

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RESMED CORP.
Petitioner

v.

CLEVELAND MEDICAL DEVICES, INC.
Patent Owner

CASE PGR: 2024-00012
U.S. Patent No. 11,602,284
Issue Date: March 14, 2023
Title: Devices and Methods for Sleep Disorder Diagnosis and Treatment

DECLARATION OF JACOB SHARONY, Ph.D.

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I. INTRODUCTION

I, Jacob Sharony, declare as follows:

1. I have been retained as a technical expert for ResMed Corp. to provide technical assistance in analyzing U.S. Patent No. 11,602,284. I may refer to this patent as the '284 Patent or as the "Challenged Patent" in this Declaration. Additionally, I may refer to ResMed Corp. as simply "ResMed" or "Petitioner."

2. I am familiar with the technology at issue in the period prior to the earliest priority date that is claimed by the '284 Patent. In formulating my opinions, I have relied upon my knowledge, education, training, skill, and experience in the relevant art, as well as on the documents and information described below. I have also considered the viewpoint of a person of ordinary skill in the art ("POSITA"). I may review other materials throughout this proceeding, including any other documents or testimony that may emerge. Those materials may affect my opinions in this matter.

3. I have reviewed the '284 Patent, its prosecution history (application 17/825,266), and the prosecution of its parent applications (16/057,963, 13/440,116, 11/266,899). I have also reviewed the Exhibits cited in this Declaration. A full list of the documents that I have considered in forming these opinions appears in a subsequent section of this Declaration.

4. I have been asked to consider certain prior art and to provide in this Declaration my opinions related to the patentability of the claims recited in the Challenged Patent.

5. I am being compensated at my standard hourly rate of \$550 per hour. My compensation is not dependent on the outcome of the PGR and in no way affects the substance of my statements in this Declaration. I have no financial interest in or against ResMed, the Challenged Patent, or who I understand to be the Patent Owner, **Cleveland Medical Devices, Inc.**

6. I make this Declaration based on my own personal knowledge and, if called upon to testify, would testify competently to the matters contained herein.

7. This Declaration is a statement of my opinion on issues related to the patentability of claims 1-20 of the '284 Patent (the "challenged claims"). I reserve the right to supplement my opinions expressed in this Declaration to address any new information obtained in the course of this proceeding.

II. BACKGROUND & QUALIFICATIONS

8. Included as an **Appendix** to this Declaration is a copy of my *curriculum vitae*, which includes a detailed record of my professional qualifications, including a list of publications, awards and honors, and professional activities. Relevant highlights are summarized below.

9. I have over 35 years of experience working in data networks and mobile and wireless technologies, which has resulted in over 50 issued patents and numerous publications in scientific journals and conferences. I have also served on various government expert panels, including for the National Science Foundation and National Institutes of Health.

10. Since 2010, I have been an Adjunct Professor in Electrical Engineering at Columbia University, teaching graduate level courses on advanced wireless technologies including in the areas of wireless sensing and Auto ID technologies, mmWave communications, and applications for 5G wireless networks and systems. I have experience working with and analyzing physiological sensors, including but not limited to human activity sensors, heart rate and pulse sensors, and environmental sensors (e.g., proximity, temperature).

11. I received a Bachelor's Degree (1979) and Master's Degree (1984) in Electrical Engineering from Tel Aviv University. I have M.Phil. (1991) and Ph.D. (1993) Degrees in Electrical Engineering from Columbia University. I also have an MBA Degree (1989) from Tel Aviv University.

12. I have been involved with mobile and wireless networking technologies since the mid-1990s working as a researcher, developer and educator on wireless wide, local and personal area networks (WWAN, WLAN and WPAN), infrastructure and mobile devices. Over these two and a half decades I have

witnessed the change from voice-centric to data-centric networks, and have worked on enterprise mobility products and solutions as early as the late 1990s.

13. After obtaining my Ph.D., I led the advanced mobile networking group at BAE Systems, developing tactical mesh-based wireless network systems for the U.S. Department of Defense. I also conducted research and development in advanced mobile and wireless networks. My work resulted in several issued patents such as U.S. Patent No. 5,652,751 titled “Architecture for mobile radio networks with dynamically changing topology using virtual subnets,” and U.S. Patent No. 5,742,593 titled “On-line distributed TDMA/FDMA/CDMA link assignment in mobile radio networks with flexible directivity.”

14. From 1997 to 2005, I held various positions at Symbol Technologies (acquired by Motorola Solutions). While working at Motorola/Symbol I gained substantial experience in application-specific and data-capture mobile devices, and wireless networking and architecture solutions in several vertical applications, e.g., transportation and logistics, healthcare, warehousing, retail, and education, among others. As Senior Director, Research and Development, I initiated and led several research and development programs in wireless LAN technologies including mobile device management and security. As Senior Director, Technology Strategy and Development, I was responsible for the research and development of new mobile applications for delivering multimedia-rich content to mobile devices

connected over heterogeneous networks. That work resulted in several U.S. patents, including U.S. Patent Nos. 7,019,663 and 7,706,809 titled “RF tracking system and method,” U.S. Patent No. 7,778,649 titled “System and method for asset location in wireless networks,” and U.S. Patent No. 6,925,094 titled “System and method for wireless network channel management.”

15. In 2004, I founded Mobius Consulting, a consulting firm providing professional services in mobile wireless strategy, technologies, systems, and applications, including enterprise mobility, wireless communication networks, mobile embedded devices, device management, and mobile applications and services. In this capacity, I have worked with many companies in the mobile and wireless ecosystem including service providers and operators, equipment vendors, and semiconductor companies. Since founding Mobius Consulting, I have worked with many enterprises interested in deploying mobile and wireless solutions in order to become more productive, efficient, and cost effective. These solutions spanned numerous industry sectors and involved various mobile and wireless technologies including 3G/4G/5G Cellular, Wi-Fi, Bluetooth, ZigBee, and RFID. That work resulted in several U.S. patents, including U.S. Patent No. 9,014,702 titled “Location processing in small cells implementing multiple air interfaces,” U.S. Patent No. 9,088,923 titled “Small cells implementing multiple air

interfaces,” and U.S. Patent No. 10,080,177 titled “Unlicensed spectrum offload architecture for small-cell base stations.”

16. I worked for several years in the field of data capture devices, including digital images, and wireless communications. For example, I worked at Symbol Technologies, conducting research and development in data capture devices such as bar code imagers. Many of those devices used solid state image sensors, such as CMOS or CCD, which are particularly useful in capturing two-dimensional images in which machine readable code might be found. Such image sensors could be used as physiological sensors to sense changes in blood oxygen saturation or blood vessels volume and detect various vital signs. My involvement included reviewing illumination devices that project optical energy toward a surface, image capture devices such as those mentioned earlier in this paragraph, and communications systems like Bluetooth® and Wi-Fi which transmitted data from these data capture devices to physically separate devices such as mobile and wrist computers. For example, in logistics and warehousing applications we used a ring barcode scanner connected to a wrist computer via Bluetooth. The wrist computer was connected via Wi-Fi to the enterprise computing network.

III. LEGAL PRINCIPLES

A. A Person of Ordinary Skill in the Art (“POSITA”)

17. I understand that issues I address in this Declaration should be evaluated from the perspective of the person of ordinary skill in the art (“POSITA”). I understand that the POSITA is a hypothetical person. The POSITA is presumed to be one who uses conventional wisdom in the art, but also is hypothetically presumed to have knowledge of all related material references to the claimed invention. I am told that this hypothetical person is one who shows ordinary creativity in the application of the relevant scientific principles in the field but is not expected to be an innovator.

B. Burden of Proof

18. I understand from counsel that a post-grant review may be instituted if Petitioner shows that it is more likely than not that at least one claim of the challenged patent is unpatentable. I understand Petitioner bears the ultimate burden of proving that the challenged claims are unpatentable by a preponderance of the evidence.

19. I understand that preponderance of the evidence means that the evidence must establish that it is more likely than not that a challenged claim is unpatentable for lack of written description or enablement, or if the claims are indefinite, anticipated, or rendered obvious, as described further below. I am also

told that preponderance of the evidence means that there is a greater than 50% chance that the challenged claim is invalid.

C. The Written Descriptions Requirement

20. I am told that 35 U.S.C. §112(a) says: “The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.”

21. I understand that the term patent “specification” refers to the full application and the claims as originally filed in a provisional application or a U.S. non-provisional or PCT international application. The specification does not necessarily include patent claims that were filed in a later continuing application after the priority dates unless it is shown that the specification complies with the written description and enablement requirements for those continuation claims. I understand from counsel that a later filed patent claim is only supported by the written description of a patent specification if the specification reasonably conveys to the POSITA that the inventor had possession of the full scope of the claimed subject matter as of the filing date. I have been informed that this requirement is in

place to ensure that the claims do not overreach the scope of the inventor's contribution to the field of art as described in the patent specification.

22. I am also told that to establish that the inventors had possession of the claimed invention, the specification must describe the invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention. I understand that compliance with the written description requirement is essentially a fact-based inquiry that will depend on the nature of the invention.

23. I have also been told that under U.S. patent law, new matter cannot be introduced into a patent application after its asserted priority filing dates. This serves to prevent a patent applicant from adding information that goes beyond the subject matter originally filed. Therefore, if new claims are added that do not find clear support in the priority specification, then new matter has been added to the application.

24. I have also been informed that a patent application is entitled to the benefit of the filing date of an earlier filed application only if the disclosure of the earlier application provides support for the claims of the later application, as required by 35 U.S.C. § 112. Each application in the chain leading back to the earlier application must comply with the written description requirement of U.S.C. § 112.

25. I have also been informed that the test for adequate written description support requires an objective inquiry into the four corners of the specification from the perspective of a person of ordinary skill in the art. Based on that inquiry, the specification must describe an invention understandable to that skilled artisan and show that the inventor actually invented the invention claimed.

26. I have also been informed that it is not enough to show that the written description would render the claimed invention obvious. I have further been informed that it is also not enough to point to disjointed language in the written description that separately covers each limitation. I have been informed that the test is not about the presence or absence of literal support in the specification for the claim language, but rather whether the specification conveys possession of the complete and final invention with all of its claimed limitations.

27. I have further been informed that claims that lack written description support are invalid. Moreover, dependent claims that depend on an independent claim that is invalid for lack of written description are consequently also invalid.

D. The Enablement Requirement

28. I have also been informed by counsel that the enablement requirement of 35 U.S.C. §112(a) mandates that the specification of a patent must teach the POSITA how to make and use the full scope of the claimed subject matter without undue experimentation. I understand that whether experimentation is undue is a

conclusion reached by weighing many factual considerations, including (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claims. I understand that these factors are illustrative and not mandatory, and that some factors may be more important than others depending on the circumstances.

29. I have further been informed that claims that lack enablement are invalid. Moreover, dependent claims that depend on an independent claim that is invalid for enablement are consequently also invalid.

E. Obviousness

30. I have been told that the concept of obviousness under 35 U.S.C. §103 involves four factual inquiries: (1) the scope and content of the prior art; (2) the difference between the claimed invention and the prior art; (3) the level of ordinary skill in the art; and (4) secondary considerations, which I understand are also known as objective indicia of nonobviousness.

31. I have also been informed that when there is some recognized reason to solve a problem, and there are a finite number of identified, predictable, known solutions, a POSITA is motivated to pursue the known options within his or her technical grasp. If this approach leads to the expected success, it is likely the

product of ordinary skill and common sense rather than the product of innovation.

Where a patent simply arranges known elements, with each element performing its known function and the whole yielding no more than would be expected, the combination is obvious. I understand that in assessing obviousness that I should guard against hindsight bias that infers from the inventor's success in making the invention that the invention was obvious.

32. I understand that secondary indicia of non-obviousness may include (1) a long felt but unmet need in the prior art that was satisfied by the invention of the patent; (2) commercial success of processes covered by the patent; (3) unexpected results achieved by the invention; (4) praise of the invention by others skilled in the art; (5) taking of licenses under the patent by others; (6) deliberate copying of the invention; (7) failure of others to find a solution to the long felt need; and (8) skepticism by experts. I also understand that there must be a nexus between any such secondary considerations and the invention.

F. Claim Construction

33. I understand that the words of a claim are generally given their ordinary and customary meaning, which is the meaning that the term would have to a POSITA at the time of the invention. I understand the POSITA is deemed to read the claim term not only in the context of the particular claim in which the term

appears, but in the context of the entire patent, including the patent's specification, which includes the definitions, structures, examples, data and figures.

34. I understand claim construction focuses on the “intrinsic evidence,” which consists of the claims themselves, the specification, and if necessary, the patent prosecution history.

35. I understand that “extrinsic evidence” may also be considered when determining the meaning of a claim. I understand there are different sources of extrinsic evidence, including publications, dictionaries, inventor testimony, expert testimony, and learned treatises. I understand that intrinsic evidence is generally favored over extrinsic evidence, and that extrinsic evidence may not be used to contradict the meaning of the claim when read light of the intrinsic evidence.

36. I understand that an “independent claim” sets out the broadest scope of the claimed invention. I understand that a “dependent claim” is narrower than the claim from which it depends. A dependent claim includes each and every limitation of the claim and one or more additional limitations which narrow the scope of the claim. A dependent claim can be dependent on either an independent claim or another dependent claim.

IV. INFORMATION CONSIDERED

37. In forming my opinions, I have considered, in addition to my knowledge and experience, the documents and materials listed below. Additional documents might be referenced in the body of this Declaration.

Exhibit No.	Description
EX1001	U.S. Patent No. 11,602,284
EX1002	File History of U.S. Patent No. 11,602,284
EX1004	File History of U.S. Patent No. 8,172,766
EX1005	File History of U.S. Patent No. 10,076,269
EX1006	File History of U.S. Patent No. 11,375,921
EX1007	U.S. Patent No. 6,167,258 (“Schmidt”)
EX1008	U.S. Patent No. 8,172,766
EX1009	U.S. Patent Application Publication 2016/0193437 (“Bao”)
EX1010	U.S. Patent Application Publication 2018/0199882 (“Klee”)
EX1011	WO 2021/152526 (“Shouldice”)
EX1012	U.S. Patent Application Publication 2007/0161913 (“Farrell”)
EX1013	U.S. Patent Application Publication 2007/0155208 (“Pirzada”)
EX1014	USPTO’s June 2022 Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation.
EX1015	U.S. Patent No. 5,424,942 (“Dong”)
EX1016	Roux et al., <i>Continuous positive airway pressure: new generations</i> , Clinics in Chest Medicine, Vol. 24 (2003), pp.315-342
EX1017	US 5,704,345 (“Berthon-Jones”)
EX1018	US 6,644,311 (“Truitt”)
EX1019	U.S. 2004/0129838 (“Lisy”)
EX1020	Declaration of Dr. Alan R. Schwartz

EX1021	Memorandum Opinion re: Claim Construction, <i>Cleveland Med. Devices, Inc., v. ResMed Inc.</i> , C.A. No. 22-794-GBW, D.I. 181 (October 30, 2023 D. Del.)
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V. OVERVIEW OF THE '284 PATENT

A. Summary of the '284 Patent Specification

38. The '284 patent claims a positive airway pressure (PAP) sleep disorder treatment system that determines the severity of a patient's sleep disorder and transmits certain data amongst a PAP device, a cell phone, and a remote internet site. The patent owner acknowledged that prior art PAP devices already adjusted pressure through sensors built into the device that treats sleeping disorders. EX1001, 2:25-34.

39. The '284 patent acknowledges that "the most common method of treating the sleeping disorder of sleep apnea is by apply[ing] a continuous positive gas pressure to the patient's airway, which has the effect of forcing the patient to breath[e] through application of the pressure. More advanced, but still very basic *devices have been developed that adjust this continuous positive gas pressure through sensors built into the device* for creating the positive gas pressure, *which measure gas flow through the device.*" EX1001, 2:25-34 (emphasis added).

40. Despite the patent owner's acknowledgement that prior art CPAP devices already used feedback sensors to adjust their operation, the '284 patent

purports to provide an inventive “integrated apnea diagnosis and treatment device” and a “method of sleep diagnosis and treatment” (EX1001, 1:27-31) where “an object of the present invention [is] to provide a system and method of treatment, which analyzes a subject’s sleeping disorder or symptoms and adjusts a treatment device based, in part, on this analysis.” EX1001, 2:46-49. Among the calculations the ’284 patent purportedly claims as its invention are an *unspecified* “index of treatment efficacy of the subject using a PAP device” that is based on “data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject,” “both related to the subject's treatment and the treatment's efficacy.” *See* challenged Claim 1.

1. The ’284 Patent Copies a Previous Patent’s Description of Prior Art Sensors, Wireless Signal Processing Unit, and Wireless Base Station.

41. Upon my review of the ’284 Patent and another patent provided by counsel, U.S. 6,167,258, it is apparent that ten columns of the ’284 patent’s specification – from 9:1 to 18:60 – copy the entire Detailed Description of U.S. 6,167,258 (Schmidt) (EX1007). Schmidt further appears to share a common inventor with the ’284 Patent (Robert Schmidt). The ’284 patent also copies all of Schmidt’s Figures 1-6. Of the remaining two figures, Figures 7 and 8, Figure 7 of the ’284 patent depicts a “conventional pressure support system” (22:53-62)

leaving only Figure 8 to depict purportedly new subject matter over the Schmidt reference.

42. Schmidt disclosed a wireless physiological data acquisition system that gathers patient data. EX1007, 4:7-22. As in the '284 patent, Schmidt's SpO₂ sensor, PO₂ sensor (partial pressure of oxygen dissolved in blood), PCO₂ sensor (partial pressure of CO₂ in blood), "air flow" sensor, respiration sensor, and others supply data to signal processing module 16 for conditioning and processing by its "module microcontroller [which dynamically] adapts the signal processing module in response to variation in the range, character and type of the physiological signal such that the adaptation occurs during signal processing module operation." *See* EX1007, 4:7-22; 14:40-54; EX1001, 18:46-60. The processing module 16 wirelessly transmits data to base station 40 via bidirectional transceivers (EX1007, 5:32-38; Fig. 1), as in the '284 patent (EX1001, 9:37-45).

43. Schmidt's invention was designed to "be adapted for different applications by software programming" (EX1007, 1:15-20) including a "biomedical environment" (EX1007, 8:32-33; 6:28-35) and, in fact, as a "universal platform design [that] can be utilized for all applications." EX1007, 6:40-41; 7:16-20.

2. The Purported Invention Uses Known Treatment Devices

44. The '284 patent does not purport to disclose a new sleep disorder treatment device. Instead, “[t]he treatment device can be any device known to those skilled in the art. The treatment device can either physically or chemically treat the subject’s sleeping disorder. An example of physically treating the subject’s sleeping disorder would be a device to provide positive airway pressure to a subject.” EX1001, 3:56-61; *see also* 4:6-12 (“a continuous positive airway pressure (CPAP) device [is] for treating the subject’s sleep apnea”); 2:25-29 (aka “continuous positive gas pressure” devices). A “conventional” CPAP device 310 (Figure 7) is acknowledged as including “a pressure generator 312, a blower, a piston or bellows, that receives a supply of gas from a gas source, such as ambient atmosphere ... or pressurized gas tanks ... [and] a flexible conduit [that] delivers the elevated pressure breathing gas to the airway of the subject.” EX1001, 22:55-64.

45. The '284 patent further acknowledges that “[p]hysical and chemical methods to treat sleeping disorders *are known to those skilled in the art.* ... Physical methods to therapeutically treat sleeping disorders and symptoms of these disorders include [CPAP], electrical stimulation of the muscles and nerves, and the like.” EX1001, 22:21-31 (emphasis added).

3. The Purported Invention Uses Known Sensor(s)

46. The '284 patent also did not invent a new type of sensor. "Sensors which can be used are known to those skilled in the art." EX1001, 6:21-22. "The diagnostic part of the system of device can use various sensors for measuring the subject's brain wave signals, respirations and the like. ... Sensors for measuring the subject's respirations or oxygen levels include sensors to measure airflow, respiratory effort, oxygenation and ventilation, and the like." EX1001, 3:17-23.

4. The Purported Invention Uses Known Data Analysis Algorithms

47. The '284 patent relies on data analysis algorithms that were known in the art. "Various algorithms known to those skilled in the art are used to filter out noise from the signal or data, and to then quantify the level of severity of the subject's sleeping disorder or symptoms." EX1001, 20:11-14. "Various sleeping disorders have symptoms that can be predicted based on various combinations of physiological signals or data. Various embodiments of the present invention include the approach to identifying these symptoms prior to onset by identifying various characteristic shifts in the power spectrum of the sensors being used to monitor these physiological conditions." EX1001, 20:19-25. The purported invention "would also include other on-line signal processing algorithms known to those skill in the art, such as wavelet analysis...." EX1001, 20:36-41.

5. The '284 Patent Copies a Previous Patent's Description of a "Prior Art" "Conventional" PAP System

48. The '284 patent's Figure 7 and corresponding description (22:49-23:25) are copied from U.S. 6,644,311 (Truitt) at Figure 1 (labeled "Prior Art") and "Background of the Invention" at 1:45-2:10. EX1018. Figure 7 of the '284 patent depicts a "conventional pressure support system" (22:53-62), leaving only Figure 8 to depict purportedly new subject matter. Despite the '284 patent's assertion that Figure 7 is a "device of the present invention," the description of a flow sensor internal to a PAP device and using information from a flow sensor to control or monitor usage were copied, without citation, from Truitt's description of prior art. Compare EX1001, 23:15-25 with EX1018, 1:45-2:10.

B. The '284 Patent's Prosecution History

49. The '284 patent was filed as the '266 application on May 26, 2022, as a continuation of the '963 application filed August 8, 2018, now U.S. 11,375,921. EX1001, cover page (63). The '963 application is a continuation of the '116 application filed on April 5, 2012, now U.S. 10,076,269, which is a continuation of the '899 application filed on November 4, 2005, now U.S. 8,172,766. EX1001, cover page (63).

50. Claim 1 initially broadly recited a "sleeping disorder treatment system" comprising:

- “a first device for diagnosing and creating a quantitative output of a level of severity of a subject's sleeping disorder or symptoms;” and
- “a second device for physically or chemically treating a subject’s sleeping disorder or symptoms, which can be adjusted using in part the output of the level of severity of the subject’s sleeping disorder.”

EX1004, 295; EX1002, 235.

51. Over the course of 17+ years of patent prosecution of the family applications, Claim 1 became a “positive airway pressure (PAP) sleep disorder treatment system” comprising, among other things:

- “first software executable by a first processor and configured to be used with a cell phone to display . . . an index of treatment efficacy of the subject using a PAP device . . . on the cell phone,”
- “an index of treatment efficacy . . . based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject,”
- a PAP device calculating both “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject,”
- a PAP device comprising “a second processor adapted for receiving the airflow sensor data [an airflow sensor internal to the PAP device],

for calculating the data of a severity of the symptoms of the subject and/or the index, and for calculating the data of usage of the PAP device;” and

- a “remote internet site adapted to receive the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject.”

EX1001, Claim 1.

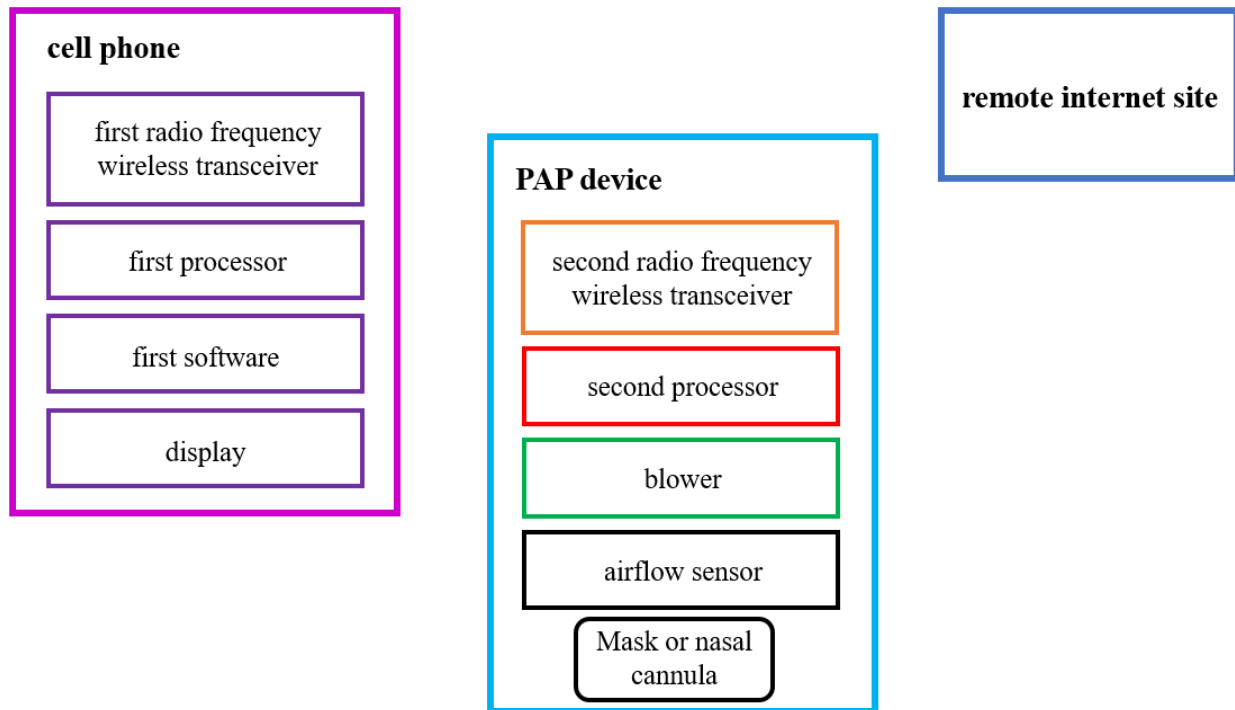
52. At no point, however, did the Applicant indicate support for any claim amendment, particularly during the prosecution of the '266 application, which issued as the '284 patent. *See, e.g.*, EX1002, 67, 107, 172; EX1004, 35, 95, 155, 202; EX1005, 105, 186, 247, 300, 370, 478; EX1006, 181, 229. In my opinion, this is significant because many limitations of independent Claim 1 lack written description support and are not enabled. *See infra* Sections V.C, VIII.A and VIII.B.

53. In addition, during the prosecution of the '266 application, the Applicant overcame an obviousness rejection of most of the pending claims, including the claim that issued as Claim 1, over the combination of Farrell (EX1012) and Pirzada (EX1013) by alleging that Pirzada was not prior art. EX1002, 67 (“The Examiner agreed that Pirzada is not a valid “prior art” reference against the presently claimed invention.”). But this argument was made with respect to the alleged priority date of November 4, 2005. EX1002, 67. As noted

below, in my opinion, the '284 patent is not entitled to this priority date. *See infra* Section V.D. Thus, the Examiner erred by disqualifying Pirzada as prior art and then allowing the '284 patent over the combination of Farrell and Pirzada.

C. Summary of Independent Claim 1

54. None of the figures in the '284 patent illustrate the single independent claim of the '284 patent, therefore I have prepared the below block diagram to assist in explaining my opinions set forth herein.



55. As illustrated above, independent claim 1 recites three primary components: a cell phone, a PAP device, and a remote internet site. This illustration does not connect these three components together because claim 1 does not clearly specify both the “from” and “to” aspects of the path of any particular

data amongst the three components. From the claim 1 language, it may be implied that the PAP device calculates, generates and transmits the data of severity and usage data and the cell phone and/or remote internet site receive them. For example, in limitation 1g, the “remote internet site [is] adapted to receive” the data generated by the PAP device and in limitation 1a reciting that the cell phone displays data calculated by the PAP device (“calculated by the PAP and received by the cell phone”). Thus, claim 1 suggests that data flows from the PAP device to the cell phone, and from the PAP device to the internet site.

56. However, it is my opinion that the communications paths are not clearly stated in the claims or in the patent specification. For example, it could be that the data flowing to the remote internet site comes from (relayed by) the cell phone, i.e., PAP device—>cell phone (as a relay) —> remote internet site. Alternatively, PAP device—>cell phone (as a relay) —> remote internet site —> cell phone (for displaying the information). In this last example, the cell phone displays the information after relaying the data to the remote internet site and then receiving the information from the remote internet site. That is, the cell phone does not receive the displayed information directly from the PAP device. Several possible scenarios can be supported, see, e.g., dependent claims 14, 16.

D. The Challenged Claims Have a Priority Date No Earlier Than May 26, 2022

57. The challenged claims are not entitled to the 2005 priority date alleged by the patent owner during the prosecution of the '266 application that issued as the '284 patent. Specifically, the challenged claims each include several limitations that were first introduced during the prosecution of the '266 application, 17 years after the filing of the initial '899 priority application. Some of these limitations include:

- “an index of treatment efficacy of the subject using a PAP device, ... the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject;”
- “the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject both related to the subject’s treatment and the treatment's efficacy;”
- “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone;” and
- “software ... configured to be used with a cell phone to display to a subject for viewing on the cell phone ... an index of treatment

efficacy of the subject using a PAP device, the first software used for displaying the index on the cell phone” as required by Claim 1.

I note that the Applicant did not make a statement or provide any evidence of how the specification of the '266 application or any of the priority applications supported this new claim language. *See, e.g.*, EX1002, 67, 107, 172.

58. Moreover, none of the above limitations appear in the '284 patent's specification. Significantly, none of the above limitations appear in any of the priority applications, whose specifications are almost identical to the '284 patent's specification. In my opinion, and as confirmed by Dr. Schwartz, a POSITA, reading the written description of each priority application, would not have understood that the inventor had invented or had actual possession of the newly claimed subject matter. EX1020, ¶¶41-60. Instead, a POSITA, reading the written description of each priority application, would have understood that the inventor had not invented nor had actual possession of the newly claimed subject matter. EX1020, ¶¶41-60. As such, *each* priority application fails to provide proper written description support for at least the above limitations of the challenged claims. EX1020, ¶¶41-60.

59. Thus, based on my understanding from counsel, because each of the priority applications lack written description support for the challenged claims, there cannot be a continuous chain of copending applications each of which

satisfies the requirements of § 112 with respect to the subject matter presently claimed. As such, based on my understanding from counsel, the challenged claims are not entitled to a priority date of any of the prior applications in the chain. Instead, the correct priority date of the challenged claims can therefore be no earlier than the date in which the '266 application was filed – May 26, 2022. EX1001, cover page (22).

VI. PERSON OF ORDINARY SKILL IN THE ART (POSITA)

60. In my opinion, a POSITA would have had a bachelor's degree in mechanical engineering, electrical engineering, computer science or an equivalent field and two years of industry experience working with diagnostic sensor systems and networked data systems, where an increase in experience could compensate for less education, and vice-versa.

VII. CLAIM CONSTRUCTION

61. I do not believe any claim term needs formal construction for purposes of evaluating the prior art in this Petition, but I reserve the right to propose formal constructions in other forums where disputed issues may differ, or in response to patent owner's arguments in this proceeding.

VIII. HOW THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-20 are not Supported by the Written Description

62. In my opinion, challenged claims 1-20 lack written description support for the reasons explained below.

1. “index of treatment efficacy”

63. I have reviewed the declaration of Dr. Alan R. Schwartz and his opinions on this claim language. EX1020, ¶¶41-49, 57-60. I agree with Dr. Schwartz’s conclusions that the ’284 patent lacks adequate written description support to support the “index of treatment efficacy” term.

2. “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device,”

64. This limitation was added to then pending Claim 21 in the September 20, 2022 Amendment. EX1002, 102-103. Prior to this amendment, Claim 21 was newly added to the ’266 application via the June 10, 2022 Preliminary Amendment and merely recited “an index based in part on a data of severity of symptom data and data of usage related to a subject’s treatment efficacy with the PAP device calculated by and received from a PAP device on a cell phone.” EX1002, 168. The Applicant when submitting the June 10, 2022 Preliminary Amendment and the subsequent September 20, 2022 Amendment did not provide statements informing the Patent Office where support for these new claim limitations could be found in

the '266 application or its priority applications. In my opinion, no such support exists.

65. The term “data of usage” does not appear in the '284 patent's specification, nor is there a disclosure of a PAP device calculating the data of usage. Instead, the lone reference to “usage” appears in a catch all statement on how “information from the flow sensor 320 and/or pressure sensor 322 is used, for example, to control the pressure or flow of gas provided to the subject, monitor the condition of the subject, *monitor the usage of the pressure support device*, any combination thereof, or the like.” EX1001, 23:20-25. This single statement provides no suggestion that this usage be displayed, used in any calculation, or otherwise be combined with any other data collected from the PAP device. Indeed, there is simply no disclosure or suggestion of “calculating” “data of usage” by the PAP device or any device for that matter. That correlation is simply not disclosed or contemplated by the '284 patent's specification.

66. As such, in my opinion, a POSITA would not have understood from the specification that the applicant actually invented, or “possessed,” any claim limitation reciting that “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device.”

67. Thus, in my opinion, Claim 1 is invalid for the additional reason that the “data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone” is not supported by the written description of the ’284 patent. Dependent Claims 2-20 are invalid for at least the same reasons.

3. **“non-transitory computer readable medium comprising a first software executable by a first processor and configured to be used with a cell phone to display to a subject for viewing on the cell phone on to which the first software is downloaded an index of treatment efficacy of the subject using a PAP device....” (Claim 1)**

68. This limitation was added to then pending Claim 21 in the September 20, 2022 Amendment. EX1002, 102-103. Prior to this amendment, Claim 21 was newly added to the ’266 application via the June 10, 2022 Preliminary Amendment and merely recited “software configured to be used with and to display to the subject for viewing an index based in part on a data of severity of symptom data and data of usage related to a subject’s treatment efficacy with the PAP device calculated by and received from a PAP device on a cell phone.” EX1002, 168. The Applicant when submitting the June 10, 2022 Preliminary Amendment and the subsequent September 20, 2022 Amendment did not provide statements informing the Patent Office where support for these new claim limitations could be found in

the '266 application or its priority applications. In my opinion, no such support exists.

69. The '284 patent simply does not identify, describe or refer to any software “configured to be used with” or “downloaded” on a cell phone, let alone any software “to display to a subject for viewing on the cell phone ... an index of treatment efficacy of the subject using a PAP device.” The instances where software is described in the '284 patent relate to software on the signal processing module 16 or the computer used to program the signal processing module 16 or base station 40. *See, e.g.*, EX1001, 9:23-26; 12:22-25; 19:5. As a side note, it is my opinion that Claim 1 and the '284 patent’s specification both fail to identify which component (i.e., PAP device, cell phone, or remote internet site) calculates the index of treatment efficacy. It could be the cell phone, the PAP device itself or the remote internet site.

70. Similarly, references to a cell phone are not made with respect to software. Even if one presumes that a cell phone includes software, the '284 patent does not describe or even suggest displaying on the cell phone “an index of treatment efficacy of the subject using a PAP device.” Functions attributed to the cell phone by the '284 patent’s specification, are listed as “receiv[ing] the physiological data transmission, optionally re-process[ing] the information, and re-transmit[ting] the information via cell towers, land phone lines, satellite, radio

frequencies or cable to a remote site for analysis.” EX1001, 19:45-51. Display of “data or records” is only mentioned with respect to an “example where the remote communication system is a computer or processor,” not a cell phone, “which receives the data transmission and displays the data or records it on some recording medium, which can be displayed or transferred for analysis at a later time.” EX1001, 19:51-55.

71. As such, in my opinion, a POSITA would not have understood from the specification that the applicant actually invented, or “possessed,” any claim limitation reciting software “configured to be used with” or “downloaded” on a cell phone, or software on the cell phone “to display to a subject for viewing on the cell phone ... an index of treatment efficacy of the subject using a PAP device.”

72. Thus, in my opinion, Claim 1 is invalid for the additional reason that the “first software executable by a first processor and configured to be used with a cell phone to display to a subject for viewing on the cell phone on to which the first software is downloaded an index of treatment efficacy of the subject using a PAP device, the first software used for displaying the index on the cell phone” is not supported by the written description of the ’284 patent. Dependent Claims 2-20 are invalid for at least the same reasons.

4. **“the remote internet site is configured to retransmit to the first radio frequency wireless transceiver on the cell phone the data of the severity of the symptoms of the subject, the**

index, a second index and/or the data of usage related to the subject's treatment and the treatment's efficacy, in whole or part, calculated by the PAP device" (Claims 10, 14)

73. A majority of these dependent claims were added to the '266 application via the June 10, 2022 Preliminary Amendment. EX1022, 170-171. One amendment (related to amendments to the independent claim) revised this language to its current form. EX1002, 105. The specification only describes the "remote internet site" as *receiving* data "for analysis," including in one example from a "cell phone." EX1001, 19:4351. However, the specification does not disclose that the remote internet site is (1) configured to retransmit anything *to* a radio frequency wireless transceiver on a cell phone, and (2) is configured to retransmit "a second index." As discussed in more detail below, the term "retransmit" refers to an operation where data is transmitted again (i.e., same data multiple times). In my opinion, there is no support for such an operation in the specification of the '284 patent.

74. As such, in my opinion, a POSITA would not have understood from the specification that the applicant actually invented, or "possessed," any claim limitation reciting a "remote internet site is configured to retransmit to the first radio frequency wireless transceiver on the cell phone the data of the severity of the symptoms of the subject, the index, a second index." Accordingly, Claims 10 and 14 are invalid for the additional reason that the limitation is not supported by

the written description of the '284 patent. Dependent Claims 15-17 are invalid for at least the same reasons.

B. Ground 2: Claims 1-20 are not Enabled

75. I have reviewed the opinions of Dr. Alan R. Schwartz and his opinions concerning the lack of enablement of the challenged claims. EX1020, ¶¶50-56. I agree with Dr. Schwartz's conclusions that the claims of the '284 patent are not enabled. *Id.*

C. Ground 3: Claims 1-8, 14, and 19 are Rendered Obvious by Bao in view of Klee

76. As discussed in Section V.D, the earliest possible priority date of the challenged claims is May 26, 2022.

77. Bao (EX1009) published July 7, 2016.

78. Klee (EX1010) published July 19, 2018.

1. Claim 1

79. In my opinion, it is more likely than not that claim 1 is rendered obvious by Bao in view of Klee for the reasons set forth below.

a. 1pre. "A positive airway pressure (PAP) sleep disorder treatment system comprising:"

80. In my opinion, Bao discloses the Claim 1 preamble. For example, Bao discloses "a CPAP device/apparatus 200 incorporating certain features, aspects and advantages of an embodiment of the present invention. The CPAP apparatus 200

comprises a blower 202 that propels a stream of pressurized air through a breathing conduit 106 (see FIG. 1) to an interface 107 wearable by a patient.” EX1009, ¶124; FIGS. 1, 2.

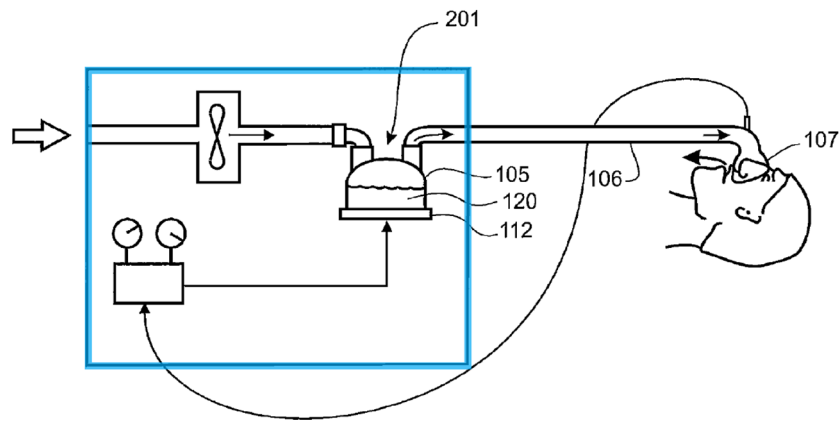


FIGURE 1

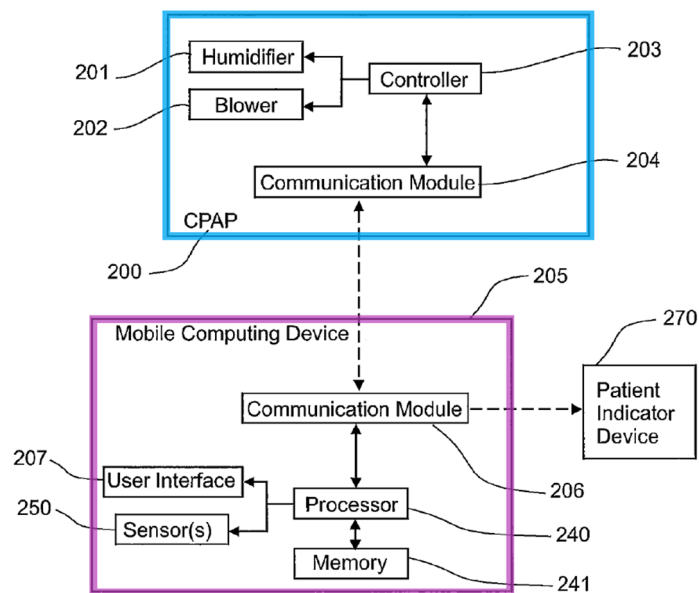


FIGURE 2

81. The Bao system also comprises a “mobile computing device 205,” EX1009, ¶¶125, 126, that “may be configured to transmit (e.g. through use of the internet) data such as, but without limitation, patient and compliance data to a website that also hosts details of other patients and/or support groups. EX1009, ¶156.

- b. **1a. “a non-transitory computer readable medium, the non-transitory computer readable medium comprising a first software, the first software executable by a first processor and configured to be used with a cell phone to display to a subject for viewing on the cell phone on to which the first software is downloaded an index of treatment efficacy of the subject using a PAP device, the first software used for displaying the index on the cell phone, the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject, the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone, the cell phone comprising at least one first radio frequency wireless transceiver, the first processor, the first software when downloaded and a display;”**

82. In my opinion, Bao in view of Klee disclose the subparts of this limitation directed to the components, configuration and use of the cell phone.

non-transitory computer readable medium comprising first software executable by a first processor and configured to be used with a cell phone, the cell

phone comprising at least one first radio frequency wireless transceiver, the first processor, the first software when downloaded and a display:

83. In my opinion, the Bao mobile computing device 205 is “a cellular phone comprising a display screen 207 comprising a graphical user interface 208.” EX1009, ¶132. As such, it discloses the “cell phone” and “display” portions of this limitation.

84. “The mobile communication device 205 comprises a processor 240 with associated memory 241 configured to execute computer-executable instructions.” EX1009, ¶126, FIG. 2. The processor 240 is the claimed “first processor” and executes the “first software” to perform the functions discussed below because it can “connect to the internet ... and download a software update and/or modification for the mobile computing device 205.” EX1009, ¶170. In my opinion, a POSITA would have understood that to “download a software update,” the mobile device 205 would necessarily comprise software needing to be updated. Likewise, a POSITA would have understood that the software was stored in a computer readable medium in at least the memory 241 of the mobile device 205 so that it would be downloaded and executed by the processor 240.

85. As shown in FIG. 2, mobile computing device 205 further includes a communication module 206. According to Bao, the mobile device’s 205 communication module 206 can be a “radiofrequency (RF) module[] capable of

communication.” EX1009, ¶125. In addition, communication module 206 can receive and transmit data and other signals from/to a communication module 204 in the CPAP device 200 “through one or more types of wireless networks and associated protocols, including but not limited to WiFi, Bluetooth, and 2G/3G/4G.” EX1009, ¶125. In my opinion, a POSITA would have understood that because the communication module 206 can transmit and receive data wirelessly, it would necessarily comprise a transceiver and therefore disclose the claimed “at least one first radio frequency wireless transceiver.”

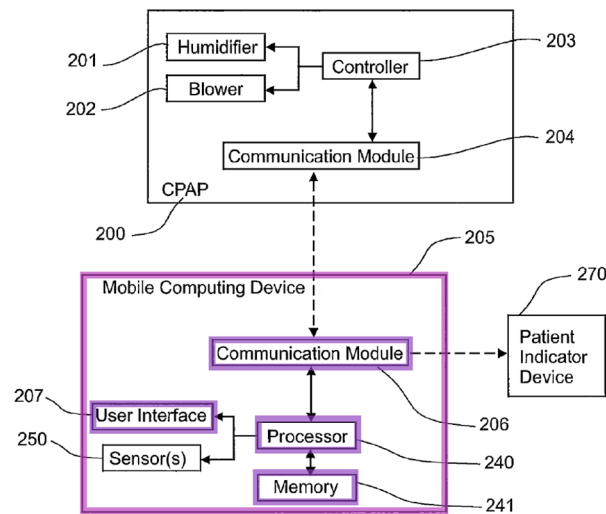


FIGURE 2

displaying, on the cell phone, an index of treatment efficacy of the subject:

86. In my opinion, Bao discloses “display[ing] to a subject for viewing on the cell phone on to which the first software is downloaded an index of treatment efficacy of the subject using a PAP device, the first software used for displaying the index on the cell phone.” For example, Bao discloses that “the mobile

computing device 205 is shown in the form of a cellular phone comprising a display screen 207 comprising a graphical user interface 208” and the “first software” as discussed above. EX1009, ¶¶126, 131-132, 170. Regarding the claimed “index of treatment efficacy of the subject using a PAP device,” Bao discloses:

The graphical user interface 208 may also comprise a data button (not pictured) that, when pressed, may display, though (sp.) the use of one or more pop-up window(s) or some other display configuration, one or more value(s) conveying information to the patient. This information may convey at least one or more of the following: compliance data, *therapy efficacy data*, trending data representing compliance and/or *therapy efficacy for a patient over time*, AHI data, number of hours used, severity of mask leak, current humidity, current pressure, current flow, and/or data concerning the CPAP apparatus (including but not limited to, the product family model number, serial number, and/or software version).

EX1009, ¶132 (emphasis added). As noted above, the '284 patent contains no written description support or enabling disclosure for the claimed “index of treatment efficacy.” See *supra* Sections VIII.A.1, VIII.B. In my opinion,

a POSITA would have understood that at least one of the “*therapy efficacy data*” or “*therapy efficacy for a patient over time*” would comprise an index, which, as known in the art, is merely one way of a limited number of options to quantify the “therapy efficacy” disclosed by Bao. For example, Bao discloses “AHI data,” and a POSITA would have understood that “AHI” means “Apnea-Hypopnea-Index,” and that Bao contemplated indices for its patient therapy information. EX1010, ¶41. For example, it is known that AHI averages apneas and hypopneas over time and is an index. *See, e.g.,* EX1016, 321. In the same way, Bao’s therapy efficacy “over time” would also have been recognized as an index (i.e., an index of treatment efficacy).

the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject:

87. In my opinion, to the extent this term can be understood in the context of the ’284 patent specification, Bao in view of Klee discloses “the index [of treatment efficacy of the subject being] based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” For example, Bao discloses that its mobile computing device 205 and graphical user interface 208 can display, among other things, “*therapy efficacy data, ..., therapy efficacy for a patient over time, ..., number of hours used.*”

EX1009, ¶132 (emphasis added). As such, in my opinion, Bao discloses at least one component (i.e., data of usage of the PAP device by the subject) for determining the claimed, but not disclosed or enabled, “index of treatment efficacy.”

88. Bao also discloses AHI data, which in my opinion a POSITA would have understood based e.g., on Klee, to be “an index used to indicate the *severity of sleep apnea*.” EX1010, ¶41 (emphasis added). Accordingly, Bao discloses a form of “data of severity of sleep disorder symptoms of the subject,” as best understood. Bao, however, does not appear to disclose use of different forms of data (e.g., severity and usage) to produce the claimed “index of treatment efficacy.”

89. Klee, however, discloses an analogous system that uses a broad range of therapy data and ways to *combine* the data to determine, e.g., “an overall sleep apnea severity score.” EX1010, ¶41. Specifically, and as shown below, Klee discloses both the sleep severity data and the time of usage data that determine the “index of treatment efficacy.”

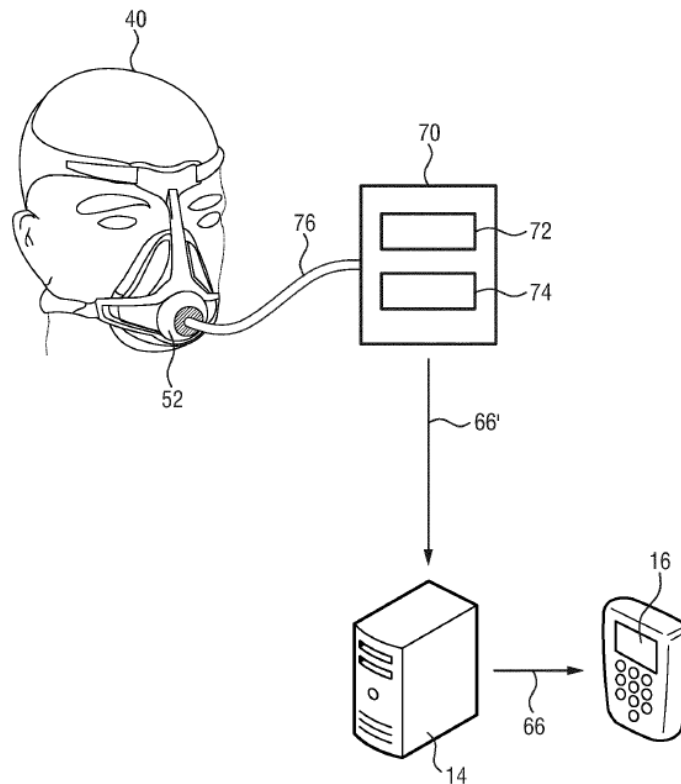


FIG.2b

90. Specifically, Klee discloses that:

“Therapy data” include all data which may be measured and/or determined along therapy and data relating to controlling the device used for therapy. Preferred therapy data include one or more of the *Apnea-Hypopnea-Index (AHI)*, *overall sleep apnea severity score*, number of apneas and/or apopneas per time unit, e.g. by night, *and time of usage of a therapy device for providing said therapy*, fit of mask but any other parameters might be also included. *The AHI is an index used to indicate*

the severity of sleep apnea. It is represented by the number of apnea and hypopnea events per hour of sleep. The apneas (pauses in breathing) must last for at least 10 seconds and are associated with a decrease in blood oxygenation. ***Combining AHI and oxygen desaturation gives an overall sleep apnea severity score that evaluates both number sleep disruptions and degree of oxygen desaturation (low blood level).***

EX1010, ¶41 (emphasis added).

91. As mentioned above, there is no disclosure of how the '284 patent determines the “index of treatment efficacy.” However, seeing as how Bao and Klee disclose therapy efficacy data, therapy efficacy for a patient over time, usage of the PAP device (i.e., number of hours used), an index (i.e., AHI), and combining data to achieve an overall sleep apnea severity score, in my opinion, a POSITA would have understood that the combined teachings of Bao and Klee would be used to determine, as best understood, an “index of treatment efficacy” “based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.”

92. To the extent that Bao does not expressly disclose the details of all of the different types of therapy data required by the Claim, in my opinion a POSITA would have looked to disclosures like Klee for details on what types of therapy

data would be used for the recited “treatment efficacy.” In my opinion, a POSITA, with knowledge of Bao and Klee, would have considered it obvious to combine their respective teachings. For example, Bao and Klee share commonalities in terms of their general subject matter (e.g., using CPAP and other devices to treat sleeping/breathing disorders) and technique used (e.g., evaluating patient, treatment and other data) to improve operation of CPAP treatment devices to better treat the patient and its disorder. Moreover, Bao and Klee are within the same technical field as each other and the '284 Patent.

93. In my opinion, a POSITA would have been further motivated to combine the teachings of Bao and Klee to arrive at the claimed treatment system because it would amount to merely applying a known technique (i.e., determining treatment efficacy based on multiple factors) to a known device ready for improvement (e.g., CPAP treatment system comprising multiple devices) to yield predictable results (i.e., improve operation of CPAP treatment to better treat the patient and its disorder).

94. For example, it was well known and disclosed in both Bao and Klee that a number of useful parameters could be calculated at the PAP processor. *See, e.g.,* EX1009, ¶¶129-131; EX1010, ¶¶41, 122, 128. It was also known that compliance and efficacy were important, and could be used to motivate a patient to comply with their prescribed treatment. *See, e.g.,* Bao at ¶102 (“several ways in

which such mobile computing device may be used to help the patient comply with a CPAP therapy regime ...”); Klee at ¶44 (“Feedback information preferably encompasses information regarding the progress and effort of the therapy.”); *see also* ¶52. Accordingly, in my opinion, a POSITA would have been motivated to make the claimed combination, and had a reasonable expectation of success in making such a combination.

95. Moreover, there is simply nothing in the ’284 patent to contradict such a combination.

the data of severity and the data of usage both calculated by the PAP device and received by the cell phone:

96. In my opinion, Bao in view of Klee discloses that “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone.”

97. For example, Bao discloses that “the mobile computing device 205 may be configured to interrogate the CPAP apparatus 200 for compliance data.” EX1009, ¶¶150, 159 (receiving information from the CPAP), 163 (“CPAP apparatus 200 could sense the wakefulness of the patient through conditions sensed at the CPAP apparatus 200 (e.g., using any suitable algorithm ...)”), 132 (listing examples of relevant information, including compliance data, number of hours used). It is my opinion that a POSITA would have understood that compliance data

from the CPAP apparatus 200 would include data of usage of the PAP device by the subject.

98. Moreover, Klee discloses that “PAP system 70 also generates therapy data 22 derived from system settings and one or more sensors of the system 70 for measuring system related parameters.” EX1010, ¶122. According to Klee, the “therapy data include[s] one or more of the Apnea-Hypopnea-Index (AHI),” and “overall sleep apnea severity score,” and “time of usage of a therapy device.” EX1010, ¶41. Moreover, Klee discloses that “a remote device, such as a smartphone or tablet, [is] provided for instant or later displaying the feedback information 30 based on the data 20, 22, 24, 26 and 28.” EX1010, ¶¶119, 128 (“CPAP data 22' encompass data about AHI 80, ... mask usage 84”), 130 (“CPAP usage data 22 (therapy data) can be downloaded by the patient 40 via an app from his/her mobile phone”). In my opinion, a POSITA would have understood that the Bao and Klee data comprising “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject” are therefore “both calculated by the PAP device and received by the cell phone.”

c. 1b. “the PAP device with an enclosure further comprising: a blower having an air output,”

99. In my opinion, Bao discloses this limitation. For example, Bao discloses that “FIG. 2 is a block diagram illustrating an embodiment of a CPAP

device/apparatus 200 incorporating certain features, aspects and advantages of an embodiment of the present invention.” EX1009, ¶124. As shown in FIG. 2, the “CPAP apparatus 200 comprises a blower 202 that propels a stream of pressurized air through a breathing conduit.” EX1009, ¶124.

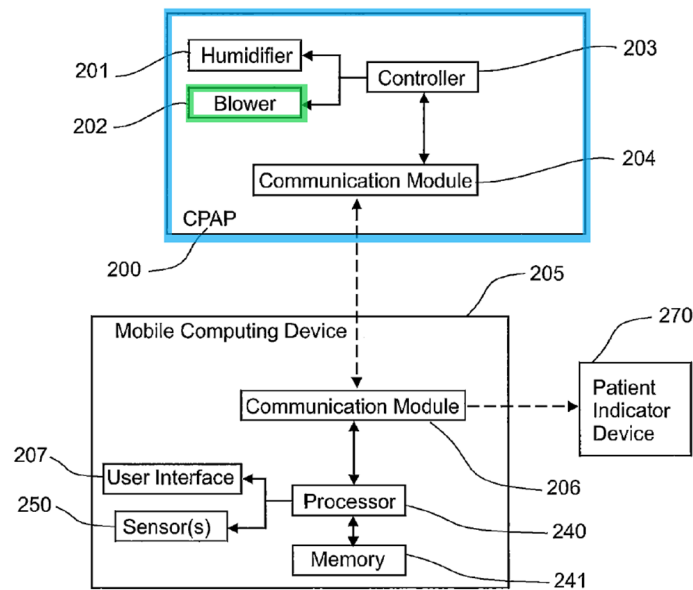


FIGURE 2

100. Although the blower 202 is not specifically disclosed in the text of Bao as being within the CPAP apparatus’ housing/enclosure, the humidifier 201 and other components are. *See, e.g.*, EX1009, ¶¶124, 141-143, 160. A POSITA would also recognize that a blower is depicted in FIG. 1 within the same PAP apparatus as the humidifier 201. Thus, in my opinion, a POSITA would have understood that the blower 202 is within the apparatus’ enclosure.

- d. 1c. “an airflow sensor internal to the PAP device adapted for measuring or deriving the respiratory**

**airflow of a subject while using the PAP and
outputting airflow sensor data,”**

101. In my opinion, Bao discloses this limitation. For example, Bao discloses that “[t]he operation parameters of the CPAP apparatus 200 that are capable of being adjusted may include, but are not limited to, ... *flow*.... Additionally, such parameters along with other data, including data obtained by *sensors* on, *within* or connected to the CPAP apparatus 200 can be displayed on the display screen of the mobile computing device 205.” EX1009, ¶131 (emphasis added), 132 (“current flow”), 99 (“sensors” as “hardware modules on a typical CPAP device”). It is my opinion that a POSITA would have understood the reference to “flow” as meaning airflow and that the corresponding sensor would be an “airflow sensor” internal to the CPAP apparatus as explicitly disclosed by Bao (i.e., “sensors ... within ... the CPAP apparatus 200”). A POSITA would have also recognized that there were two typical locations for placement of a “flow” sensor, which were (1) at the flow generator (blower), or (2) at or near the mask. *See, e.g.*, EX1017, 8:31-36. Accordingly, a POSITA would have recognized a flow sensor is the type of sensor that would be “within” the CPAP apparatus. Alternatively, based on these two location options known to a POSITA, it would have at least been obvious to locate the flow sensor within the CPAP apparatus enclosure as known to those skilled in the art.

102. Bao further discloses that its sensors output “sensor data.” For example, “one or more of the CPAP apparatus 200, the mobile computing device 205, and *associated sensor(s)* are configured to transmit ... *sensor data generated by the sensors and/or information corresponding to the sensor data* to another computing device.” EX1009, ¶149 (emphasis added).

103. The phrase “respiratory airflow of a subject” could be understood to be the airflow at the mask. A POSITA would have recognized that Bao’s flow sensor within the apparatus would be used to derive “mask flow” as known in the art by accounting for pressure loss along the tubing and exhaust and/or leak at the mask. EX1017, 8:31-62, FIG. 3; EX1009, ¶132 (“severity of mask leak, ... current flow”); EX1018, 2:1-10 (copied into the ’284 at 23:15-25) (using flow information from an internal flow sensor to “determine the volume of gas passing through patient circuit,” and to “monitor the condition of the patient”).¹ A POSITA would have recognized the “mask flow” calculation is used as part of Bao’s disclosed “sleep algorithm” as feedback for “controlling the blower” of the CPAP apparatus, and that it would have at least been obvious to calculate “mask flow” at the CPAP apparatus’s controller as disclosed by Bao, rendering this limitation at least

¹ I note that the PO argued in IPR2023-00565 that this description of conventional devices, copied into the ’284 patent from EX1018, describes the claimed airflow sensor. IPR2023-00565, Paper 6, 5-6.

obvious. EX1009, ¶¶127, 171 (“mobile computing device 205 may be configured to process at least one sleep algorithm for the control of the CPAP apparatus 200, rather than the controller 203”).

- e. **1d. “a second processor adapted for receiving the airflow sensor data, for calculating the data of a severity of the symptoms of the subject and/or the index, and for calculating the data of usage of the PAP device,”**

104. In my opinion, Bao in view of Klee discloses this limitation. For example, Bao discloses “a controller 203, which preferably comprises a microprocessor with associated memory.” EX1009, ¶125; FIG. 2.

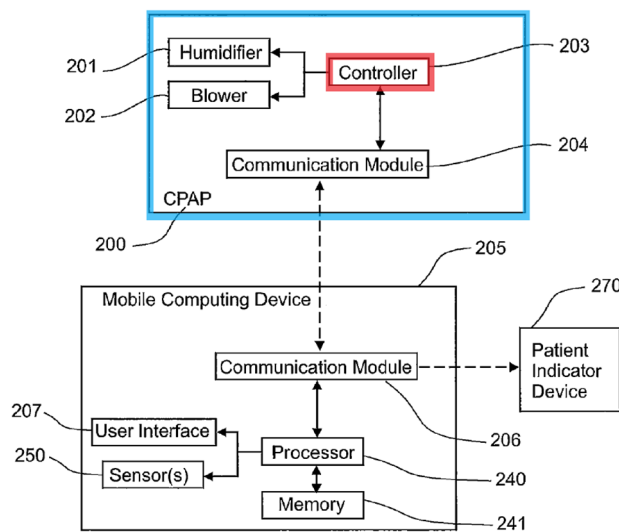


FIGURE 2

105. As discussed above, the combination of Bao and Klee disclose “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by

the cell phone.” Section VIII.C.1.b. In my opinion, a POSITA would have understood that the controller 203 is the claimed “second processor” because it controls the operation of the CPAP apparatus 200. EX1009, ¶¶125, 127.

106. Moreover, it is my opinion that a POSITA would have understood that the Bao controller 203 “is adapted to” receive the airflow sensor data because the CPAP apparatus 200 is configured to “transmit ... sensor data generated by the sensors and/or information corresponding to the sensor data to another computing device,” meaning that the airflow sensor data must be received by the controller 203, which interacts with the communication module 204 that transmits such information off of the CPAP apparatus. EX1009, ¶¶125, 149.

107. I further note that while the claimed second processor is adapted to receive the airflow sensor data, the claim does not require it to be used in any of the claimed calculations.

f. 1e. “a mask or a nasal cannula, and”

108. In my opinion, Bao discloses this limitation. For example, Bao discloses that the “CPAP apparatus 200 comprises a blower 202 that propels a stream of pressurized air through a breathing conduit 106 (see FIG. 1) to an interface 107 wearable by a patient.” EX1009, ¶124. The “patient interface 107” is shown and described as a “mask.” EX1009, ¶135.

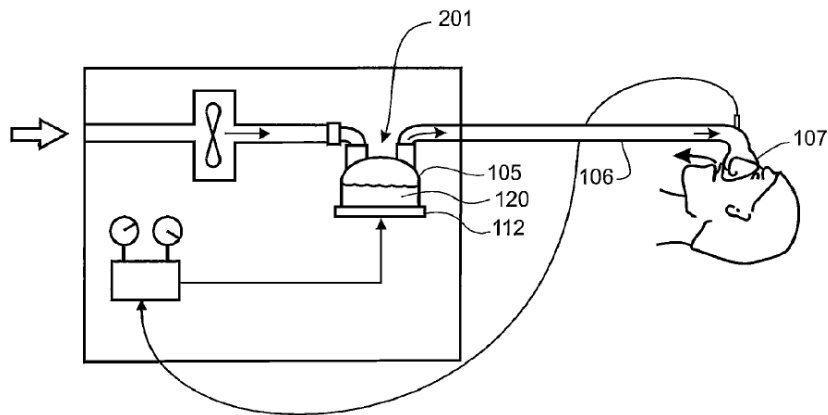


FIGURE 1

- g. 1f. “at least one second radio frequency wireless transceiver, the at least one second radio frequency wireless transceiver adapted for transmitting the data of severity of the symptoms of the subject and/or the index, and the data of usage calculated by the second processor; and”

109. In my opinion, Bao in view of Klee discloses this limitation. For example, Bao discloses “a communication module 204, which may transmit and/or receive control signals and/or other data to and/or from a corresponding communication module 206 in a mobile computing device 205 through at least one communication or data link, such as at least one communications network.”

EX1009, ¶124.

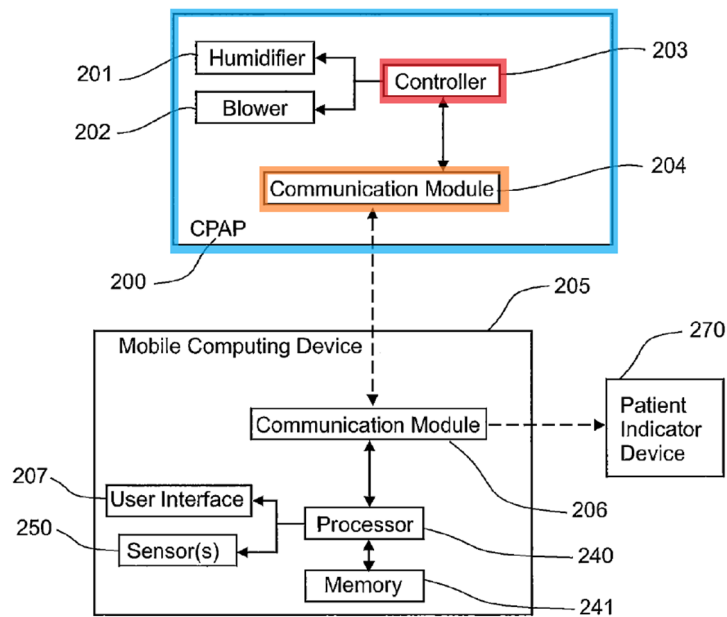


FIGURE 2

110. According to Bao, the communication module 204 can be a “radiofrequency (RF) module[] capable of communication.” EX1009, ¶125. In addition, communication module 204 can receive and transmit data and other signals from/to a communication module 206 “through one or more types of wireless networks and associated protocols, including but not limited to WiFi, Bluetooth, and 2G/3G/4G.” EX1009, ¶125. In my opinion, A POSITA would have understood that because the communication module 204 can transmit and receive data wirelessly, it would necessarily comprise a transceiver and therefore disclose the claimed “at least one second radio frequency wireless transceiver.”

111. As discussed above, the combination of Bao and Klee disclose “the data of severity of sleep disorder symptoms of the subject and the data of usage of

the PAP device by the subject both calculated by the PAP device and received by the cell phone.” Section VIII.C.1.b. As discussed above, it is my opinion that a POSITA would have understood that the controller 203 is the claimed “second processor.” Section VIII.C.1.e. Accordingly, the communication module’s 204 ability to “transmit and/or receive control signals and/or other data,” this means that the communication module 204 “is adapted for transmitting the data of severity of the symptoms of the subject and/or the index, and the data of usage calculated by the second processor.”

- h. 1g. “a remote internet site, the remote internet site adapted to receive the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject both related to the subject's treatment and the treatment's efficacy, in whole or part, generated by the PAP device and transmitted via the at least one second radio frequency wireless transceiver.”**

112. In my opinion, Bao in view of Klee discloses this limitation. For example, Bao discloses that “one or more of the CPAP apparatus 200, the mobile computing device 205, and associated sensor(s) are configured to transmit compliance data, therapy efficacy data, sensor data generated by the sensors and/or information corresponding to the sensor data to another computing device. The other computing device may be located remotely from the CPAP apparatus 200 and the mobile computing device 205, for example, and may be accessible by a

clinician overseeing operation of the CPAP apparatus” EX1009, ¶¶149, 159 (“a data connection may be established in which information can be transferred from the CPAP apparatus 200 to the mobile computing device 205 ... , and then from the mobile computing device 205 ... to *the internet* or another mobile computing device”). Moreover, BAO discloses that “the CPAP apparatus 200 ... [is] configured to communicate with the other computing device ... through one or more communication or data links including WiFi, Bluetooth, 2G/3G/4G, the internet. EX1009, ¶149.

113. Bao further discloses “a remote cloud based service” where “data such as, but not limited to, sensor data, patient settings, compliance data, and/or therapy efficacy data” can be accessed in real-time, shared and analyzed. EX1009, ¶151. According to Bao, “the CPAP apparatus 200 or one or more sensor modules (e.g. sensor modules 310, 312) may be configured to transmit sensor data through a wireless or wireless data connection directly (not through the mobile computing device 205) to the remote cloud based service.” EX1009, ¶151.

114. Bao also discloses that “the mobile computing device 205 may be configured to transmit (e.g. through use of the internet) data such as, but without limitation, patient and compliance data to a *website* that also hosts details of other patients and/or support groups. In some configurations, the *website* may be configured so patients can participate in challenges and/or compare compliance

with other patients.” EX1009, ¶156. In my opinion, a POSITA would have understood that the CPAP apparatus, and specifically its “radio frequency wireless transceiver,” would be adapted to transmit the “the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject both related to the subject’s treatment and the treatment's efficacy” disclosed by Bao in view of Klee (see Section VIII.C.1.g) “in whole or part” to a website (such as the one disclosed for use by the patient) or cloud based service (storing “sensor data, patient settings, compliance data, and/or therapy efficacy data” so they can be accessed in real-time, shared and analyzed) through the mobile computing device 205.

115. Doing so would have merely involved combining prior art elements (i.e., transmission of patient, sensor, therapy data and treatment efficacy from devices in a CPAP system to a website) according to known methods (e.g., wireless transmissions over the internet) to yield predictable results (a remote website reachable over the internet for receiving, storing and analyzing the patient, sensor, therapy data and treatment efficacy information). Doing so would have, among other things, improved the clinician’s ability to access the data in real time and analyze it. In addition, the website allows patients to participate in challenges and/or compare compliance with other patients, which would entice the patients to adhere to their therapy because “patients feel their goals are attainable.” EX1009,

¶156. In my opinion, a POSITA would have had a reasonable expectation of success in implementing such a remote internet site based on the combined teachings of Bao and Klee.

2. Claim 2

- a. **“The system of claim 1, wherein the at least one second radio frequency wireless transceiver of the PAP device and the first radio frequency wireless transceiver of the cell phone are adapted to communicate using Bluetooth wireless protocol.”**

116. In my opinion, Bao discloses this limitation. Specifically, Bao discloses that “the modules 204, 205 can communicate through one or more types of wireless networks and associated protocols, including but not limited to WiFi, *Bluetooth*, and 2G/3G/4G.” EX1009, ¶125.

3. Claim 3

- a. **“The system of claim 1, wherein the at least one second radio frequency wireless transceiver is configured to transmit the data to the remote internet site and/or the cell phone of the data of the severity of the symptoms of the subject and/or the index, and the data of usage via in part by cell towers.”**

117. In my opinion, Bao discloses this limitation. Specifically, Bao discloses that “the modules 204 [of the CPAP apparatus], 205 [of the mobile computing device] can communicate through one or more types of wireless networks and associated protocols, including but not limited to WiFi, Bluetooth, and *2G/3G/4G*.” EX1009, ¶125. In my opinion, a POSITA would have recognized

the reference to “2G/3G/4G” to disclose cellular communication protocols that use cell towers.

4. Claim 4

- a. “The system of claim 3, the PAP device further comprising at least one second software stored on a memory and executed by the second processor, the at least one second software which is configured for calculating the data of severity of the symptoms of the subject, wherein the PAP is further adapted to be reprogram or modify the at least one second software from the remote internet site or a second remote internet site.”**

118. In my opinion, Bao in view of Klee discloses this limitation. For example, Bao in view of Klee discloses that the CPAP apparatus 200 comprises the “second processor ... for calculating the data of a severity of the symptoms of the subject and/or the index, and for calculating the data of usage of the PAP device.” Section VIII.C.1.e. Bao discloses a memory associated with the second processor. EX1009, ¶125 (“a controller 203, which preferably comprises a microprocessor with associated memory.”), FIG. 2. Bao further discloses downloading “a software update and/or modification for the ... the CPAP apparatus 200.” EX1009, ¶170. A POSITA would have understood that to “download a software update,” the CPAP apparatus 200 would necessarily comprise software needing to be updated. This software is the claimed “second software stored on a memory and executed by the second processor.”

119. Bao further discloses that the software update and/or modification is received over the internet. EX1009, ¶170. In my opinion, a POSITA would have understood that the software update and/or modification, received over the internet, would have been from an internet site remote from the CPAP apparatus; meaning that Bao discloses that “the PAP is further adapted to be reprogram or modify the at least one second software from the remote internet site or a second remote internet site.”

5. Claim 5

- a. “The system of claim 4, wherein the PAP device further comprises at least one electronic component adapted to allow the PAP device to be adjusted remotely based on the data of the severity of the symptoms of the subject and/or the index, based in part on the data measured, calculated and then transmitted to the remote internet site.”**

120. In my opinion, Bao in view of Klee discloses this limitation. For example, Bao in view of Klee discloses that the CPAP apparatus 200 comprises the “second processor ... for calculating the data of a severity of the symptoms of the subject and/or the index, and for calculating the data of usage of the PAP device.” Section VIII.C.1.e. Bao in view of Klee further disclose “the remote internet site adapted to receive the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject ... generated by the PAP device.” Section VIII.C.1.h.

121. Bao discloses that a “mobile computing device, for example, a laptop computer, tablet computer, personal digital assistant (PDA), cellular phone, or computerized wristwatch, may be linked to a CPAP apparatus in such a way that the CPAP apparatus may be remotely controlled through use of a user interface located on the mobile computing device. Additionally, using the communication link, data obtained from sensors on or connected to the mobile computing device may be used to adjust various operating parameters of the CPAP device.” EX1009, ¶100. Bao further discloses “the clinician’s computing device may be a mobile computing device. In some configurations, the clinician’s computing device may be remotely located from the patient and/or CPAP apparatus 200, such as in a sleep laboratory. The clinician may analyze and use the data to adjust the pressure and/or flow settings, for example, of the CPAP apparatus 200.” EX1009, ¶145. Bao further discloses “[t]he operation parameters of the CPAP apparatus 200 that are capable of being adjusted may include, but are not limited to, treatment pressure, flow, motor speed, heater plate power/temperature, heated breathing tube power, level of humidification, clock/time settings, alarm clock settings, and thresholds for responding to mask leaks.” EX1009, ¶131. Thus, in my opinion, the CPAP apparatus 200 comprises more than one “electronic component adapted to allow the PAP device to be adjusted remotely based on the data of the severity of the

symptoms of the subject and/or the index, based in part on the data measured, calculated and then transmitted to the remote internet site.”

6. Claim 6

- a. “The system of claim 1, wherein the PAP device further comprises at least one electronic component adapted to allow the PAP device to be adjusted remotely based on the data of the severity of the symptoms of the subject and/or the index, based in part on the data measured, calculated and then transmitted to the remote internet site.”**

122. In my opinion, Bao discloses this limitation for at least the same reasons discussed for Claim 5. Section VIII.C.5.a.

7. Claim 7

- a. “The system of claim 1, wherein the first software is configured to be stored on and executed by the cell phone and is further adapted to be reprogrammed or modified remotely.”**

123. In my opinion, Bao discloses this limitation. For example, as noted above, Bao discloses “first software” stored a computer readable medium on the cell phone (i.e., mobile computing device 205) and executed by the cell phone, which is adapted to “connect to the internet ... and download a software update and/or modification for the mobile computing device 205.” EX1009, ¶170; Section VIII.C.1.b.

124. In my opinion, a POSITA would have understood the download of the software update and/or modification in the Bao system would have been initiated

remotely. For example, Bao discloses that a remote clinician's computing device can adjust the CPAP apparatus 200 via communications with the mobile computing device 205. EX1009, ¶145. Thus, the capability of remotely updating components of the Bao system from a device external to the CPAP apparatus 200 and mobile computing device 205 already exists in the Bao system. Indeed, the "mobile computing device 205 may notify the patient if such an update and/or modification can be made and request permission to install the update and/or modification." EX1009, ¶170. It is my opinion that a POSITA would have understood that by seeking "permission to install the update and/or modification" from the patient, the mobile computing device 205 is "adapted to be reprogrammed or modified remotely."

125. Should the patent owner dispute that Bao discloses the mobile computing device 205 or its software being "adapted to" be reprogrammed or modified remotely, such a limitation would have been obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., remote reprogramming/modification v. local reprogramming/modification), with a reasonable expectation of success (updated/modified software on the device).

8. Claim 8

- a. "The system of claim 7, wherein the first software is configured to be stored on and executed by the cell**

phone and is further adapted to be reprogrammed or modified remotely.”

126. Bao discloses this limitation for at least the same reasons discussed for Claim 7. Section VIII.C.7.a.

9. Claim 14

- a. “The system of claim 1, wherein the remote internet site is configured to retransmit to the first radio frequency wireless transceiver on the cell phone the data of the severity of the symptoms of the subject, the index, a second index and/or the data of usage related to the subject's treatment and the treatment's efficacy, in whole or part, calculated by the PAP device.”**

127. In my opinion, Bao in view of Klee discloses this limitation. As noted above, Bao in view of Klee discloses the remote internet site “adapted to receive the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject.” Section VIII.C.1.h. For example, Bao discloses an external computing device communicating to the mobile communication device 205 and also the CPAP apparatus 200 via the internet and a clinician’s computer that can set and transmit goals or challenges to the user via the mobile communication device 205. EX1009, ¶¶149, 151 (CPAP transmitting “directly (not through the mobile computing device 205) to the remote cloud based service”), 156, 159 (transferring “from the internet or another mobile computing device to the mobile computing device associated with the CPAP apparatus”). Bao

discloses that “the mobile computing device 205 may be configured so challenges and/or goals can be issued, such as by a remote cloud based service for example, to a patient through the user interface 207 of the mobile computing device 205. In some configurations, the website and/or remote cloud based service may be configured to host and/or issue challenges and/or goals that are specific to an individual patient and/or group of patients.” EX1009, ¶156.

128. Bao may not explicitly disclose the remote internet site being configured to “retransmit” the claimed data to the cell phone. Bao, however, discloses that the CPAP can communicate directly (via cellular) with the remote website or indirectly (via the mobile computing device 205). EX1009, ¶¶149, 151, 156, 159. In my opinion, a POSITA would have found it obvious that the remote website retransmits the AHI and usage hours (received directly from the CPAP) to the mobile computing device 205 so it can correlate it with the corresponding challenges or goals set and transmitted by the remote website.

129. In my opinion, a POSITA would have understood that issued challenges and or goals, for example, sent to the mobile communication device 205, whether in relation to the patient or group of patients, would include one or more of “retransmit[ting] to the first radio frequency wireless transceiver on the cell phone the data of the severity of the symptoms of the subject, the index, a second index *and/or* the data of usage related to the subject's treatment and the

treatment's efficacy, *in whole or part*, calculated by the PAP device” as broadly claimed by the '284 patent. For example, a POSITA would have recognized, or at least found it obvious, that a challenge or goal related to usage hours or AHI transmitted to the mobile communication device would include retransmission of the patient's actual usage hours and AHI information (i.e., a second index) calculated by their CPAP device so as to indicate whether the patient has met the challenge or goal. Moreover, neither the claim nor the '284 patent specify any particular modification or special use of the claimed controller, and merely use it for its intended purpose as a controller.

10. Claim 19

- a. “The system of claim 1, wherein the remote internet site is hosted on a remote communication system with a third processor for reprocessing and/or outputting data received from the first or second radio frequency wireless transceiver in whole or part, wherein the remote internet site is configured to output to a printer in a report form or to a second display the reprocessed and/or outputted data, for review by a clinician to determine the treatment efficacy.”**

130. Bao in view of Klee discloses this limitation.

131. Bao in view of Klee discloses a remote internet site adapted to receive data from the first or second radio frequency wireless transceiver. *See, e.g.*, Section VIII.C.1.h. Bao in view of Klee also discloses that “remote internet site is hosted

on a remote communication system with a third processor.” *See, e.g.*, Section VIII.C.5.a.

132. Bao discloses that “the clinician's computing device may be remotely located from the patient and/or CPAP apparatus 200, such as in a sleep laboratory. The clinician may analyze and use the data to adjust the pressure and/or flow settings, for example, of the CPAP apparatus 200.” EX1009, ¶145. By having the capability for the clinician to analyze the data received on his/her computing device and determined adjustments need to the CPAP apparatus, a POSITA would have understood that Bao discloses that “the remote internet site *is configured to output ... to a second display* the reprocessed and/or outputted data, for review by a clinician to determine the treatment efficacy.”

D. Ground 4: Claims 9-13, and 20 are Rendered Obvious by Bao in view of Klee and Shouldice

133. Shouldice (EX1011) published August 5, 2021.

1. Claim 9

- a. **“The system of claim 8, wherein the airflow sensor data is processed by the second processor, in part, using one or more of the signal processing techniques from the group consisting of a standard deviation technique, a recursively fit ARMAX system identification model, a short-time Fourier transform technique, a discrete Fourier transform technique, a fast Fourier transform technique, a time-frequency signal analysis with a variety of different kernels, and a wavelet analysis.”**

134. In my opinion, Bao in view of Klee and Shouldice discloses this limitation. For example, Bao discloses “an airflow sensor internal to the PAP device adapted for measuring or deriving the respiratory airflow of a subject while using the PAP and outputting airflow sensor data.” Section VIII.C.1.d. Bao in view of Klee discloses “a second processor adapted for receiving the airflow sensor data.” Section VIII.C.1.e.

135. While Bao in view of Klee disclose use of airflow sensor data, the combination does not specifically, disclose, “using one or more of the signal processing techniques from the group consisting of a standard deviation technique, a recursively fit ARMAX system identification model, a short-time Fourier transform technique, a discrete Fourier transform technique, a fast Fourier transform technique, a time-frequency signal analysis with a variety of different kernels, and a wavelet analysis” to process “in part” the data. Shouldice, however does.

136. For example, Shouldice discloses that “airflow data associated with the user of the respiratory device (e.g., the respiratory device 122 of the system 100 shown in FIG. 1) is received” and at “step 720, the airflow data associated with the user is analyzed.” EX1011, ¶191. The “airflow data further includes flow rate data.” EX1011, ¶192. According to Shouldice, “airflow data can include pressure

data.” EX1011, ¶192. Shouldice specifically discloses that “the airflow data is processed.” EX1011, ¶194.

137. Specific signal processing of the airflow data disclosed by Shouldice includes, among other things, “derivative of the flow signal,” “standard deviation of the flow signal,” a “fast Fourier transform (FFT) with a sliding window, a spectrogram, a neural network, a short time Fourier transform (STFT), a wavelet-based analysis, or any combination thereof.” EX1011, ¶¶203, 245, 250 (“The method of any one of Alternative Implementations 1 to 9, further comprising: receiving, from a flow sensor, airflow data associated with the user of the respiratory device during the sleep session; analyzing the airflow data associated with the user; and determining the mouth leak status based, at least in part, on both the analysis of the first acoustic data and the analysis of the airflow data of the user.”). Thus, Bao in view of Klee and Shouldice discloses “one or more of the signal processing techniques from the group consisting of a standard deviation technique, a recursively fit ARMAX system identification model, a short-time Fourier transform technique, a discrete Fourier transform technique, a fast Fourier transform technique, a time-frequency signal analysis with a variety of different kernels, and a wavelet analysis.”

138. In my opinion, a POSITA would have found it obvious, and had reasonable expectations of success, to incorporate one or more of the claimed

signal processing techniques, all of which were well-known to POSITA, into the Bao-Klee CPAP system. A POSITA, with knowledge of Bao, Klee and Shouldice, would have considered it obvious to combine their respective teachings. For example, Bao, Klee and Shouldice share commonalities in terms of their general subject matter (e.g., using CPAP and other devices to treat sleeping/breathing disorders) and technique used (e.g., evaluating data from a CPAP device and other devices) to improve operation of CPAP treatment devices to ensure treatment. Moreover, Bao, Klee and Shouldice are within the same technical field as each other and the '284 Patent.

139. Notably, the '284 patent relies on the knowledge of a POSITA to implement this well-known feature: “The present invention would also include other on-line signal processing algorithms known to those skilled in the art, such as *wavelet analysis*, which is similar to time-frequency analysis with a particular kernel function, to identify the shift in power spectrum associated with imminent flow separation that is discussed herein.” EX1001, 20:36-41 (emphasis added); *see also* EX1019, ¶¶40-45 (copied into '284). For at least the same reasons, a POSITA would have found it obvious, and known how, to successfully implement these techniques in the Bao-Klee CPAP system to arrive at the claimed system. This is true, for example, where a POSITA having the Bao-Klee combination would have

looked to a disclosure like Shouldice that provided details on how to implement the controller.

2. Claim 10

- a. “The system of claim 9, wherein the remote internet site is configured to retransmit to the first radio frequency wireless transceiver on the cell phone the data of the severity of the symptoms of the subject, the index, a second index and/or the data of usage related to the subject's treatment and the treatment's efficacy, in whole or part, calculated by the PAP device.”**

140. In my opinion, Bao in view of Klee and Shouldice discloses this limitation for at least the same reasons discussed for Claim 14. Section VIII.C.9.a.

3. Claim 11

- a. “The system in claim 9, wherein the airflow sensor data is processed by the second processor, in part, using a Fourier transform technique.”**

141. In my opinion, Bao in view of Klee and Shouldice discloses this limitation for at least the same reasons discussed for Claim 9. Section VIII.D.1.a.

4. Claim 12

- a. “The system of claim 1, wherein the airflow sensor data is processed by the second processor, in part, using one or more of the signal processing techniques from the group consisting of a standard deviation technique, a recursively fit ARMAX system identification model, a short-time Fourier transform technique, a discrete Fourier transform technique, a fast Fourier transform technique, a time-frequency**

**signal analysis with a variety of different kernels, and
a wavelet analysis.”**

142. In my opinion, Bao in view of Klee and Shouldice discloses this limitation for at least the same reasons discussed for Claim 9. Section VIII.D.1.a.

5. Claim 13

- a. “The system in claim 12, wherein the airflow sensor data is processed by the second processor, in part, using a Fourier transform technique.”**

143. In my opinion, Bao in view of Klee and Shouldice discloses this limitation for at least the same reasons discussed for Claim 11. Section VIII.D.3.a.

6. Claim 20

- a. “The system in claim 1, wherein the second processor of the PAP is configured to distinguish between and calculate the severity of both obstructive apneas and central apneas of the subject during a treatment with the PAP device.”**

144. In my opinion, Bao in view of Klee and Shouldice discloses this limitation. Bao in view of Klee discloses the second processor calculating, among other things, “the data of a severity of the symptoms of the subject and/or the index.” Section VIII.C.1.e. The combination, even when considered with Dong, does not appear to explicitly disclose that the second processor is “configured to distinguish between and calculate the severity of both obstructive apneas and

central apneas of the subject during a treatment with the PAP device.” Shouldice, however, does.

145. For example, Shouldice discloses determining “a number of events per hour, a pattern of events, ... during the sleep session.” EX1011, ¶80. “The event(s) can include snoring, apneas, *central apneas*, *obstructive apneas*, mixed apneas, hypopneas, a mask leak (e.g., from the user interface 124), a restless leg, a sleeping disorder...” EX1011, ¶80 (emphasis added); *see also* ¶81. Specifically, Shouldice discloses that the “data from the one or more sensors 130 can be analyzed to determine one or more sleep-related parameters ... The one or more events can include snoring, apneas, *central apneas*, *obstructive apneas*, mixed apneas, hypopneas, a mask leak, a cough, a restless leg, a sleeping disorder.” EX1011, ¶105 (emphasis added).

146. Accordingly, in my opinion, a POSITA would have understood that the combination of Bao, Klee, Dong and Shouldice discloses that “the second processor of the PAP is configured to distinguish between and calculate the severity of both obstructive apneas and central apneas of the subject during a treatment with the PAP device.” Motivation for the combination is provided above in the discussion of Claim 9

E. Ground 5: Claims 15, 16 and 18 are Rendered Obvious by Bao in view of Klee and Dong

1. Claim 15

- a. “The system of claim 14, wherein the PAP device further comprises an extended horizon, adaptive, predictive controller to adjust the flow of the blower based in part on the data of the severity of the symptoms of the subject calculated by the second processor.”**

147. In my opinion, Bao in view of Klee and Dong discloses this limitation. As noted above, Bao in view of Klee discloses “data of the severity of the symptoms of the subject calculated by the second processor.” Section VIII.C.1.e.

148. Bao also discloses a controller that adjusts the flow of the blower that the “blower 202 and/or the humidifier 201 may be controlled by a controller 203, which preferably comprises a microprocessor with associated memory or some other suitable control configuration.” EX1009, ¶125. A POSITA would have understood that the controller 203, which calculates the claimed discloses “data of the severity of the symptoms of the subject” and also controls the blower 202, would have performed the control of the blower 202 “based *in part* on the data of the severity of the symptoms of the subject.”

149. Dong discloses an extended horizon adaptive, predictive controller. EX1015, 7:60-62 (“FIG. 1 illustrates the overall structure of extended horizon

adaptive block predictive controller with an efficient prediction system.”). A POSITA would have a motivation and reasonable expectation of success in combining Bao’s controller that adjusts the flow of the blower based in part on the data of the severity of the symptoms of the subject and Dong’s extended horizon adaptive, predictive controller. For example, Bao and Dong are in related fields i.e., Dong concerns a class of adaptive controllers using predictive techniques in dynamic systems and Bao concerns controlling respiratory devices which are dynamic systems. In addition, a POSITA would have been aware that using such a controller “reduces run time and memory requirements” in comparison to other controllers. EX1015, 6:44-46, 2:1-41 (describing known controllers). The ’284 patent further acknowledges that an “extended horizon, adaptive, predictive controller” for use with a PAP device was available off-the-shelf by the time of the November 2005 filing of the 11/266,899 application, and known over ten years before the filing of any of the priority applications. EX1001, 20:55-59 (referencing Dong, which issued June 13, 1995). Thus, a POSITA having knowledge of the well-known “extended horizon, adaptive, predictive controller” would have found it suitable for use with the Bao CPAP apparatus 200, and specifically its controller 203. Indeed, it would have been obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., adaptive, predictive controller v. a controller that was not adaptive and predictive), with a reasonable expectation of

success (suitable control of a CPAP blower based in part of the patient's "data of the severity of the symptoms of the subject" with reduced run time and memory requirements). Moreover, neither the claim nor the '284 patent specify any particular modification or special use of the claimed controller, and merely use it for its intended purpose as a controller. *Id.*

2. Claim 16

- a. "The system of claim 15, wherein the remote internet site is hosted on a remote communication system with a third processor for reprocessing and/or outputting data received from the first or second radio frequency wireless transceiver in whole or part, wherein the remote internet site is configured to output to a printer in a report form or to a second display the reprocessed and/or outputted data, for review by a clinician to determine the treatment efficacy."**

150. In my opinion, Bao in view of Klee discloses this limitation for at least the same reasons as discussed with respect to claim 19. Section VIII.C.10.

3. Claim 18

- a. "The system of claim 1, wherein the PAP device further comprises an extended horizon, adaptive, predictive controller to adjust the flow of the blower based in part on the data of the severity of the symptoms of the subject calculated by the second processor."**

151. Bao discloses this limitation for at least the same reasons discussed for Claim 15. Section VIII.E.1.a.

F. Ground 6: Claim 17 is Rendered Obvious by Bao in view of Klee, Dong and Shouldice

1. Claim 17

- a. “The system in claim 16, wherein the second processor of the PAP is configured to distinguish between and calculate the severity of both obstructive apneas and central apneas of the subject during a treatment with the PAP device.”**

152. In my opinion, Bao in view of Klee and Shouldice discloses this limitation for at least the same reasons discussed for Claim 20. Section VIII.D.6.

153. Motivation for the combination of Bao, Klee, and Shouldice is provided above in the discussion of Claim 9. *Id.* A POSITA would further have been motivated to combine Bao, Klee, and Shouldice with Dong. A POSITA would have found it obvious, and had reasonable expectations of success, to incorporate one or more of the claimed signal processing techniques, all of which were well-known to POSITA, into the Bao-Klee CPAP system. A POSITA, with knowledge of Bao, Klee, Shouldice and Dong would have considered it obvious to combine their respective teachings. Bao, Klee, Shouldice and Dong share commonalities in terms of their general subject matter (e.g., using CPAP and other devices to treat sleeping/breathing disorders) and technique used (e.g., evaluating data from a CPAP device and other devices) to improve operation of CPAP treatment devices to ensure treatment and techniques to process and control signals

and dynamic systems. *Id.*; EX1015, 2:1-43. Moreover, Bao, Klee, Shouldice and Dong are within the same technical field as each other and the '284 Patent. Section VII.D.6; *e.g.*, EX1015, 1:7-15, 2:1-43.

G. Ground 7: Claims 1-3, 6 and 19-20 are Rendered Obvious by Farrell in view of Pirzada

154. Farrell (EX1012) published July 12, 2007.

155. Pirzada (EX1013) published July 5, 2007.

1. Claim 1

156. In my opinion, it is more likely than not that claim 1 is rendered obvious by Farrell in view of Pirzada for the reasons set forth below and in the October 21, 2022 Final Rejection (EX1002), 85-93.

a. 1pre.

157. In my opinion, to the extent it is a limitation, Farrell discloses the Claim 1 preamble.

158. For example, Farrell discloses an “apparatus for treating and monitoring sleep disordered breathing (“SDB) in patients with cardiovascular disease...” EX1012, ¶2; FIG. 1. The apparatus itself is not labeled, but its components are. The Farrell system also comprises a hand-held display and control device 12. EX1012, ¶2.

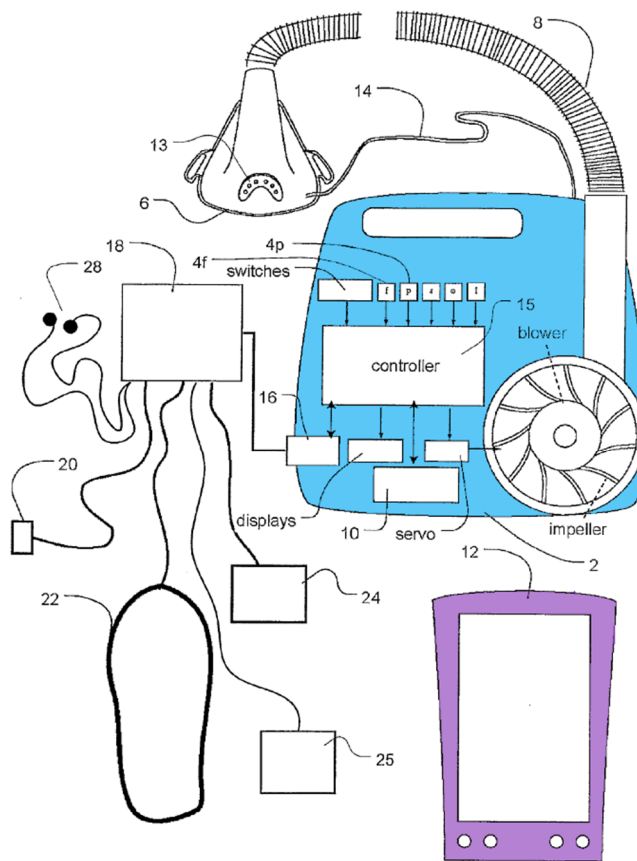


FIG. 1

b. Limitation 1a.

159. In my opinion, Farrell in view of Pirzada discloses Limitation 1a.

cell phone components: wireless transceiver, processor, software, and display.

160. Farrell discloses that the apparatus contains “a communication port or module 10,” which is a “wireless communication transceiver and/or a network card, for communication with other devices or computers such as hand-held display and control devices 12.” EX1012, ¶26. One example hand-held device 12

is a “Palm Pilot.” EX1012, ¶28. Using the hand-held device 12, “a physician may, for example, remotely monitor, analyze or record the status or data history of a patient. For example, remote devices may send to or retrieve from the apparatus any desired cardiovascular or other information.” EX1012, ¶28. In my opinion, A POSITA would have understood that to wirelessly exchange data/information with the apparatus, the hand-held device 12 necessarily requires the claimed “first radio frequency wireless transceiver.” Likewise, to “remotely monitor, analyze or record the status or data history of a patient,” a POSITA would have understood that the hand-held device 12 comprises a display, a non-transitory computer readable medium for storing first software executed by a processor so that the device can perform its functions and for storing data/information processed by the device 12.

161. Farrell does not explicitly disclose that the hand-held device 12 is a cell phone as required by Claim 1. A POSITA, however, would have understood that a cell phone could also have been used as the hand-held device 12 in the Farrell system. Specifically, cell phones with a display and wireless data transmissions in PAP systems were well known as evidenced by Pirzada. EX1013, ¶83. A POSITA would have found it obvious to try implementing a cell phone as a hand-held device 12 as merely choosing from a finite number of identified, predictable solutions (i.e., cell phone v. PDA), with a reasonable expectation of

success (allowing doctors to remotely monitor their patients and patients to monitor their therapy from cell phone).

cell phone displaying an index of treatment efficacy:

162. Farrell discloses that its PAP “device provides *efficacy tracking* by detecting and recording or scoring *SDB events or related information or indices over time*, for example, by tracking or detecting central apneas, obstructive apneas, hypopneas, partial obstructions (e.g., flow flattening) or snoring.” EX1012, ¶36. One such index is the “AHI (apnea hypopnea index).” EX1012, ¶37. Moreover, Farrell discloses that the PAP “device preferably performs compliance tracking in which the time on and time off of the mask are recorded with SDB related events for evaluation by statistical summaries and charting.” EX1012, ¶37. “Preferably, the cardiovascular and SDB information may be periodically *remotely transferred to the physician.*” EX1012, ¶47. One remote destination for the index is Farrell’s hand held device (or cell phone).

163. As noted above, the ’284 patent contains no written description support or enabling disclosure for the claimed “index of treatment efficacy.” See *supra* Sections VIII.A.1, VIII.B. In my opinion, a POSITA would have understood that Farrell’s disclosure of “efficacy tracking” and scoring “indices over time” would comprise an “index of treatment efficacy,” as best understood.

the index based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject:

164. To the extent this limitation can be understood, Farrell discloses “the index [of treatment efficacy of the subject being] based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.” For example, in my opinion, a POSITA would have understood that Farrell’s disclosure of “efficacy tracking” and scoring “indices over time” would comprise an “index of efficacy” as best understood. It is also my opinion that a POSITA would have also understood that Farrell’s “detecting and recording or scoring SDB events or related information or indices over time” would be the claimed, but undefined, “data of severity of sleep disorder symptoms.” Moreover, Farrell discloses “compliance tracking in which the time on and time off of the mask are recorded with SDB related events for evaluation by statistical summaries and charting.” EX1012, ¶36. In my opinion, a POSITA would have understood this to be the “data of usage of the PAP device by the subject.”

165. As mentioned above, there is no disclosure of how the ’284 patent determines the “index of treatment efficacy.” However, seeing as how Farrell discloses tracking efficacy, SDB and other events, determining indices, tracking usage of the PAP device over time, and combining data to calculate scores, a POSITA would have understood that the Farrell determines, as best understood, an

“index of treatment efficacy” “based in part on data of severity of sleep disorder symptoms of the subject and data of usage of the PAP device by the subject.”

data of severity and data of usage calculated by the PAP device:

166. Farrell discloses that the PAP apparatus’ controller 15 is “configured and adapted to implement” Farrell’s methodology. EX1012, ¶25. As such, Farrell discloses that the claimed “data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject,” as best understood, are “both calculated by the PAP device.” The same data is received by the Farrell hand held device (or cell phone) as discussed above.

c. Limitation 1b.

167. In my opinion, Farrell discloses Limitation 1b. For example, Farrell FIG. 1 illustrates a blower within an enclosure of the PAP apparatus. EX1012, ¶24.



d. Limitation 1c.

168. In my opinion, Farrell discloses Limitation 1c. For example, Farrell discloses “a flow sensor 4f ... may also be utilized in which case mask flow may be measured ... to derive a flow signal $F(t)$.” EX1012, ¶24. The flow signal $F(t)$ is sent to the PAP apparatus’ controller 15 for processing. EX1012, ¶24. In my opinion, a POSITA would have understood that the flow sensor 4f outputs airflow sensor data in the form of the flow signal $F(t)$.

169. PO is expected to argue that the PTO examiner agreed that “Farrell makes clear that flow and pressure measurements of the delivered are used to adjust the PAP device—not [the subject’s] respiratory effort.” IPR2023-00565,

paper 6, 31 (citing to an alleged agreement in the prosecution of the related '269 patent). But PO would be wrong as the patent examiner subsequently determined that Farrell discloses limitation 1c. EX1002, 122 (Farrell discloses “an airflow sensor (‘flow sensor’) 4f internal to the PAP device adapted for measuring or deriving the respiratory airflow of a subject while using the PAP and outputting airflow sensor data (see para. [0024])”).

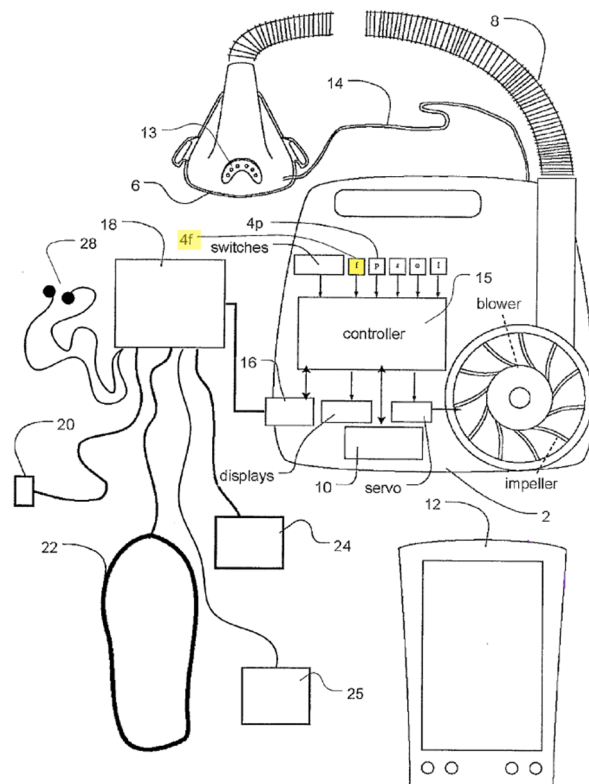


FIG. 1

e. Limitation 1d.

170. In my opinion, Farrell discloses Limitation 1d. Farrell discloses that the PAP apparatus comprises “a controller or microprocessor 15.” EX1012, ¶¶24, 25; FIG. 1. As discussed above, Farrell discloses “data of severity of sleep disorder

symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone.” Section VIII.G.1.b. Farrell also discloses the controller 15 receiving the flow signal $F(t)$. Section VIII.G.1.c.

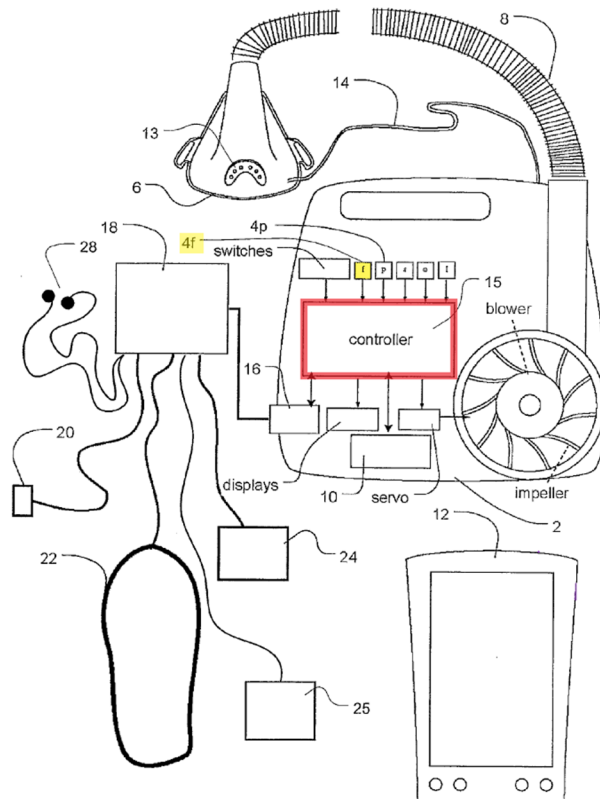


FIG. 1

171. In my opinion, a POSITA would have understood that the controller 15 is the claimed “second processor” because it is a microprocessor “configured and adapted to implement” Farrell’s methodology. EX1012, ¶25.

f. Limitation 1e.

172. In my opinion, Farrell discloses Limitation 1e. For example, Farrell discloses “mask 6.” EX1012, ¶24; FIG. 1.

g. Limitation 1f.

173. In my opinion, Farrell discloses Limitation 1f. Specifically, Farrell discloses that the PAP apparatus “preferably also includes a communication port or module 10, for example, a wireless communication transceiver ... for communication with other devices or computers such as hand-held display and control devices 12.” EX1012, ¶26. “Preferably, the cardiovascular and SDB information may be periodically remotely transferred to the physician...” EX1012, ¶47.

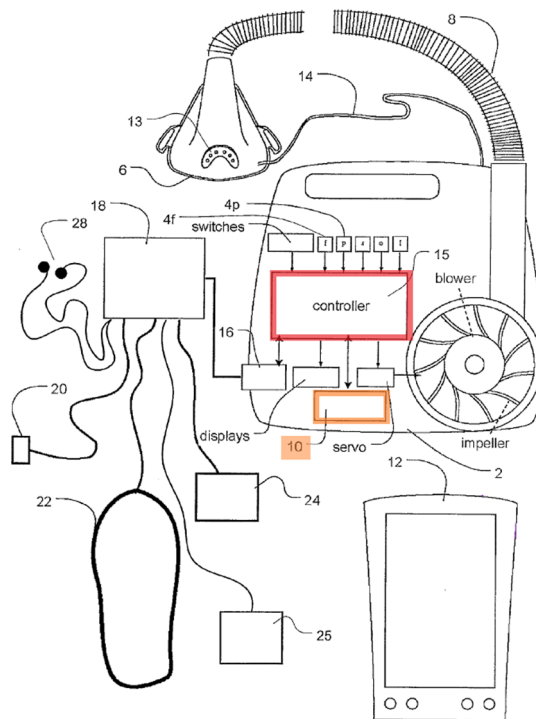


FIG. 1

174. As discussed above, Farrell disclose “the data of severity of sleep disorder symptoms of the subject and the data of usage of the PAP device by the subject both calculated by the PAP device and received by the cell phone.” Section

VIII.G.1.b. Moreover, in my opinion, a POSITA would have understood that the controller 15 is the claimed “second processor.” Section VIII.G.1.e. Accordingly, in my opinion, a POSITA would have understood that Farrell discloses “at least one second radio frequency wireless transceiver adapted for transmitting the data of severity of the symptoms of the subject and/or the index, and the data of usage calculated by the second processor.”

h. Limitation 1g.

175. In my opinion, Farrell or Farrell in view of Pirzada discloses Limitation 1g. Specifically, Farrell discloses “the cardiovascular and SDB information may be periodically remotely transferred to the physician” from the PAP apparatus. EX1012, ¶47. Farrell further discloses that the apparatus can transmit the information “remotely, for example, over a secure electronic network to a database.” EX1012, ¶47. In my opinion, a POSITA would have understood that the “information may be periodically remotely transferred to the physician [website or portal].” EX1012, ¶47. During prosecution, the Examiner indicated that this read on the claimed “remote internet site.” EX1002, 89-90. The patent owner disagreed. EX1002, 72. To the extent that the patent owner maintains its position that Farrell does not disclose Limitation 1g because the Internet would not be considered “a secure electronic network,” a POSITA would have found it obvious because transmitting treatment and other information from a PAP apparatus to a

remote website was well known at the time as evidenced by Pirzada. For example, Pirzada discloses that the prior art already included “a method and apparatus for health and disease management combining patient data monitoring with wireless internet connectivity.” EX1013, ¶2. Regarding the system disclosed by Pirzada, Pirzada discloses that its “device 10 can communicate ... via WiFi communication 152, through GSM network or any cellular based telephone communication 154, or through broadband communication network 156” and that its “SIM card can interact with the Internet 160 to communicate with an off-site database 170.” EX1013, ¶60. Pirzada also discloses that “[d]atabase 170 can be stored on a server 162 or any other type personal computer,” EX1013, ¶60, and that “web applications are also in communication with the database 170.” EX1013, ¶68. Pirzada also discloses a “web page” accessible to control its device 10. EX1013, ¶83. A POSITA would have understood that “web applications” and or a “web page” would be implemented by a remote internet site.

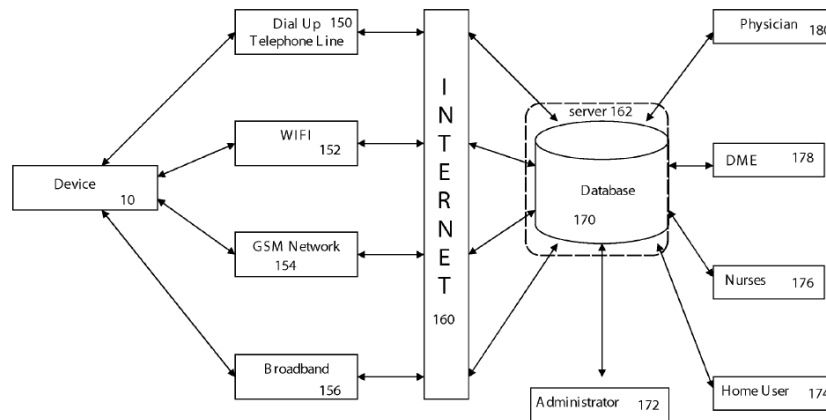


FIG. 4

176. In my opinion, a POSITA would have understood that the CPAP apparatus, and specifically its “radio frequency wireless transceiver,” would be adapted to transmit the “the data of the severity of the symptoms of the subject and/or the index, and the data of usage of the PAP device by the subject both related to the subject’s treatment and the treatment's efficacy” (see Section VIII.G.1.g] “in whole or part” to the database 170 where it is accessible by a web application or internet site, remote to the PAP system. A POSITA would have been additionally motivated to combine the teachings of Farrell and Pirzada because they are from the same technical field as the ’284 patent.

2. Claim 2

177. In my opinion, Farrell in view of Pirzada discloses Claim 2. Farrell discloses the claimed “first radio frequency wireless transceiver” and “second radio frequency wireless transceiver.” Sections VIII.G.1.b, VIII.G.1.g. Farrell

does not explicitly disclose these transceivers as implementing the Bluetooth protocol. But a POSITA would have understood that a PAP system comprising wireless transceivers that implement the Bluetooth protocol was well known at the time as evidenced by Pirzada. EX1013, ¶¶37, 64, 70. It is also my opinion that a POSITA would have understood that implementing the Bluetooth protocol in both the first and second radio frequency wireless transceivers disclosed by Farrell would have been obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., cellular or wireless WiFi communications v. Bluetooth wireless communications), with a reasonable expectation of success (exchanging information throughout the PAP system wirelessly).

3. Claim 3

178. In my opinion, Farrell in view of Pirzada discloses Claim 3. Farrell discloses the claimed “second radio frequency wireless transceiver.” Section VIII.G.1.g. Farrell does not explicitly disclose the transceiver transmitting the claimed data using cell towers. But a POSITA would have understood that a PAP apparatus comprising a wireless transceiver that transmits data using cell towers was well known at the time as evidenced by Pirzada. EX1013, ¶¶54, 60. A POSITA would have understood that transmitting the data via cell towers would have been obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., wireless WiFi or Bluetooth communications v. cellular

communications), with a reasonable expectation of success (exchanging information throughout the PAP system wirelessly).

4. Claim 6

179. In my opinion, Farrell discloses Claim 6. Farrell discloses “automated changes to the control of the device may be made such as a change in treatment protocol” based on information calculated by the PAP apparatus and transmitted to the remote internet site. EX1012, ¶47; *see also* ¶28; Section VIII.G.1.h. One example is the changing of pressure via “controlling an opening of a servo-valve that may variably divert/vent or deliver airflow to the mask.” EX1012, ¶24.

5. Claim 19

180. In my opinion, Farrell or Farrell in view of Pirzada discloses Claim 19. Farrell or Farrell in view of Pirzada discloses the remote internet site. Section VIII.G.1.h. Moreover, Farrell discloses that “[v]arious appropriate input and output devices such as keypads and display screens and other alternatives are known in the art.” EX1012, ¶27. Farrell further discloses that “the treatment program that is being run on the patient can be monitored and changed remotely.” EX1012, ¶28. As such, a POSITA would have understood that, at a minimum, the computer implementing the remote internet site disclosed by Farrell or Farrell and Pirzada would be configured to output to a second, remote display for review by a clinician to determine treatment efficacy.

6. Claim 20

181. In my opinion, Farrell discloses Claim 20. Farrell discloses “the device provides efficacy tracking by ... tracking or detecting central apneas, obstructive apneas, ...” EX1012, ¶36.

H. Ground 8: Claims 4, 5, 7, 8, and 14 are Rendered Obvious by Farrell in view of Pirzada and Bao

1. Claim 4

182. In my opinion, Farrell in view of Pirzada and Bao discloses Claim 4. Farrell discloses the claimed second processor. Section VIII.G.1.g. While a POSITA would have understood that Farrell’s second processor would execute the claimed second software from the corresponding memory, Farrell does not explicitly disclose reprogramming or modifying the software from a remote internet site. Bao, however, does. *See* Section VIII.C.4.a.

183. In my opinion, a POSITA would have been motivated to modify Farrell’s system with Bao’s remote software reprogramming. Doing so would have merely involved combining prior art elements (i.e., known remote software updating) according to known methods (e.g., wireless transmissions over the internet) to yield predictable results (an enhanced device with current updates and/or modifications). A POSITA would have had a reasonable expectation of

success in remotely updating/modifying Farrell's PAP apparatus software based on the combined teachings of Farrell and Bao.

2. Claim 5

184. In my opinion, Farrell in view of Pirzada and Bao discloses Claim 5 for at least the reasons discussed for Claim 6. Section VIII.G.4.

3. Claim 7

185. In my opinion, Farrell in view of Pirzada and Bao discloses Claim 7. For example, Farrell in view of Pirzada discloses the claimed "first software" stored a computer readable medium on the cell phone and executed by the cell phone. Section VIII.G.1.b. The combination does not explicitly disclose being adapted to be reprogrammed or modified remotely.

186. Bao, however, does. *See* Section VIII.C.7.a.

187. In my opinion, a POSITA would have been motivated to modify Farrell's system with Bao's remote software reprogramming. Doing so would have merely involved combining prior art elements (i.e., known remote software updating) according to known methods (e.g., wireless transmissions over the internet) to yield predictable results (an enhanced device with current updates and/or modifications). In my opinion, a POSITA would have had a reasonable expectation of success in remotely updating/modifying Farrell's hand-held device software based on the combined teachings of Farrell and Bao.

4. Claim 8

188. In my opinion, Farrell in view of Pirzada and Bao discloses Claim 8 for at least the same reasons discussed for Claim 7. Section VIII.H.3.

5. Claim 14

189. In my opinion, Farrell in view of Pirzada and Bao discloses Claim 14. Farrell or Farrell in view of Pirzada discloses the remote internet site receiving the claimed data from the PAP device. Section VIII.G.1.h. The combination (including Bao), however, does disclose the remote internet site retransmitting the data to the cell phone. See Section VIII.C.9.a.

190. In my opinion, a POSITA would have been motivated to update the Farrell/Pirzada system such that the cell phone received retransmitted data from the remote internet site as known and disclosed by Bao. Such capability, for example, would have provided hand-held device users to participate in challenges and/or achieve “goals that are specific to an individual patient and/or group of patients.” EX1009, ¶156. A POSITA would have found doing so obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., retransmitting certain data and information to a patient’s handheld device v. keeping the data and information accessible only to the clinician), with a reasonable expectation of success (patients’ enhanced use of the therapy to meet the challenge or achieve the goals).

I. Ground 9: Claims 9-13 are Rendered Obvious by Farrell in view of Pirzada, Bao and Shouldice

1. Claim 9

191. In my opinion, Farrell in view of Pirzada, Bao and Shouldice discloses Claim 9. For example, Farrell discloses airflow sensor data received by the second processor. Section VIII.G.1.d.

192. Neither Farrell, Pirzada nor Bao specifically, disclose, using one or more of the Claim 9 signal processing techniques to process” the data. Shouldice, however does. Section VIII.D.1.a.

193. In my opinion, a POSITA would have found it obvious, and had reasonable expectations of success, to incorporate one or more of the claimed signal processing techniques, all of which were well-known to POSITA, into the Farrell-Pirzada-Bao CPAP system. A POSITA, with knowledge of Farrell, Pirzada, Bao and Shouldice, would have considered it obvious to combine their respective teachings. For example, Farrell, Pirzada, Bao and Shouldice share commonalities in terms of their general subject matter (e.g., using CPAP and other devices to treat sleeping/breathing disorders) and technique used (e.g., evaluating data from a CPAP device and other devices) to improve operation of CPAP treatment devices to ensure treatment. Moreover, Farrell, Pirzada, Bao and Shouldice are within the same technical field as each other and the '284 Patent.

194. Notably, the '284 patent relies on the knowledge of a POSITA to implement this well-known feature: “The present invention would also include other on-line signal processing algorithms known to those skilled in the art, such as *wavelet analysis*, which is similar to time-frequency analysis with a particular kernel function, to identify the shift in power spectrum associated with imminent flow separation that is discussed herein.” EX1001, 20:36-41 (emphasis added). For at least the same reasons, a POSITA would have found it obvious, and known how, to successfully implement these techniques in the Farrell-Pirzada-Bao CPAP system to arrive at the claimed system.

2. Claim 10

195. In my opinion, Farrell in view of Pirzada, Bao and Shouldice discloses this limitation for at least the same reasons discussed for Claim 14. Section VIII.H.5.

3. Claim 11

196. In my opinion, Farrell in view of Pirzada, Bao and Shouldice discloses this limitation for at least the same reasons discussed for Claim 9. Section VIII.I.1.

4. Claim 12

197. In my opinion, Farrell in view of Pirzada, Bao and Shouldice discloses Claim 12 for at least the same reasons discussed for Claim 9. Section VIII.I.1.

5. Claim 13

198. In my opinion, Farrell in view of Pirzada, Bao and Shouldice discloses Claim 13 for at least the same reasons discussed for Claim 11. Section VIII.I.3.

J. Ground 10: Claims 15-18 are Rendered Obvious by Farrell in view of Pirzada, Bao and Dong

1. Claim 15

199. In my opinion, Farrell in view of Pirzada, Bao and Dong disclose Claim 15. For example, Farrell discloses adjusting the flow of a blower unit. EX1012, ¶25 (“many different pressure treatment therapies simply by adjusting the pressure delivery equation that is used to set the speed of the blower.”). It is also my opinion, a POSITA based on the teachings of Farrell, Pirzada and/or Bao would have understood that the controller, which calculates the claimed “data of the severity of the symptoms of the subject” and also controls the blower, would have performed the control of the blower “based *in part* on the data of the severity of the symptoms of the subject.”

200. In addition, extended horizon adaptive, predictive controllers were well known to the POSITA as evidenced by Dong. EX1015, 7:60-62 (“FIG. 1 illustrates the overall structure of extended horizon adaptive block predictive controller with an efficient prediction system.”). A POSITA would have also been aware that using such a controller “reduces run time and memory requirements” in comparison to other controllers. EX1015, 6:44-46. The ’284 patent acknowledges that an “extended horizon, adaptive, predictive controller” for use with a PAP device was well known years before the filing of any of the priority applications. EX1001, 20:55-59. Thus, in my opinion, a POSITA having knowledge of Dong’s well-known “extended horizon, adaptive, predictive controller” would have found it suitable for use with the Farrell apparatus and its controller. Indeed, it would have been obvious to try as merely choosing from a finite number of identified, predictable solutions (i.e., adaptive, predictive controller v. a controller that was not adaptive and predictive), with a reasonable expectation of success (suitable control of a CPAP blower based in part of the patient’s “data of the severity of the symptoms of the subject” with reduced run time and memory requirements). .

2. Claim 16

201. In my opinion, Farrell in view of Pirzada, Bao and Dong disclose Claim 16 for at least the reasons discussed for Claim 19. Section VIII.G.5.

3. Claim 17

202. In my opinion, Farrell in view of Pirzada, Bao and Dong discloses Claim 17 for at least the reasons discussed for Claim 20. Section VIII.G.6.

4. Claim 18

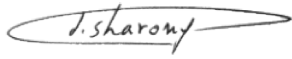
203. In my opinion, Farrell in view of Pirzada, Bao and Dong discloses Claim 18 for at least the reasons discussed for Claim 15. Section VIII.J.1.

IX. CONCLUSION

204. For all the foregoing reasons, it is my opinion that it is more likely than not that claims 1-20 of the '284 Patent are each unpatentable under one or more of 35 U.S.C. § 103 and 35 U.S.C. § 112.

205. I hereby declare under penalty of perjury, under the laws of the United States of America, that I believe that the foregoing statements, analysis, and opinions are true and correct.

Date: December 13, 2023

Signed: 

Jacob Sharony, Ph.D.

JACOB SHARONY, PhD, MBA

+1 (631) 546-5840

jacob@mobiusconsulting.com

Dix Hills, New York 11746

Seasoned professional with over 35 years experience and expertise in information communications technologies (ICT), wireless networks, mobile devices/applications, data capture and sensing; visionary, creative and innovative with strong technology and business skills.

EXPERIENCE**MOBIUS CONSULTING**, Huntington Station, NY**2004 –*****Founder, Principal Consultant***

- Professional consulting services in mobile wireless strategy, technologies, systems and applications.
- “Trusted Advisor” role facing large clients in telecom, vertical enterprises and government, building trust and relationships.
- Expertise includes WiFi, 4G LTE and 5G, WiMAX, picocell/femtocell, DAS, mesh networking, Internet of Things (IoT), M2M, RFID, RTLS, smart antennas, MIMO/beamforming, cloud computing, mobile crowd sourcing/sensing, enterprise mobility, security protocols, mobile embedded devices, device management, mobile applications/services, LBS, VoIP, video streaming, Zigbee, Bluetooth, sensor networks, RTLS, smart grid, m-health, m-learning, smart home networking.
- System and network protocol analysis, modeling and simulations of wireless systems (e.g., WiFi, LTE) for network performance assessment and optimization.
- Participated in a lead role in several medium-large projects in various vertical, enterprise and government/military markets, e.g., smart grid, mobile health, WiFi and 4G deployments.
- Selected consulting engagements are listed below: Lattice Semiconductor, SiBEAM, Powerwave Technologies, Time Warner Cable, and Corning-MobileAccess.

COLUMBIA UNIVERSITY, New York, NY**2010 –*****Adjunct Professor***

- Professor of Electrical Engineering. Teaching graduate courses on advanced wireless technologies: mmWave Wireless Communications and Applications for 5G, Wireless Sensing (RFID, RTLS, M2M communications, smart grid/energy, smart infrastructure, intelligent transportation, m-health).

LATTICE SEMICONDUCTOR, Sunnyvale, CA**2014 – 2016*****CTO Office Senior Advisor***

Developing 5G solutions using mmWave and Phased Array Antenna technologies. Applications include ‘wireless fiber’ backhaul/front-haul, connected cars, in-home connectivity.

SIBEAM, Silicon Valley**2014 – 2016*****Technology Strategy Senior Consultant***

Developing intelligent millimeter wave (60 GHz) technologies for wireless communications (802.11ad) and fixed access solutions for 5G.

POWERWAVE TECHNOLOGIES, Santa Ana, CA**2011 – 2013*****CTO Office Senior Principal Consultant / VP Innovation***

- Leading innovation, strategy and development of HetNets, DAS and small cells (picocell) solutions using 4G LTE and WiFi technologies to enhance coverage and capacity of wireless network infrastructure.

CENTER OF EXCELLENCE IN WIRELESS & IT, SUNY, Stony Brook, NY**2006 – 2010*****Director, Network Technologies Research Division***

- Leading network technologies research, development and commercialization efforts
- Industry liaison, working on smart energy, wireless healthcare and intelligent transportation solutions.
- Deployed mobile WiMAX pico/femto solution as part of the 4G-campus initiative.
- Key contributor to the Long Island Broadband Wireless Access Initiative using WiFi and 4G.

TIME WARNER CABLE, Stamford, CT

2007 – 2008

Wireless Strategy & Development Senior Consultant

- Worked on a large wireless project involving WiFi, WiMAX and 3G with advanced mobile devices.
- Developed concept and product requirements documents, architecture and RF design, and test plans.
- Supported the business development group on femtocells models, MVNO's models and services, etc.

MOBILE-ACCESS (Acquired by Corning), Vienna, VA

2006 – 2008

CTO Office DAS Strategy & Development Senior Consultant

- Worked with the CTO and senior engineers to develop WiFi DAS systems.
- Developed detailed analysis and novel method to support MIMO (802.11n) in DAS systems.

MOTOROLA (formerly Symbol Technologies), Holtsville, NY

1997 – 2005

Senior Director, Technology Strategy and Development

2003 – 2005

- Served as “the eyes of the company” – Charter was to identify and evaluate emerging/disruptive technologies, and conduct technology/business due diligence of possible partners/acquisitions. Team leader.
- Guided the company technology roadmap by generating Technology Position Statements (TPS). Selected topics include: 802.11a/b/g migration strategy, 802.11e (QoS), Broadband Wireless Access - 802.16d/e fixed and mobile WiMAX, mesh networks, RFID, RTLS, and MIMO. These TPS were fact based and relied on results obtained through modeling, analysis and simulations.
- Explored a new family of products based on multi-point MIMO architecture in mesh wireless networks.
- Investigated VoIP capacity in 802.11a/b/g networks and initiated work on admission control algorithms/policies.
- Researched and developed new mobile applications delivering multimedia-rich content to heterogeneous networked mobile devices.
- Developed strategic alliances and led technology initiatives with technology/business partners.
- Participated actively in IEEE 802.11, 802.15 and 802.16 standards meetings.
- Awarded several patents.

Senior Director, Research and Development

1997 – 2003

- Initiated and led several R&D programs in wireless LAN technologies: intelligent access point, reliable multicast video streaming, mobile device management/security and spatial wireless switching.
- Conceived, investigated and developed a novel wireless switching architecture based on MIMO technology.
- Conducted innovative research in WLAN QoS, Bluetooth interference mitigation, multicast video streaming, mobile security, RFID, RTLS - location tracking (RSSI/TDOA), VoIP and smart antennas.
- Participated in strategic planning and impacted the technology/business direction of the company.
- Awarded several patents.

BAE SYSTEMS, Greenlawn, NY

1994 – 1997

Research Scientist

- Led the advanced mobile networking group.
- Developed tactical mesh-based wireless network systems for DoD.
- Worked on advanced antenna techniques including beam steering/switching.
- Awarded several patents.

NEC RESEARCH INSTITUTE, Princeton, NJ

1992 – 1994

Research Fellow

- Worked on optical interconnects for parallel processing.
- Investigated multi-dimensional switches using wavelength, space and time.
- Designed a wavelength router/switch using free-space optics.

IBM RESEARCH CENTER, Hawthorne, NY

1990 – 1992

Research Associate

- Developed and prototyped a gigabit switch.
- Built a testbed of multi-wavelength optical network.
- Developed algorithms for WDMA using AO tunable filters.

Head of Fiber-optics Systems Engineering

- Pioneered security products using fiber optic sensors.
- Conducted research & development in fiber optic sensors.
- Co-developed and deployed a large fiber optic data communications network.

EDUCATION

COLUMBIA UNIVERSITY, New York, NY

- Ph.D., Electrical Engineering, 1993.
- M.Phil, Electrical Engineering, 1991.

TEL AVIV UNIVERSITY, Tel Aviv, Israel

- MBA, Recanati Business School, 1989.
- MSc., Electrical Engineering, 1984.
- BSc., magna cum laude, Electrical Engineering, 1979.

PUBLICATIONS / PATENTS / OTHER

- Numerous publications in proceedings and conference papers.
- Numerous US and international patents issued.
- Served on several government agencies expert panels (NSF, NIH).
- IEEE Senior Member.
- Featured speaker on several industry sponsored webinars.
- Served as an expert witness/consultant in District Court, IPR, PGR, ITC, FRAND, PCA, AAA cases.

COURSES TAUGHT

- Introduction to Auto ID and Data Capture (AIDC) Technologies (State University NY, Stony Brook)
- Wireless Sensing Networks (Columbia University)
- mmWave Communications and Applications for 5G (Columbia University)

RECENT EXPERT WITNESS CONSULTING¹

- 2023: Maxell Ltd. v. Samsung Electronics (Litigation)
- 2023: Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions (IPR)
- 2023: OZMO Licensing v. Dell Technologies (Litigation/IPR)
- 2022: Howlink Global v. AT&T (Litigation)
- 2022: Cleveland Medical Devices v. ResMed Corp (Litigation/IPR)
- 2022: Lone Star Systems v. Zebra Technologies (Litigation/IPR)
- 2022: Telecom Network Solutions v. AT&T, Verizon, and T-Mobile (Litigation/IPR)
- 2021: BillJCo v. Apple (Litigation/IPR)
- 2021: BillJCo v. Cisco Systems et al. (Litigation)
- 2021: Zebra Technologies v. OnAsset Intelligence (ITC)
- 2021: CellSpin Soft v. Under Armour (Litigation)
- 2021: CellSpin Soft v. Nike (Litigation)
- 2021: Intellectual Ventures v. Hewlett Packard Enterprise (Litigation/IPR)
- 2021: AEGIS v. Hisense (Litigation)
- 2020: Soter Technologies v. IP Video Corp. et al (Litigation)
- 2020: Intellectual Tech v. Zebra Technologies (Litigation)
- 2020: Uniloc v. Apple (Litigation)
- 2020: American Patents v. Juniper Networks (Litigation)
- 2020: Proxicom Wireless v. Target Corporation (Litigation)

¹ Represented parties are underlined.

- 2020: Sol IP v. AT&T et al. (Litigation)
- 2019: Cellular Evolution v. AT&T et al. (Litigation)
- 2019: Philips v. HTC (Litigation, UK)
- 2019: Ericsson v. Tishman Interiors (AAA Arbitration)
- 2019: Uniloc v. Samsung, Huawei (Litigation)
- 2018: Intel et al. v. Hera Wireless (IPR)
- 2018: Deutsche Telecom v. The Republic of India (UNCITRAL Arbitration, Paris Tribunal)
- 2017: Devas v. The Republic of India (UNCITRAL Arbitration, The Hague Tribunal)
- 2017: RPX Corp. et al. v. Iridescent Networks (IPR)
- 2017: Intellectual Ventures v. FedEx (Litigation)
- 2017: FedEx v. Intellectual Ventures (IPR)

PREVIOUS TESTIMONY

- *Deutsche Telekom AG v. The Republic of India*, PCA Case No. 2014-10 (UNCITRAL) Expert Reports + Arbitration Hearing.
- *Devas (Mauritius) Ltd. et al v. The Republic of India*, PCA Case No. 2013-09 (UNCITRAL) Expert Reports + Arbitration Hearing.
- *Philips v. HTC*, Claim HP-2015-000063 (UK) Expert Report.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01419 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01736 (PTAB) Expert Declaration.
- *Intel Corporation v. Hera Wireless S.A.*, Case IPR2018-01702 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01418 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01739 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01700 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01701 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01732 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01737 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01686 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01420 (PTAB) Expert Declaration.
- *Intel Corporation et al v. Hera Wireless S.A.*, Case IPR2018-01687 (PTAB) Expert Declaration.
- *Ruckus Wireless, Inc. et al v. Hera Wireless S.A.*, Case IPR2018-01738 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc. (McEwen, Kathy, inventor)*, Case IPR2018-00254 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc. (McEwen, Kathy, inventor)*, Case IPR2017-01661 (PTAB) Expert Declaration.
- *RPX Corporation et al v. Iridescent Networks, Inc.*, Case IPR2017-01662 (PTAB) Expert Declaration.
- *Intellectual Ventures II LLC v. FedEx Corp.*, (2:16-cv-00980), Expert Report + Deposition + Trial (Texas Eastern District Court).
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-00729 (PTAB) Expert Declaration.
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-02030 (PTAB) Expert Declaration.
- *FedEx Corp. v. Intellectual Ventures II LLC*, Case IPR2017-00741 (PTAB) Expert Declaration.
- *Uniloc USA, Inc., Uniloc Luxembourg, S.A., and Uniloc 2017 LLC (Uniloc) v. Samsung*, (2:18-cv-00042) Expert Report + Deposition.
- *Uniloc USA, Inc., Uniloc Luxembourg, S.A., and Uniloc 2017 LLC (Uniloc) v. Samsung*, (2:18-cv-00044) Expert Report + Deposition.
- *SoL IP v. AT&T et al.*, (2:18-cv-00526), Expert Report + Deposition.
- *Juniper Networks v. American Patents*, Case IPR2020-01114 (PTAB) Expert Declaration.
- *Juniper Networks v. American Patents*, Case IPR2020-01115 (PTAB) Expert Declaration.
- *Intellectual Tech v. Zebra Technologies*, (6:19-cv-00628) Expert Declaration.
- *Aegis 11 S.A. v. Belkin Int'l, Inc.*, Civ. Nos. 19-1161-RGA, -1162-RGA, and 1163-RGA Expert Declaration.
- *Aegis 11 S.A. v. TTE Tech., Inc.*, Civ. No. 19-1165-RGA Expert Declaration
- *Aegis 11 S.A. v. Funai Electric Co.*, Civ. No. 20-03890
- *AEGIS v. Hisense*, (1:20-cv-03891) Expert Declaration.

- *Soter Technologies, LLC v. IP Video Corp. et al*, SDNY 20-cv-05007(LJL) Expert Declaration.
- *Soter Technologies, LLC v. IP Video Corp. et al*, EDNY 2:20-cv-02989(GRB)(AKT) Expert Declaration + Deposition.
- *Cellspin Soft, Inc. v. Nike, Inc.*, NDCA 4:17-cv-05931YGR Expert Report.
- *Cellspin Soft, Inc. v. Under Armour, Inc.*, NDCA 4:17-cv-05932YGR Expert Report.
- *BillJCo, LLC v. Cisco Systems, Inc. et al.*, EDTX 2:21-cv-181, 183-JRG Expert Reports + Deposition.
- *BillJCo, LLC v. Apple, Inc.*, WDTX 6:21-cv-528-ADA Expert Declaration.
- *Zebra Technologies v. OnAsset Intelligence, Inc.*, ITC Washington DC, Investigation No. 337-TA-1278 Expert Reports on Infringement & Validity + Deposition + Trial/Hearing.
- *Intellectual Tech LLC v. Zebra Technologies*, WDTX 6:19-cv-00628-ADA Expert Report.
- *Hewlett Packard Enterprise v. Intellectual Ventures II LLC*, Case IPR2021-01377 (PTAB) Expert Declaration + Deposition.
- *Hewlett Packard Enterprise v. Intellectual Ventures II LLC*, Case IPR2022-00096 (PTAB) Expert Declaration + Deposition.
- *Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions LLC*, Case IPR2022-1572 (PTAB) Expert Declaration.
- *Ericsson Inc. and Oracle Corporation v. Telecom Network Solutions LLC*, Case IPR2022-1573 (PTAB) Expert Declaration.
- *Zebra Technologies v. Lone Star Systems*, Case IPR2022-01374-01377 (PTAB) Expert Declarations + Deposition.
- *Howlink Global v. AT&T*, EDTX 2:22-cv-00040-JRG, Expert Report + Deposition.
- *Unified Patents LLC v. OZMO Licensing LLC*, Case IPR2023-02060 (PTAB) Expert Declaration.

ADDENDUM

Publications

- J. Sharony, "Understanding Het-Nets, Antennas and other Advanced Techniques in LTE-Advanced; Advanced Systems and Techniques," LTE-Advanced: Understanding 3GPP Release 10 and Beyond – Workshop presented by 4G Americas, Marina del Rey, CA, October 2012.
- J. Sharony, V. Ramanna, "Self Learning Real Time Location Tracking in Wireless Sensor Networks," Accepted to WiCOM, The 5th International Conference on Wireless Communications, Networking and Mobile Computing, China, 2009.
- J. Sharony, "Introduction to Wireless MIMO – Theory and Applications", IEEE LI, November 2006.
- J. Sharony, M. Sen, "Bandwidth management in 802.11 wireless LANs," ICC 2004 - IEEE International Conference on Communications, vol. 27, no. 1, Paris, France, June 2004 pp. 3837-3843.
- L-T.Cheok, J.Sharony and A.Eleftheriadis, "A SMIL-enabled Mobile Shopping Mall Application," SMILEurope Conference, Paris, France, February 2003.
- L-T.Cheok, J.Sharony and A.Eleftheriadis, "Symshop: A Mobile Shopping Mall Application," International Conference on Mobile and Ubiquitous Multimedia (MUM), Oulu, Finland, December 2002.
- J. Sharony, "Effective Throughput of 802.11 Wireless LAN with Interference from Nearby Cells," Proc. of Mobile Multimedia Communications (MoMuC), 7th International Workshop, Tokyo, Japan, 2000.
- J. Sharony, "An Architecture for Mobile Radio Networks With Dynamically Changing Topology Using Virtual Subnets," Mobile Networks & Applications, vol. 1, no. 1, 1996 pp. 75-86.
- J. Sharony, "A Multi-Star Optical Backbone Network Suitable for Distributed Microcellular Wireless Systems," Proc. of IEEE GLOBECOM'96, London, UK, November, 1996.
- J. Sharony, A. C. Sevdinoglou, "On-line distributed TDMA/FDMA/CDMA Link Assignment in Mobile Radio Networks with Flexible Directivity," Hazeltine Technical Bulletin, 1996.
- Y. Li, T. Wang, Z. G. Pan, J. Sharony, "Minimum-Complexity Free-Space Optical Nonblocking Networks for Multicast Interconnect Applications," Optical Letters, vol. 19, no. 8, April 1994 pp. 515-517.
- Y. Li, T. Wang, Z. G. Pan, J. Sharony, "Complexity-Minimized Optical Non-Blocking Interconnects for Multicast Computer Communications," Proceedings of the SPIE - Advances in Optical Information Processing VI 2240:192-204, 1994.
- Y. Li, T. Wang, J. Sharony, "Free-Space Optical Interconnects Using Connectivity-Enhanced Mesh-Based Networks," Optical Engineering, vol. 33, no. 5, 1994 pp. 1532-1542.
- Y. Li, T. Wang, Z. G. Pan, J. Sharony, "Free-Space Optical Implementations of Connectivity-Enhanced Mesh-Based Networks," Proceedings of the SPIE - International Society for Optical Engineering Optoelectronic Interconnects II, vol. 2153 pp. 57-68, 1994.
- J. Sharony, T. Stern, Y. Li, "The universality of multidimensional switching networks," IEEE/ACM Transactions on Networking, vol. 2, no. 6, December 1994 pp. 602-612.
- J. Sharony, "Broadcast and switch – A new class of WDM networks for high switching-speed, high connectivity applications," in Photonics in Switching Topical Meeting'93 Digest, Palm Springs, CA, Mar. 1993.
- J. Sharony, K. W. Cheung, T. E. Stern, "The Wavelength Dilation Concept in Lightwave Networks – Implementation and System Considerations," Journal of Lightwave Technology, vol. 11, no. 5/6, May/June 1993 pp. 900-907.
- J. Sharony, "Architectures of Dynamically Reconfigurable Wavelength Routing/Switching Networks," Ph.D. Thesis, Columbia University, May 1993.
- J. Sharony, K. W. Cheung, T. E. Stern, "Wavelength Dilated Switches (WDS) – A New Class of Suppressed Crosstalk, Dynamic Wavelength-Routing Crossconnects," OFC'92, paper TuO3, San Jose, CA, Feb 1992.
- J. Sharony, C. Georgiou, "Wavelength Selective Optical Crossconnect," IBM Technical Disclosure Bulletin, vol. 34, no. 10A, March 1992.
- J. Sharony, S. Jiang, T. Stern, K. Cheung, "Wavelength Rearrangeable and Strictly Non-Blocking Networks," Electronics Letters, vol. 28, no. 2, March 1992 pp. 536-537.
- J. Sharony, K. W. Cheung, T. E. Stern, "The Wavelength Dilation Concept – Implementation and System Considerations," Proc. ICC'92, paper 330.3, Chicago, IL, June 1992.
- J. Sharony, K. W. Cheung, T. E. Stern, "Wavelength Dilated Switches (WDS) – A New Class of High Density, Suppressed Crosstalk, Dynamic Wavelength-Routing Crossconnects," IEEE Photonics Technology Letters, vol. 4, no. 8, August 1992 pp. 933-935.

- Y. Li, T. Jiang, J. Sharony, "Massively Parallel Free-Space Optical Clos Network Using Wavelength-Division Multiple Access," Electronics Letters, vol. 28, no.21, October 1992 pp. 2001-2002.
- J. Sharony, T. E. Stern, K. W. Cheung, "Extension of Classical Rearrangeable and Non-Blocking Networks to the Wavelength Dimension," Proc. of IEEE GLOBECOM'92, December, 1992.
- J. Sharony, "Bounds on Threshold Effects in Frequency Estimation," Master Thesis, Tel Aviv University, April 1984.

Issued U.S. Patents

- 10,200,924 - Small-cell gateway configured for multiple air interfaces
- 10,080,177 - Unlicensed spectrum offload architecture for small-cell base stations
- 10,028,188 - Location processing in small cells implementing multiple air interfaces
- 9,854,489 - Location processing in small cells implementing multiple air interfaces
- 9,807,657 - Small-cell gateway configured for multiple air interfaces
- 9,474,500 - Method and system for transfer of cardiac medical image data files
- 9,161,273 - Small cells implementing multiple air interfaces
- 9,148,835 - Small cells implementing multiple air interfaces
- 9,143,996 - Small cells implementing multiple air interfaces
- 9,125,121 - Small cells implementing multiple air interfaces
- 9,088,923 - Small cells implementing multiple air interfaces
- 9,014,702 - Wireless location processing in small cells implementing multiple air interfaces
- 7,827,610 - Wireless LAN intrusion detection based on location
- 7,778,649 - System and method for asset location in wireless networks
- 7,706,809 - RF tracking system and method
- 7,668,201 - Bandwidth management in wireless networks
- 7,596,388 - Sectorized wireless communication network operating under 802.11 specifications
- 7,426,383 - Wireless LAN intrusion detection based on location
- 7,373,154 - System and method for asset location in wireless networks
- 7,174,172 - System and method for asset location in wireless networks
- 7,164,929 - Method and apparatus for location tracking in a multi-path environment
- 7,069,024 - System and method for determining location of rogue wireless access point
- 7,039,358 - Coexistence techniques in wireless networks
- 7,019,663 - RF tracking system and method
- 6,990,587 - Cryptographic architecture for secure, private biometric identification
- 6,925,094 - System and method for wireless network channel management
- 6,853,293 - Wearable communication system
- 6,735,445 - System and method for medium access control in a wireless network
- 6,577,609 - Local addressing of mobile units in a WLAN with multicast packet addressing
- 6,411,608 - Method and apparatus for variable power control in wireless communications systems
- 5,953,143 - Multidimensional switching networks
- 5,742,593 - On-line distributed TDMA/FDMA/CDMA link assignment in mobile radio networks with flexible directivity
- 5,652,751 - Architecture for mobile radio networks with dynamically changing topology using virtual subnets
- 5,495,356 - Multidimensional switching networks
- 4,867,820 - Preparation of laminated structure containing an optical fiber
- 4,847,596 - Wallpaper comprising an optical fibre

Issued International Patents

- EP2974520 - Unlicensed spectrum offload architecture for small-cell base stations
- EP1906294 - Wearable communication system
- EP1851978 - System and method for asset location in wireless networks
- EP1678960 - System and method for determining location of rogue wireless access point
- EP0886981 - An architecture for mobile radio networks with dynamically changing topology using virtual subnets
- EP1552632 - Apparatus and method for wireless network channel management

- EP1207654 - Coexistence techniques in a gateway between Bluetooth and WLAN wireless networks
- CA2599012 - Sectorized wireless communication network operating under 802.11 specifications
- AU2011202551 - Sectorized wireless communication network operating under 802.11 specifications
- CA2599406 - System and method for asset location in wireless networks
- AU783921 - Coexistence techniques in wireless networks

Published U.S. Patent Applications

- 20180220347 - SMALL-CELL GATEWAY CONFIGURED FOR MULTIPLE AIR INTERFACES
- 20170150412 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20150382272 - UNLICENSED SPECTRUM OFFLOAD ARCHITECTURE FOR SMALL-CELL BASE STATIONS
- 20150365861 - SMALL-CELLS GATEWAY CONFIGURED FOR MULTIPLE AIR INTERFACES
- 20150257077 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130090119 - LOCATION PROCESSING IN SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089077 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089072 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089071 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089070 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130089069 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20130084873 - SMALL CELLS IMPLEMENTING MULTIPLE AIR INTERFACES
- 20080201377 - Wireless LAN Intrusion Detection Based on Location
- 20080182593 - System and Method for Asset Location in Wireless Networks
- 20070105566 - System and method for asset location in wireless networks
- 20060221928 - Wireless device and method for wireless multiple access
- 20060221904 - Access point and method for wireless multiple access
- 20060221873 - System and method for wireless multiple access
- 20060211372 - Coexistence techniques in wireless networks
- 20060194616 - Sectorized wireless communication network operating under 802.11 specifications
- 20060194587 - System and method for asset location in wireless networks
- 20060194568 - System and method for determining location of rogue wireless access point
- 20060172756 - System and method for clustering mobile devices in a wireless network
- 20060125631 - RF tracking system and method
- 20050153713 - Method and apparatus for location tracking in a multi-path environment
- 20050136891 - Wireless lan intrusion detection based on location
- 20050135321 - Spatial wireless local area network
- 20050113090 - System and method for determining location of rogue wireless access point
- 20050096091 - Method and system for wireless communications using multiple frequency band capabilities of wireless devices
- 20050047343 - Bandwidth management in wireless networks
- 20040157604 - System and method for medium access control in a wireless network
- 20040057459 - System and method for wireless network channel management
- 20040038695 - SYSTEM AND METHOD FOR MEDIUM ACCESS CONTROL IN A WIRELESS NETWORK
- 20040027251 - RF tracking system and method
- 20030020629 - Wearable communication system
- 20020152391 - Cryptographic architecture for secure, private biometric identification
- 20020150098 - Local addressing of mobile units in a WLAN with multicast packet addressing
- 20020018451 - Method and apparatus for variable power control in wireless communications systems

Published International Patent Applications

- WO2013036487 - Small cells implementing multiple air interfaces

- WO0227989 - Logical addressing of mobile units in a wlan with multicast packet addressing
- WO2005046256 - Method and system for wireless communication using multiple frequency band capabilities of wireless devices
- WO2009146082 - Rfid monitoring of drug regimen compliance
- WO2004019539 - System and method for medium access control in a wireless network
- WO2005060172 - Wlan with a plurality of antennas in both access point and mobile unit
- WO2006093884 - Sectorized wireless communication network operating under 802.11 specifications
- WO2014140877 - Unlicensed spectrum offload architecture for small-cell base stations
- WO2006107538 - System and method for wireless multiple access
- WO2004028054 - System and method for wireless network channel management
- WO0205578 - Method and apparatus for variable power control in wireless communications systems
- WO2005072000 - Method and apparatus for location tracking in a multi-path environment
- WO2006093710 - System and method for asset location in wireless networks
- WO2005046254 - System and method for determining location of rogue wireless access point
- WO2006083535 - System and method for clustering mobile devices in a wireless network
- WO2006107537 - Wireless device and method for wireless multiple access
- WO2006107535 - Access point and method for wireless multiple access
- WO9736444 - An architecture for mobile radio networks with dynamically changing topology using virtual subnets
- JP2017225127 - Small cells implementing multiple air interfaces
- JP2002185476 - Coexistence technique in wireless network
- CA2495618 - System and method for wireless network channel management
- CA2602569 - System and method for wireless multiple access
- CA2543459 - Method and system for wireless communication using multiple frequency band capabilities of wireless devices
- CA2602399 - Wireless device and method for wireless multiple access
- CA2602572 - Access point and method for wireless multiple access
- EP2752051 - Small cells implementing multiple air interfaces
- EP1232594 - Logical addressing of mobile units in a wlan with multicast packet addressing
- EP1678836 - Method and system for wireless communication using multiple frequency band capabilities of wireless devices
- EP1702491 - Method and apparatus for location tracking in a multi-path environment
- EP1864396 - System and method for wireless multiple access
- EP1733511 - Wlan with a plurality of antennas in both access point and mobile unit
- EP1300029 - Method and apparatus for variable power control in wireless communications systems
- EP1844615 - System and method for clustering mobile devices in a wireless network
- EP1864404 - Wireless device and method for wireless multiple access
- EP1864516 - Access point and method for wireless multiple access
- EP0886981 - An architecture for mobile radio networks with dynamically changing topology using virtual subnets
- EP1906294 - Wearable communication system
- AU9483001 - Logical addressing of mobile units in a wlan with multicast packet addressing
- AU2003272648 - System and method for wireless network channel management
- AU2006218786 - Sectorized wireless communication network operating under 802.11 specifications
- AU2003265675 - System and method for medium access control in a wireless network
- AU2001294830 - Logical addressing of mobile units in a wlan with multicast packet addressing
- GB2319439 - Network Architecture for Linking Base Stations