0095].



*Takahashi*, Figure 5.

58. The heart rate monitor functions by emitting light via a LED and later detect “modulated and reflected” light. *Takahashi*, [0066]. The detection is completed by a light receiving element 12 and is used in conjunction with a CPU to determine a pulse rate. *Takahashi*, [0072]-[0073], Figure 1.

59. Both *Takahashi* and the '998 Patent are directed towards monitoring the heart rate of an athlete using a wearable device. *Compare* '998 Patent, 5:5-7 (describing a pulse measuring unit) *with Takahashi*, [0095] (describing heart rate measuring during swimming). Both devices involve a device worn on the body of the athlete and both devices involve measuring the athlete's heart rate. As such *Takahashi* is in a same field of endeavor as the '998 Patent.

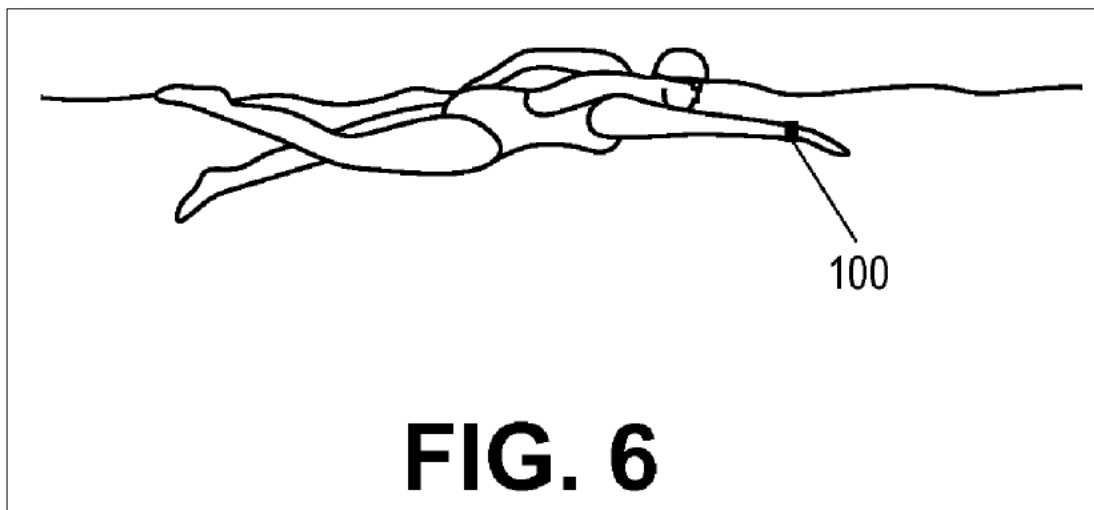
60. Further, each of *Takahashi* and the '998 Patent are directed towards the same problem of measuring the heart rate of an athlete with a body-worn device. *Compare* '998 Patent, 5:3-22 (describing measuring heart rate of an athlete when they are submerged in water) *with Takahashi*, [0072]-[0073], [0095] (describing a method of measuring heart rate contained in a swimming cap). It is understood that when an athlete is submerged, they are swimming. Additionally, both devices also address the movement of swimming and the effect on heart rate measurements. *Compare* '998 Patent, 5:15-17 (describing eliminating the adverse effect on the pulse measurement during sudden movements) *with Takahashi*, [0058] (describing that the head is the most stable place on the body during exercise). Thus, *Takahashi* is analogous art to the '998 Patent.

## VIII. GROUND 1: OPINIONS REGARDING *DOWNEY*

### A. Claim 10

*[10(Pre)] A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:*

61. *Downey* discloses a “**watch device** for use by a **swimmer** while **swimming**[.]” *Downey*, 1:25-26 (emphasis added). During a training activity, specifically swimming, the watch device 100 is worn on an arm or on the wrist (a body part) by that person who is swimming and training.



*Id.*, Figure 6; 2:28-35.

62. There is an inertial sensor within the watch device 100 that “detect[s] movement of the watch device 100 and therefore **movement of the user’s right arm**.” *Id.*, 5:43-44 (emphasis added). Using information collected from the inertial sensor, “the processing system 110 **may generate a stroke model** representing the

predicted or expected duration the user's arm will be in various positions during each stroke[.]” *Id.*, 6:56-60 (emphasis added).

63. Therefore, *Downey* discloses a watch device 100 (personal device) for measuring a swimming activity (measuring a training activity of a trainee) where the movement of the user's right arm (a body part) is measured, and a stroke model is generated (a stroke being a movement that at least partially defines the activity of swimming). Thus, a stroke model at least partially defines said training activity.

***[10(a)] a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;***

64. *Downey* discloses this limitation. The watch device 100 contains an inertial sensor 114 (sensing unit) used to “detect movement of the housing 102” and ultimately the movement of body part with which the watch device 100 is connected to. *Downey*, 4:39; Figure 6. It would have been obvious that when the watch sensor is attached to an arm or wrist, for example, the watch device will measure movement of said arm and wrist. Furthermore, it would have been obvious to a POSITA that a watch device would be worn on the wrist, as traditional watches conventionally are. Inertial sensor 114 is made up of at least accelerometer means, a compass, and a gyroscope. Specifically, the inertial sensor 114 includes “one or more single or ***multi-axis accelerometers*** operable to detect acceleration along one, two, and/or

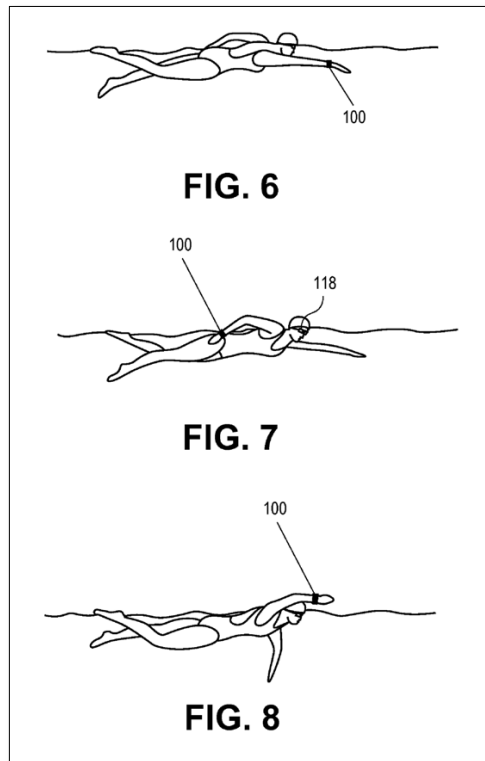
three axes of movement utilizing micro electro-mechanical system (MEMS) components or other suitable methods. Additionally or alternatively, the inertial sensor 114 may comprise inclinometers, tiltmeters, **gyroscopes, compasses**, magnetic field sensors, mechanical switches, combinations thereof, and the like.” *Downey*, 4:39-47 (emphasis added).

65. Accelerations of a swimmer’s arm to form swimming motions are detected by the inertial sensor 114. The detected acceleration signatures are associated with specific swimming motions:

[T]he inertial sensor 114 may **generate acceleration signals** that may be analyzed by the inertial sensor 114 itself and/or by the processing system 110 to **identify acceleration signatures generally unique to each part of the user’s swimming stroke**.

*Id.*, 5:45-49 (emphasis added). *Downey’s* inertial sensor 114 outputs electric acceleration signals corresponding to detected swimmer acceleration. Since the inertial sensor 114 and the processing system 110 are used to “identify acceleration signatures generally unique to **each part of the user’s swimming stroke**[.]” the sensor is “repeatedly measuring” the parameters associated with the movement of the user’s arm, where the user is a swimmer. In order to identify the acceleration signatures of each part of a swimming stroke, the entire stroke must be repeatedly measured. For example, with a freestyle stroke (also known as the front crawl stroke), all four stages: the catch, the pull, the push, and the recovery stages must be

repeatedly measured. Without *repeatedly* measuring, the watch device 100 could not determine “each part” of the user’s swimming stroke and, instead, would only be capable of determining a “single part” of the swimming stroke. Thus, a POSITA would have understood the identification of “each part of the user’s swimming stroke” to teach “repeatedly measur[ing].” Said in a different way, repeatedly measuring entails measuring the entirety of a swimming stroke. In a hypothetical situation where the watch device 100 only measures the “catch” stage of a freestyle stroke, the device would not be to interpret the acceleration signatures for other stages of the stroke without *repeatedly* measuring and analyzing the acceleration signals. Thus, the watch device needs to repeatedly measure the entirety of the stroke in order to collect and distinguish acceleration signatures from each unique stroke stage and “identify acceleration signatures generally unique to each part of the user’s swimming stroke.” *Downey*, 5:45-49 Figures 6, 7, and 8 help depict the importance of repeatedly measuring a stroke, as further explained.



*Downey*, Figures 6-8. *Downey* describes watch device 100 generating and analyzing a plurality of acceleration signals from inertial sensor 114 to determine “movement from the first position of FIG. 6 to the second position of FIG. 7” and from “second position of FIG. 7 to the third position of FIG. 8[.]” *Id.*, 5:49-6:3. Distinguishing the unique acceleration signals from one position to another would not be possible without “repeatedly measur[ing]” the signals. Additionally, *Downey* discloses that a plurality of acceleration signals are generated by the inertial sensor 114, further indicating that it is repeatedly measuring, as a plurality of acceleration signals is only possible when more than one measurement is taken. *See Downey*, 5:45-49 (discussing that the inertial sensor 114 may generate acceleration signals (plural)).

A POSITA would have understood that although Figures 6-8 show three stages in a freestyle stroke, repeated measurements are still required to identify each unique stage's acceleration signatures. A POSITA would understand that a stroke could be broken into any number of unique stroke stages and that there are other stage breakdowns for the freestyle stroke. The four previously discussed stages (the catch, the pull, the push, and the recovery stages) are exemplary in nature. Overall, it is my opinion that *Downey* indicates to a POSITA that the inertial sensor 114 is “repeatedly” measuring sensor data.

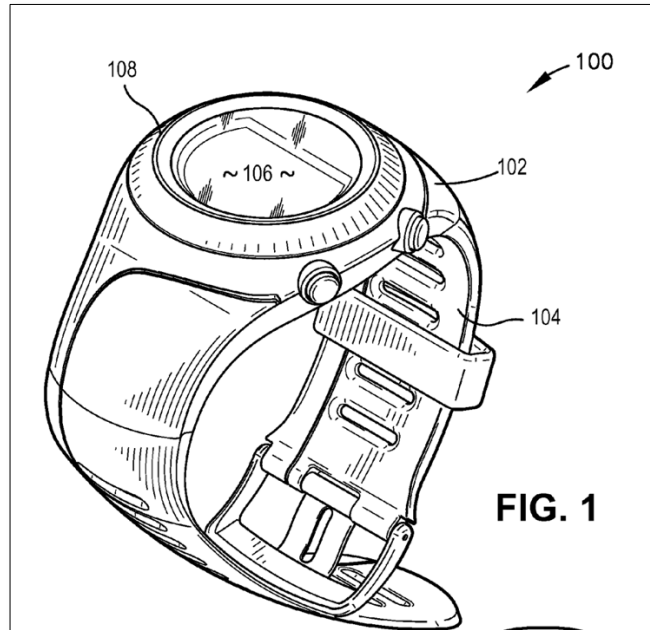
66. The inertial sensor 114 and processing system 110 use the acceleration signals taken from the swimmer and “generate a stroke model[.]” *Id.*, 6:56-60. Thus, *Downey*'s inertial sensor 114 (sensing unit) repeatedly measures parameters (acceleration signals) associated with the movement of a body part (strokes of the user's arm) during the training activity (swimming). Thus, *Downey* discloses a sensing unit in the form of inertial sensor 114. The inertial sensor 114 comprises of at least accelerometers, gyroscopes, and compasses. *Downey*, 4:39-47. The inertial sensor 114 utilizes this hardware to repeatedly measure parameters associated with the movement of a body part during a training activity. The training activity is a swimming activity and thus, the repeatedly measured parameters associated with the movement of a body part is the acceleration made by an arm during a swimming stroke. A POSITA would have understood that the repeated measurements are of the

body part to which the watch device 100 is attached and which generates acceleration.

***[10(b)] means for attaching the sensing unit to said body part;***

67. I have been informed the “means for attaching” recites the function of attaching the sensing unit to a user’s body part. *Downey* also provides functions for attaching the watch device 100 (sensing unit) to a body part: “[A] watch device 100 constructed in accordance with embodiments of the present invention is described. [] The watch device 100 includes a housing 102 ***shaped to be worn on the arm of the user ... which is coupled to the user’s wrist via a wristband 104.***” *Downey*, 2:28-39 (emphasis added). It is obvious that wristband 104 is a function for attaching the watch device 100 to a body part, in this situation, a wrist.

68. *Downey*’s watch device 100 comprises a sensing unit that “is coupled to the user’s wrist ***via a wristband 104.***” *Downey*, 2:36-39 (emphasis added).



*Downey*, Figure 1. The processing system 110 and inertial sensor 114 are contained within the housing of *Downey's* device. *Id.*, Figures 3-5, 3:35-60. Since the inertial sensor 114 is contained within the watch device 100, the wristband 104 attaches the inertial sensor 114 to the user's wrist. Therefore, using terminology from the '998 Patent, the sensing unit (inertial sensor 114) is attached to a body part (a user's wrist).

***[10(c)] a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and***

69. *Downey's* invention discloses this limitation, explaining that the watch device 100 includes a sensing unit, specifically inertial sensor 114. This inertial sensor 114 measures "parameters" such as the movement of a user's arm when conducting a stroke during a swimming activity (training activity). *Supra*, 10(a). The watch device 100 further includes a processing system 110 that "may include any

number of *processors, controllers, or other processing elements* and resident or external memory for storing data and other information accessed and/or generated by the watch device 100” inside a housing which subsequently “protect[s] these internal components.” *Id.*, 3:43-45 (emphasis added); Figures 3-5.

70. During operation, *Downey’s* “inertial system 114 may detect movement of the watch device 100 and therefore movement of the user’s right arm. [] [T]he inertial sensor 114 may generate acceleration signals that may be analyzed by the inertial sensor 114 itself and/or by the processing system 110 to identify acceleration signatures generally unique to each part of the user’s swimming stroke.” *Id.*, 5:43-49. The generated acceleration signals from the inertial system 114 are then used to analyze “movement from the first position of FIG. 6 to the second position of FIG. 7[,]” and the “movement from the second position of FIG. 7 to the third position of FIG. 8[.]” *Id.*, 5:49-56. The data analyzed and generated by the processing system 110 “may be adapted to identify . . . user positions and movements,” and “stroke and location information for strokes other than the front crawl illustrated in FIGS. 6 through 8.” *Id.*, 5:67-6:7. Subsequently, the processing system 110 will “automatically identify the stroke used by employing information provided by the inertial sensor 114, such as acceleration signatures corresponding to the various strokes identified above.” *Id.*, 6:12-16. Additionally, “the inertial sensor 114 may generate *acceleration signals* that may be *analyzed by the inertial sensor 114 itself*

*and/or by the processing system 110 to identify acceleration signatures* generally unique to each part of the user's *swimming stroke*." *Id.*, 5:45-49 (emphasis added). The resulting information from the processing system 110 is useful in purposes of training the user on the various swim strokes and will provide training data such as "current and average speed, pace, stroke count, distance traveled, lap count, energy expended, goal and target information, virtual partner information, combinations thereof, and the like." *Id.*, 7:22-8:2 (describing metronome functionality, desired stroke rate, and feedback to modify the user's training performance), 8:3-13 (triathlon mode), 8:14-64 (track mode and route generation/tracking for training), 8:65-9:10 (course correction), 9:11-50 (heart rate training). Therefore, *Downey's* processing system 110 (processor) receives acceleration signals corresponding to swim strokes (parameters) from the inertial sensor 114 (sensing unit) and then calculates data in the form of acceleration signatures (identifying swimming strokes) related to swimming (a training activity). In summary, acceleration generated by the swimmer's arm is repeatedly captured by the inertial sensor 114, which outputs acceleration *signals*. The acceleration *signals* are then analyzed by processing system 110, which outputs acceleration *signatures* indicative of the swimming stroke and the various stages within said stroke. *Id.*, 5:45-49.

***[10(d)] a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, said presentation unit comprising vibrating element adapted to generate vibratory pulses according to a predetermined rule, and to direct said pulses to the skin of said trainee.***

71. Downey discloses a user interface 108 (a “presentation unit”) including a display 106, illustrated below in Fig. 2, “so that [data] may be viewed by the user of the watch device[.]” Downey, 2:47-57.

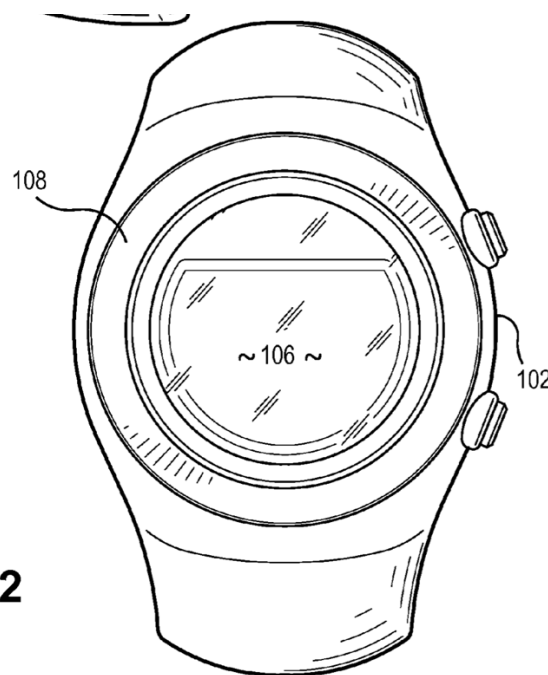


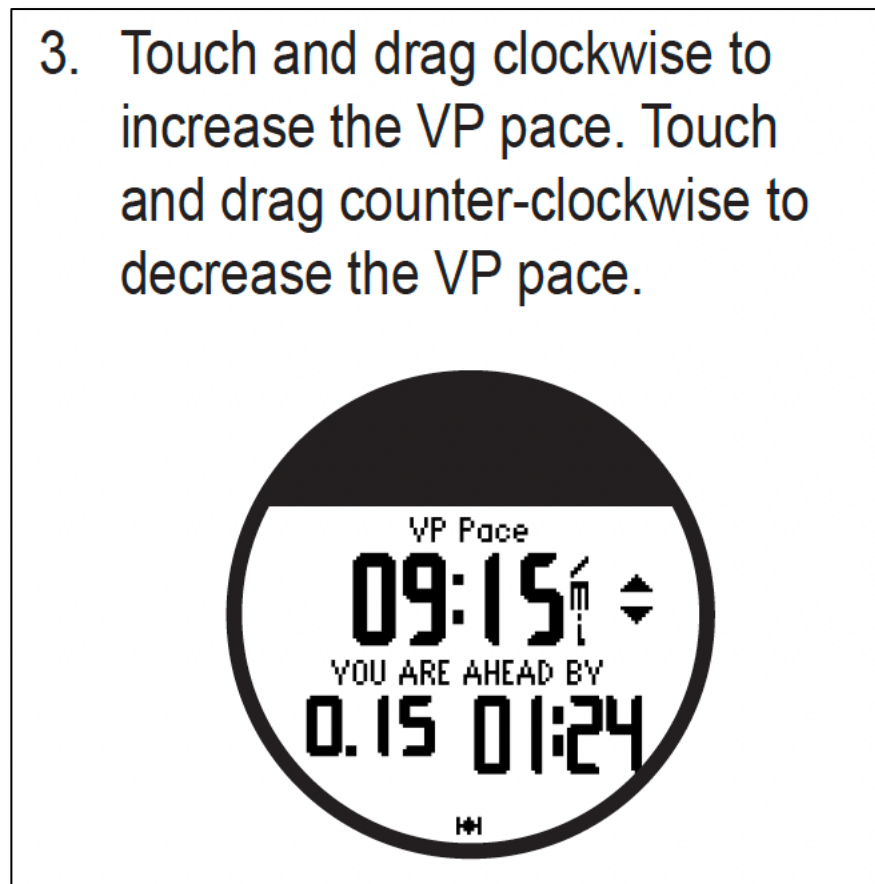
**FIG. 2**

Downey, Figure 2. Another feedback-related structure envisioned by Downey is a speaker and “a vibrating element to vibrate or rumble the housing 102 for communication with the user while swimming.” Downey, 3:6-11. Downey’s user interface 108 may generate sound, visuals ***and/or vibrations*** to instruct the user to decrease stroke rate.” *Id.*, 8:1-2. In some embodiments, Downey’s device may combine multiple output modalities to provide sophisticated feedback to the

swimmer, teaching that if a user needs to swim faster to attain a desired stroke rate (see 7:56-58) the user interface 108 may generate sound, ***visuals, and/or vibrations*** to ***instruct the user to increase stroke rate.***” *Id.*, 7:46-47. In this way, the device trains the swimmer to maintain a desired stroke rate by generating an “audible sound using the speaker and/or vibration/movement using the vibrating element to indicate that a stroke is to be performed.” *Id.*, 7:60-63. In embodiments, additional useful information may be relayed to the swimmer via the presentation unit, including route corrections. *Id.*, 9:6-10. For input, *Downey’s* watch device 110 includes more mechanical buttons and/or a touch sensitive user interface, allowing the user to interact with the device. *Downey*, 3:12-34, 49-53.

72. I note that *Downey* incorporates by reference a number of other patents to support and describe the “performance-monitoring functionality” intended to be provided in embodiments, expressly calling out with specificity the disclosures of U.S. Pat. Nos. 6,837,827, 7,085,678, and 7,057,551, as well as the exercise modes previously present in the Garmin® Forerunner® line of products commercially-available prior to the ’998 Patent. *Id.* 7:32-37. The incorporated performance-monitoring functionality involves using the watch device’s inertial sensor 114 and processing system 110 to send sounds or vibrations, informing the user’s stroke rate. *Id.*, 7:63-8:2. Thus, a POSITA would have expected *Downey’s* device to be able to operate in any of the manners taught by the incorporated patents and the Garmin®

Forerunner® line of products for presenting feedback instructions and other data to a trainee. For instance, the Garmin® Forerunner® 405 owner's manual (Ex. 1018, "Forerunner 405") provides instructions for controlling the Virtual Partner® (VP) feature. With this feature, a user can set a running pace to run against. *Forerunner 405*, pp. 13-14.



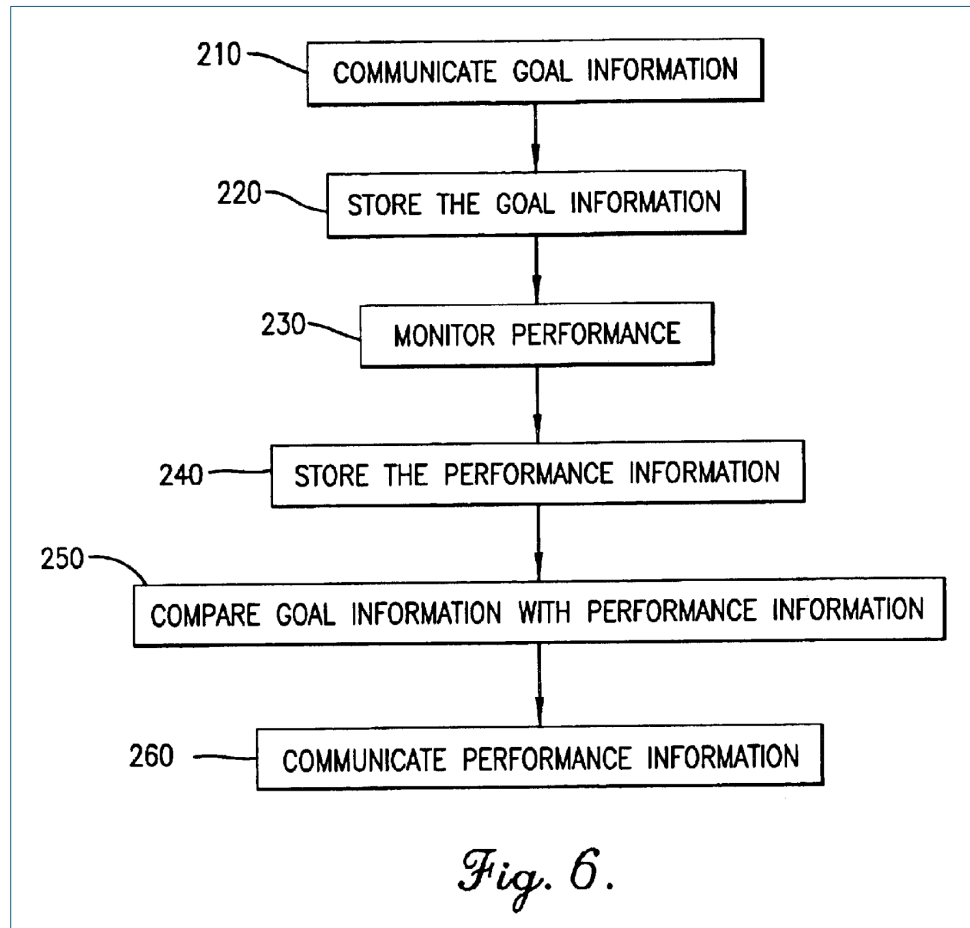
*Forerunner 405*, p. 14. A POSITA would have understood that setting and competing against a running pace is providing training instruction to the trainee. As evident in the owner's manual, information is provided to the athlete as to

whether they are ahead or behind the set running pace. A POSITA would have understood that this concept could have also been applied to stroke rate.

73. *Downey* itself directly envisions that “the user may input a desired stroke rate into the user interface 108 and/or the processing system 110 may calculate a desired stroke rate based on performance related information.” *Id.*, 7:53-59. A POSITA would have recognized that the user would have input the desired stroke rate prior to swimming – it would be awkward, difficult, and detrimental to enter the stroke rate while actively swimming. Thus, the desired stroke rate is a predetermined metric that is provided to *Downey*’s watch, and providing an indication to the user to increase/decrease their current stroke rate to match the desired stroke rate thus teaches generating vibratory pulses according to a “predetermined rule,” as claimed.

74. Patents incorporated by reference in *Downey* provide additional predetermined-rule explanation relating to performance-monitoring. For instance, *Downey* expressly incorporates U.S. Patent No. 6,837,827 (Ex. 1013, “*Lee*”) to support its performance-monitoring functionality. *Downey*, 7:32-35. In the ’827 Patent, performance-monitoring functionality is described as “assist[ing] the user in accomplishing the first task of **reaching a performance goal** by first allowing the user to communicate goal information to the processor 60[.]” *Lee*, 7:31-34. Goal information may include “average speed, maximum speed, distance, or time for one or more training intervals[.]” *Id.*, 7:35-38. Similar to the above, a POSITA would

have expected or at least found obvious that the “goal” information being described here would have been entered prior to swimming, and is thus “predetermined.” The ’827 Patent discloses such a “predetermined rule” (i.e. processor functionality to help a user attain a predetermined goal) may be set for speed (e.g., desired swim pace and/or stroke count) used by ’827 Patent’s processing system to inform a user of their current performance (and thus also present in the *Downey* device by incorporation), allowing the user to make adjustments to their strokes during the training activity. Further, the ’827 Patent’s Figure 6 directly depicts communicating and storing goal information (according to a predetermine rule) occurring prior to monitoring the user’s performance.



'827 Patent, Figure 6. Here, storing Goal Information occurs at step 220, before the performance is monitored at step 230 and communication is performed at step 260.

75. A POSITA would have also recognized instructions to increase stroke rate, to swim right or left, and/or to perform a stroke also teach the claimed “training instructions,” as described in each of *Downey* itself and in the incorporated '827 Patent. Very much akin to how a human coach verbally tells a student swimmer to swim faster by increasing stroke rate is a training instruction, the *Downey* watch device is operable to notify a swimmer to increase stroke rate, providing training

instructions. Though *Downey* does not explicitly state that feedback provided by watch vibrations are “directed to the skin of the trainee,” as claimed, a POSITA would have understood that the vibrating element is contained within a watch device 100 “worn on the arm” of the user and, therefore, directs vibration pulses to at least the skin of the trainee. *Downey*, 2:49. Even if the user was wearing a swimming suit that covered their bare skin, a watch device worn on the arm/wrist would transfer the vibration pulses through the swimming suit fabric and unto the user’s skin.

**B. Claim 11**

***[11(Pre)] A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:***

76. *Supra* claim 10(Pre).

***[11(a)] a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;***

77. *Supra* claim 10(a).

***[11(b)] means for attaching the sensing unit to said body part;***

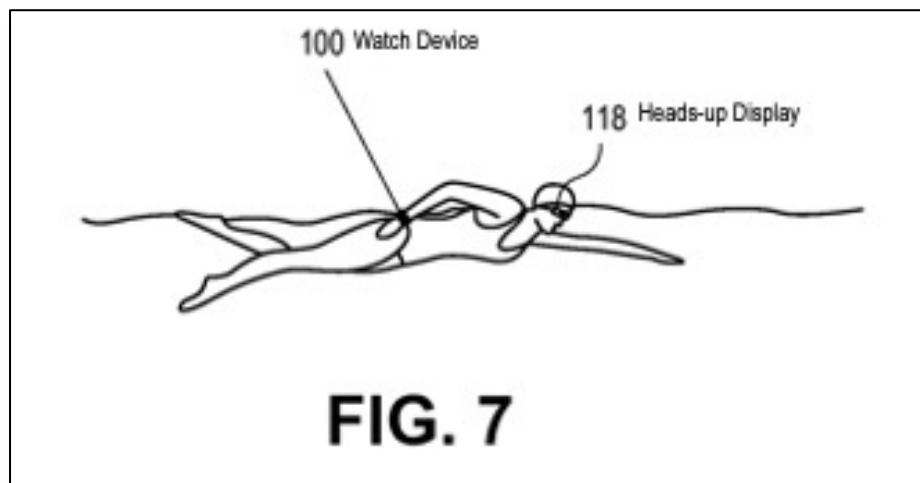
78. *Downey* discloses this limitation under the appropriate claim construction. *Supra* claim 10(b).

***[11(c)] a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and***

79. *Supra* claim 10(c).

***[11(d)] a presentation unit adapted to present to the trainee at least said data or training instructions based on said data, said presentation unit comprising at least one earphone with a receiving module adapted for wirelessly receiving readings including at least the data from said device or training instructions to the trainee based on said data, and converting said readings into audio signal to be transmitted to the trainee via said at least one earphone.***

80. Downey discloses this limitation. As previously discussed, Downey teaches user interface 108 (mapped as the “presentation unit”). *Supra* claim 10(d). Downey also discloses that the watch device could be connected to a “heads-up display 118 for use by the user while swimming.” Downey, 4:48-50. Additionally, Downey’s “heads-up display 118 may be incorporated into swim goggles[.]” Downey, 4:50-52, Figures 6-8. Specifically, the heads-up display 118 can be combined with a “*swim cap including earphones* that can *emit sound* in either of the user’s ears.” Downey, 4:65-5:2 (emphasis added).



*Id.*, Figure 7 (annotated).

81. *Downey's* watch device 100 is capable of instructing a swimmer to maintain a predetermined stroke rate. *Supra* claim 10(c) and 10(d). In addition to this feature, *Downey's* watch device 100 contains earphones which can be used to provide feedback and training instructions to the user. *Id.*, 9:1-10, 4:63-5:2. Specifically, *Downey* states that heads-up display 118 may provide feedback on the user's strokes (*Downey*, 7:58-59) and that the earphones are part of the heads-up display 118 (*Downey*, 4:48-5:2). By using these earphones, the watch device 100 audibly conveys instructions to the user "by generating a certain sound in a selected one of the user's ears (e.g., generate sound in the user's right ear to prompt the user to swim to the right)." *Id.*, 9:3-6. Using the data collected and processed by the inertial sensor 114 and processing system 110, the device can provide audible stroke corrections to the swimmer. In one embodiment, *Downey's* exercise mode monitors a user's swim stroke based on a predetermined rule, a desired stroke rate. *Supra* claim 10(d). "[T]he user interface 108 may generate audible sound using the speaker . . . to indicate that a stroke is to be performed" and "additionally or alternatively indicate to the user a desired increase or decrease in swim rate." *Downey*, 7:60-65. If the stroke rate needs to be adjusted, the system will "generate sound . . . to instruct the user[.]" *Id.*, 7:65-8:2. The sounds prompting a user to modify their stroke rate qualifies as training instructions. As previously discussed, the audible training instructions are sent to the user when monitored data strays from a predetermined

rule or goal. Thus, the training instructions provided to the user are “based on” data generated by the user’s stroke.

82. A POSITA would have understood that the *Downey’s* speaker and earphones are used to communicate sounds to the user when a stroke correction is required. It would have been obvious that these audible notifications regarding corrections to a stroke would occur while strokes are taking place – when a user is swimming. Therefore, sounds should be directed to an earphone, as the sounds from the speaker may not be heard due to ambient noise. The earphones are part of heads-up display 118 and will generate a sound into an ear in which the earphone is placed in. Therefore, the earphones (presentation unit) communicate to the user a correction indication (training instruction based on said data).

83. *Downey’s* watch device 100 wirelessly communicates with the heads-up display 118 and the earphones. Specifically, *Downey’s* watch device 100 includes “**wireless transmission components** (e.g., cellular, BLUETOOTH™, ANT™, IEEE 802.11 (Wi-Fi), etc.), and the like.” A POSITA would have recognized or at least found obvious that the communication between the watch device and the heads-up display 118 with corresponding earphones is performed wirelessly. It would have been overly burdensome for a swimmer to swim with wired earphones. The wired earphones could interfere with the user’s stroke, which could lead to inaccurate stroke monitoring and poor performance. Further, a wired connection would present

safety issues, potentially leading to unnecessary sources of potential electrical shock or entanglement and drowning hazards. This is further supported by *Downey* itself, where the heads-up display, including the earphones is “operable to wirelessly communicate with the processing system[.]” *Id.*, 10:55-57; Figures 6-8 (showing no wires connecting the watch device 100 to the heads-up display 118). It would have been obvious to a POSITA that wirelessly transmitting data to earphones would require the conversion of said signals into audible signals in order for a user to understand the training instruction.

84. To the extent Patent Owner argues *Downey* does provide wireless architecture, it would have been obvious to a POSITA to implement such a design. A POSITA would have recognized that removing wires running from the swimmer’s wrist to the head would have been desirable. As previously discussed, wired earphone connections would be at the least, annoying to the user, and in worst case situations, would have been dangerous. Wires would have impeded the swim stroke leading to inaccurate measurements, and would have tangled about the user, becoming disconnected while swimming. Since a POSITA would have understood the risks associated with corded audio systems as well as the benefits associated with general audio feedback, they would have been further motivated to pursue a wireless audio system. For example, a POSITA would have recognized the benefit of an uninterrupted swimming stroke. In a non-audio system, a user would have to look at

the watch face for training instruction, interrupting the flow of the stroke, leading to inaccurate stroke monitoring. Furthermore, audio notifications allow for more detail to be provided to the user instead of a simple, non-audio indication to swim faster or slower. For example, with audio notifications or training instructions, specific instructions can be sent to the swimmer such as to straighten or bend their arm(s) more/less.

85. A POSITA would have been aware of wireless headphones used for swimming prior to *Downey*. For example, International Publication WO 01/00281 A2 to Wadell (Ex. 1014, “*Wadell*”), published on January 4, 2001, discloses a wireless headphone “worn by player 216.” *Wadell*, 20:6-7. Specifically, it contemplates that wireless headphones can be used in sporting events, such as swimming. *See Wadell*, 3:9-14, 16:8-13, 27:24-28 (describing the various activities the invention can be used for). With this knowledge, implementing wireless earphones into *Downey*’s watch device would have been a simple modification without any difficulties or challenges because *Downey*’s watch device already includes hardware to support wireless architecture. *Downey*, 3:37-38. Furthermore, *Wadell* discloses wireless audio architecture including a receiving module and processing unit from as early as 2001. Specifically, a transceiver 306 (receiving module) and a processor 308 are disclosed, as shown in Figure 3. The player mounted device 102, which can also be a be worn on the user’s wrist in certain

embodiments, contains the transceiver 306 and processor 308. *See Wadell*, 21:21-29 (describing the wrist-worn embodiment). The transceiver 306 acts as a receiving module and “converts incoming radio frequency (RF) signals from the antenna 302[.]” *Wadell*, 17:3-5. Processor 308 is a processing unit that converts communication signals into audio signals. For example, the processor 308 generates “synthesized voice, music, or other audible sounds” to be used with the wireless headphones. *Wadell*, 20:4-7.

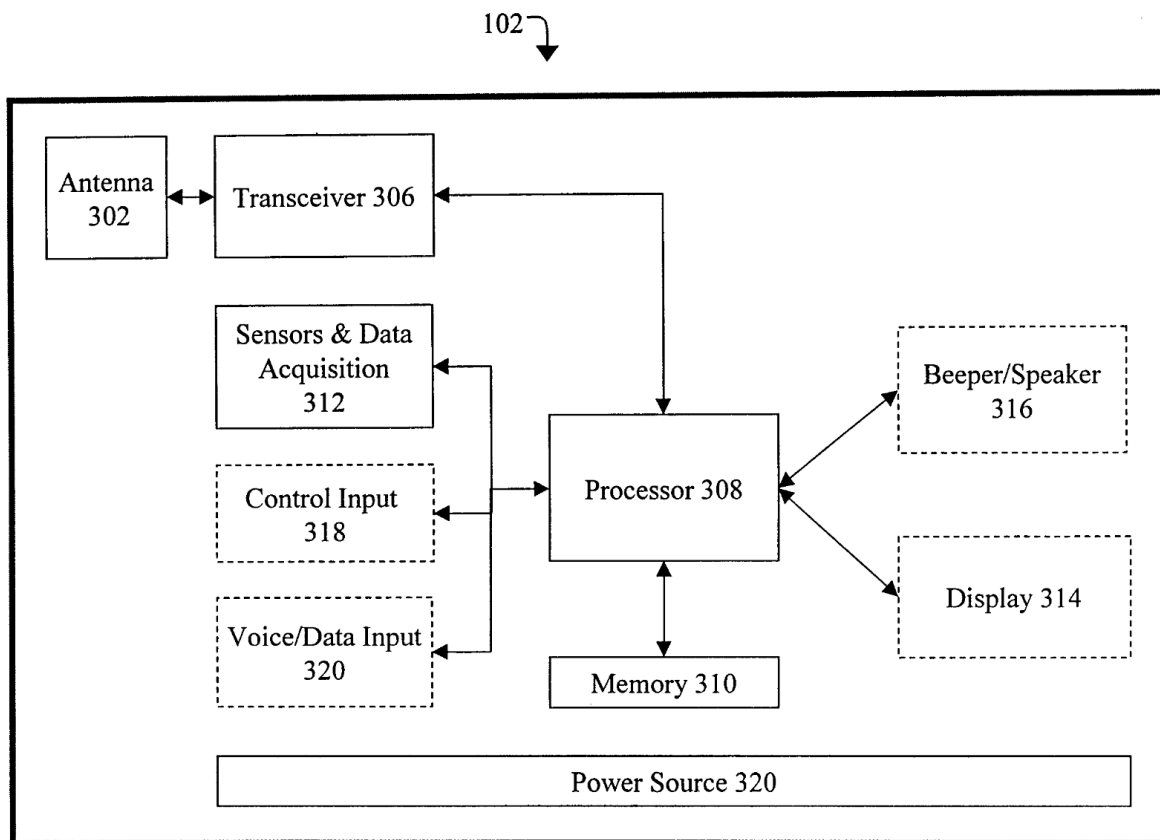


**Figure 3**

*Wadell*, Figure 3. Given that the disclosure of a receiving module and a processing unit capable of receiving communications and converting the communication signals into audio signals, respectively, well prior to the disclosure of *Downey*, it would have been obvious to modify the earphones of *Downey* to operate in a wireless manner.

## **IX. GROUND 2: OPINIONS REGARDING *DOWNEY* AND *MACINTOSH***

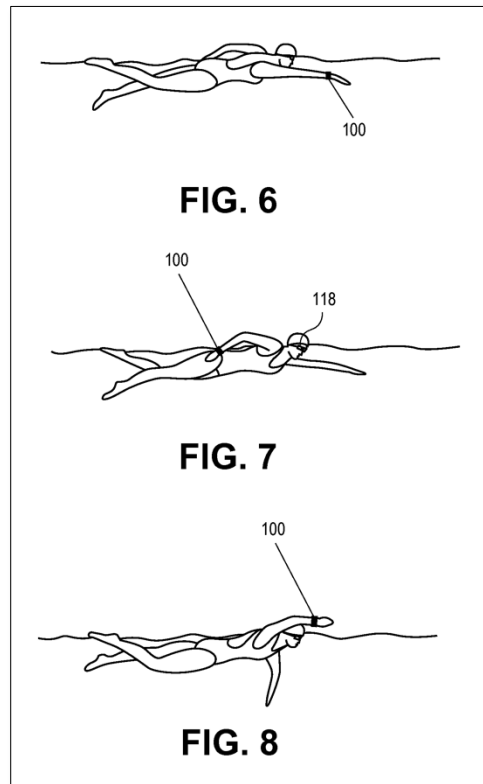
86. I understand that independent claims 1 and 7 are similar in scope to Claim 13, but additionally require that characterizing location and orientation of a body part is based on an initial position. Additionally, both linear and angular acceleration are used to characterize position and orientation. A POSITA would have been motivated to combine *MacIntosh's* gyrosensor and dead reckoning functionality into *Downey's* watch device to accomplish both of these additional limitations, as further discussed.

### **A. Claim 1**

***1(Pre) A personal device for measuring a training activity of a trainee having a body part which moves and changes its location and orientation, during said training activity, this movement at least partially defining said training activity, said device comprising:***

87. To the extent the preamble is limiting *Downey* discloses this limitation. *Supra* claim 10(Pre). As discussed, *Downey* is a personal device attached to a user's arm for measuring a swimming training activity. *Id.* It is obvious to a POSITA that swimming requires the movement of body parts and limbs, and thus, the changing of a body part's location and orientation. As seen in *Downey's* Figures 6-8, a

swimmer's arms (and legs) are moving, and with it, the attached watch device 100 also moves, following the same trajectory as the arm. *Downey*, Figures 6-8. As the arm follows the trajectory shown in Figures 6-8, the location and orientation of said arm changes. This arm movement (as well as the kicking motion) “at least partially defines a [swimming] training activity,” as claimed. A POSITA would have found it obvious that the attached watch device would measure the changes of the limb it is attached to, capturing the accelerations of the limb in each direction through each part of the stroke. Furthermore, a POSITA would have understood that limb movements have unique patterns within a stroke. For example, the movement of the arms in a within a freestyle or front crawl stroke is different throughout the stroke. Distinct swimming strokes are differentiated from one another specifically because they comprise distinct movements, and thus the arm moves through a set of distinct orientations for each stroke. As another specific example, the stroke movements are different between a freestyle stroke, having large overhead motions, and that of a breaststroke, comprising long side-sweeping motions. These unique movements or patterns help define the training activity.



*Downey*, Figures 6-8. The wrist attached watch device 100 is modified to incorporate *MacIntosh*'s ability to measure both linear and angular acceleration via respective accelerometers, as further explained below.

***1(a) a sensing unit...***

88. *Downey* in view of *MacIntosh* teaches this limitation, as discussed below.

***a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part***

89. *Downey* teaches this limitation. *Supra* claim 10(a). The base *Downey* watch device already repeatedly measures linear acceleration and now, when combined with *MacIntosh*'s ability to measure angular acceleration via *MacIntosh*'s

gyroscopes, would *repeatedly* measure angular acceleration for the same reasons as those detailed above regarding linear acceleration. Further, *MacIntosh* clearly discloses how accelerometers and gyroscopes employ sampling frequencies, and thus “repeatedly measure” parameters associated with the movement of said body part. *MacIntosh*, [0053]-[0054].

***and characterizing the location and orientation of said body part relative to its initial location and orientation, and wherein***

90. Gyroscopes are used in *MacIntosh* to perform conventional angular acceleration measurement. These sensors are used to track both a swimmer’s individual strokes and the change in the swimmer’s location while swimming. *MacIntosh*, [0024]-[0025], [0039]. The acceleration data from individual strokes may be analyzed to identify the stroke type, the number of turns, and distance (such as a number of laps that have been swum, for example). *Id.* As discussed previously, the arm (or leg) movement sensed by an accelerometer, and its corresponding unique movement within a stroke can be used to distinguish between stroke types, whether the motion is linear, sensed by a linear accelerometer, or angular, sensed by a gyro (angular accelerometer). *Supra* 1(Pre). Specifically, a POSITA would have recognized that the combined *Downey+MacIntosh* device, strapped to a swimmer’s arm, would have used the relative change in position of a swimmer’s arm about their body in order to identify and analyze the particular stroke being performed by the

user. In a similar manner, *MacIntosh* teaches that unique movement patterns can be used to keep track of the number of turns and therefore the total number of laps swum (and thus the distance swum, as the distance swum is the product of the total number of laps and the length of each lap) through standard dead reckoning, in which the change from an initial known position is used to keep track of a body's location. *MacIntosh*, [0024]-[0025], [0039].

91. *MacIntosh* has gyroscopes that measure “angular change in up to 3 dimensions (pitch, yaw and roll)...to sense movements like strokes and turns in swimming[.]” *MacIntosh*, [0024]. The arm movement measured by *MacIntosh*'s gyros and accelerometers is analyzed to “gather and transmit complete 3 dimensional information about an athlete's motion.” *MacIntosh*, [0039]. This analysis is performed by determining “[t]he deviation from a known starting point” by “integration of acceleration in each axis over time.” *Id.*, [0039], Fig. 4.

92. A POSITA would have understood that integration of acceleration over time requires an initial point (initial location and orientation) from which to begin the integration. *MacIntosh* provides additional examples of utilizing initial location and orientation points to characterize changes in movement. Specifically, “accelerometers are used concurrently with gyroscopes to form an inertial or **dead reckoning system.**” *MacIntosh*, [0039] (emphasis added). As the dead reckoning concept has been known and used since as early as the fifteenth century, a POSITA

would have understood that a dead reckoning system utilizes a known starting point (initial location and orientation) in order to characterize subsequent changes of a body part in comparison to said initial location and orientation. *See* Ex. 1015 (“*Sobel*”) (discussing the history of early navigation using dead reckoning). Thus, *Downey+MacIntosh* modified device teaches measuring the location and orientation of a body part (the stroke of a swimmer’s arm) relative to its initial location and orientation.

***said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means,***

93. *Downey* discloses this element. *Supra* claim 10(a). Additionally, *MacIntosh* also discloses accelerometers, a compass, and gyroscopes. *MacIntosh*, [0074]-[0076].

***said accelerometer means being adapted to measure linear acceleration of said body part along three axes, said gyroscope means being adapted to measure angular acceleration of said body part around said three axes, and said parameters being at least linear and angular acceleration values;***

94. *Downey* in view of *MacIntosh* teaches this element. *Downey*’s three dimensional accelerometer is “operable to detect acceleration along one, two, and/or ***three axes of movement***[.]” *Downey*, 4:40-42. Similarly, *MacIntosh* describes that “[a]ccelerometers measure linear acceleration and gyroscopes measure angular acceleration (***pitch, yaw and roll***).” *MacIntosh*, [0038] (emphasis added). Thus, the *Downey* and *MacIntosh* combined device includes acceleration sensing components

adapted to measure both linear acceleration and angular acceleration. Specifically, the multi-axis or three dimensional accelerometer in *Downey* measures three linear axes of movement and the gyroscope in *MacIntosh* measures angular acceleration around the three angular (pitch, yaw, and roll) axes.

### **1. Motivation to Combine**

95. A POSITA would have been motivated and found it obvious to utilize the gyroscope already contained and disclosed by *Downey's* watch device with the capabilities as described by *MacIntosh* to enable more detailed and accurate tracking of a swimmer's performance by using *MacIntosh's* 3-dimensional gyroscope which repeatedly measures angular acceleration parameters of the user's arm about three axes (pitch, yaw, and roll) in a similar manner as the linear accelerometers are employed in the unmodified *Downey* device. This angular acceleration will be used in conjunction with the linear acceleration data collected by *Downey's* inertial sensor 114 to perform stroke analysis and provide information to the performance analysis algorithms. Specifically, the gyroscope natively found within *Downey's* watch device would have been configured to operate as described by *MacIntosh* or substituted with *MacIntosh's* gyroscopes to enable the device to track rotational movement of the swimmer's arms. A POSITA would have recognized the benefits of *MacIntosh's* gyroscope in *Downey's* watch device. Three-dimensional information for an athlete is more complete and provides better performance insights

when angular acceleration is also used to characterize the location and orientation of a body part. Specific to swimming, the rotation of an arm during a stroke is not purely linear and includes angular movement as well. Indeed, propulsive, “pulling movements are rotational movements of extremities in the joints[.]” Ex. 1016 (“*Zatsiorsky*”), p. 206. the ac additional capability of detecting angular acceleration and determining the relative position and orientation of the user’s arm helps with accurately and fully analyzing “the efficiency of strokes and turns.” *MacIntosh*, [0061]. For example, a POSITA would recognize the value in being able to quantify changes in the angular acceleration of a swimmer’s pull phase when performing a freestyle or front crawl type stroke. A slowing angular acceleration in the pull phase could result with a loss of performance in the overall stroke, while an “increase of  $\omega$  [ $\omega$  = angular acceleration] would improve the efficiency of the pulling action.” *Zatsiorsky*, pp. 206-207. Being able to detect such details in a swimmer’s performance would have improved the usefulness and desirability of the *Downey* training device.e

96. A POSITA would have expected success in making the *Downey* and *MacIntosh* combination to include the capability of measuring angular acceleration because of the similarities in function and architecture between *Downey* and *MacIntosh*. Both teach wrist-worn devices comprising of accelerometers and

gyroscopes for tracking a swimmer. *MacIntosh*, [0024]-[0025], [0075]-[0076]; *Downey*, 1:5-9, 4:38-47.

97. The similarities in architecture would minimize any hardware modifications a POSITA would have to perform. The skill required to implement *MacIntosh*'s gyroscope would be the same skill required to implement *Downey*'s gyroscope, at most requiring simple software changes to also account for mathematical differences between linear and angular accelerations, well-understood for centuries. Because the *Downey* device would have already included software to calculate the effects of linear acceleration, it would have been straightforward to further include software to account for angular acceleration coming from the added gyroscopes. Therefore, there a POSITA would have had a reasonable expectation of success in making the proposed modification.

***1(b) means for attaching the sensing unit to said body part; and***

98. *Downey* discloses this limitation under the appropriate claim construction. *Supra* claim 10(b).

***1(c) a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity, said data including at least the location and orientation of said body part for ach [sic] of the measurements.***

99. The modified *Downey* watch device teaches this limitation. *Downey* discloses a processing system adapted to receive from the sensing unit said

parameters, and to calculate based thereon, data indicative of said training activity. *Supra* claim 10(c). By utilizing information from inertial sensor 114, *Downey* discloses that “the processing system 110 may generate a stroke model representing the predicted or expected duration the user’s arm will be in various positions during each stroke[.]” *Id.*, 6:56-60. *MacIntosh* further specifically teaches how signals from linear and angular accelerometers are used in tandem to track an athlete’s performance, stating that “[b]oth gyroscopic and accelerometric transducers are [sic] combined to gather and transmit complete [sic] 3 dimensional information about an athletes [sic] motion.” *MacIntosh*, [0039]. Here, a POSITA would have understood the multi-axis accelerometer are being used to measure position of an athlete’s arm (the body part to which the device is attached), while the gyroscope measures the arm’s orientation. *MacIntosh* discloses that its gyroscopes are capable of measuring “pitch, yaw and roll[.]” *MacIntosh*, [0038]. A POSITA would have understood that pitch, yaw, and roll define the orientation of a body in space and thus, *MacIntosh*’s gyroscope measures orientation of the user’s arm. Additionally, since the watch device 100 is worn on a user’s body part (arm), a POSITA would have understood any measurements made by inertial sensor 114 would come from movement generated by said arm, indicating the location and orientation of the arm during a swimming movement. *Downey*, Figures 6-8.

**B. Claim 2**

*A device according to claim 1, wherein said activity is a swimming session and said data further includes statistics and summary results for said session.*

100. The '998 Patent is broad in its description of the claimed “statistics and summary results,” describing them as including a variety of data types, such as total training time, number of laps, average lap time, and average lap velocity. '998 Patent, 12:34-42. Downey similarly discloses communicating statistics that summarize a swimming session to a user including elements such as “**current and average speed, pace, stroke count, distance traveled, lap count, energy expended, goal and target information**, virtual partner information, combinations thereof, and the like.” Downey, 7:40-48 (emphasis added). A POSITA would have recognized the data collected and presented to a user by Downey, as exemplified in the previous list, discloses the claimed “statistics and summary results” at least because the summarization statistics include average speed and lap count (i.e. “average lap velocity” and “number of laps” as listed by the '998). A POSITA would have recognized that communicating lap count is the claimed “summary result” because the total number of laps is, in itself, a summary of what was done during the particular training activity.

**C. Claim 3**

*A device according to claim 2, wherein said results include one or more of the following: total training time, number of laps, average lap time, average lap velocity, average strokes per lap, fastest and slowest lap, highest and lowest number of hand strokes per lap, instantaneous speed during the laps, hand or leg lifting height for each stroke, distance traveled for each stroke, comparative results to other trainees using similar devices.*

101. *Supra* Claim 2 citing *Downey*, 7:40-45 disclosing swim-related information including a “lap count,” and “number of laps.”

**D. Claim 5**

*A training advisor comprising a device according to claim 1, and further comprising a presentation unit adapted to present to the trainee at least said data or training instructions based on said data.*

102. *Downey* discloses this element, teaching that watch device 100 has a presentation unit containing at least a display 106 presentation unit. *Supra*, Claim 10(d) citing *Downey*, 2:47-49. *Downey*’s watch device is capable of displaying both the measured data from the inertial sensor as well as training instructions such as “current and average speed, pace, stroke count, distance traveled, **lap count**, energy expended, goal and target information, [or] virtual partner information[.]”. *Downey*, 7:40-59. A POSITA would have recognized this list of information relates to the data measured during a swimming activity: the laps and distance swum, energy expended, speed, and swimming stroke count. *Downey*, 7:40-50. A POSITA would have recognized that the lap count and stroke count would reflect the swimming

performance of the athlete (swimmer) to which the device is attached (and thus the only person's performance that may be sensed).

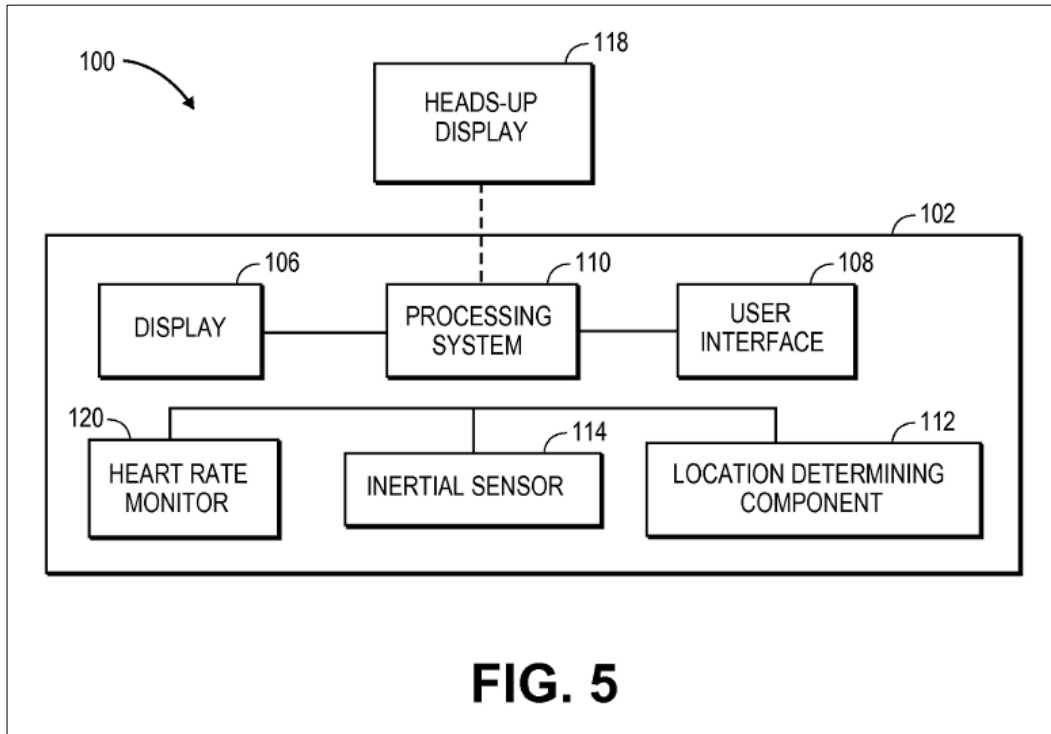
103. Additionally, *Downey* discloses functionality wherein display 108 “may flash each time a stroke is to be performed” to “help the user swim at a certain rate or pace[.]” *Downey*, 7:53-59. A POSITA would have recognized the flashing display to be “training instructions.” A POSITA would have understood that a flashing display is meant to aid a swimmer maintain or correct a swimming pace. Each time the display flashes, the swimmer performs a stroke, matching the desired pace, and thus training their swimming performance by following the device's instructions. Thus, to the extent the phrase is limiting, *Downey's* modified device constitutes as a “training advisor” because it provides training instructions to the user, advising the user on how to modify their swimming technique.

#### **E. Claim 6**

***A training advisor according to claim 5, wherein said presentation unit comprises a screen connected to said processor and adapted for displaying to the trainee readings including at least said data or training instructions to the trainee based on said data.***

104. *Downey* teaches “display 106 may comprise an ***LCD (Liquid Crystal Display), TFT (Thin Film Transistor)*** LED (Light Emitting Diode), LEP (Light Emitting Polymer) and/or PLED (Polymer Light Emitting Diode), or the like, capable of displaying text and graphical information” such as training instructions or other data. *Downey*, 2:50-55 (emphasis added). Therefore, *Downey's* display 106

teaches the claimed “screen[,]” which is connected to the processor (processing system 110) as illustrated below in Fig. 5.



*Id.*, Figure 5.

**F. Claim 7**

*A training advisor according to claim 5, wherein the processor of said device is further adapted to provide said training instructions according to predetermined rules.*

105. *Supra*, claim 10(d).

**X. GROUND 3: OPINIONS REGARDING *DOWNEY, MACINTOSH AND BURTON***

**A. Claim 8**

***[8(Pre)] A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:***

106. To the extent the preamble is limiting, *Downey* discloses this limitation.

*Supra* claim 10(Pre).

***[8(a)] a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;***

107. *Supra* claim 10(a).

***[8(b)] means for attaching the sensing unit to said body part;***

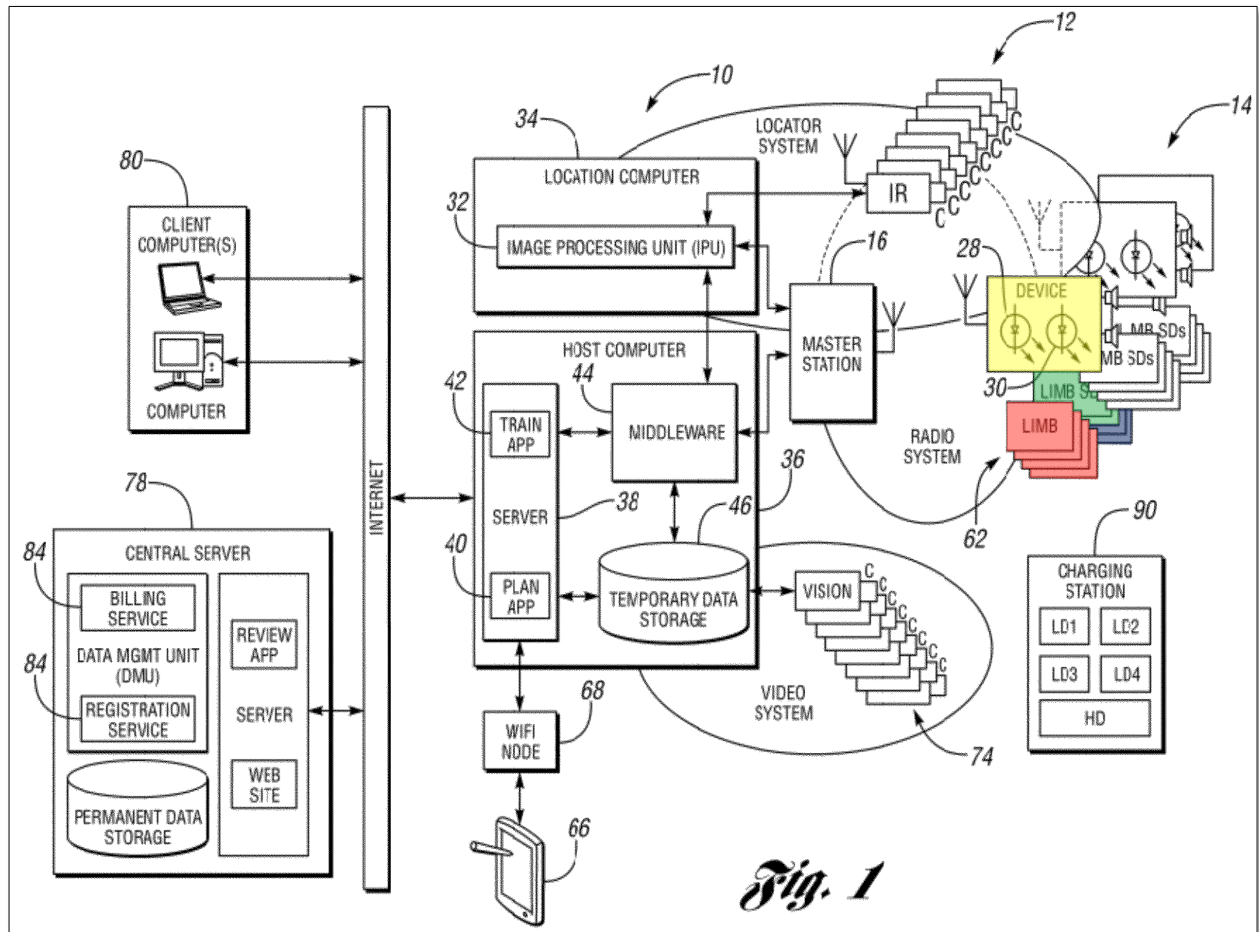
108. *Downey* discloses this limitation under the appropriate claim construction. *Supra* claim 10(b).

***[8(c)] a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity; and***

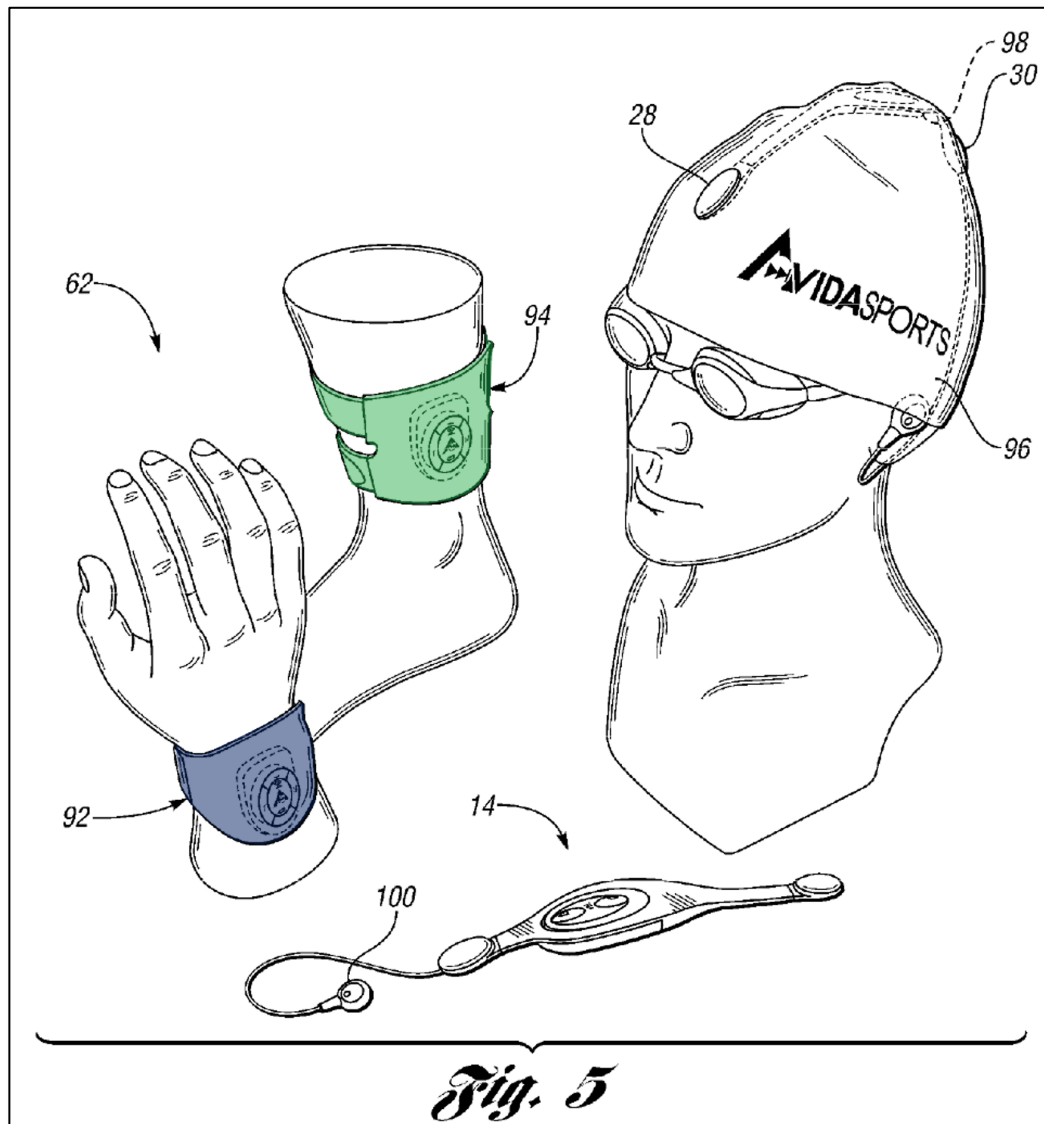
109. *Supra* claim 10(c).

***[8(d)] at least one additional sensing unit and means for its attaching to an additional body part of said trainee, the sensing unit adapted to repeatedly measure, during said activity, parameters characterizing at least the location and orientation of said additional body part relative to its initial position and orientation; and said processor being further adapted to receive from said at least one additional sensing unit said parameters, and to calculate, based thereon, at least the location and orientation of said additional body part for each of the measurements, for use thereof in providing said data.***

110. *Downey* and *MacIntosh* in further view of *Burton* teaches this limitation. Multiple limb devices are attached to the “arms and legs of the swimmers” as discussed in *Burton*. *Burton*, 3:52-53; *Burton-Provisional*, 186. This is depicted in the annotated version of *Burton*’s Figure 1 reproduced below, illustrating a plurality of limb devices associated to a plurality of limbs of a single swimmer. Figure 1 depicts red, blue, and green boxes 62 representing a plurality of limb swimmer devices (“limb SDs”).



*Burton*, Figure 1, annotated; *Burton-Provisional*, 186. As further seen in annotated Fig. 5 *Burton* envisions that its swimmer devices may be worn on the wrist and ankle of a swimmer.



*Burton*, Figure 5, annotated; *Burton-Provisional*, 186; *Burton* discloses “[a]rm (limb) [swimmer devices] SDs were mounted on the inside of the wrist” and “[l]eg limb SDs were mounted on the inside of the legs, above the ankle in the same orientation as the arm SDs[.]” *Burton-Provisional*, 186. Whether attached to the swimmer’s wrist or ankle, the SDs are illustrated as including a means for attaching the device to the swimmer’s body, such as a strap around the user’s ankle or wrist.

Because, as described regarding claim 10, the first sensing unit is mapped as being the wrist-worn device, the ankle-worn device taught by *Burton* is being mapped as being the claimed “additional sensing unit.” Of course, this additional sensing unit is equivalently taught by a second wrist-worn device on the swimmer’s other wrist (enabling the system to desirably measure and analyze the movement of each arm independently during swimming strokes) and/or by one or more SDs mounted elsewhere on the swimmer’s body. In any case, a POSITA would have recognized that each of *Burton*’s SDs include means for attaching the device to the swimmer such that the device is securely attached and able to operably capture the swimmer’s performance data as intended, whether it be attached by wrist strap, ankle strap, or any other material affixing the SD to the selected swimmer body part. Attaching the second sensing unit, as illustrated, includes an ankle wrap, 94 comprising bands that wrap around the swimmer’s ankle, thus attaching the sensing unit to the swimmer’s leg. *Burton*, 5:28-43, Fig. 5. Therefore, *Burton* teaches “means for attaching” an additional sensing unit to an “additional body part[,]” as claimed.

111. *Burton*’s additional SDs would have operated in substantively the same as described by *Downey* regarding its wrist-worn device, with any necessary modifications being made to the analysis of the captured parameters to account for the differences between analyzing the stroke of an arm and the kick of a leg. For instance, the leg may kick with greater force and/or a wider range of motion, but a

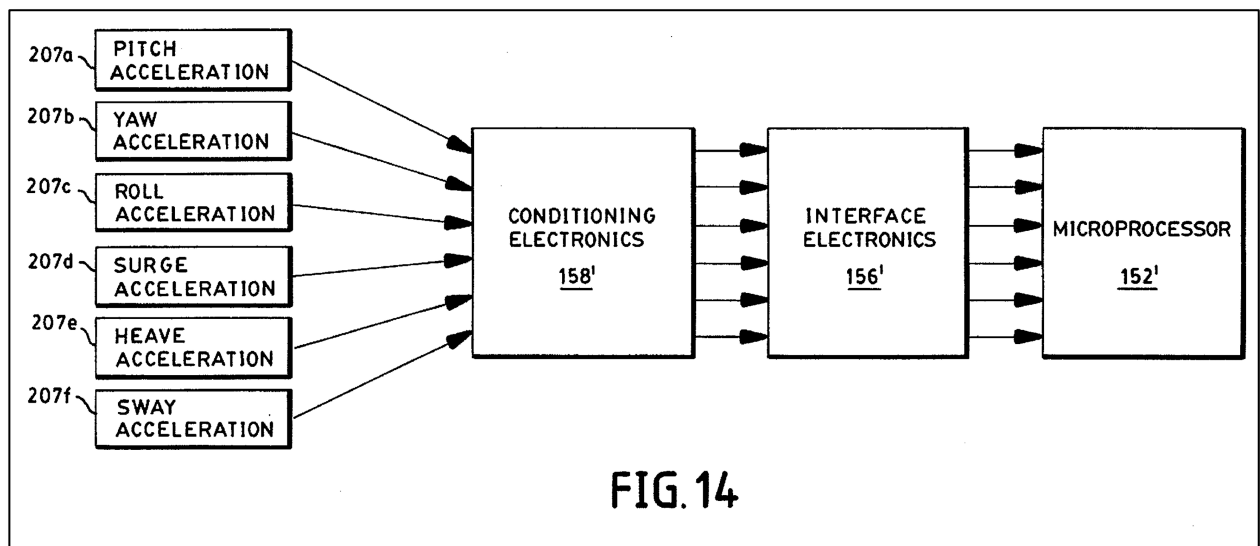
POSITA would have found it obvious and been capable of and motivated to configure the ankle-worn device to accurately track the motion of the swimmer's leg throughout its repeated motion in the same way that *Downey's* device tracks the swimmer's arm through its repeated motion, requiring at most minor modifications to the software already present. However, any differences between the sensors would arise during data processing, not data collection (parameter measurement) – the accelerometers (angular and/or linear) would have collected and transmitted the accelerations of the body parts in an identical manner, whether arm or leg, and the software (which is already operable to successfully do so in *Burton*) would have appropriately translated the captured signals into limb motion corresponding to the appropriate limb. Thus, the *Downey+MacIntosh+Burton* second (ankle) sensor would have “repeatedly measured parameters characterizing at least the location and orientation of said additional body part relative to its initial position and orientation” for the same reasons as detailed above regarding claim 10(a) relating to the first body part, the user's arm. Similarly, the combined *Downey+MacIntosh+Burton* device would have included a “processor being further adapted to receive from said at least one additional sensing unit said parameters” for the reasons described above regarding claim 10(c), now receiving parameters from the second (e.g. ankle or other wrist) sensor in addition to those from the first wrist-mounted sensor taught by *Downey*.

112. As discussed above, *Downey's* sensing unit teaches repeatedly measuring parameters associated with a swimmer's body part. *Supra*, Claim 10(a). In the proposed modification, *Downey's* sensing unit (inertial sensor 114) and its functionality is duplicated into a second sensing unit. This second sensing unit is attached to an additional body part, specifically the user's ankle, as taught by *Burton*. The second sensing unit would operate substantively in the same way as disclosed by *Downey's* device attached to a swimmer's arm. There may be slight modifications made to the analysis of the captured parameters to account for the differences between analyzing the stroke of an arm and the kick of a leg. For example, a POSITA would have understood that the movement of a leg during a swimming stroke is different than that of an arm. However, any differences between the sensors would arise during data processing, not data collection (parameter measurement). That is, the acceleration signals generated by the leg is still captured in the same manner as if the acceleration signals were generated by an arm. Thus, the *Downey*, *MacIntosh*, and *Burton* additional (ankle) sensing unit would have "repeatedly measured parameters characterizing at least the location and orientation of said additional body part relative to its initial position and orientation" for the same reasons as detailed above regarding claim 10(a). Similarly, the combined *Downey*, *MacIntosh*, and *Burton* device would have contained a "processor being further adapted to receive from said at least one additional sensing unit said parameters" for the reasons

described above regarding claim 10(c), but now receiving parameters from the additional (ankle) sensing unit in addition to those from *Downey's* wrist-mounted sensor. To the extent necessary, a POSITA would have been motivated and found it obvious to make additional modifications to the *Downey* system to receive parameters from multiple sensing units, using hardware already present in *Downey's* device and with skills known to a POSITA. It would have been obvious to a POSITA that a swimming stroke is not only defined by arm movements, but also leg movements. They would have been motivated to also capture data surrounding the leg movements of a swimming stroke for a more wholistic picture of a stroke. Furthermore, a POSITA would have understood that the left/right measurements of a swimmer could impact swimming performance and thus should be measured and analyzed. For example, *Burton's* Figure 1 depicts four limbs with a plurality of swimmer devices in connection. This suggests that a swimmer device could be attached to each limb on a swimmer and a POSITA would have understood that this allows stroke data to be compared from the left side limbs to the right side limbs of a swimmer, further allowing swimmers to see any imbalances with their swimming strokes.

113. A POSITA would have had a reasonable expectation of success to implement this modification at least because *Burton* itself provides an operable system with an architecture that allows receiving parameters from multiple sensing

units. *Burton*, 3:41-60, 4:34-53. It would have been well within the skillset of a POSITA to capture data from another sensing unit (SD) in the same manner as implemented to capture data from a singular sensing unit, using *Burton's* system intended to collect data from a plurality of devices. It was well-known and widely-used at the time of the '998 Patent, to have a processor receiving inputs from multiple sensors. For example, U.S. Patent No. 5,636,146 (Ex. 1017, "*Flentov*"), issued June 3, 1997, discloses a sports related invention related to measuring loft time (airtime) and speed in sporting activities, such as skiing. *See Flentov*, Abstract. In addition to disclosing that translational (linear) and rotational (angular) accelerometers are well known in the art, it is disclosed that "a plurality of six accelerometers . . . are connected to a microprocessor subsystem[.]" *Flentov*, 17:22-24, 18:12-14, Figure 14.



*Flentov*, Figure 14A. This reference provides an example of the well-known and widely-used functionality of accepting data from a plurality of sources and combining it in a single microprocessor prior to the '998 Patent.

114. The wrist mounted sensing unit taught by *Downey+MacIntosh* characterizes at least the location and orientation of a body part (arm) relative to its initial position and orientation. *See supra* claim 1(a). Thus, in a similar manner, the *Downey+MacIntosh+Burton* second sensing unit would have been configured to characterize at least the location and orientation of an additional, second body part (e.g. leg) relative to its initial position and orientation for the same reasons and in the same manner as discussed regarding the first sensing unit. A POSITA would have understood that utilizing the architecture already implemented in the first, wrist mounted sensing unit would be the most efficient and cost-effective method of implementing additional sensing units. Additionally, *MacIntosh* itself already contemplates analyzing the movement of a leg or kick, leading to a reasonable expectation of success to include additional sensing units in the modified *Downey* device. *MacIntosh*, [0065]-[0067], [0072], [0105]. Armed with the disclosure from *MacIntosh*, a POSITA would have been capable of adjusting the algorithm from processing arm acceleration data to leg acceleration data. Using programming skills already used to analyze the arm acceleration data, a POSITA would have had the skill and found it obvious, to perform any required reprogramming in order to for

the *Downey*, *MacIntosh*, and *Burton* device to analyze the motion of a leg relative to its initial position and orientation. Since the hardware between the arm attached and leg attached sensing units are substantively similar, a POSITA would have been able to avoid making hardware changes, further contributing to the expectation of success of implementing the combination.

### **1. Motivation to Combine**

115. A POSITA would have been motivated and found it obvious to include a second sensing unit attached to the swimmer's leg as taught by *Burton* in the *Downey* and *MacIntosh* personal training device. This modified device has the advantage of capturing additional data related to the performance of the athlete, such as kicking pace, number, and efficiency of the swimming stroke accounting for the motion of multiple limbs of a swimmer, which would have provided deeper insights into the swimmer's performance and how it might be improved. A POSITA would have understood that arm movement is not the only factor associated with perfecting a swimming stroke. A POSITA would have recognized that modifying the system according to *Burton* would have allowed for more data to be collected from an individual athlete, enabling more accurate and complete analysis of the swimmer's performance. Although legs "possess significantly greater propelling surface area" and have "significantly stronger" muscle groups than those found in the arms, a "leg kick creates a smaller effective propulsive force than arm pull[.]" accounting for

only “about 15%” of the total propulsive force in a front crawl stroke, but “approximately equal proportions” with the breaststroke. *Zatsiorsky*, p. 224. A POSITA would have understood that even when measuring strokes that are arm dominated, the legs still significantly contribute to the overall performance of the stroke and should be measured. Indeed, “leg movements create useful propulsive forces in every swimming stroke at any swimming velocity[.]” *Zatsiorsky*, p. 224. Thus, a POSITA would have been motivated to also measure and analyze the leg portion of a stroke as they too contribute to the overall swimming stroke.

116. Each of *Downey*, *MacIntosh*, and *Burton* describe similar devices used for tracking a swimmer’s performance and include similar components like processors, accelerometers, gyroscopes, compasses, and GPS, leading to a reasonable expectation of a success. The existence of these sensor components in *Downey*, *MacIntosh*, and *Burton* would have simplified the modification to implement an additional sensing device because the additional sensing device would have utilized the same hardware architecture to measure acceleration. *Compare Downey*, Abstract, *with MacIntosh*, Abstract, [0062], *with Burton* 3:49-60; *Burton-Provisional*, 186, 188; *Downey*, 3:61-4:1, 3:46-49; *with MacIntosh*, [0019], [0011].

117. A POSITA would have expected *Burton*’s limb sensors (swimmer devices or sensing unit) to operate in a similar manner to the modified *Downey* and *MacIntosh*’s sensing units, which include “accelerometers or other devices

configured to monitor and report movements of the swimmer[.]” *Burton*, 3:53-55; *Burton-Provisional*, 5; It would have been obvious to a POSITA that the accelerometers would measure acceleration in the same manner regardless if the acceleration is generated by an arm or a leg. *Burton-Provisional* discloses the intention of “acquir[ing] basic physical measurements (e.g. stroke, amplitude, motion) from accelerometers in telemetry devices worn by the swimmers.” *Burton-Provisional*, 5. A POSITA would have recognized that the modification of providing a second sensing unit, per *Burton*, constitutes application of a known technique to a known device, *Burton*’s additional sensor added to the modified *Downey+MacIntosh* swimming analysis system, for the advantage of providing a more complete analysis of a swimmer’s performance, motivating the combination. As previously discussed, the breaststroke has “approximately equal proportions” of leg and arm propulsion. *Zatsiorsky*, p. 224. Training the leg movement is thus of vital importance to the breaststroke, as the leg stroke accounts for roughly half of the overall swimming propulsion. Consumers would have desired analysis of kicking technique in addition to arm stroke technique to provide the most improvement to their swimming performance, leading to increased desirability for the modified system and thus increased sales of the device. A POSITA would have also understood that additional limb devices would provide increased sales of sensing units if they were sold separately, where potentially one device is used for

each limb of a swimmer. Regardless, a POSITA would have expected the improved system to be more desirable due to its increased accuracy and use as a training tool, and thus would have expected higher sales and potentially a higher price-point for the device.

**B. Claim 12**

***[12(Pre)] A personal device for measuring a training activity of a trainee having a body part which moves during said training activity, this movement at least partially defining said training activity, said device comprising:***

118. To the extent that preamble is limiting, *Downey* discloses this limitation. *Supra* claim 10(Pre).

***[12(a)] a sensing unit adapted to repeatedly measure, during said training activity, parameters associated with the movement of said body part, and wherein said sensing unit comprising at least accelerometer means, a compass and optionally gyroscope means;***

119. *Supra* claim 10(a).

***[12(b)] means for attaching the sensing unit to said body part***

120. *Downey* discloses this limitation under the appropriate claim construction. *Supra* claim 10(b).

***[12(c)] a processor adapted to receive from the sensing unit said parameters, and to calculate based thereon, data indicative of said training activity;***

121. *Supra* claim 10(c).

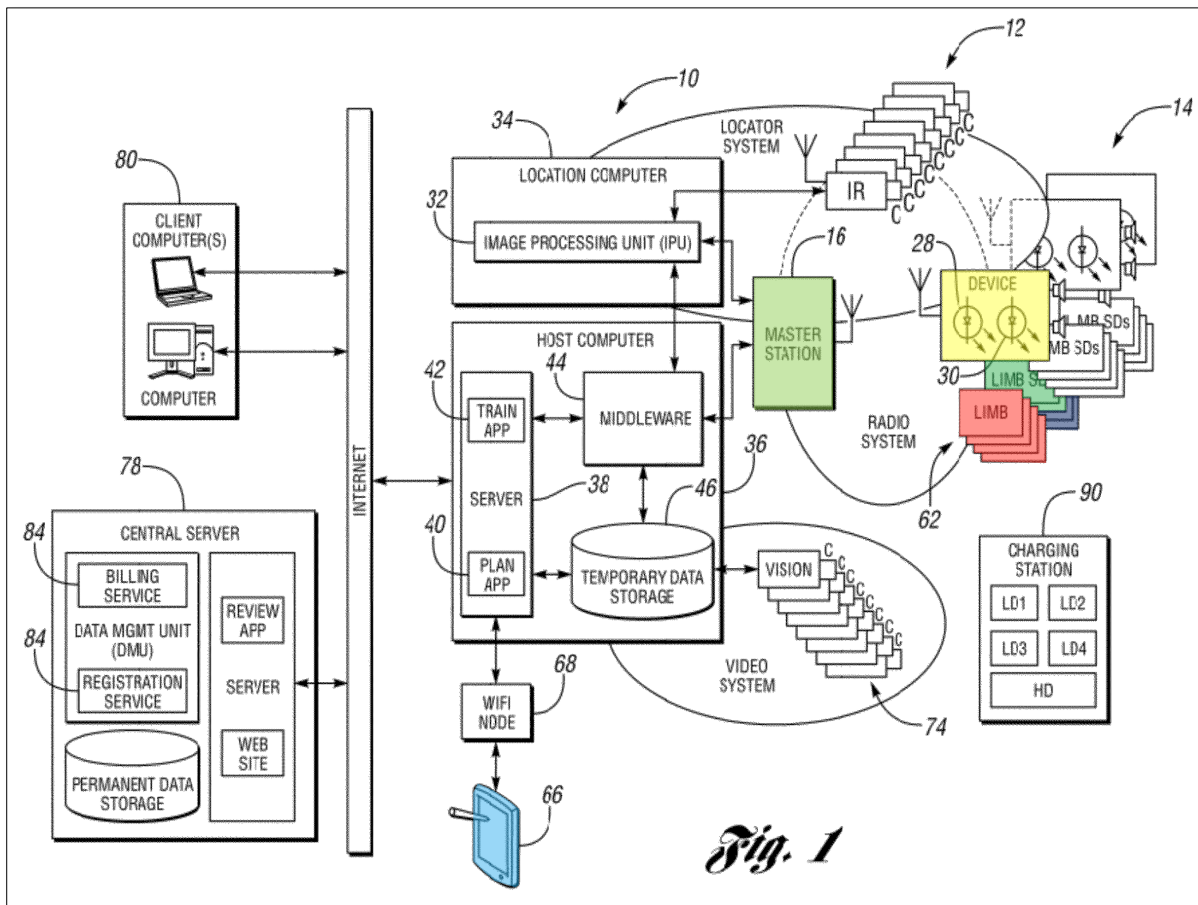
***[12(d)] a presentation unit adapted to present to the trainee at least said data or training instructions based on said data; and***

122. *Supra* claim 5.

***[12(e)] a computer adapted for being located at a location spaced from said processor and for wirelessly receiving the data from said device, and having a monitor for displaying to a user of said computer said data or information derived therefrom.***

123. *Downey+MacIntosh* and in further view of *Burton* teaches this limitation via a hand-held user device 66 that may be “a tablet computer used by a coach to monitor swimmer performance.” *Burton*, 3:64-65; *Burton-Provisional*, 135, 159-160, 165, 190-191, 193-197. The hand-held user device of *Burton* includes the coaches’ tablet described in *Burton-Provisional*. For example, *Burton-Provisional* discloses that the coaches’ tablet enables a user of “a handheld PC” to “view live action,” “replay an athlete’s performance,” and analyze the collected data.” *Burton-Provisional*, 135. *Burton-Provisional* describes a “coach’s tablet” for use at the master station and further depicts tablet PCs being connected to said master station. *Burton-Provisional*, 159-160. Further, it is disclosed that “poolside tablet PCs” perform similar functions. *Burton-Provisional*, 193-194. A POSITA would have understood that the various terms for hand-held device (e.g., coaches’ tablet, coach’s tablet, poolside tablet PCs, tablet PCs) are all substantively the same device. Indeed, *Burton-Provisional* discloses that portable devices for on-deck use are “**hand-held devices** capable of displaying content” and that “portable coaches [sic]

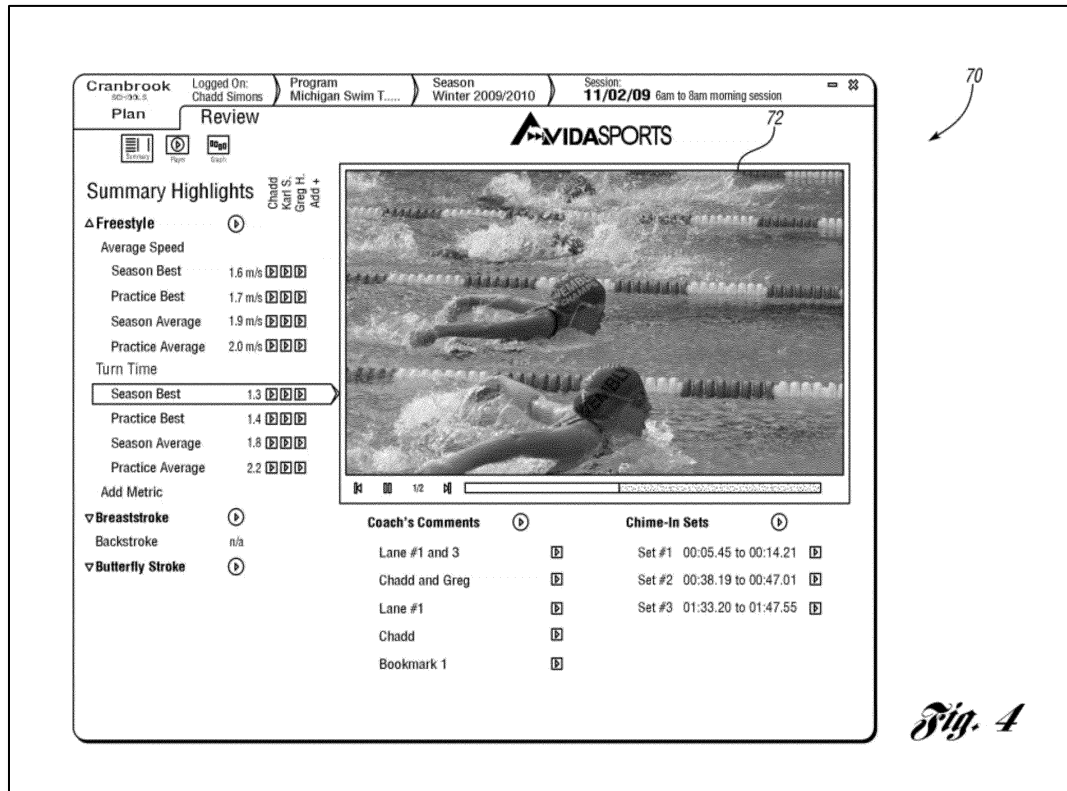
tablets” are provided to each coach “on deck[.]” *Burton-Provisional*, 165, 191 (emphasis added). All of these disclosures in *Burton-Provisional* describe that the coaches’ tablet is a tablet computer that is used by a coach to monitor swimmer performance, similar to that of *Burton*’s hand-held user device 66.



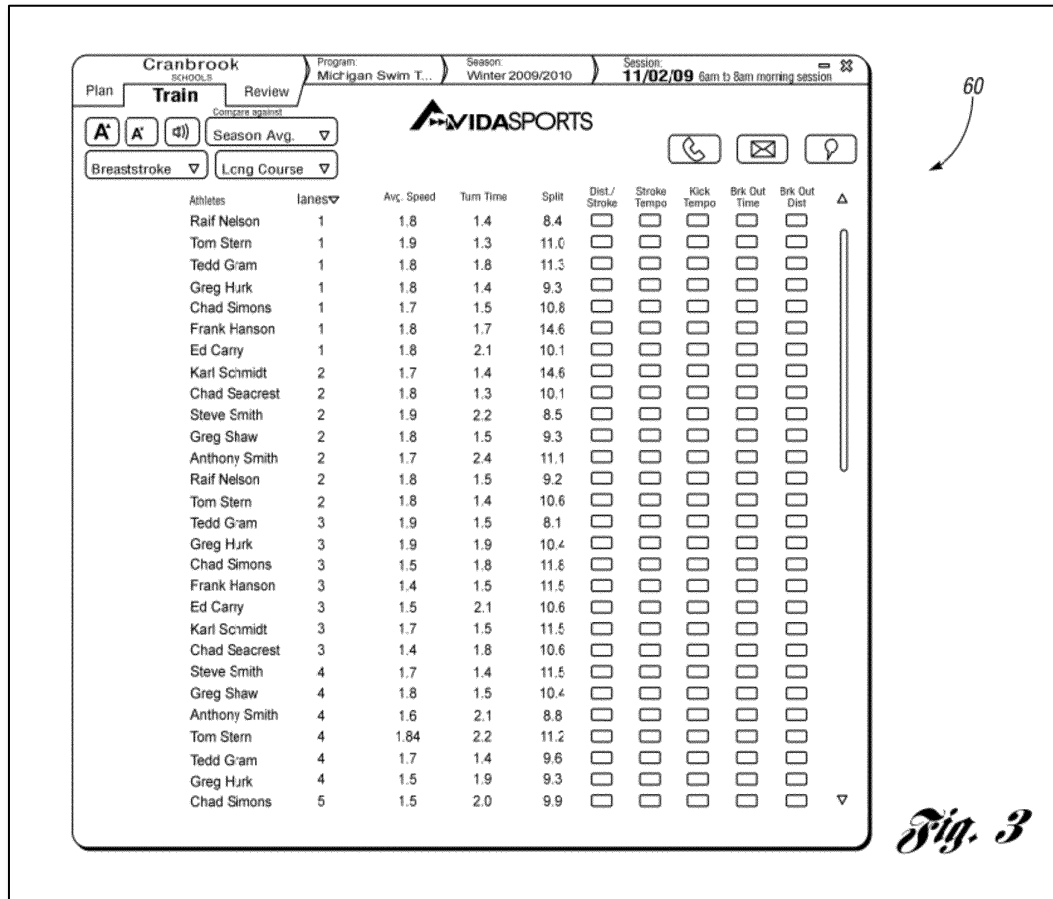
*Burton*, Figure 1 (annotated); *Burton-Provisional*, 159-160, 163, 194-197. As disclosed in *Burton-Provisional*, *Burton*’s Figure 1 depicts the hand-held user device 66 interfacing with the master station 16.

124. *Burton* teaches “real-time telemetry may be output on a user interface of [the] hand-held user device 66 (see FIG. 1) connected to the master station 16 by

way of a wireless node 68” from the host computer, and thus the user device 66 is “adapted for being located at a location spaced from said processor and for wirelessly receiving the data from said device,” as claimed. *Burton*, 3:61-4:3; *Burton-Provisional*, 159, 163, 192-197. Specifically, the user interface may be a “**graphical user interface 70** where the **telemetry information of a particular swimmer is display[ed] with numerical values of current performance.**” *Burton*, 3:66-4:3 (emphasis added); *Burton-Provisional*, 135, 190-191, 194-197. As disclosed by *Burton-Provisional*, “collected data” such as “swimmer statistics (e.g.: start time, lap times, turn times, finish times)” can be displayed in “various ways (graphical charts, running meters, traveling averages) to facilitate easy interpretation of the data.” *Burton-Provisional*, 135. This is substantively the same to *Burton*’s disclosure regarding the information shown on the graphical user interface 70. Specifically, the graphical user interface 70 may display information for an individual swimmer’s performance, such as average speed, as shown in Figures 3-4.



Burton Figure 4; *Burton-Provisional*, 135, 190-191, 194-197. Burton's Figure 4 depicts numerical values of current performance swimmer statistics such as average speed.



Burton Figure 3; *Burton-Provisional*, 135, 190-191, 194-197. *Burton's* Figure 3 depicts numerical values of current performance swimmer statistics such as average speed.

125. A POSITA would have understood that the content displayed in the *Downey*, *MacIntosh*, and *Burton* combination, such as the swimmer's speed and particular strokes, would have been derived from data measured by the modified watch device as discussed in Claim 10(c). *Burton* specifically envisions displaying start time, lap times, turn times, and/or finish times in various ways (graphical charts, running meters, traveling averages), all of which would have been at least partially

based on data measured by the modified athletic performance monitoring device. *Supra*, Claim 10(c). Therefore, implementing *Burton*'s hand-held user device (tablet computer) in the *Downey* and *MacIntosh* combination provides a computer for being located at a location spaced from said processor, which also wirelessly receives the data. Said data being wirelessly received from the modified *Downey* and *MacIntosh* device, and displayed on the graphical user interface 70 (a monitor), wherein such data is swimmer statistics (the "data or information derived therefrom"). In summary, *Burton*'s hand-held user device is a separate and spaced from the processor within the sensing unit, wirelessly receives data from the sensing unit, and displays said data.

### **1. Motivation to Combine**

126. A POSITA would have been motivated and found it obvious to include *Burton*'s hand-held user device 66 that displays swimmer data in the *Downey* and *MacIntosh* personal training device for the advantage of conveniently providing analysis pertinent to the performance and improvement of the swimmer's technique to a coach or teammate in real-time and allowing immediate and/or delayed feedback regarding improvement of a swimmer's performance. Displaying a swimmer's performance data on a display spaced from the sensing unit allows for more data to be displayed and for comparisons to be made on a swimmer's performance over time, which would be difficult on the display found on the sensing unit. For example,

*Burton* and *Burton-Provisional* disclose that a swimmer's performance can be compared "against another of his or her own." See *Burton* Figure 4 (depicting season bests for average speed and turn time), *Burton-Provisional*, 135.

127. A POSITA would have recognized that the system modified with *Burton's* teachings would have enabled insights into the swimmer's technique in an easy-to-understand format, without having to manually analyze the measured data. Indeed, *Burton* and *Burton-Provisional* additionally contemplate that the visuals should "[c]onvey meaningful information in a manner that is quick to understand and easy to access." *Burton-Provisional*, 136. A POSITA would have understood that the screens shown in *Burton's* Figures 3 and 4 both show information that is both quick to understand (depicting data in a table format) and easy to access (depicting filters for stroke type and various other filtering options). Further, a POSITA would have recognized that the remote display would have been much more convenient for a coach, teammate, or other assistant to receive performance data quickly and in an easy-to-understand format, enabling them to assist, coach, or otherwise train the swimmer.

128. *Downey* itself contemplates a display "mounted externally to the user... capable of displaying text and graphical information." *Downey*, 4:48-63. Additionally, *Downey* includes wireless communication hardware, leading to a reasonable expectation of a success for the combination, allowing information to the

modified watch device to be wirelessly sent to a separate and external display. *Downey*, 3:35-53, 5:3-17, 7:45-52. A POSITA would have recognized the modification constitutes a known technique of displaying performance data on a separate, wirelessly-connected display, per *Burton*, being applied to a known device (*Downey* and *MacIntosh's* swimming analysis system) for the advantage of providing better and more convenient analysis of a swimmer's performance, motivating the combination. *Downey* discloses that "performance-related information generated by the watch device 100 **may be presented** on the display 106, the heads up display 118, and/or stored...for later use by the watch device 100 or **other systems or devices.**" *Downey*, 7:48-52 (emphasis added). This disclosure means that a POSITA would already have the skills required to implement displaying swimming related data on an external, separate, and spaced device like *Burton's* hand-held user device. Consumers would have desired fast, visually-appealing analysis of a swimmer's performance, leading to increased desirability for the modified system and thus increased sales of the device. A POSITA would have a reasonable expectation of success because the combination of devices are all swimming related, contain the same necessary hardware, and disclose overlapping teachings which show the skillset available to a POSITA. For example, *Downey* discloses presenting data and using data collected from its watch device with other systems or devices. *Downey*, 7:48-52. *Burton* discloses a hand-held user device (e.g.,

other systems or devices) capable of presenting data. *Burton* Figures 3 and 4; *Burton-Provisional*, 135, 190-191, 194-197. These overlapping disclosures show what is possible (displaying information on a separate, spaced device) and one embodiment of what the implementation may look like (a hand-held user device displaying information).

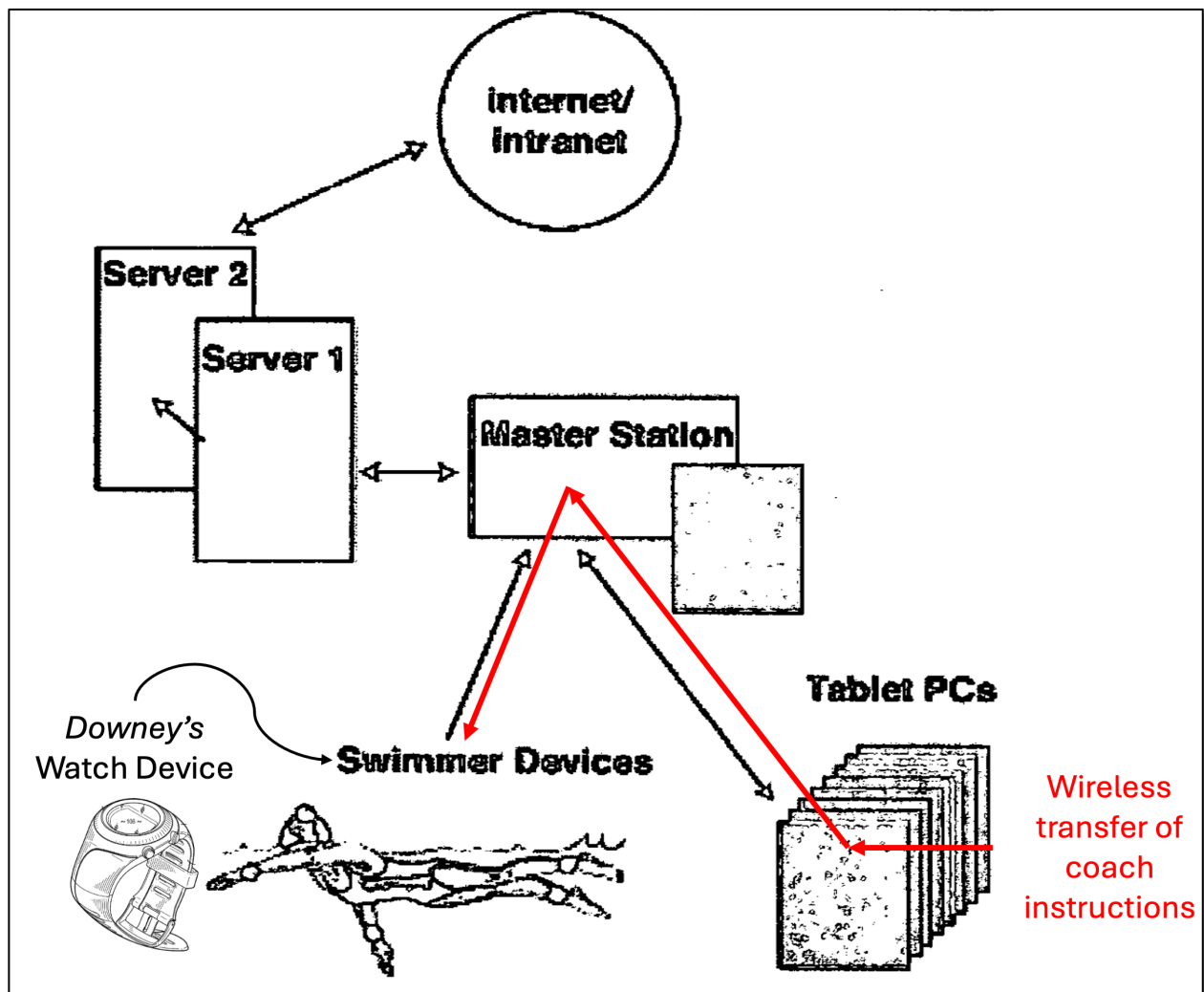
### C. Claim 13

***A training advisor according to claim 12, wherein said computer further comprises an input unit to receive said training instructions from its user, the computer being adapted to wirelessly transfer said instructions directly or indirectly to said presentation unit.***

129. *Downey* in view of *Burton* and further in view of *MacIntosh* teach this limitation. *Burton* discloses a hand-held user device 66 (a computer spaced from the processor of the sensing device) that may be a tablet computer. *Supra* claim 12(e). “One form of audio communication may include the master station 16 or ***other device wireless transmitting verbal instructions from the coach to the swimmer, such as through a microphone*** (not shown) ***included on the tablet device.***” *Burton*, 6:3-7 (emphasis added); *Burton-Provisional*, 10, 154, 159-160, 190-191, 198. Like *Burton*, *Burton-Provisional* discloses that the table device includes a microphone. The microphone allows a “coach to voice communicate to a swimmer, small group, or entire pool of swimmers[.]” *Burton-Provisional*, 190.

130. Instructions from a coach are spoken into the tablet computer’s microphone and subsequently wirelessly transmitted to the earphone within

*Downey's* presentation unit and, consequently, to the swimmer. *Supra* claims 12(e), 11(d). A POSITA would have understood that any transmission to the earbud is indirect as it must route through at least the master station. As depicted in *Burton-Provisional's* System Architecture Diagram, p. 159, the hand-held user device (tablet PCs) are not directly connected to the swimmer devices (*Downey's* modified watch device).



*Burton-Provisional*, System Design Architecture, 159 (annotated). As previously discussed, *Downey* discloses earphones (presentation unit) that “emit[s] sound in either of the user’s ears.” *Downey*, 5:1-2; *see supra* claim 11(d). It would have been obvious in light of *Burton* to transmit audio to the earphones disclosed by *Downey*, as “[t]he [swimmer devices] support audio output. For the final product, this is to be used to **deliver audio instructions from the coach to a swimmer.**” *Burton-Provisional*, 154 (emphasis added). This would have allowed the coach to provide training instruction to the swimmer while the swimmer is performing, without requiring the swimmer to stop and restart.

### **1. Motivation to Combine**

131. A POSITA would have been motivated and found it obvious to add *Burton’s* audio communication to the *Downey and MacIntosh* device. *Downey* already teaches providing training instructions. A POSITA would have been motivated to audibly provide training instructions back to the swimmer to improve training and performance, conveniently supporting the coach-athlete relationship when the swimmer would otherwise be unlikely to be able to hear the coach’s instruction. *Supra* claim 11(d). A POSITA would have been motivated to implement audio based training instructions because it provides a communication method which does not impede the swimming stroke, which also allows for detailed information to be conveyed. Audio communication would allow for the coach to provide precise

information that would be difficult to convey with pulses of vibration or may be inconvenient to provide via a display while swimming.

132. A POSITA would have had a reasonable expectation of success for the combination at least because microphones, earphones, and wireless transmission were well-known and widely-used long before the '998 Patent. For example, *Wadell*, published in early 2001, discloses wireless headphones and a microphone that “allow[s] the player to send and receive short voice messages.” *Wadell*, 20:4-9. Furthermore, the combination would have constituted combining known technologies like *Downey* and *MacIntosh*’s watch and *Burton*’s audio feedback system according to known techniques (wireless transmission, audio reproduction) to provide the predictable result of a system enabling coaches to provide audio feedback to swimming athletes. As wireless audio communications were disclosed as early as 2001 per *Wadell*, a POSITA would have the skillset of implementing the wireless audio disclosures provided by *Burton* in the year 2009, 8 years later. Doing so would have improved the desirability of the system as a training and teaching aid, leading to improved sales. By providing wireless audio capabilities, the *Downey*, *MacIntosh*, and *Burton* device would have allowed coaches to provide detailed, precise, and individualized instructions to their students, instead of generic training instructions.

**D. Claim 14**

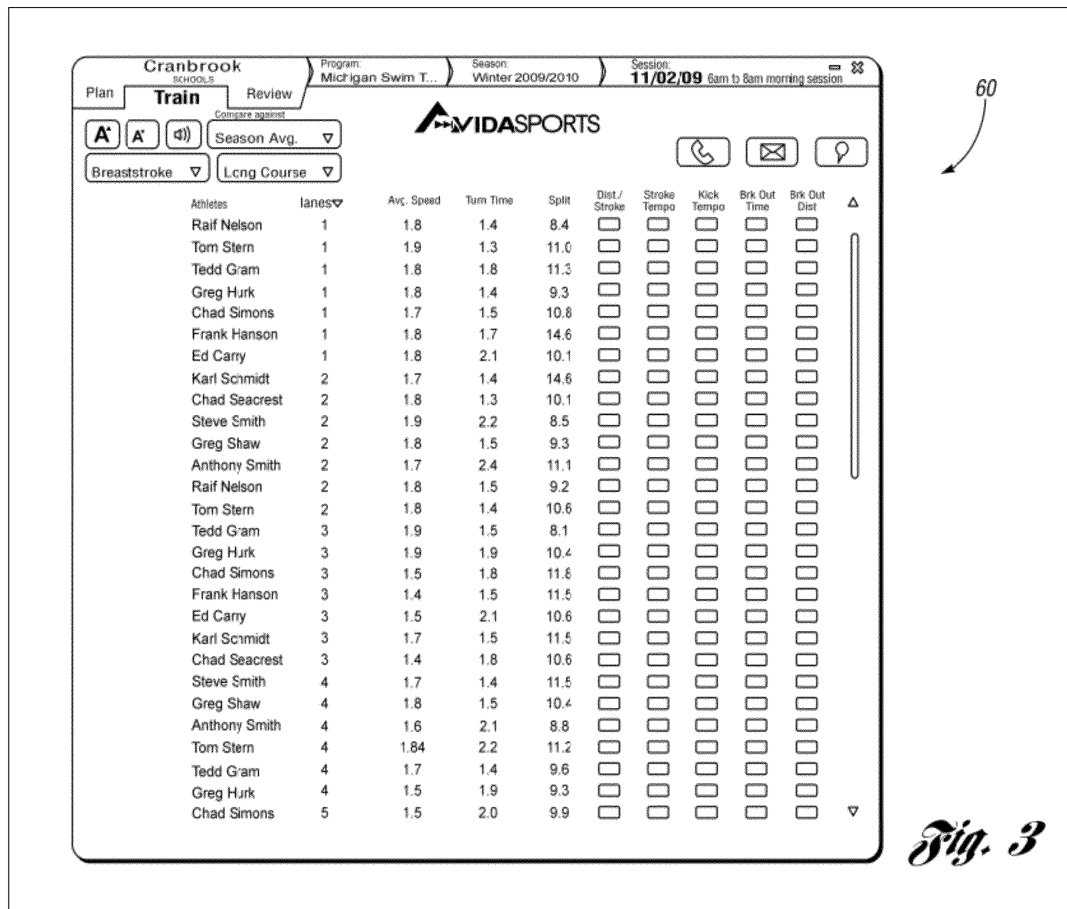
***A training advisor according to claim 12, constituting a part of a training system comprising a plurality of such training advisors for a corresponding plurality of trainees, and wherein said monitor is adapted to display to said user said data or information derived therefrom, relating to said plurality of trainees.***

133. *Downey* in view of *MacIntosh* and further in view of *Burton* teach this limitation. I note that *Burton's* Figure 3 shows "information collected from the swimmers, such as based on information collected from limb devices 62 attached to arms and legs of the swimmers (see FIG. 1)." *Burton*, 3:50-53, Figure 3; *Burton-Provisional*, 153-154, 186-187, 194-197; As disclosed by both *Burton* and *Burton-Provisional*, *Burton's* Figure 3 depicts numerical values of current performance swimmer statistics such as average speed. Indeed, *Burton's* system can "[r]ecognize each swimmer at each practice and associate his/her swimmer devices[.]" *Burton-Provisional*, 191. A POSITA would have understood that *Burton's* system collects data from multiple swimmers. This data is transmitted and displayed on the tablet computer as shown in Figure 3. As can be seen within *Burton's* Figure 3, there is a list of "Athletes" on the left most column with additional swimming related data in the right columns. It would have been obvious to a POSITA that to generate a list of performance metrics for multiple athletes, data has to be collected by at least one training advisor (swimmer device, sensing unit, watch device) per athlete.

134. As I have previously discussed, a graphical user interface 70 displays data of the swimmers. *See supra* claim 12(e). Here, *Burton* discloses that "FIG. 3

illustrates a display 60 of exemplary performance metrics that may be generated based at least in part on the coordinate values.” *Burton*, 3:47-49; *Burton-Provisional*, 135, 165, 186-187, 190-191, 194-197. *Burton-Provisional* discloses displaying performance metrics of a swimmer and even comparing the performance of multiple swimmers. *See Burton-Provisional*, 135 (describing that a swimmer’s performance can be compared to others).

135. Additionally, I believe that *Burton* provides disclosure regarding tracking multiple swimmers: “50 or 100 swimmers [to be] tracked at the same time.” *Burton*, 5:13-14; *Burton-Provisional*, 5, 190. Indeed, *Burton-Provisional* contemplates the “ability to track 100 swimmers in a pool” and provides swimming statistics “for each swimmer[.]” *Burton-Provisional*, 5, 190. I see that within *Burton*’s Figure 3, the graphical user interface displays to said user (a coach), said data or information derived from a plurality of swimmers. As discussed, the left most column contains a list of athlete names, which a POSITA would have understood to correspond to a plurality of trainees (e.g. swimmers).



Burton, Figure 3; *Burton-Provisional*, 135, 165, 190-191, 194-197; Figure 3 shows a plurality of swimmers and their corresponding swimming data. Further, the user interface includes a “live action” (real-time review) mode where “dynamic performance metrics” are displayed. *Burton-Provisional*, 196. A POSITA would have understood that due to these disclosures, the data represented by the display depicted in Figure 3 is obvious. In support of the obviousness of displaying this data, *Burton-Provisional* also states that the system should be capable of recognizing “each swimmer at each practice and associate his/her swimmer device[.]” *Burton-Provisional*, 191. Since both *Burton* and *Burton-Provisional* disclose displaying

swimmer metrics and tracking multiple swimmers, it is obvious to have the live action data screen of Figure 3, as contemplated, to display all the swimmer's metrics currently present at practice.

136. I conclude that the contemplated dynamic performance metrics consist of: “data transmitted from [sic] the limb devices 62 . . . sent in real-time and coordinated with the real-time calculation of the coordinate values to provide a real-time analysis of the swimmers actions, i.e., ***stroke rate, stroke style, speed, splits, etc.***” *Burton*, 3:56-60; *Burton-Provisional*, 205. *Burton-Provisional* supports this disclosure and states that metrics such as “stroke rate” and “speed” can be viewed for live events (in real-time) or for recorded events viewed at a later time. *Burton-Provisional*, 205.

137. The motivation to combine coach feedback functionality into *Downey's* modified device and reasonable expectation of success for this combination is provided above regarding claim 13 and incorporated herein by reference. That is, there is desire for providing feedback to multiple swimmers for the same reason as to a single swimmer. I advance that providing data for multiple swimmers increases the capability and thus, the desirability of the *Downey*, *MacIntosh*, and *Burton* system.

**E. Claim 15**

*A training advisor according to claim 14, wherein said monitor is adapted to display to said user said data or information derived therefrom, in a real-time activity of said plurality of trainees.*

138. *Supra* claim 14.

**F. Claim 16**

*A training advisor according to claim 14, wherein said computer further comprises an input unit to receive from its user the training instructions, the computer being adapted to simultaneously and wirelessly transfer said instructions directly or indirectly to each of said plurality of trainees.*

139. *Downey* in view of *Burton* and further in view of *MacIntosh* teach this limitation. *Supra* claim 13. I note that *Burton* discloses “[o]ne of the advantageous [sic] contemplated by the present invention relates to its ability to **provide real-time feedback** during practice and retrieval feedback at a later time, such as to support film study and review by the swimmer themselves.” *Burton*, 4:25-29 (emphasis added); *Burton-Provisional*, 154, 190-191, 194-197. A POSITA would have understood “real-time feedback” discloses simultaneously transferring instructions the swimmers while they are swimming, and thus transmitting instructions “directly or indirectly” to the plurality of trainees (swimmers).

140. *Burton* specifically discloses its system allows the “coach to voice communicate to a swimmer, small group, or **entire pool of swimmers[.]**” *Burton-Provisional*, 190 (emphasis added). Thus, a POSITA would have understood that instructions are wirelessly transferred to each of a plurality of swimmers. A POSITA

would have understood that in order to communicate with an entire pool of swimmers in real-time, the instructions will have to be transmitted to the entire pool of swimmers simultaneously. If the instructions were transmitted swimmer by swimmer, the instructions would no longer be real-time for at least the last swimmer. Furthermore, it would have been obvious to implement the pool wide communication with wireless capabilities, otherwise, all the swimmers would have to be awkwardly wired into a receiver. With at least the contemplated 50 swimmers *Burton's* system is capable of functioning with, a POSITA would have understood that wired connections would be overly burdensome, impractical, and unattractive to users, if not wholly impossible to implement.

141. The motivation to combine coach feedback functionality into *Downey's* modified device and the reasonable expectation of success for the combination is provided above regarding claim 13 and incorporated herein by reference. I briefly summarize that here, in that there would have been desire to provide feedback to multiple swimmers for the same reason as to a single swimmer. Communicating with multiple swimmers increases the capability and thus, the desirability of the *Downey*, *MacIntosh*, and *Burton* system.

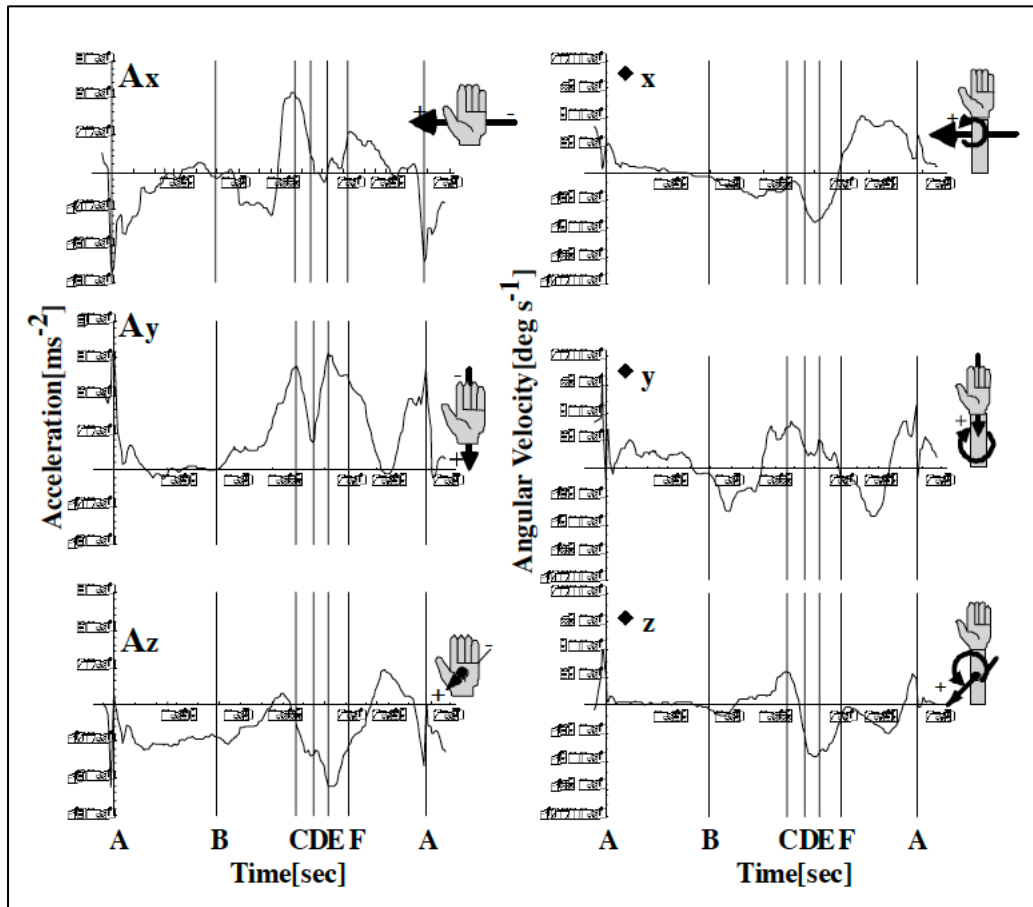
**XI. GROUND 4: OPINIONS REGARDING *DOWNEY*, *MACINTOSH*, *BURTON*, AND *OHGI***

142. I discuss how *Downey* in view of *MacIntosh* teaches the elements of claims 1-3 and 5-7, while *Downey* and *MacIntosh* in further view of *Burton* teach

the elements of claim 8. *See supra* claims 1-3, 5-7 (Ground 2), and claim 8 (Ground 3). In summary, *Downey* teaches a watch device used for monitoring swimming activities. *MacIntosh* is used to modify *Downey's* device to measure angular acceleration. *Burton* modifies the *Downey* and *MacIntosh* device to incorporate real-time communication with swimmers and the display of related swimming metrics. I emphasize that independent claims 1 and 8 each require “said data including at least the location and orientation of said body part for [e]ach of the measurements.” As discussed in Section III, it is ambiguous whether “each of the measurements” requires (1) the location and orientation of the body part to be calculated from *each* sensor or (2) the location and orientation to be calculated for *each* measurement taken by any of the sensors. *Downey+MacIntosh* and further in view of *Ohgi* teaches the second interpretation, where the location and orientation is calculated for every measurement taken by any of the sensors.

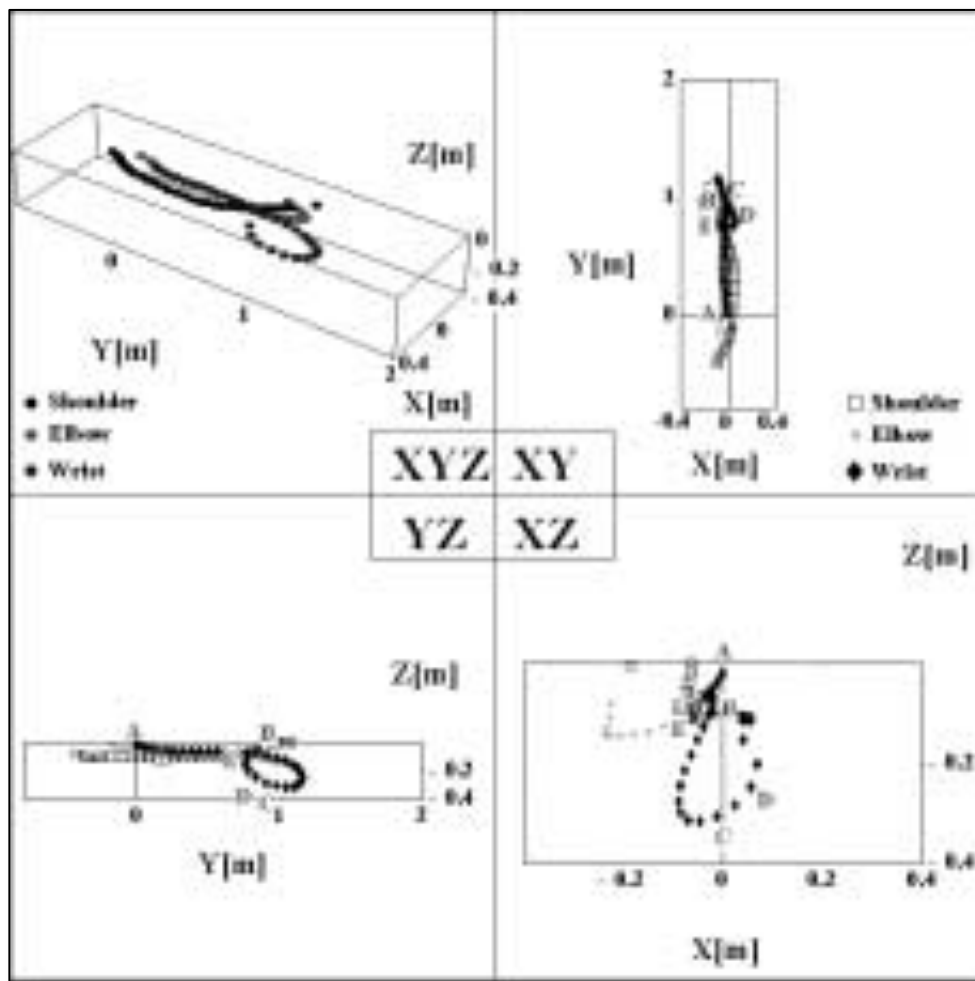
143. *Downey's* modified watch device, combining *MacIntosh's* accelerometers and gyroscope, is further modified by *Ohgi's* disclosure of processing a location and orientation from each measured sensor reading. Specifically, *Ohgi* discloses a methodology for processing collected data where a processor calculates location and orientation data from each of the measurements taken by a sensing unit. I emphasize that *Ohgi* discloses that “[t]he ***whole*** time series of the acceleration and the angular velocity were extracted ***as every single stroke***

*pattern* using stroke distinctive acceleration by our methodology[.]” *Ohgi*, 3 (emphasis added). *Ohgi*’s Figure 6 depicts the time series of the acceleration and angular velocity measured by the device in *Ohgi*.



*Ohgi*, Figure 6. The whole time series that collected is utilized to create the stroke path of the swimmer’s wrist as shown in Figure 7. As seen in the figures, the orientation of the swimmer’s arm is determined for *each* of the measurements taken in *Oghi*. A POSITA would have understood that while Figure 7 does not show orientation plotted, orientation would have been calculated along with the position of the swimmer to produce the stroke path shown. Indeed, *Ohgi*’s Figure 6 depicts

angular velocity plots on the right hand side. A POSITA would understand that, like the modified *Downey* device, angular velocity may be used to determine changes in orientation. Although, *Ohgi* discloses angular velocity instead of angular acceleration as measured by the *Downey* and *MacIntosh* device, a POSITA would have understood that angular velocity can still be used to measure changes to roll, pitch, and yaw. *Supra* claim 1(c).



*Ohgi*, Figure 7.

144. A POSITA would have understood *Ohgi* thus teaches that a whole time series of linear and angular velocity measurements may be taken and used to calculate location and orientation based on the data collected from a swimmer, providing a very high-accuracy model of the swimmer's movement that does not miss the change in location or orientation that may result from any sensed movement. Thus, the *Downey+MacIntosh* device described above further configured to operate in the detailed manner taught by *Oghi* teaches each of claims 1-3 and 5-8 under the strict interpretation of "each of the measurements."

### **1. Motivation to Modify the Combination with *Oghi***

145. A POSITA would have been motivated to combine *Ohgi* into the modified *Downey* device to increase tracking accuracy. In the event that *Downey's* watch device required increased location and orientation accuracy, but at a potential expense of power consumption, a POSITA would have look towards *Ohgi* and understood that higher levels of accuracy are achieved by processing every measured data point. By utilizing every captured data point, there is an increase in accuracy of the overall algorithm because there is less interpolation between data points. As with determining the equation of a line, a POSITA would have recognized that the more data points there are, the more accurate the resulting model of the swimmer's motion will be because the analysis has more information to work with. Thus, a POSITA

would have desired to utilize the high-accuracy *Oghi* approach when available power resources allowed.

146. A POSITA would have further understood that although using every measured data point for data calculations would improve the accuracy of the model, it would also negatively impact the power consumption of the wearable device. The additional data requires more processing power to process the extra data points. Although this tradeoff could deter a POSITA from making this combination, a POSITA would have understood that such calculations are needed in particular situations. For example, the increased data processing would occur when in an exercise tracking mode rather than when in use as a normal, everyday watch. In another possibility, a casual or amateur user might prefer the lower-power-consumption and lower accuracy mode, while a professional swimmer at the collegiate or international level might prefer the higher-power-consumption and higher accuracy mode of *Oghi*. Therefore, a POSITA would have found it obvious to use every sensor reading to measure location and orientation in instances where maximum accuracy is preferred, and battery life is less important. Furthermore, a POSITA would have been motivated to provide secondary modes within the modified *Downey* device. The addition of a more accurate mode would have provided the advantage of allowing the watch to act in different manners when preferences of athletes changed, and would have allowed the same watch to be sold

to athletes of various levels. It would prevent the user from having to remember to bring a separate and specific devices to the training event and to remember to keep it charged. Consumers would have desired an all-in-one device, leading to increased attractiveness for the modified system and thus increased sales of the device.

147. The combination of *Downey's* modified watch device with *Ohgi's* disclosure of processing *each* measured data point is a known technique to improve similar devices in the same way. All of the disclosed inventions are used to track the swimming stroke of a swimmer. Additionally, both *Downey* and *Ohgi* use devices worn on the wrist of a swimmer. *Compare Downey*, Abstract, 2:36-39, *with Ohgi*, 2 (both describing wrist mounted swim sensors for tracking arm movement). Additionally, a POSITA would have a reasonable expectation of success in making the modification. For example, all that would be required is for the existing, modified *Downey* device to process every data point it collects. *Downey* and *MacIntosh* already collect acceleration data and processes it into swimming related metrics. The combination with *Ohgi* would simply require the existing data processing software to process more often, a modification a POSITA would have had the skill to implement without undue experimentation.

**XII. GROUND 5: OPINIONS REGARDING DOWNEY AND  
MACINTOSH AND TAKAHASHI OR DOWNEY, MACINTOSH,  
BURTON, OHGI, AND TAKAHASHI**

**A. Claim 4**

*A device according to claim 1, further adapted for infrared measurement of the pulse and wherein said data includes the pulse of the trainee.*

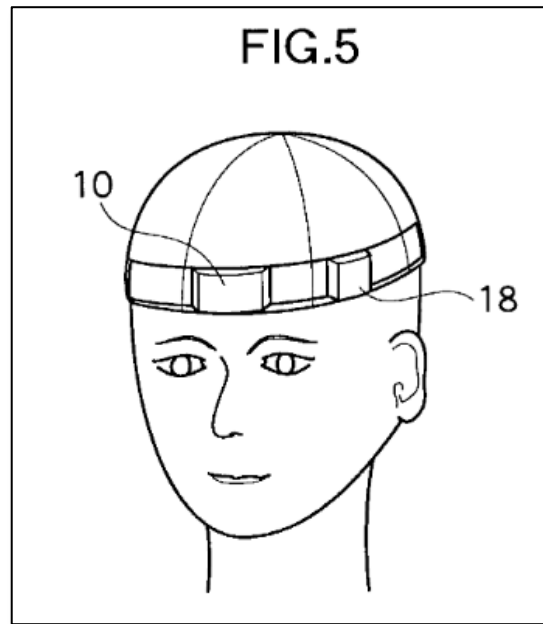
148. *Downey* in view of *MacIntosh* or, alternatively, *Downey* in view of *MacIntosh*, *Burton*, and *Ohgi* disclose the elements of claim 1. See Ground 2, Claim 1, and Ground 4.

149. *Downey* teaches that the watch device 100 may include a heart-rate monitor:

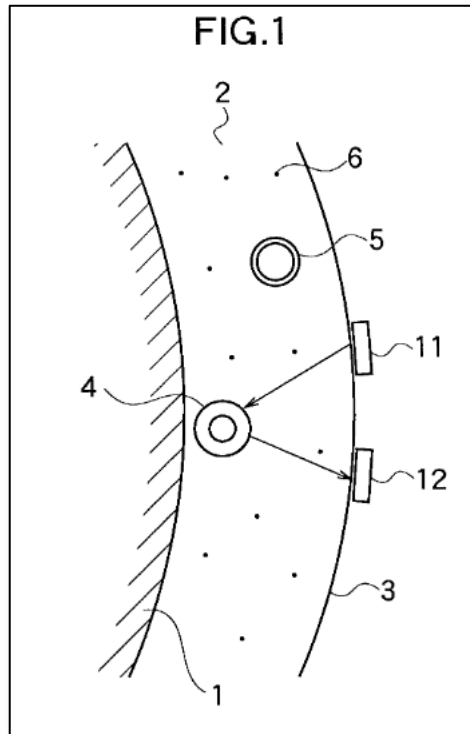
In some embodiments, the **watch device 100 may comprise or otherwise be coupled with a heart-rate monitor (HRM) 120**. The HRM 120 is operable to monitor the user's heart rate, **such as by employing one or more electrodes or other sensors to monitor electrical voltages in the user's heart or the flow of blood from the user's heart**.

*Downey*, 5:3-7 (emphasis added); see also 5:8-14, 7:45-52. *Downey* does not expressly contemplate an infrared based heart monitor. However, it contemplates using “other sensors” that monitor “the flow of blood from the user’s heart.” *Id.* Therefore, a POSITA would have understood that other common heart-rate monitors, such as the monitor of *Takahashi*, may be used instead.

150. *Takahashi* discloses a heart rate monitor 10 that “is integrated with, for example, a swimming cap to further reduce a burden on a subject person, for the heart rate measurement on the occasion of swimming.” *Takahashi*, [0095]. A transmitter 28 transmits a heart rate signal to a receiver. *Takahashi*, [0091].



*Takahashi*, [0095]. *Takahashi* describes a heart rate monitor 10 that includes “a light-emitting element 11 and a light-receiving element 12 ....” *Takahashi*, [0064]. The light-emitting element 11 is “preferably an **infrared** LED[.]” *Takahashi*, [0066] (emphasis added). *Takahashi*’s Figure 1 shows how infrared LED may detect heart rate:



*Takahashi*, Figure 1, [0090]-[0095]. Here, infrared light is produced by light-emitting element 11, reflected from artery 4 and received by light-receiving element 12 to detect the user's pulse. *Takahashi*, [0068]. Thus, like the sensor envisioned by *Downey*, *Takahashi's* sensor is able to monitor "the flow of blood from the user's heart" to measure the trainee's pulse, as claimed.

151. This combination takes *Takahashi's* infrared heart rate monitor 10 and implements it into the *Downey-MacIntosh* swim watch system, perhaps by being incorporated into a swim cap as already present in *Downey*. *Downey*, 4:48-5:2. Subsequently, the heart rate data is wirelessly transmitted to the modified *Downey* device as contemplated by *Downey*. *Downey*, 9:11-13.

## 1. Motivation to Combine

152. A POSITA would have been motivated and found it obvious to implement *Takahashi's* heart rate monitor into *Downey's* modified athletic training device coupled to a heads-up display. Indeed, *Downey's* heads-up display 118 “may be integrated in a swim cap[,]” further making the combination obvious to make, since *Takahashi's* heart rate monitor is also integrated into a swim cap. *Downey*, 4:54–5:2; *Takahashi*, [0095]. Additionally, *Takahashi* contemplates that the head is “the most stable spot in a human body during exercise” further motivating a POSITA to implement a heart rate monitor into a swim cap. *Takahashi*, [0058].

153. The modified watch system would have also benefited from more comfortable heart rate monitoring, as sensing heart rate from the wrist or from chest worn electrodes is cumbersome and must be secured so tightly as to cause strain to the user. *Takahashi*, [0007]. Moreover, *Downey* and *Takahashi* describe measuring heart rate during a physical activity, including swimming. *Compare Downey*, 5:3-17, *with Takahashi*, [0015]. Thus, a POSITA would have recognized the similarities between *Downey* and *Takahashi* and the ease of combining their disclosures.

154. These similarities in function and architecture would have led a POSITA to expect success in making the proposed combination. Specifically, *Downey*, *MacIntosh* and *Takahashi* all disclose heart rate monitors. *See Downey*, 5:3-17; *MacIntosh*, [0021]. Further, *Downey* provides architecture that would allow

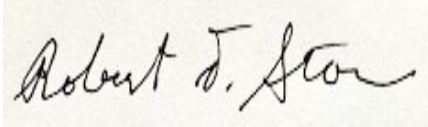
for *Takahashi's* disclosure of a swim cap heart rate monitor to be easily integrated. Specifically, *Downey* discloses a swim cap with an integrated heads-up display. *See Downey*, 4:54-55. Adding heart rate monitoring capabilities to a swim cap already capable of other advance functions would have been within the skillset of a POSITA, especially when heart rate monitoring has been contemplated by the *Downey*.

155. Thus, the purposed combinations are straightforward and would have been known and well within the capabilities of a POSITA at the time, further supporting a reasonable expectation of success in making the proposed combination. For example, *Downey* discloses that heart rate data can be wirelessly transmitted. *Downey*, 5:3-17. *Takahashi* similarly discloses data from the heart rate sensor being wirelessly transmitted. *See Takahashi*, [0076], Figure 5. This would have indicated to a POSITA that it would have been appropriate to configure *Downey's* heart rate monitor to operate as taught by *Takahashi* or substitute *Downey's* heart rate monitor for *Takahashi's*. Indeed, other forms of heart rate measurements techniques are contemplated by *Downey*, including external HRM devices. *Id.* *Takahashi's* infrared monitor would have advantageously improved the *Downey* system by being more reliable and less invasive than *Downey's* native sensor monitoring electrical voltages in the user's heart.

### **XIII. CONCLUSION**

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

Date: November 19, 2024

By:   
Dr. Robert T. Stone

**SUMMARY**

Dr. Stone has over thirty-eight years of academic and industry experience in the field of medical electronics systems and instrumentation. As Chief Executive Officer and founder of Medical Design Solutions, Inc, Dr. Stone is responsible for all phases of product development including concept definition, prototyping, design, evaluation, patenting and technology licensing. He is an experienced expert witness both as a background consultant and testimonial expert.

**Expertise**

|                                       |                                   |
|---------------------------------------|-----------------------------------|
| Carbon Monoxide Monitoring            | FDA Product Certification         |
| Doppler Ultrasound                    | Ultrasonic Imaging                |
| Analog Electronics                    | Telemetry (remote monitoring)     |
| Medical Electronics                   | Newborn Hearing Screening Devices |
| Portable Vascular Analysis Systems    | Pulse Oximetry                    |
| Pulse Oximetry Signal Processing      | Technology Licensing              |
| Invasive and non-invasive thermometry |                                   |

**PROFESSIONAL EXPERIENCE**

**2011 to Present      Medical Design Solutions, Inc**  
**Founder and CEO**

Responsible for virtually all phases of product development including concept definition, prototyping, design, evaluation, patenting, technology licensing, for various products directed at various markets.

**2008 to 2011      Tronics MedTech, Inc**  
**CTO**

Responsible for virtually all phases of product development including concept definition, prototyping, design, evaluation, patenting, technology licensing, for various products directed at various markets.

**2004 to 2008      MedTech Development, LLC**  
**Founder, CTO**

Responsible for virtually all phases of product development including concept definition, prototyping, design, evaluation, patenting, technology licensing, for various products directed at various markets.

**1997 to 2004**                      **Pacific Consultants, LLC**  
**Director of Medical Electronics**

Responsible for virtually all phases of product development including concept definition, prototyping, design, evaluation, patenting, technology licensing, for various products directed at various markets.

**1991 to 1996**                      **Natus Medical, Inc.**  
**Vice President Research & Development, Chief Technical Officer**

Responsible for all phases of new product development including concept definition, prototyping, design, clinical trials, FDA clearance, regulatory compliance including UL, CSA, CE listings, patenting and technology licensing for products directed at the pediatric hospital market. Responsibilities included contract negotiation, international distributor technical support, distributor evaluation and contract negotiations, Federal Research Grant proposal and management. Developed and patented broad patents for a new concept in breath analysis, covering design, embodiment, and a disposable element. Other achievements included:

- Conceived and guided the development of, and maintained the second generation of newborn hearing screening devices, a product that was the current backbone of the Natus product line. Worked extensively with researchers in refining and defining product specifications and performance parameters. Wrote and managed the FDA 510(k) clearance process during the peak of the FDA logjam in 1993-1994. The introduction of this product caused growth in sales to virtually double in the marketplace, and was a major factor in the company's pending profitability.
- Conceived the re-design of the company's first generation product to incorporate some of the major benefits of the second-generation product in a package, which allowed major expansion of the product market, both domestically and internationally.
- Invented a device, which can be used to diagnose the most significant contributing factor of the most common disorder present in newborns. Developed and obtained three patents covering the devices design plus a valuable disposable. Managed early clinical validation trials, expanded the concept to other applications, and executed a Federal Grant which demonstrated successfully the application of the patent to forensic breath alcohol analysis. Current plans to market this device are based upon pressing marketplace needs and the potential application in virtually every birthing center, pediatric clinic, and emergency in the developed countries.
- Obtained a license from the Medical Research Council of the UK to a new generation of auditory screening devices, and developed the technology into a device that is generating pressing demands upon the company for launch and distribution.

**1989 to 1991                      MedaSonics, Inc.**  
**Vice President Engineering**

Managed a group of 15 engineers, technicians, designers in the design and development of portable vascular analysis equipment designed for clinics, hospitals, and physicians offices. Coordinated the development of specifications, project planning, cost analysis and resource allocation for multiple simultaneous projects, evaluated new technological opportunities, negotiated technology licensing and consulting agreements, participated in company directors strategic planning. Wrote several patent disclosures. Took over an engineering department that was in great disarray, faced with an urgent need for products late for a closing market window, and key engineers were leaving in frustration. Completed the urgent projects in a timely fashion, helped develop a new direction for the corporation, and defined the product lines which could provide the needed growth and stability.

**1983 to 1989                      Nellcor, Inc.**  
**Manager, Electronic Research**

Performed general research and development of new products in the area of blood gas monitoring, oxygen saturation, carbon dioxide gas analysis, and cardiac output. Early prototype development, clinical validation, and presentation of results to corporate officers for development selection. Wrote several patent disclosures, some of which were filed and granted, and some of which were maintained as trade secrets. Contributed to several marked advances in pulse Oximetry signal processing (two US patents issued), and developed an Oximetry telemetry system. Two of the patents were vital to market growth of Pulse Oximetry. One of the patents allowed the positioning of the second-generation product in awake, agitated, or ambulatory patients. The second patent significantly improved the product performance during physiologic transients, and is currently in use in as many as 50% of the pulse Oximeters in the world. The Oximetry marketplace expanded from critical care facilities to step down wards and general wards with the introduction of the OXINET telemetry system that was a sole contributor definition, design, and development

**1981 to 1983                      Virginia Polytechnic Institute and State University**  
**Assistant Professor, Engineering**

Taught classes in system analysis, instrumentation, thermodynamics, and signal analysis. Developed and taught classes in microprocessor applications in instrumentation and control. Obtained research funding in analysis of control systems for nuclear reactors.

**1979 to 1981**

On sabbatical from Virginia Polytechnic Institute as a NSF Fellow at Stanford University to earn Ph.D.

**1971 to 1979                      Virginia Polytechnic Institute and State University**  
**Nuclear Reactor Supervisor**

Managed and maintained a research and teaching reactor which routinely performed neutron activation analysis as a research service to university, state, and industry laboratories. Scheduled, supervised, and assisted in performing all laboratory functions, participated in University Safety Committee and Reactor Safety Committee, directly interfaced with the Nuclear Regulatory Commission, assuring compliance with all nuclear device regulations, upgraded all reactor controls, shielding, and instrumentation to allow five-fold power increase for increased laboratory sensitivity. Performed these duties while studying continually for BSEE and MSEE degrees.

**1965 to 1971                      United States Navy**  
**Nuclear Reactor Operator, Electronics Technician & Engineering**  
**Watch Supervisor**

Highest rank achieved, Electronics Technician (Nuclear) First Class (E-6) Qualified in Officer position as Engineering watch supervisor/Engineering watch officer on the USS Bainbridge, DLG-N25. Spent two years as an instructor in nuclear theory and instrumentation at Schenectady New York Nuclear Power Prototype facility

**EDUCATION**

Ph.D., Electrical Engineering, Stanford University, 1981  
MSEE, with distinction, Virginia Polytechnic Institute and State University, 1979  
BSEE, Virginia Polytechnic Institute and State University, 1977

**LITIGATION RELATED EXPERIENCE**

Type of Matter: Patent Litigation; IPR  
Law Firm: Arnold & Porter  
Case Name: Lululemon Athletica vs Nike, Inc  
Date Filed: November 9, 2022  
Services provided: Expert Report; deposition  
Status: unknown

Type of Matter: Patent Infringement  
Law Firm: Stern, Kessler, Goldstein, & Fox PLLC  
Case Name: Willow Innovations vs Chiaro Technology

Date Filed: ?  
Services provided: background research, Expert Report  
Export report: Deposition Scheduled  
Status: ongoing

Type of Matter: Patent Infringement  
Law Firm: Stern, Kessler, Goldstein, & Fox PLLC  
Case Name: Boston Scientific vs. Nevro  
Date Filed: ?  
Services provided: background research, Expert Report  
Testified at Deposition: not yet scheduled  
Status: ongoing

Type of Matter: Patent Infringement  
Law Firm: Merchant and Gould  
Case Name: Masimo vs True Wearables  
Date Filed: ?  
Services provided: background research, Expert Report  
Testified at Deposition: 1 time testified at trial  
Status: decision against client on other matters.

Type of Matter: Patent Infringement  
Law Firm: Lathan & Watkins, LLP  
Date filed: ?  
Case Name: Itamar vs Ectosense  
Services Provided: background research, analysis  
Status: Ongoing

|                    |                                                                                                       |
|--------------------|-------------------------------------------------------------------------------------------------------|
| Type of Matter:    | Patent Infringement                                                                                   |
| Law Firm:          | <b>Merchant &amp; Gould, LLP</b>                                                                      |
| Case Name:         | Terumo v ?                                                                                            |
| Date Filed:        | ?/2018                                                                                                |
| Services Provided: | IPR proceedings on behalf of Terumo. Advised attorneys, interpreted technology, Writing expert report |
| Status:            | Settled                                                                                               |

|                 |                                          |
|-----------------|------------------------------------------|
| Type of Matter: | Patent Infringement                      |
| Law Firm:       | <b>Baker Hostetler, LLP</b>              |
| Case Name:      | Bracco Diagnostics vs Jubilant Draximage |
| Date Filed:     | 3/2018                                   |

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Services Provided: IPR proceedings on behalf of Jubilant, ITC hearing - testify  
Advised attorneys, interpreted technology, wrote expert report.  
Testified at deposition 3 times  
Testified before ITC

Status: IPR and ITC decisions on behalf of client.

Type of Matter: Patent Infringement  
Law Firm: **Cooley, LLP**  
Case Name: Beijing Choice v. Contec  
Date Filed: ?/2018  
Services Provided: IPR proceedings on behalf of Contec. Advised attorneys,  
interpreted technology, wrote expert reports. Testified at  
deposition 2 times

Type of Matter: IPR filing and patent infringement  
Status: Ongoing

Type of Matter: Patent Infringement  
Law Firm: **Latham & Watkins LLP**  
Case Name: Cardionet vs Infobionic  
Date Filed: 6/2015  
Services Provided: IPR proceedings on behalf of Infobionics. Advised attorneys,  
interpreted technology, wrote expert reports and declarations.  
Testified at deposition 1 time

Type of Matter: IPR filing and patent infringement  
Status: PTB find on behalf of client.  
Damages for Trade theft allegation arbitration – decision for client

Law Firm: K&L Gates, LLP; Morgan, Lewis, & Bokius LLP  
Case Name: INO Therapeutics v Praxair  
Date Filed: 8/2014  
Services Provided: IPR institution. Advised attorneys, interpreted technology, wrote  
expert reports and declarations. Testified at deposition 2 times.  
Testified at trial.

Type of Matter: Patent Infringement Lawsuit  
Status: Verdict on behalf of client.

Law Firm: **Finnegan, Henderson, Farabow, Garrett & Dunner, LLP**  
Case Name: **Syneron and Viora**  
Date Filed: ?  
Services Provided: Patent Infringement matter medical device for treatment of  
celluliteAdvised attorneys, interpreted technology, wrote expert  
reports and declarations. Deposed 1 time  
Status: Settled on behalf of client

Law Firm: Kirkland and Ellis, LLP  
Case Name: Medtronic Puerto Rico Operations Co. et al v. Animas Corporation, 2:12-cv-04471-RSWL-RZ (C.D. Cal.)  
Date Filed: 5/22/2012  
Services Provided: Patent Infringement matter involving remotely controlled insulin pump. Advised attorneys, interpreted technology, wrote expert reports and declarations. Testified at deposition  
Status: Settled on behalf of client

Type of Matter: Patent Infringement  
Law Firm: Kirkland and Ellis, LLP  
Case Name: Medtronic Minimed Inc. at al v. Insulet Corporation, 2:12-cv-08048-PA-CW (C.D. Cal.)  
Date Filed: 9/18/2012  
Services Provided: Patent Infringement matter involving remotely controlled insulin pump. Advised attorneys, interpreted technology, wrote expert reports and declarations. Deposed 1 time  
Status: Settled on behalf of client

Type of Matter: Whistleblower, Fraud  
Law Firm: Scott Bonagofsky, Atty at Law  
Case Name: United States et al v. Masimo Corporation, 2:10-cv-08169-CJC-VBK (C.D. Cal.)  
Date Filed: 10/29/2010  
Services provided: Advised Attorneys, analyzed technology, prepared expert report and declaration.  
Status: Resolved

Type of Matter: Patent Infringement  
Law Firm: Foley and Lardner, LLP  
Case Name: Masimo Corporation v. Mindray DS USA, Inc. et al, 8:12-cv-02206-CJC-JPR (C.D. Cal.)  
Date Filed: 12/21/2012  
Services Provided: Patent Infringement matter involving frequency domain signal processing of biological signals and Oximetry electronics on behalf of defendant. Advised attorneys, interpreted technology. Deposed once.

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|                    |                                                                                                                                                                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Status:            | settled                                                                                                                                                                                                                                                  |
| Type of Matter:    | Patent Infringement                                                                                                                                                                                                                                      |
| Law Firm:          | Mayer Brown LLP                                                                                                                                                                                                                                          |
| Case Name:         | Masimo Corporation v. Philips Electronics North America Corporation et al, 1:09-cv-00080-LPS-MPT (D. Del.)                                                                                                                                               |
| Date Filed:        | 2/3/2009                                                                                                                                                                                                                                                 |
| Services Provided: | Patent Infringement matter involving frequency domain signal processing of biological signals and Oximetry electronics on behalf of defendant. Advised attorneys, interpreted technology, wrote expert reports, testified at jury trial. Deposed 4 times |
| Status:            | Settled                                                                                                                                                                                                                                                  |
| Type of Matter:    | Patent Infringement                                                                                                                                                                                                                                      |
| Law Firm:          | Merchant and Gould, PC                                                                                                                                                                                                                                   |
| Case Name:         | Robert Bosch Healthcare Systems, Inc. v. CardioCom, LLC, 5:12-cv-03864-EJD (N.D. Cal.)                                                                                                                                                                   |
| Date Filed:        | 7/24/2012                                                                                                                                                                                                                                                |
| Services Provided: | Patent Infringement matter involving remote health monitoring systems. Prepared declarations for re-examination of patents<br>deposed ~ 4 times                                                                                                          |
| Status:            | Settled on behalf of client                                                                                                                                                                                                                              |
| Type of Matter:    | Patent Infringement                                                                                                                                                                                                                                      |
| Law Firm:          | Merchant and Gould, PC                                                                                                                                                                                                                                   |
| Case Name:         | My Health, Inc. et al v. CardioCom, LLC, 13-cv-00136-RSP (E.D. Tex.)                                                                                                                                                                                     |
| Date Filed:        | 2/15/2013                                                                                                                                                                                                                                                |
| Services Provided: | Patent Infringement matter involving remote health monitoring systems. Prepared declarations for re-examination of patents.<br>Deposed ~ 4 times                                                                                                         |
| Status:            | Settled on behalf of client                                                                                                                                                                                                                              |
| Type of Matter:    | Product Liability/Malpractice                                                                                                                                                                                                                            |
| Law Firm:          | MacDonald-Devin PC                                                                                                                                                                                                                                       |
| Case Name:         | Guinn et al v. Nonin Medical, Inc. et al, 3:11-cv-00230 (S.D. Tex.)                                                                                                                                                                                      |
| Date Filed:        | 5/16/2011                                                                                                                                                                                                                                                |
| Services Provided: | Opined on performance, design and operation of Pulse Oximeter,<br>wrote expert report                                                                                                                                                                    |
| Status:            | Settled                                                                                                                                                                                                                                                  |

**PUBLICATIONS**

HJ Vreman, LM Baxter, RT Stone, and DK Stevenson, "Evaluation of a fully automated end-tidal carbon monoxide instrument for breath analysis," Clin Chem, 1996 42: 50-56.

Robert T. Stone & Howard M. Berlin, "Design of VMOS Circuits with Experiments," Howard W. Sams Publications, 1980.

Robert T. Stone, "An Energy Discriminating Photon Counting Detector for Computed Tomography," Ph.D. thesis, Stanford University, 1981.

## **PATENTS**

| <u>Patent Number</u> | <u>Year Issued</u> | <u>Title</u>                                                                                                 |
|----------------------|--------------------|--------------------------------------------------------------------------------------------------------------|
| 8,292,800            | 2012               | Implantable Pump system                                                                                      |
| 6,694,157            | 2004               | Method and Apparatus for Determination of pH pCO <sub>2</sub> , Hemoglobin, and Hemoglobin Oxygen Saturation |
| 6,594,511            | 2003               | Method and Apparatus for Determining Physiological Characteristics                                           |
| 6,503,207            | 2003               | Multi-Mode Audiometric Device and Associated Screening Method                                                |
| 6,480,729            | 2002               | Method for Determining Blood Constituents                                                                    |
| 6,443,908            | 2002               | Method and Apparatus for In Vivo Measurement of Carbon Monoxide Production Rate                              |
| 6,368,289            | 2002               | Acoustic Coupling Device                                                                                     |
| 6,368,288            | 2002               | Acoustic Coupling Device                                                                                     |
| D444.237             | 2001               | Ear Coupler                                                                                                  |
| 5,913,309            | 1999               | Disposable Element for Use with a Hearing Screener                                                           |

|           |      |                                                                                                            |
|-----------|------|------------------------------------------------------------------------------------------------------------|
| 5,826,582 | 1998 | Ear Phone Assembly for Use with a Hearing Screener                                                         |
| RE35,122  | 1995 | Method and Apparatus for Detecting Optical Pulses                                                          |
| D0354808  | 1995 | End-Tidal Carbon Monoxide Monitor Filter                                                                   |
| 5,404,885 | 1995 | Filter Unit for End-Tidal Carbon Monoxide Monitor                                                          |
| 5,357,971 | 1994 | Filter Unit for End Tidal Carbon Monoxide Monitor                                                          |
| 5,293,875 | 1994 | In-Vivo Measurement of End-Tidal Carbon Monoxide Concentration Apparatus and Methods                       |
| 5,078,136 | 1992 | Method and Apparatus for Calculating Arterial Oxygen Saturation Based Plethysmographs Including Transients |
| 4,934,372 | 1990 | Method and Apparatus for Detecting Optical Pulses                                                          |
| 4,911,167 | 1990 | Method and Apparatus for Detecting Optical Pulses                                                          |
| 4,869,254 | 1989 | Method and Apparatus for Calculating Arterial Oxygen Saturation                                            |
| 4,869,254 | 1989 | Method and Apparatus for Calculating Arterial Oxygen Saturation                                            |

#### Published Applications

|   | PUB. APP. NO.               | Title                                                                                   |
|---|-----------------------------|-----------------------------------------------------------------------------------------|
| 1 | 20170303808 A1              | <a href="#">Capacitive Electrocardiography (ECG) Systems</a>                            |
| 2 | 20170303810 A1              | <a href="#">Capacitive Electrocardiography (ECG) Systems</a>                            |
| 3 | <a href="#">20110288436</a> | <a href="#">Materials and methods for insulating electronic components and services</a> |
| 4 | <a href="#">20110160609</a> | <a href="#">Method and system for monitoring pressure in a body cavity</a>              |

|    |                             |                                                                                                      |
|----|-----------------------------|------------------------------------------------------------------------------------------------------|
| 5  | <a href="#">20110160560</a> | <a href="#">Pressure sensor apparatus, system and method</a>                                         |
| 6  | <a href="#">20110144587</a> | <a href="#">Liquid agent delivery apparatus, system and method</a>                                   |
| 7  | <a href="#">20090312785</a> | <a href="#">Implantable Pump System</a>                                                              |
| 8  | <a href="#">20080275525</a> | <a href="#">Method and system for regulating respiration by means of simulated action potential</a>  |
| 9  | <a href="#">20080161875</a> | <a href="#">Gastric restriction method and system for treatment of eating disorders</a>              |
| 10 | <a href="#">20060287679</a> | <a href="#">Method and system to control respiration by means of confounding neuro-electrical s</a>  |
| 11 | <a href="#">20060173508</a> | <a href="#">Method and system for treatment of eating disorders by means of neuro-electrical co</a>  |
| 12 | <a href="#">20060111755</a> | <a href="#">Method and system to control respiration by means of neuro-electrical coded signals</a>  |
| 13 | <a href="#">20060064137</a> | <a href="#">Method and system to control respiration by means of simulated action potential sign</a> |
| 14 | <a href="#">20030208196</a> | <a href="#">Control system for limited-use device</a>                                                |
| 15 | <a href="#">20010049477</a> | <a href="#">Method and apparatus for in vivo measurement of carbon monoxide production rate</a>      |
| 16 | <a href="#">20010037059</a> | <a href="#">Method and apparatus for determining physiological characteristics</a>                   |
| 17 | <a href="#">20010037058</a> | <a href="#">Method for determining blood constituents</a>                                            |
| 18 | <a href="#">20010036277</a> | <a href="#">Audiometric apparatus and associated screening method</a>                                |
| 19 | <a href="#">20010034494</a> | <a href="#">Acoustic coupling device</a>                                                             |
| 20 | <a href="#">20010034493</a> | <a href="#">Multi-mode audiometric device and associated screening method</a>                        |
| 21 | <a href="#">20010034492</a> | <a href="#">Acoustic coupling device</a>                                                             |
| 22 | <a href="#">20010033220</a> | <a href="#">Security control method and system</a>                                                   |

#### Recent Patent Status

| TITLE                                                                                                                   | COUNT<br>RY | APP./PAT. NO.<br>PRIORITY/ISSU<br>E DATE | REFERENCE             | STATUS                                                                      |
|-------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------|-----------------------|-----------------------------------------------------------------------------|
| <i>Respiration Monitoring<br/>System and Method</i>                                                                     | USA         | <b>10,064,570</b><br><b>09.04.2018</b>   | MDS-02-010            | <b><i>Issued; 3.5 Year<br/>Maintenance Fee Due<br/>04 March 2022</i></b>    |
| <i>Respiration Monitoring<br/>System and Method</i>                                                                     | USA         | <b>10,314,517</b><br><b>06.11.2019</b>   | MDS-02-<br>010CON1    | <b><i>Issued; 3.5 Year<br/>Maintenance Fee Due<br/>10 December 2022</i></b> |
| <i>Wearable Monitoring<br/>System and Methods for<br/>Determining Respiratory<br/>and Sleep Disorders with<br/>Same</i> | USA         | 16/363,290<br>03.25.2019                 | MDS-02-<br>010C1/CIP1 | <b><i>Pending; Issue Fee<br/>Paid</i></b>                                   |

| TITLE                                                                                                   | COUNTRY | APP./PAT. NO.<br>PRIORITY/ISSUE DATE   | REFERENCE            | STATUS                                                                               |
|---------------------------------------------------------------------------------------------------------|---------|----------------------------------------|----------------------|--------------------------------------------------------------------------------------|
| <i>Wearable Monitoring System and Methods for Determining Respiratory and Sleep Disorders with Same</i> | USA     | <b>10,993,638</b><br><b>05.04.2021</b> | MDS-02-010C1/CIP2    | <b><i>Issued; 3.5 Year Maintenance Fee Due</i></b><br><b><u>04 November 2024</u></b> |
| <i>Wearable Physiological Monitoring System</i>                                                         | USA     | 16/419,358<br>05.22.2019               | MDS-02-010C1/CIP3    | Pending; <b><i>Issue Fee Paid</i></b>                                                |
| <i>Wearable Physiological Monitoring System</i>                                                         | USA     | 17/518,053<br>11.03.2021               | MDS-02-010C1/CIP3/C1 | Pending;                                                                             |
| <i>Wearable Physiological Monitoring System</i>                                                         | EC      | 20776824.3<br>10.13.2021               | MDS-03-010C1/CIP3/EC | Pending; Renewal due<br><b><u>March 20, 2022</u></b>                                 |
| <i>Wearable Physiological Monitoring System</i>                                                         | Canada  | 3,133,993<br>09.16.2021                | MDS-03-010C1/CIP3/CA | Pending; Renewal due<br><b><u>March 20, 2022</u></b>                                 |
| <i>Wearable Physiological Monitoring System</i>                                                         | Japan   | 2021-557317<br>09.24.2021              | MDS-03-010C1/CIP3/JP | Pending;                                                                             |

**PROFESSIONAL AFFILIATIONS & AWARDS**

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Elder for a Congregation of approximately 450 members

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Inactive member, SPIE

Inactive member American Nuclear Society

National Science Foundation Fellow

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