

UNITED STATES PATENT AND TRADEMARK OFFICE

**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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SONOVA USA INC.,

Petitioner,

v.

STARKEY LABORATORIES, INC.,

Patent Owner.

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Case No. PGR2026-00076

**U.S. PATENT NO. 12,739,553**

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**DECLARATION OF SAYFE KIAEI, PH.D.**

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## **I. INTRODUCTION**

1. My name is Sayfe Kiaei. I have been retained by Sonova USA Inc. (“Sonova” or “Petitioner”) as an expert in this proceeding.

2. I understand Sonova is challenging the validity of claims 1–21 of U.S. Patent No. 12,739,553 (the “’553 Patent”) in a petition for post-grant review (“PGR”). I refer to these as the “Challenged Claims.”

3. Based on principles explained to me, which I identify below, I have been asked to consider whether the Challenged Claims are valid.

4. I am a Professor and the Motorola Endowed Chair of the School of Electrical, Computer and Energy Engineering at Arizona State University. I am being compensated for my time in connection with this matter at the consulting rate of \$600 per hour. My compensation is not affected by the content of my opinions, testimony, or the outcome of this matter.

5. The prior art references on which my opinions are based are:

- European Patent Application EP3240300A1 (“Chen”)
- U.S. Patent App. No. 2009/0202093A1 (“Danneman”)
- U.S. Patent No. 7,905,006B2 (“Kwon”)
- PCT Publication No. WO2017/040094A1 (“Thiers”)
- U.S. Patent No. 10,003,880B2 (“Wagman”)

6. In my opinion, the Challenged Claims are invalid over the prior art and for lacking adequate written description in the '553 Patent's specification, as summarized below:

- Chen anticipates claims 1, 2, 10, 12-15, and 20;
- Chen in combination with Thiers renders obvious claim 1-21;
- Chen in combination with Thiers and Wagman renders obvious claims 7 and 21;
- Chen in combination with Wagman renders obvious claims 1-21;
- Dannemann in combination with Thiers renders obvious claims 1-6, 8-20;
- Dannemann in combination with Thiers and Kwon renders obvious claims 7 and 21;
- Dannemann in combination with Wagman renders obvious claims 1-21;
- Kwon in combination with Wagman and Thiers renders obvious claims 1-21; and
- Claims 1-9 and 12-21 lack adequate written description in the '553 Patent's specification.

## **II. BACKGROUND AND QUALIFICATIONS**

7. I am a Distinguished IEEE Fellow and Motorola Endowed Chair Professor with more than four decades of experience in both academia and industry. I have worked in fields relating to analog integrated circuits, radio frequency integrated circuits (RFIC), power management IC, power converters, communication systems,

signal and multimedia processing, sensor circuits, and bioelectronics—including hearing aid electronics and cochlear implant systems.

8. I hold a Ph.D. in Electrical and Computer Engineering from Washington State University (1987), a Master of Science in Electrical and Computer Engineering from Washington State University (1984), and a Bachelor of Science in Electrical Engineering from Washington State University (1982).

9. Since 2001, I have served as Professor and Endowed Chair Professor in Analog and RFIC in the School of Electrical, Computer and Energy Engineering at Arizona State University (“ASU”). In this role, I teach courses in integrated circuits (analog and digital IC, RFIC, VLSI), power management (PMIC, inverters, DC/AC-DC, battery management, integrated power management IC), sensors and bioelectronics (biosensors, hearing aid electronics, implanted device electronics), signal and audio processing (DSP, video/audio/acoustic processing), and communication systems.

10. From 2008 to 2012, I served as Associate Dean of Research for the Ira A. Fulton Schools of Engineering at ASU, where I was responsible for leading the research infrastructure and promoting research programs with industry and federal agencies. During my tenure, I established the first NSF Engineering Research Center (ERC) at ASU on Solar Energy (QESST), partnering with MIT, Georgia Tech,

University of Delaware, Caltech, University of New Mexico, and the University of Arizona.

11. From 1993 to 2002, I was a Senior Member of Technical Staff at Motorola Inc., where I worked on projects related to wireless communications, two-way push-to-talk radios, wireless networks, ADSL, MODEM, RF, and related areas. At Motorola, I was responsible for the development of integrated circuits and systems for wireless handsets, including cellular (2G, 3G, 4G), wireless connectivity (Bluetooth and WiFi transceiver), GPS and location receivers, wireless networks, and two-way radios. I also represented Motorola in various international standards bodies, including ITU, ETSI, 3GPP, and the Bluetooth and WiFi working groups.

12. From 1987 to 1993, I served as Assistant and then Associate Professor in the Electrical and Computer Engineering Department at Oregon State University, where I conducted research and taught courses in electronics, DSP, communication systems, multimedia, audio/video processing, wireless systems, modems, power management, and power electronics. During this period, I also co-directed the NSF Center for the Design of Analog/Digital IC (CDADIC), an NSF Industry/University Cooperative Research Center.

13. From 1985 to 1987, I was a Member of Research Staff at Boeing Co.

14. The experiences summarized above are also relevant to hearing aids, hearing-

assistance devices, wireless earbuds, wireless headphones, headsets, microphones, speakers, and audio-related consumer electronics. Such devices commonly combine low-power RF communication, Bluetooth or other short-range wireless protocols, antennas, acoustic transducers, microphones, speakers, audio signal processing, analog and mixed-signal circuits, digital filtering, noise reduction, feedback control, power management, and compact electrical and mechanical integration. I also have specific experience in hearing-aid electronics, audio systems, MEMS transducers, and biomedical integrated circuits, described more below.

15. I have authored or co-authored more than 200 journal and conference papers on communication systems, signal processing, RF integrated circuits, analog design, mixed-signal circuits, and related electronic technologies. I also have more than a dozen patents and patent applications. My publications include work on MEMS hearing aid front-end circuits, digital hearing aid signal processing, and compact loudspeakers for digital hearing aids.

16. From 2007 to 2011, I worked on NSF-funded research involving MEMS implanted hearing-aid systems and biosensors, including a micro-power multi-phase on-chip MEMS hearing aid and adaptive hearing-aid audio processor. This work combined hearing-aid audio processing, MEMS device integration, biomedical circuits, low-power electronics, and adaptive signal processing. It also included the

development of compact, low-cost MEMS loudspeaker technology for digital hearing aids, including research published in *IEEE Transactions on Biomedical Circuits and Systems* in the article “A Compact and Low-Cost MEMS Loudspeaker for Digital Hearing Aids.”

17. I also worked on MEMS-based analog front-end architectures for hearing-aid systems, including the publication “A MEMS-Based Power-Scalable Hearing Aid Analog Front End,” published in *IEEE Transactions on Biomedical Circuits and Systems*. That work involved low-power front-end circuitry, power delivery, sensor/MEMS interface design, analog and mixed-signal signal paths, and power-scalable operation for hearing-aid applications. It also involved testing, packaging, and power delivery to the hearing aid system.

18. Based on this work, we published an article “*In situ* tuning of a MEMS microphone using electrodeposited nanostructures,” published in the *Journal of Micromechanics and Microengineering*. This work presented a method for tuning the acoustic sensitivity of a MEMS microphone by using electrodeposited silver nanostructures integrated with the microphone diaphragm.

19. In addition, I contributed to mixed-signal circuit techniques for digital hearing aids, including dynamic calibration of feedback DAC non-linearity in a fourth-order continuous-time sigma-delta modulator. This work, presented at the 2011 IEEE

International SOC Conference, addressed precision data-converter design, feedback DAC linearity, sigma-delta modulation, and calibration methods for hearing-aid integrated circuits.

20. I am an IEEE Fellow, elected in 2004 in recognition of my contributions to the field. I received the IEEE Darlington Best Paper Award (1995), the Global Standards Award from Motorola (1999) for contributions in the ITU for ADSL G.Lite standards, and the Carter Best Teaching Award from Oregon State University (1992). I have served as editor and associate editor for multiple IEEE journals, including the IEEE Microwave Magazine, IEEE Transactions on VLSI, and IEEE Transactions on Circuits and Systems-II. I am a founding member of the IEEE RF Integrated Circuits Symposium (RFIC) and have served on its executive committee from 2000 to 2017. I have authored or co-authored over 130 publications in IEEE journals and conferences, and I am a named inventor on multiple U.S. patents in the areas of integrated circuits, power management, and wireless communication.

21. I have experience as an expert witness in patent litigation, patent validity, infringement, and in *inter partes* review proceedings specifically. My expert witness work spans areas directly relevant to the '553 Patent, including analog and digital IC, power management, battery management, PMIC, and hearing aids.

22. I have provided my full background in the curriculum vitae that is attached as

Exhibit 1003.

### **III. DOCUMENTS AND MATERIALS CONSIDERED**

23. In forming the opinions expressed in this Declaration, I relied upon my education, training, knowledge, and experience in the relevant field of the art, as well as information pertaining to the documents described below.

24. In preparing this Declaration, I have reviewed the '553 Patent and its file history, as well as numerous prior art references that I discuss in this Declaration, including the Chen (Ex. 1005), Dannemann (Ex. 1006), Kwon (Ex. 1007), Thiers (Ex. 1008), and Wagman (Ex. 1009) prior art references. Other references I have reviewed are mentioned below. These references and documents reflect the state of the relevant art at the time of the alleged invention and the background knowledge of a POSA.

### **IV. LEGAL PRINCIPLES**

25. I am not a lawyer; however, Sonova's counsel has explained certain legal principles to me that I have relied on in forming the opinions expressed in this Declaration. I provide a summary of my understanding below.

#### **A. Claim Construction**

26. I understand that in a post-grant review, the claims of a challenged patent are generally given their ordinary and customary meaning as understood by a person of

ordinary skill in the art (“POSA”) in light of the specification and prosecution history. I understand that the specification is the primary source for construing the meaning of a claim term, and that a person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim, but in the context of the entire patent, including the specification.

**B. Anticipation Under 35 U.S.C. § 102**

27. I understand that a patent claim is invalid as anticipated under 35 U.S.C. §102 if a single prior art reference discloses every element of the claim, arranged as in the claim. Each element of the claim must be found in the prior art reference, either expressly or inherently.

28. I understand that anticipation does not require that the prior art reference describe the claimed invention using the same words or phrases as the claims. Rather, the reference need only describe every element of the claim such that a person of ordinary skill in the art would recognize those elements.

29. I understand that a prior art reference may anticipate a claim even if it does not explicitly disclose a claim limitation, provided that the missing limitation is necessarily present in the reference’s disclosure. A disclosure that is inherent in a prior art reference is as effective for anticipation purposes as one that is explicit.

**C. Obviousness Under 35 U.S.C. § 103**

30. I understand that a patent claim is invalid as obvious under 35 U.S.C. §103 if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art.

31. I understand that obviousness is determined based on the scope and content of the prior art, the differences between the prior art and the claimed invention, the level of ordinary skill in the art, and any relevant secondary considerations.

32. I understand that the Supreme Court has identified several rationales that may support a finding of obviousness, including: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to obtain predictable results; use of a known technique to improve similar devices in the same way; applying a known technique to a known device ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions with a reasonable expectation of success; known work in one field of endeavor prompting variations of it for use in either the same field or a different one, based on design incentives or other market forces, where the variations are predictable to one of ordinary skill in the art; some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or combine references to arrive at the claimed

invention.

33. I understand that a determination of obviousness may be based on common sense and the knowledge of a person of ordinary skill in the art, and that a rigid, formalistic approach to obviousness is inappropriate. The analysis should account for the inferences and creative steps that a person of ordinary skill in the art would employ.

34. I further understand that when there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp.

35. I understand that so-called “secondary considerations” may be relevant to the obviousness analysis, including commercial success, long-felt but unresolved need, failure of others, copying, licensing, praise by others, and skepticism of experts. I understand that a nexus between the secondary considerations and the merits of the claimed invention is required for such evidence to be probative.

**D. Written Description Under 35 U.S.C. § 112(a)**

36. I understand that 35 U.S.C. §112(a) requires that the patent specification describe the invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention at the time the

application was filed.

37. I understand that the written description requirement is separate and distinct from the enablement requirement. The purpose of the written description requirement is to ensure that the inventor actually invented the claimed subject matter. The written description must clearly allow persons of ordinary skill in the art to recognize that the inventor invented what is claimed.

38. I understand that a patentee need not describe every detail of the claimed invention but must convey with reasonable clarity to those skilled in the art that, as of the filing date, he or she was in possession of the invention. The level of detail required depends on the nature and scope of the claims and on the complexity and predictability of the relevant technology.

39. I understand that a broad claim may lack adequate written description support when the specification clearly indicates that the invention is of a narrower scope. Where a specification describes only a single embodiment, a claim directed to an entire genus may fail to satisfy the written description requirement.

40. I understand that the written description requirement applies to original claims as well as amended claims. An original claim may fail to satisfy the written description requirement if the claim is broader than the disclosure in the specification, such that a person of ordinary skill in the art would not recognize from

the specification that the inventor had possession of the full scope of the claimed invention.

**E. Person of Ordinary Skill in the Art**

41. I understand that a person of ordinary skill in the art is a hypothetical person who is presumed to be aware of all the pertinent prior art. I am informed that factors that may be considered in determining level of skill include: type of problems encountered in art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field. Not every factor may be present in any single case, and one factor may predominate.

42. Having reviewed the '553 Patent, it is my opinion that a person of ordinary skill in the art ("POSA") in the subject matter of the '553 Patent would have had a bachelor's degree in electrical engineering, mechanical engineering, biomedical engineering, or a related technical field, and 2-3 years of experience in the design, development, or manufacturing of hearing devices or other small-form-factor medical or consumer electronic devices. A POSA would also have familiarity with electrical charging systems and mechanical housing design for ear-worn or similar medical devices. Additional education could offset less experience and vice versa, and a POSA could have also obtained similar knowledge and experience through other means.

43. Given my education and work experience, in my opinion, I qualify as a POSA and have been a POSA since at least 1987 (if not earlier). The opinions I am offering are from the perspective of a POSA at the time of the alleged invention.

44. For the purposes of my opinions below, I also assume that the relevant time frame is the relevant priority date for the Challenged Claims.

## **V. TECHNOLOGY BACKGROUND**

45. The '553 Patent is directed to a “[s]ystem for charging an ear-worn device.” Ex. 1001, Title. Ear worn devices, like the disclosed examples of “wearable earphones, headphones, earbuds, virtual reality headsets[], hearing aids (e.g., hearing instruments), cochlear implants, and bone-conduction devices,” were exceedingly well known in the art prior to the '553 Patent, and even part of the day-to-day life of the average consumer. *Id.* at 6:38-40. The '553 Patent itself acknowledges in its “Background” that “[h]earing devices” existed prior to the patent’s disclosure. *Id.* at 1:27-35.

46. Ear-worn devices also typically included housings for containing the electronics and circuitry of the device, as the '553 Patent acknowledges. *Id.* at 1:40-44. It was conventional in the art for years prior to the '553 Patent to divide a housing into a shell that would be placed or inserted in a wearer’s ear canal, and an external-facing faceplate that would complement the shell and enclose the housing. *See, e.g.,*

Ex. 1005, Figs. 5, 6B, 7A; Ex. 1006, Fig. 2; Ex. 1007, Fig. 2. In fact, the use of a shell and faceplate is a natural result of the conventional fabrication methods. For example, plastic injection molding was used for years prior to the '553 Patent to fabricate a shell and faceplate, and to allow electronics and circuitry within the shell prior to assembly and enclosure of the housing using the faceplate.

47. The '553 Patent also acknowledges that it was typical to “provide power to [the] electronic circuit of a hearing device,” including by a “rechargeable battery [that] is often housed within the hearing device.” *Id.* at 1:40-44. Rechargeable batteries and the basic process of charging them have also been well understood for decades, including within the context of ear-worn devices. Broadly speaking, a rechargeable battery stores electrical energy through reversible electrochemical reactions, and an external power source must deliver current through a closed circuit connecting the battery’s positive terminal and negative terminal to corresponding contacts on a charging device in order to recharge the battery.

48. The '553 Patent describes a rechargeable hearing device with an electrode arrangement in which contacts are offset such that the cathode contact touches a complementary charger contact before any anode connection. This cathode-first contact configuration results in a “consistent inrush current waveform” and “establish[es] a ground, which can reduce or minimize spurious electrical spikes in

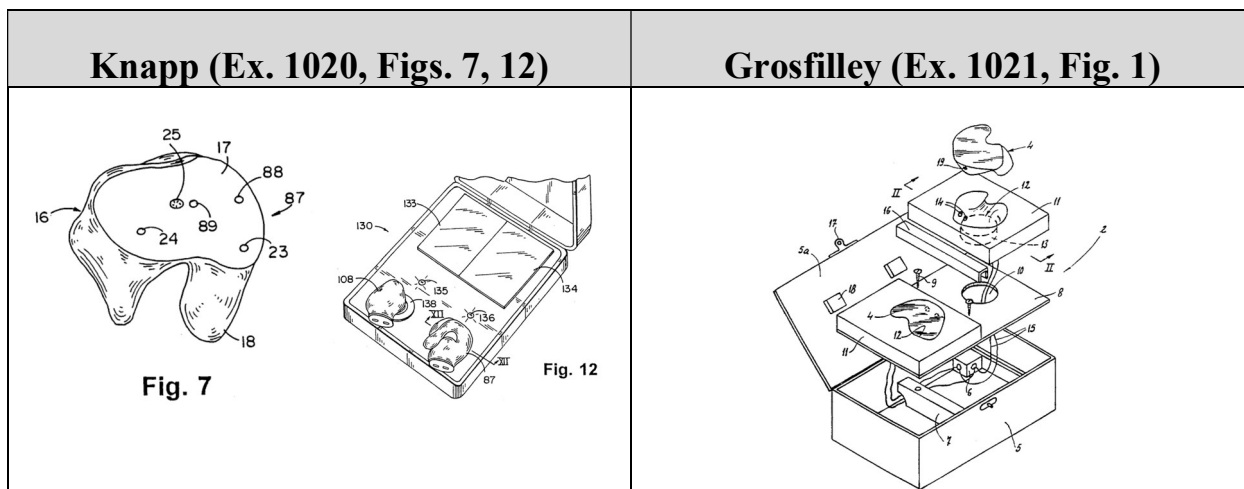
the circuitry.” Ex. 1001, 9:31-55, 24:9-14. In fact, during examination of the parent application to the ’553 Patent, the applicant identified these features as supposedly distinguishing from the prior art before the parent application was allowed. Ex. 1004, 306-07. Here, however, the ’553 Patent does not claim any cathode-first configuration. Instead, the claims generically recite a rechargeable hearing device with well-known features, none of which purport to solve any problem or provide any technical benefit, as I explain below.

49. The physical interface between a rechargeable device and its charger must generally satisfy a small number of electrical requirements. First, there must be at least two electrically distinct contact points—one for each polarity—to establish a complete circuit. Second, these contacts must be electrically isolated from one another to prevent short-circuiting. For consistent charging, the contacts should achieve and maintain reliable engagement with their counterparts on the charging device. These fundamental electrical engineering concepts have been well understood for decades prior to the ’553 Patent.

50. Because any charging interface must provide at least two electrically isolated contacts that mate reliably with a complementary charger, the universe of possible geometric arrangements is relatively few. The design of charging arrangements are limited to: (1) the number of contacts; (2) the shape of each contact (e.g., point, line,

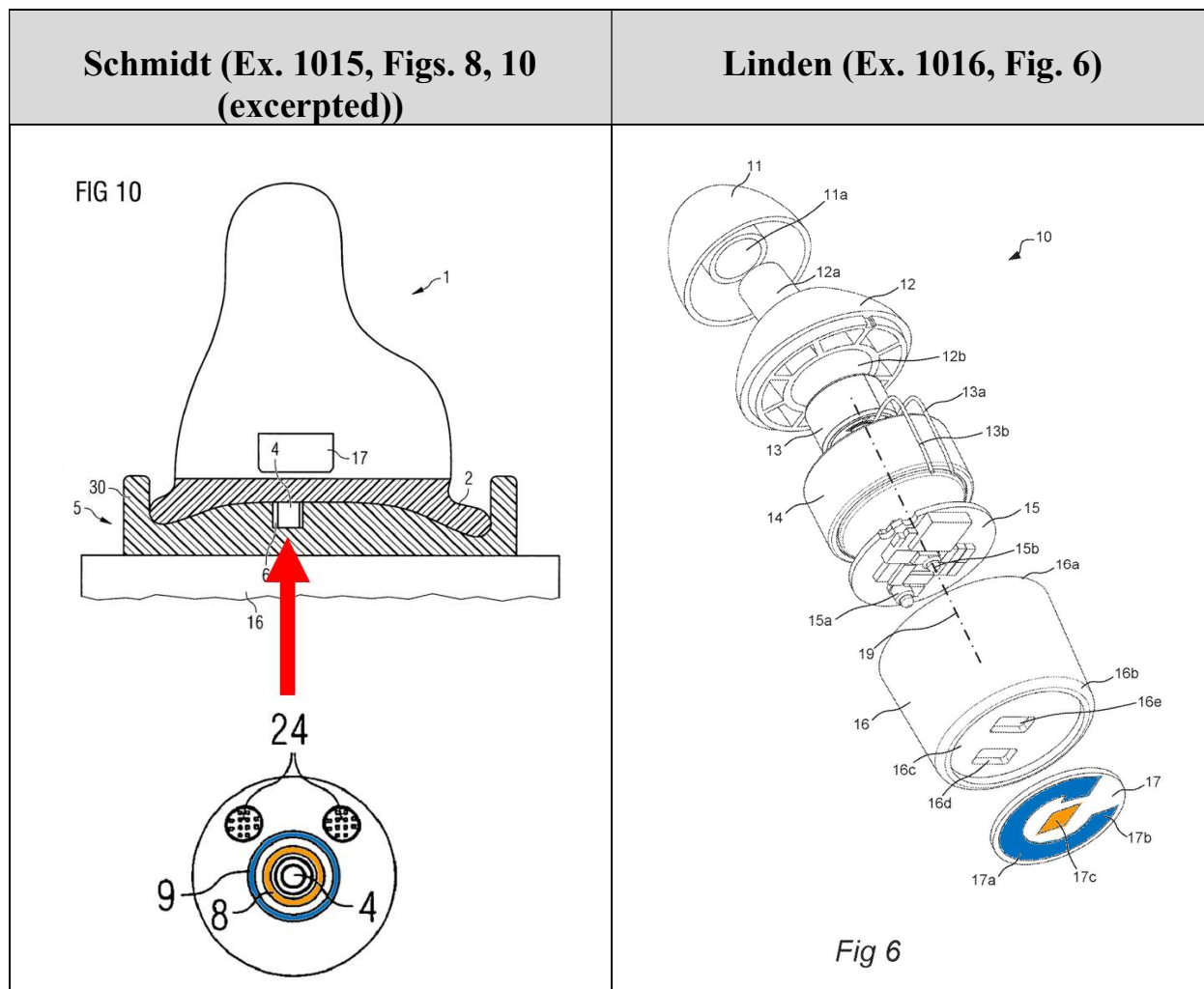
arc, ring); (3) the spatial arrangement of the contacts relative to one another; and (4) the mechanism by which the device and charger are brought into electrical engagement.

51. Within these parameters, the available geometric configurations are surprisingly few. For example, contacts can be arranged linearly (side by side), coaxially (as nested rings or arcs around a common center), or in some combination thereof. Prior art rechargeable hearing devices commonly incorporated charging contacts disposed in an outward-facing faceplate, interfacing with the contacts of an auxiliary charging case, as shown below.

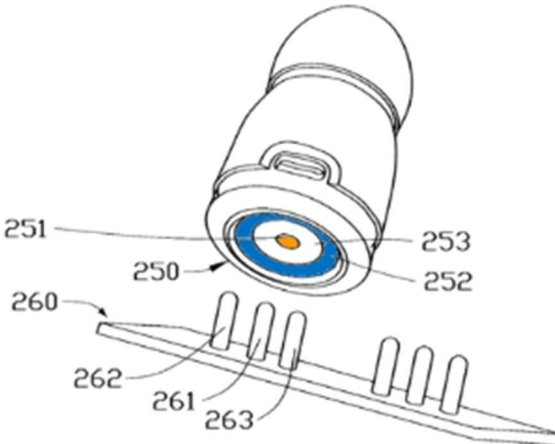
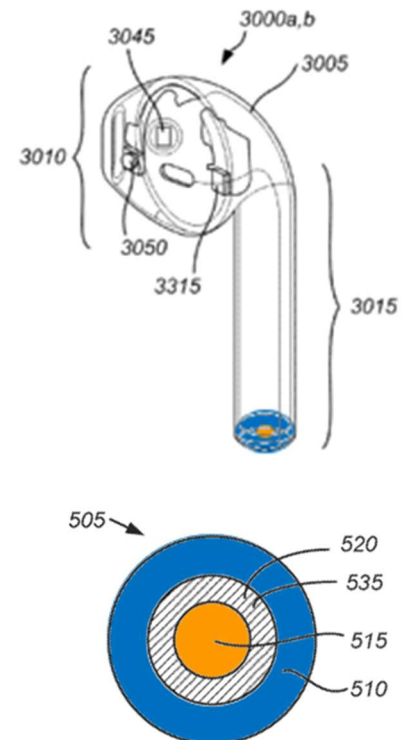


52. Early designs included small charging contacts (see above), and were often difficult to align with the contacts on a charging case. This was particularly true for elderly, visually impaired, or hearing device users with limited dexterity. Accordingly, it became increasingly commonplace for hearing devices to

incorporate relatively large, concentric, and user-friendly electrode configurations with an arcuate contact surrounding a central contact for reliable connections with a charger interface, as shown below.<sup>1</sup>



<sup>1</sup> All color annotations to the figures and emphasis to quotes are added.

| Chen (Ex. 1005, Fig. 7A)                                                                                                     | Wagman (Ex. 1009, Figs. 5B, 33 (excerpted))                                         |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  <p data-bbox="454 882 617 934">FIG. 7A</p> |  |

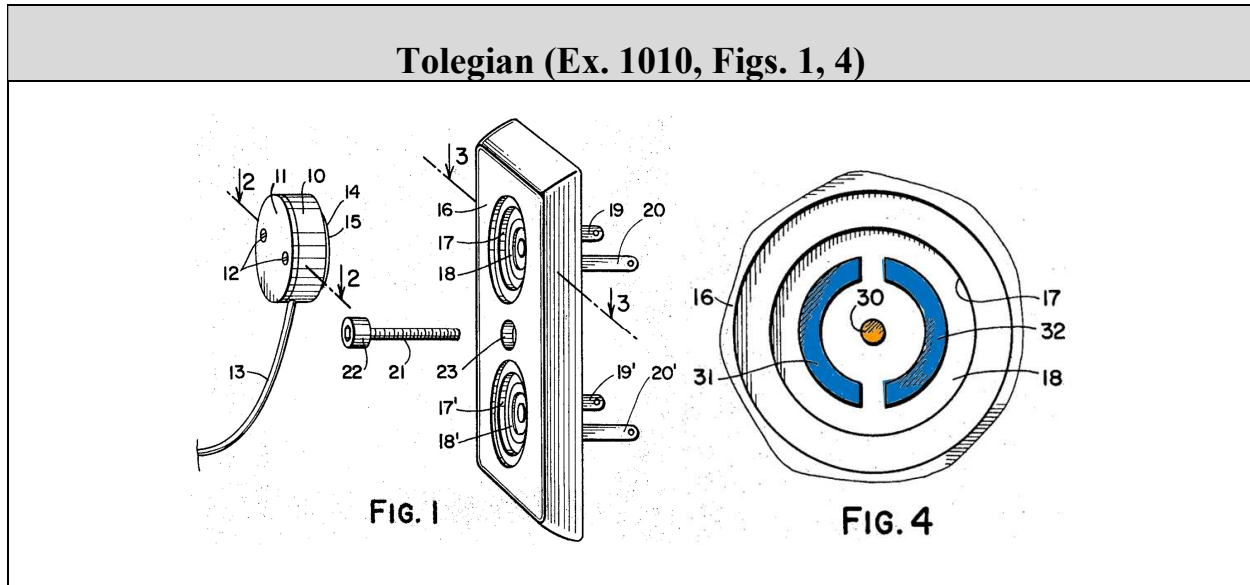
53. Concentric electrode arrangements were natural choices for relatively compact hearing devices given the electrodes' ability to maximize the device's available surface for electrical connection, and because concentric arrangements are agnostic to the alignment between a hearing device and a corresponding charger. For cylindrical or circular device geometries, the coaxial configuration is not merely one option among many; it is the geometrically natural and, in many cases, the only practical solution. A coaxial arrangement exploits the rotational symmetry present in circular geometry. When contacts are arranged as coaxial rings or arcs on a

circular surface, any rotational orientation of the device relative to the charger will produce proper electrical contact with overlapping contacts between a charging device and a charged device. Indeed, Chen identifies that concentric designs are beneficial because “users may place the rechargeable wireless earphone on the charging case in an arbitrary direction or orientation” and still “complete a charging circuit.” Ex. 1005, [0030]-[0031].

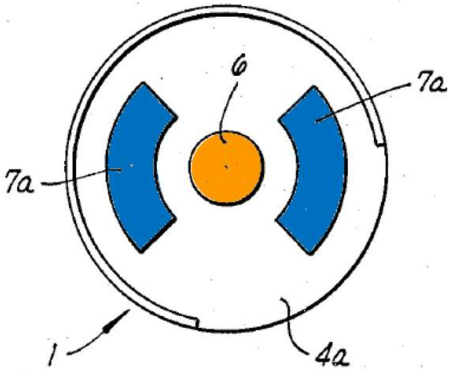
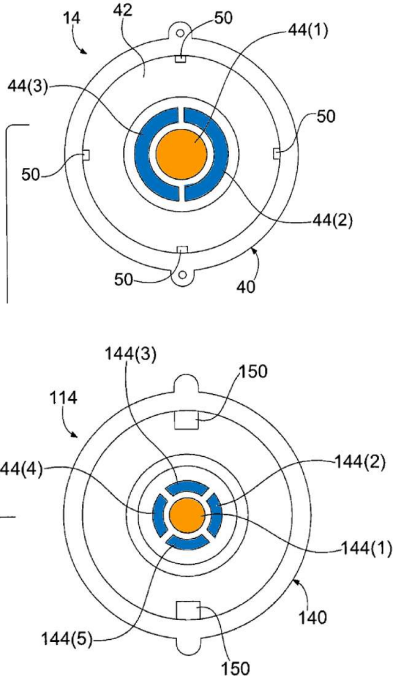
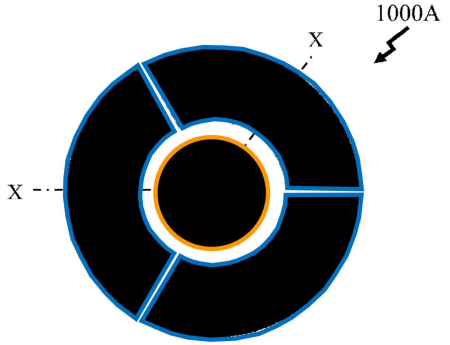
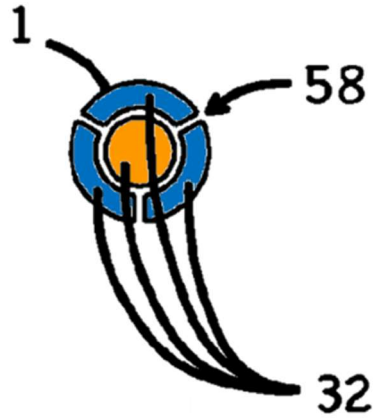
54. The fundamental physics of electrical circuits, combined with basic geometric constraints, necessarily confines the number of design choices for charging contacts on circular or rotationally symmetric devices. A POSA approaching the problem of designing a charging interface for such a device would readily recognize that concentric contacts represent the natural geometric solution. In fact, this is why such geometries are ubiquitous in the electronics industry, including with even consumer-grade earbuds, headphones, and the like.

55. Hearing devices having electrode configurations with more than two contacts were also known in the art. For example, Wagman (shown above) describes that “connector configurations can be used that have more than two contacts,” including “half rings” or “shorter length arcs.” Ex. 1009, 24:63-65, 25:47-48. In fact, concentric charging configurations with more than two contacts have existed across virtually every segment of the consumer electronics industry for decades. In 1970,

Tolegian described a magnetic plug and socket assembly with concentric electrical contacts, including embodiments with **one or more arcuate contacts** extending around a **central contact**, as shown below.



56. This design choice has become commonplace for decades, with engineers routinely incorporating electrical connectors having multiple **arcuate contacts** surrounding a **central circular contact**.

| <b>Riegler (Ex. 1011, Fig. 5a<br/>(excerpted))</b>                                  | <b>Willey (Ex. 1012, Figs. 9A-B<br/>(excerpted))</b>                                 |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
|    |   |
| <b>Murison (Ex. 1014, Fig. 10<br/>(excerpted))</b>                                  | <b>Thiers (Ex. 1008, Fig. 3 (excerpted))</b>                                         |
|  |  |

57. There were known and readily apparent benefits in having more than two contact points at the charging interface, including for example: ease of manufacturing and robustness/stability of design, faster charging, reliability through

redundancy, allowing power and data to be transmitted over distinct contacts, and available rotational symmetry.

58. For example, with respect to ease of manufacturing and robustness/stability of design, Willey describes a “need to further develop and refine connectors for mechanically and electrically connecting two devices together, in the interests of performance, convenience, manufacturability and modularity.” Ex. 1012, 2:9-13, 10:25-26, 10:46-5454. A POSA would know that the arcuate contacts shown above have distinct manufacturability and design robustness benefits. As one example, a POSA would recognize the non-conductive insulator running between the multi-contact configurations shown above could be manufactured in a single piece, whereas a closed ring contact (*e.g.*, as shown in Chen) may require a separate insulator between the central contact and the surrounding ring contact. Thiers, shown above, states the “nonconductive separating spaces 58 ... may be a nonconductive separating material such as plastic and other insulators.” Ex. 1008, [0044]. Forming the non-conductive insulator from a single, continuous material would be both easier to manufacture and less prone to failure during normal use.

59. It was also known that increasing the number of contacts could result in faster charging. For example, Workman discloses “[c]onnecting a modular adapter to both contacts may allow for higher current to be provided through the modular adapter,

which may enable faster charging or connected devices.” Ex. 1023, 8:40-43. Workman also explains that “[p]roviding multiple contacts associated with the same voltage level may enable the charging device to increase the maximum current flow into or out of the charging device at that voltage level.” Ex. 1023, 5:39-43, Figs. 2A-2B.

60. It was also known that adding “redundant” contacts improved the reliability of the electrical connection, for example in instances where there is debris on one of the contacts or any other event impeding a good electrical connection. For example, Lee discloses “redundant contact power pins,” and states “a second set of contact pins will maintain a redundant electrical connection to each contact ring, ensuring that at all times at least one of the spring-loaded contact pins is in electrical contact with the metallic ring on the female half of the 360SC. Moreover, electrical contact will continue should one of the pair of redundant contact pins be damaged.” Ex. 1024, 5:44-51, 7:54-63.

61. It was also known more than two contacts allowed power and data to be transmitted over distinct contacts, rather than running data and power over the same contacts. For example, Wagman discloses using a connector with more than two electrical contacts so that “separate power and data contacts can be used.” Ex. 1009, 20:49-55.

62. Finally, rotational symmetry was another known benefit of the designs above. For example, Willey describes that its connectors with arcuate/central contacts enables reliable contact engagement “to transfer power, ground or signals” “[r]egardless of the relative radial orientations.” Ex. 1012, 2:9-13, 10:25-26, 10:46-54; *see also* Ex. 1022 at Figs. 7, 8 (describing “annular or circulator electrode[s]” as a solution permitting a “power source plug [to be] inserted into the power source socket in any direction or at any angle,” “further improving the stability of electrical connection between the power source plug and the power source socket”).

63. Having reviewed the Challenged Claims, it is my opinion that there is nothing patentable about the claimed arrangement of electrical connections. The prior art already described using these geometries, including in hearing devices, for electrical contacts and battery charging. As I explain below, the Challenged Claims are all anticipated, or would have been obvious, to a POSA.

## **VI. BACKGROUND OF THE '553 PATENT**

64. The '553 Patent is titled “System for Charging an Ear-Worn Electronic Device.” Ex. 1001, Title.

65. The '553 Patent relates generally to ear-worn electronic devices including hearing aids. *See, e.g.*, Ex. 1001, Cl. 1. The specification describes a hearing device with a rechargeable power source, power management circuitry, a first charging

interface with cathode and anode contacts, and a charging module with a second charging interface. Ex. 1001, 1:48-58. The specification presents configurations including annular and triangular electrode arrangements, concentric “tri-trace configurations,” and split-ring pin connectors. Ex. 1001, Figs. 5-10. The specification repeatedly emphasizes that the disclosed shapes are “illustrative and non-limiting,” and expressly states that “[a]lthough shown as having a generally circular shape, the cathode and anode contacts 502, 504 can have *any* curvilinear or polygonal shape.” Ex. 1001, 15:32-34, 16:42-44. Notably, the specification does not tout advantages of the disclosed charger configurations over the prior art or among the various configurations disclosed.

66. The Challenged Claims are directed to electrode arrangements for charging ear-worn electronic devices, such as hearing aids. The claims recite a hearing device with a housing (comprising a shell and faceplate), an electrode arrangement on the faceplate with a central contact and at least one arcuate contact extending around the central contact, and circuitry coupled to the electrode arrangement. *See* Ex. 1001, Claims. However, as I explain above, hearing devices, including hearing aids, having a housing comprising a shell and faceplate were exceedingly well known prior to the ’553 Patent. § V. It was also well known in the art to include electrode contacts on the faceplate of a hearing aid. § V. It was well known to use rechargeable batteries in hearing devices. And the contact geometries claimed by the ’553 Patent were also

known in the art.

67. During examination of the '553 Patent, the Examiner rejected claims 1-6 and 8-20 as obvious in light of Pinnell (US 2008/0240480) in view of Lindel (WO 2016/036309). The applicant objected to these rejections, including by arguing that the claimed electrode configuration is novel. More specifically, the applicant argued that the prior art did not teach or suggest “a hearing device that includes [1)] an electrode arrangement disposed in an outer surface of a faceplate of a housing ... [and 2)] the electrode arrangement includ[ing] a central contact and at least one arcuate that extends around at least a portion of the central contact...” Ex. 1004, 284-293. The Examiner allowed the '553 Patent to issue, writing simply that “[c]laims 1 & 14 are allowed for the reasons set forth in applicants arguments.” Ex. 1004, 476.

68. However, as I explain above and detail below, the claimed electrode configuration was already known in the prior art and would also have been obvious to a POSA at the time of the claimed invention. In my opinion, there is nothing patentable in the Challenged Claims.

## **VII. ALLEGED PRIORITY DATE OF THE '553 PATENT**

69. The '553 Patent is a continuation of U.S. Patent Application No. 18/924,062, filed October 23, 2024, which is a continuation of U.S. Patent Application No. 18/810,014, filed August 20, 2024, which is a continuation of U.S. Patent

Application No. 17/553,716, filed December 16, 2021, now U.S. Patent No. 12,101,588, issued September 24, 2024, which is a continuation of PCT Application No. PCT/US2020/041956, filed July 14, 2020, which claims priority to U.S. Provisional Application Nos. 62/876,454, filed July 19, 2019, and 62/943,375, filed December 4, 2019.

70. For the purpose of this Declaration, I have assumed that the '553 Patent is entitled to the earliest priority date claimed by the patent—December 4, 2019—because prior art that existed before this earliest alleged priority date anticipates and renders obvious the Challenged Claims.

## **VIII. BACKGROUND OF THE PRIOR ART**

### **A. Chen**

71. Chen discloses a charging system for wireless earphones, with a first charging module having a central “**first charging electrode 251**” surrounded by an annular “**second charging electrode 252**”, and a second charging module or dock having corresponding dock electrodes (261-263):

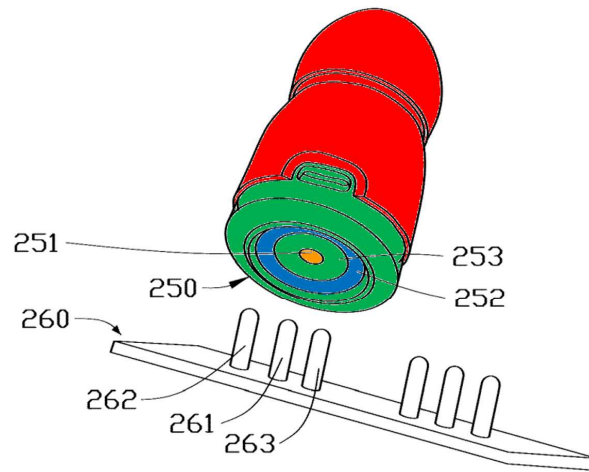


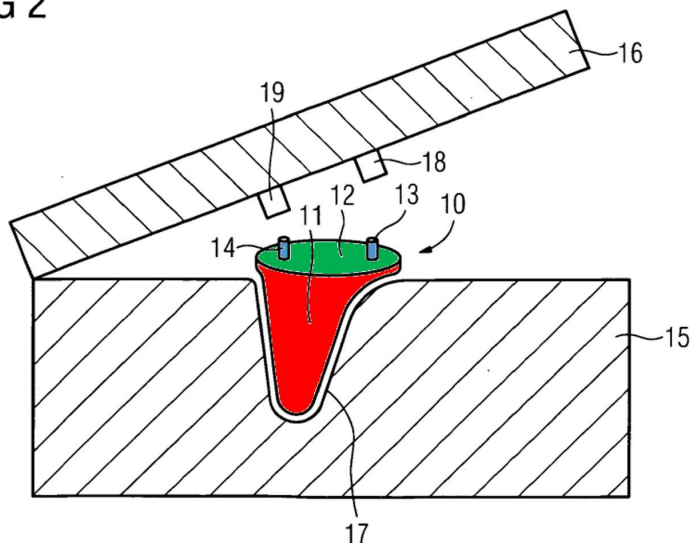
FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A; [0004], [0027-28], [0030-33]; Cls. 1, 12. Chen's earphone housing includes a tapered **shell** for insertion in a wearer's ear canal, and an outward-facing **faceplate**, in which the electrodes are disposed. *Id.*

## B. Dannemann

72. Dannemann discloses an in-the-ear ("ITE") hearing device with two charging **contacts 13, 14** arranged on the **faceplate 12**, which are connected to an integrated accumulator (battery) for recharging via a charging case:

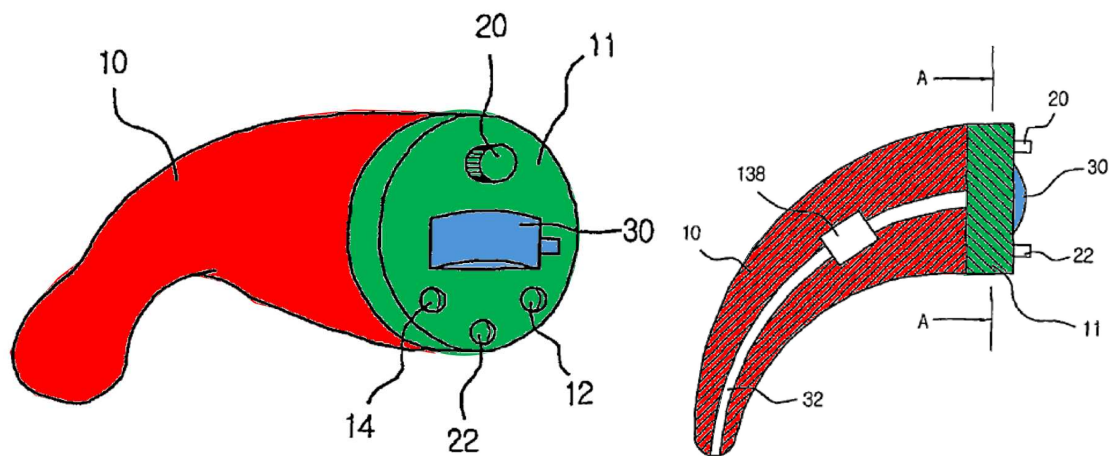
FIG 2



Ex. 1006, Fig. 2, [0027].

### C. Kwon

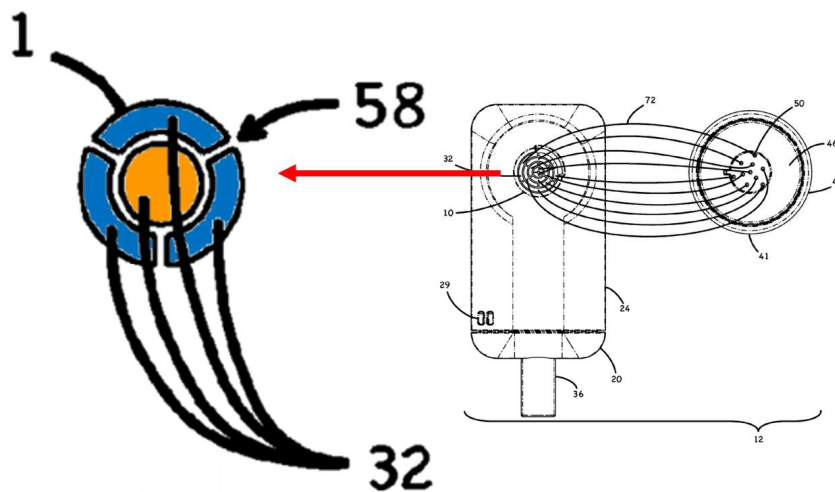
73. Kwon teaches an in-the-ear (ITE) hearing aid with a **shell 10** and a **faceplate 11** having a **cover 30** (battery door) for accessing a replaceable battery 26. Ex. 1007, Fig. 1, 3:54-4:19.



Ex. 1007, Figs. 1&2.

#### D. Thiers

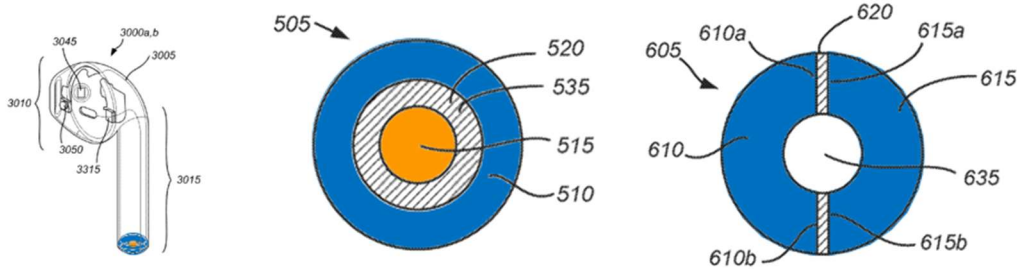
74. Thiers discloses an electrical interface between an electronic device and a charging dock. The interface of the electronic device includes four conductive traces 32: “one in the center” and “three traces that form a ring” while the dock interface has four complimentary contacts. Ex. 1008, Fig. 2, [0044]-[0049].



Ex. 1008, Figs. 2-3 (excerpted).

#### E. Wagman

75. Wagman discloses a wireless earbud with several arrangements of electrical contacts for interfacing with an external charging case, including arrangements with a central contact, and arrangements with one or more outer arcuate contacts:



Ex. 1009, Figs. 33, 5B, 6B (excerpted); *see also id.* 24:56-65, 25:9-49, claims 1-17, Figs. 4A-6B, 8A-8B, 36-40.

76. Wagman teaches that “connector configurations can be used that have more than two contacts.” Ex. 1009, 24:63-65. Wagman further explains that, “[w]hile FIG. 6B [(above on the right)] illustrates each of **contacts 610, 615** as half rings, in other embodiments the contacts can include shorter length arcs and/or have different opposing shapes altogether.” *Id.* 25:46-49.

## IX. CLAIM CONSTRUCTION

77. In this Declaration, I have applied the claim terms’ plain and ordinary meaning. None of my opinions turn on giving any broader or special meaning to any claim term.

78. I have also considered whether the preambles of claims 1-21 should be construed as limiting. In my opinion, the preambles of claims 1 and 14 merely describe the intended use or context of the claimed structure and do not impose additional structural limitations. Accordingly, I have analyzed the claims with the

preambles construed as non-limiting.

79. However, in the event the preamble is construed as limiting, I have considered whether the Challenged Claims are invalid as anticipated or obvious if the preambles are given their plain and ordinary meaning. In my opinion, the Challenged Claims are invalid under each construction, as discussed in detail below.

## **X. INVALIDITY OPINIONS: '553 PATENT**

80. In my opinions below, I reference the claims as follows:

| <b>Reference Number</b> | <b>Claim Limitation</b>                                                                                                                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Claim 1</b>          |                                                                                                                                                                                                                                      |
| [1pre]                  | A hearing device comprising:                                                                                                                                                                                                         |
| [1a]                    | a housing that encloses an internal volume and extends from an internal side to an external side, the housing comprising:                                                                                                            |
| [1b]                    | a shell arranged at the internal side, the internal side configured to be inserted in a wearer's ear canal; and                                                                                                                      |
| [1c]                    | a faceplate arranged at the external side, the external side configured to face away from the wearer;                                                                                                                                |
| [1d]                    | an electrode arrangement disposed in an outer surface of the faceplate, the electrode arrangement comprising: a central contact; and at least one arcuate contact that extends around at least a portion of the central contact; and |
| [1e]                    | circuitry disposed in the internal volume and coupled to the electrode arrangement.                                                                                                                                                  |
| <b>Claim 2</b>          |                                                                                                                                                                                                                                      |

| <b>Reference Number</b> | <b>Claim Limitation</b>                                                                                                                                                                                                                              |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [2]                     | The hearing device of claim 1, wherein the at least one arcuate contact comprises an annular contact.                                                                                                                                                |
| <b>Claim 3</b>          |                                                                                                                                                                                                                                                      |
| [3]                     | The hearing device of claim 1, wherein the at least one arcuate contact comprises a plurality of arcuate contacts.                                                                                                                                   |
| <b>Claim 4</b>          |                                                                                                                                                                                                                                                      |
| [4]                     | The hearing device of claim 3, wherein the plurality of arcuate contacts has a concentric tri-trace configuration.                                                                                                                                   |
| <b>Claim 5</b>          |                                                                                                                                                                                                                                                      |
| [5]                     | The hearing device of claim 3, wherein each of the plurality of arcuate contacts is arranged the same distance from the central contact as each other contact of the plurality of arcuate contacts.                                                  |
| <b>Claim 6</b>          |                                                                                                                                                                                                                                                      |
| [6]                     | The hearing device of claim 3, wherein the plurality of arcuate contacts defines a circle.                                                                                                                                                           |
| <b>Claim 7</b>          |                                                                                                                                                                                                                                                      |
| [7]                     | The hearing device of claim 1, further comprising: one or more microphone ports disposed in the outer surface of the faceplate; and a receiver outlet disposed in the shell.                                                                         |
| <b>Claim 8</b>          |                                                                                                                                                                                                                                                      |
| [8]                     | The hearing device of claim 1, wherein the central contact comprises an annular shape, wherein the at least one arcuate contact comprises a plurality of arcuate contacts each arranged at substantially the same distance from the central contact. |
| <b>Claim 9</b>          |                                                                                                                                                                                                                                                      |

| <b>Reference Number</b> | <b>Claim Limitation</b>                                                                                                                                                                                                                                                                                       |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [9]                     | The hearing device of claim 1, wherein the central contact comprises an annular shape, wherein the at least one arcuate contact comprises three arcuate contacts each arranged at substantially the same distance from the central contact.                                                                   |
| <b>Claim 10</b>         |                                                                                                                                                                                                                                                                                                               |
| [10]                    | The hearing device of claim 1, wherein the central contact defines a cathode contact and the at least one arcuate contact defines an anode contact.                                                                                                                                                           |
| <b>Claim 11</b>         |                                                                                                                                                                                                                                                                                                               |
| [11]                    | The hearing device of claim 1, wherein the at least one arcuate contact comprises a plurality of arcuate contacts, wherein a first arcuate contact of the plurality of arcuate contacts defines a cathode contact and a second arcuate contact of the plurality of arcuate contacts defines an anode contact. |
| <b>Claim 12</b>         |                                                                                                                                                                                                                                                                                                               |
| [12]                    | The hearing device of claim 1, wherein the circuitry comprises charging circuitry, and wherein the electrode arrangement is coupled to the charging circuitry.                                                                                                                                                |
| <b>Claim 13</b>         |                                                                                                                                                                                                                                                                                                               |
| [13]                    | The hearing device of claim 1, wherein the at least one arcuate contact is configured to communicate power and one or more information signals.                                                                                                                                                               |
| <b>Claim 14</b>         |                                                                                                                                                                                                                                                                                                               |
| [14pre]                 | A system comprising:                                                                                                                                                                                                                                                                                          |
| [14a]                   | a hearing device comprising:                                                                                                                                                                                                                                                                                  |
| [14b]                   | a housing that encloses an internal volume and extends from an internal side to an external side, the housing comprising:                                                                                                                                                                                     |

| <b>Reference Number</b> | <b>Claim Limitation</b>                                                                                                                                                                                                              |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [14c]                   | a shell arranged at the internal side, the internal side configured to be inserted in a wearer's ear canal; and                                                                                                                      |
| [14d]                   | a faceplate arranged at the external side, the external side configured to face away from the wearer;                                                                                                                                |
| [14e]                   | an electrode arrangement disposed in an outer surface of the faceplate, the electrode arrangement comprising: a central contact; and at least one arcuate contact that extends around at least a portion of the central contact; and |
| [14f]                   | circuitry disposed in the internal volume and coupled to the electrode arrangement; and                                                                                                                                              |
| [14g]                   | a charging module comprising a charging interface that comprises: a central charging contact; and an annular ring charging contact or a plurality of charging contacts equidistant to the central contact.                           |
| <b>Claim 15</b>         |                                                                                                                                                                                                                                      |
| [15]                    | The system of claim 14, wherein the at least one arcuate contact of the electrode arrangement of the hearing device comprises an annular contact.                                                                                    |
| <b>Claim 16</b>         |                                                                                                                                                                                                                                      |
| [16]                    | The system of claim 14, wherein the at least one arcuate contact of the electrode arrangement of the hearing device comprises a plurality of arcuate contacts.                                                                       |
| <b>Claim 17</b>         |                                                                                                                                                                                                                                      |
| [17]                    | The system of claim 16, wherein the plurality of arcuate contacts defines a circle.                                                                                                                                                  |
| <b>Claim 18</b>         |                                                                                                                                                                                                                                      |
| [18]                    | The system of claim 14, wherein the central contact of the electrode arrangement of the hearing device comprises an annular shape,                                                                                                   |

| <b>Reference Number</b> | <b>Claim Limitation</b>                                                                                                                                                                                                                                                                 |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | wherein the at least one arcuate contact of the electrode arrangement of the hearing device comprises a plurality of arcuate contacts each arranged at substantially the same distance from the central contact.                                                                        |
| <b>Claim 19</b>         |                                                                                                                                                                                                                                                                                         |
| [19]                    | The system of claim 14, wherein the central contact of the electrode arrangement of the hearing device comprises an annular shape, wherein the at least one arcuate contact comprises three arcuate contacts each arranged at substantially the same distance from the central contact. |
| <b>Claim 20</b>         |                                                                                                                                                                                                                                                                                         |
| [20a]                   | The system of claim 14, wherein the hearing device comprises a first charging interface comprising the electrode arrangement, wherein the circuitry of the hearing device comprises charging circuitry coupled to the electrode arrangement,                                            |
| [20b]                   | wherein the charging interface of the charging module defines a second charging interface configured to detachably couple with the first charging interface of the hearing device;                                                                                                      |
| [20c]                   | wherein the charging module further comprises charging circuitry coupled to the second charging interface and                                                                                                                                                                           |
| [20d]                   | configured to charge a rechargeable power source of the hearing device that is coupled to the first charging interface.                                                                                                                                                                 |
| <b>Claim 21</b>         |                                                                                                                                                                                                                                                                                         |
| [21]                    | The system of claim 14, wherein the hearing device further comprises: one or more microphone ports disposed in the outer surface of the faceplate; and a receiver outlet disposed in the shell.                                                                                         |

81. In my opinion, as I explain below, the Challenged Claims of the '553 Patent

are invalid based on the following grounds:

| <b>Claims</b>       | <b>Basis</b>                      |
|---------------------|-----------------------------------|
| 1, 2, 10, 12-15, 20 | §102; Chen                        |
| 1-21                | §103; Chen and Thiers             |
| 7, 21               | §103; Chen, Thiers, and Wagman    |
| 1-21                | §103; Chen and Wagman             |
| 1-6, 8-20           | §103; Dannemann and Thiers        |
| 7, 21               | §103; Dannemann, Thiers, and Kwon |
| 1-21                | §103; Dannemann and Wagman        |
| 1-21                | §103; Kwon, Wagman, and Thiers    |
| 1-9, 12-21          | §112(a); Written Description      |

**A. Ground 1: Chen Anticipates Claims 1, 2, 10, 12-15, 20**

**1. [1]/[14]**

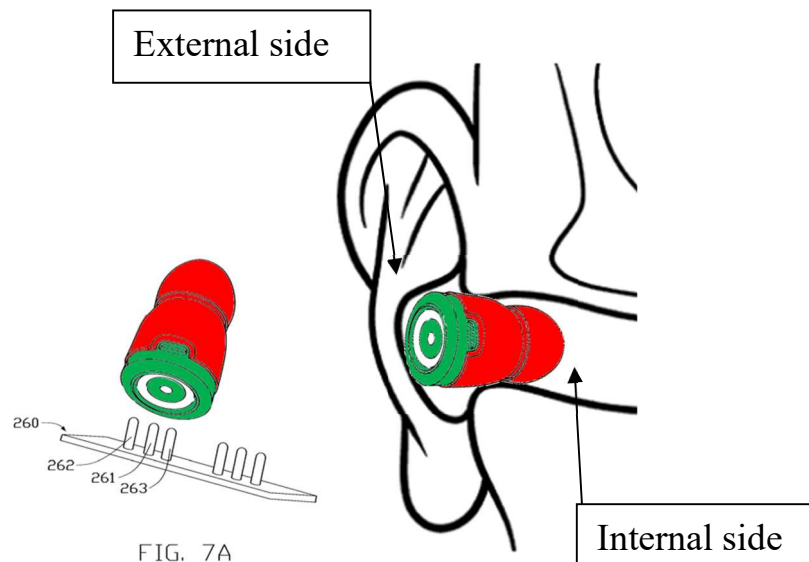
**a. [1pre]/[14a]**

82. Chen discloses a hearing device (“wireless earphones 300a and 300b”). Ex. 1005, Fig. 6B, [0030]. Chen’s earphones are hearing devices because they produce sound that is heard by a listener. Chen also discloses that its wireless earphones have a “microphone 140...to receive environmental sound or the user’s voice,” thereby “serv[ing] as a wireless intercom, a hearing aid, or a sound amplifying device.” *See* Ex. 1005, Figs. 5, 6B, 7A; [0005], [0010], [0019], [0021], [0024-25], [0029-32].

This is confirmed by the specification of the '553 Patent, which states “[h]earing devices provide sound for the wearer. Some examples of hearing devices are headsets, hearing aids, speakers, cochlear implants, bone conduction devices, and personal listening devices.” Ex. 1001, 1:27-30.

**b. [1a]/[14b]**

83. Chen discloses a housing (“device housing”) that encloses an internal volume (space within the “device housing” enclosing “rechargeable battery 130” and “charge controller 120”) and extends from an **internal side** (ear-facing surface) to an **external side** (outward-facing surface), as shown below.



84. When earphone 300 is worn by a user, as depicted above, its internal side is positioned inside a user’s ear canal, while its external side faces away the user’s ear

canal. Chen's housing comprises a **shell** and **faceplate**, as described for limitations [1b]/[14c] and [1c]/[14d].

**c. [1b]/[14c]**

85. Chen discloses a **shell** arranged at the internal side (ear-facing surface), and the internal side (ear-facing surface) is configured to be inserted in the wearer's ear canal:

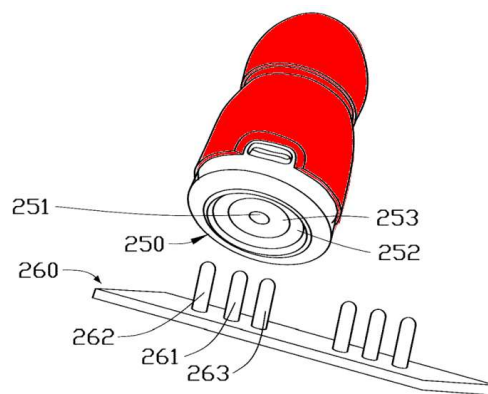


FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A.

86. POSAs would understand the ear-facing side of Chen's housing to be a "shell" because it encloses the internal components of the hearing device and is inserted into a wearer's ear canal. For example, the '533 Patent states "[t]he shell 864 houses the electronic 55 and electrical components of the hearing device 860, such as those previously described." Ex. 1001, 19:55-57. It also states, "[i]n some configurations,

the shell 864 can be constructed from semi-soft material (e.g., 60 polymeric material) which can conform to the shape of the wearer's ear canal when the shell 864 is inserted therein.” *Id.* 19:59-62. Further, Chen shows the **shell**, identified above, in an exploded view of Chen’s hearing device in the Fig. 1B embodiment.

87. The ear-facing surface of wireless earphone 300 is tapered for insertion in a wearer’s ear canal, which by friction ensures that the earphone does not fall out when being used by a user. Ex. 1005, Figs. 5, 6B, 7A; [0005], [0010], [0019], [0021], [0024-25], [0029-30]. While the depth of insertion of any hearing device in the ear canal depends on the relative size of the device and the wearer’s ear canal, regardless of the user, a POSA would understand from the tapered shape of Chen’s hearing device and the lack of any over-the-ear structures to hold the device in place that its internal side is configured for insertion in the ear canal. These characteristics distinguish Chen from other hearing devices that are not inserted in a wearer’s ear canal, such as over-the-ear or behind-the-ear hearing devices that wrap around the head or the outside of the ear.

**d. [1c]/[14d]**

88. Chen discloses a **faceplate** arranged at the external side (outward-facing surface), and the external side (outward-facing surface) is configured to face away from the wearer:

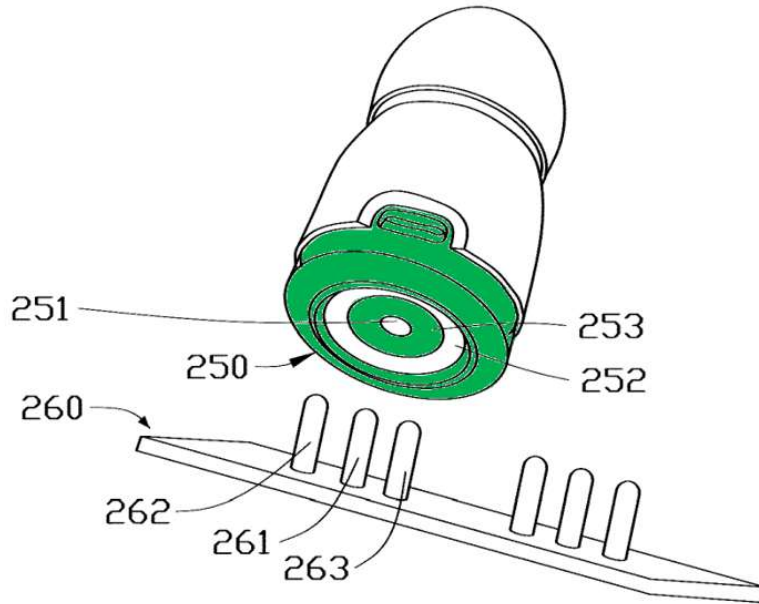


FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A.

89. Chen’s **faceplate** has portions of the outward-facing surface of the “device housing” and “annular insulation wall 253, which prevents short circuiting between the first charging electrode 251 and the second charging electrode 252.” Ex. 1005, [0031]. POSAs would understand this structure to be a faceplate. For example, the ’553 Patent’s specification states “faceplate 862 includes a charging interface 840d and other components/structures of the hearing device 860, such as one or two microphones 866.” Similarly, Chen’s **faceplate** has a charging interface (§ X.A.1.e) and ports which may be used by its “microphone 140” (§ X.B.2.6). Because the outward-facing side of earphone 300 is opposing the end that is inserted into a

wearer's ear canal, the outward-facing side is configured to face away from the wearer. Ex. 1005, Figs. 5, 6B, 7A; [0005], [0010], [0019], [0021], [0024-25], [0029-30].

e. [1d]/[14e]

90. Chen discloses an electrode arrangement (“**first charging electrode 251**” and “**second charging electrode 252**”) disposed in an outer surface of the **faceplate**, where the electrode arrangement (“**first charging electrode 251**” and “**second charging electrode 252**”) comprises a central contact (“**first charging electrode 251**”) and at least one arcuate contact (“**second charging electrode 252**”) that extends around at least a portion of the central contact (“**first charging electrode 251**”):

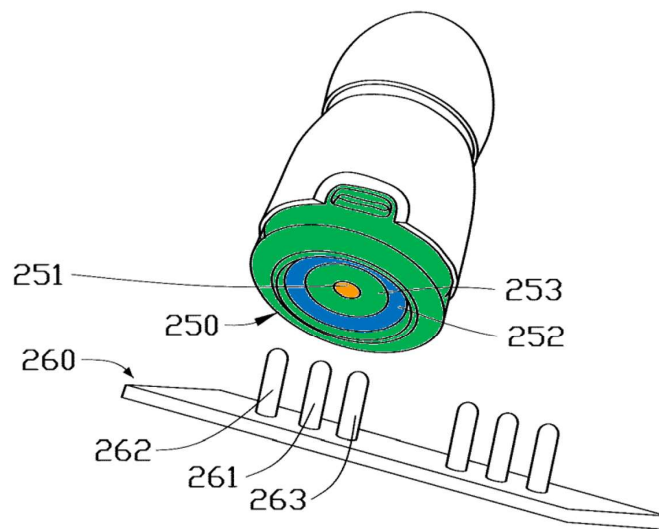


FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A; [0004] (“the **second charging electrode** is substantially annular, and the **first charging electrode** is surrounded by the **second charging electrode**”), [0027-28], [0030-33]; Cls. 1, 12.

91. For example, Chen discloses the “**first charging electrode 251** is surrounded by the **second charging electrode 252**” and that “the **second charging electrode 252** is annular.” Ex. 1005, [0031]. The annular **second charging electrode 252** is “arcuate” because it is a 360-degree arc. The “**first charging electrode 251**” and “**second charging electrode 252**” are disposed in an outer surface of the **faceplate** because they are recessed in the outer surface of the faceplate, as shown in Fig. 7A. Further, Chen discloses the faceplate includes an “annular insulation wall 253,” as shown in Fig. 7A, “which prevents short circuiting between the **first charging electrode 251** and the **second charging electrode 252**.” Ex. 1005, [0031].

f. [1e]/[14f]

92. Chen discloses circuitry (“**rechargeable battery 130**,” “**charge controller 120**,” and associated wiring) disposed in the internal volume (space within the “device housing”) and is coupled to the electrode arrangement (“**first charging electrode 251**” and “**second charging electrode 252**”):

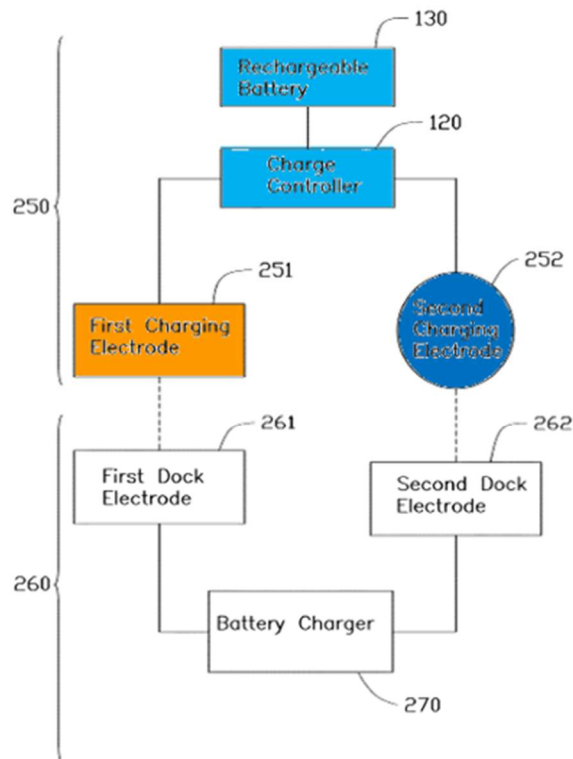


FIG. 5

Ex. 1005, Figs. 5, 6B, 7A; [0027-28].

93. Chen further discloses a “charge controller [that] may prevent [the] circuit from electrical overload. The charge controller may be configured as a charge integrated circuit.” Ex. 1005, [0015]. Chen describes that “the device housing is configured to accommodate the **rechargeable battery** [and] the **charge controller**” and that the “**first charging electrode 251** and the **second charging electrode 252** are coupled to the cathode or the anode of the **charge controller 120**.” Ex. 1005, [0027-28].

**g. [14pre]**

94. Chen discloses a system. For example, Chen is titled “Charging System and Electronic Device Having Same” and states that “[t]he present disclosure generally relates to a charging system and an electronic device having the charging system.” Chen further describes Figures 5, 6B, and 7A as “an exemplary embodiment of a charging system.” Ex. 1005, Figs. 5, 6B, 7A; Title, Abstract, [0001], [0004]-[0005], [0026]-[0028], [0031]-[0034]; Cls. 1-11.

**h. [14g]**

95. Chen teaches a charging module (“second charging module 260”) comprising a charging interface (“**electrode 261**,” “**electrode 262**,” and “**electrode 263**”) that comprises: a central charging contact (“**electrode 261**”); and an annular ring charging contact or a plurality of charging contacts (“**electrode 262**” and “**electrode 263**”) equidistant to the central contact (“**electrode 251**”):

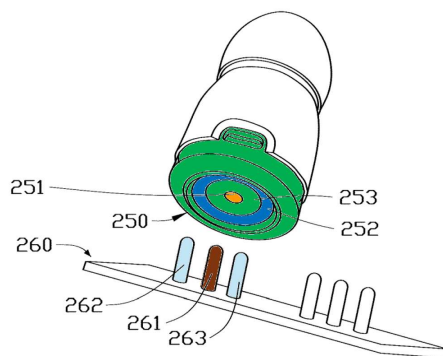


FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A; [0027]-[0033]; Cls. 1, 12.

96. Chen teaches that “[w]hen the first charging module 250 and the second charging module 260 are electrically coupled, electrical connections by the **second dock electrode 262** and the **third dock electrode 263** to the **second charging electrode 252** are assured.” Ex. 1005, [0031]. As seen in Fig. 7A, the **electrode 251** is at the center of the **electrode 252**, so when the **electrodes 262 and 263** electrically connect to the **electrode 252**, the **electrodes 262 and 263** will be the same distance to the **electrode 251**. Should this limitation be construed to require a plurality of charging contacts equidistant to the “central charging contact,” Chen meets this limitation because Chen’s outer **electrodes 262 and 263** are equidistant to middle **electrode 261**. As Chen shows, the **electrodes 262 and 263** are equidistant from the central, middle **electrode 261** in order to engage the circular **second charging electrode 252** surrounding the central **electrode 251**. Ex. 1005, Fig. 7A.

## 2. [2]/[15]

97. Chen discloses the at least one arcuate contact (“**second charging electrode 252**”) comprises an annular contact:

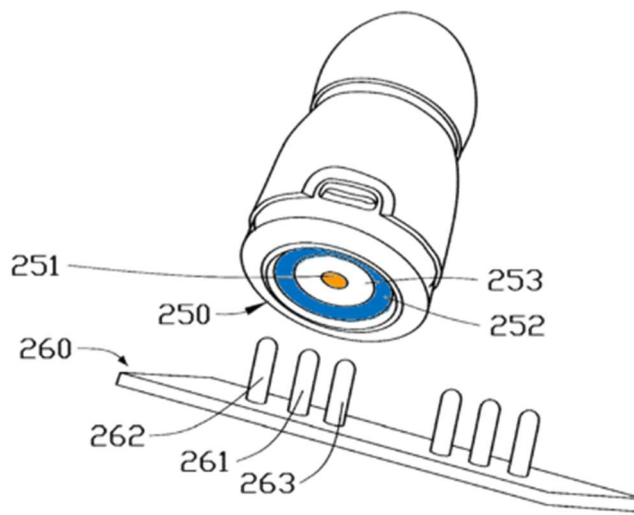


FIG. 7A

Chen describes, for example, that “the **second charging electrode 252** is annular.”

Ex. 1005, [0031]. *See also id.* Figs. 5, 6B, 7A, [0004].

### 3. [10]

98. Chen discloses that the central contact (“**electrode 251**”) defines a cathode contact and the at least one arcuate contact (“**electrode 252**”) defines an anode contact.

99. Chen describes that “[t]he **first charging electrode 251** and the **second charging electrode 252** are coupled to the cathode or the anode of the charge controller 120,” which discloses two configurations: (1) “**electrode 251**” is coupled to the charge controller 120’s cathode and “**electrode 252**” is coupled to its anode, and (2) “**electrode 251**” is coupled to the charge controller 120’s anode and

“**electrode 252**” is coupled to its cathode. Ex. 1005, [0027]. In the first configuration, the “**electrode 251**” is a cathode contact because is connected to the charge controller 120’s cathode and the “**electrode 252**” is an anode contact because it is connected to the charge controller 120’s anode.

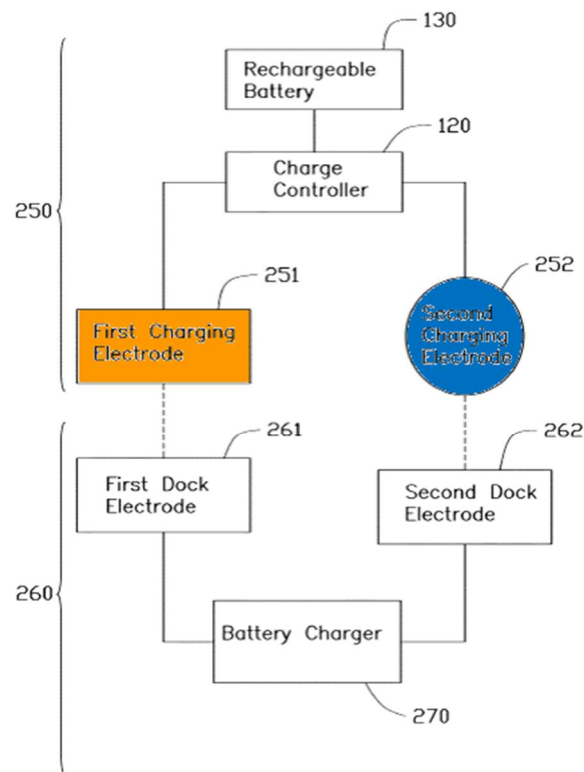


FIG. 5

Ex. 1005, Figs. 5, 6B, 7A; [0027].

#### 4. [12]

100. Chen discloses that the circuitry (“**rechargeable battery 130**,” “**charge controller 120**,” and associated wiring) comprises charging circuitry, and the electrode arrangement (“**electrode 251**” and “**electrode 252**”) is coupled to the

charging circuitry.

101. Chen's circuitry includes charging circuitry because it is used to charge "rechargeable battery 130." For example, Chen teaches "[t]he charge controller may be configured as a charge integrated circuit." Ex. 1005, [0015]. Further, Chen teaches that "[t]he rechargeable battery is coupled to the charge controller" and "[t]he charge controller is coupled to both the first charging electrode and the second charging electrode." Ex. 1005, [0028].

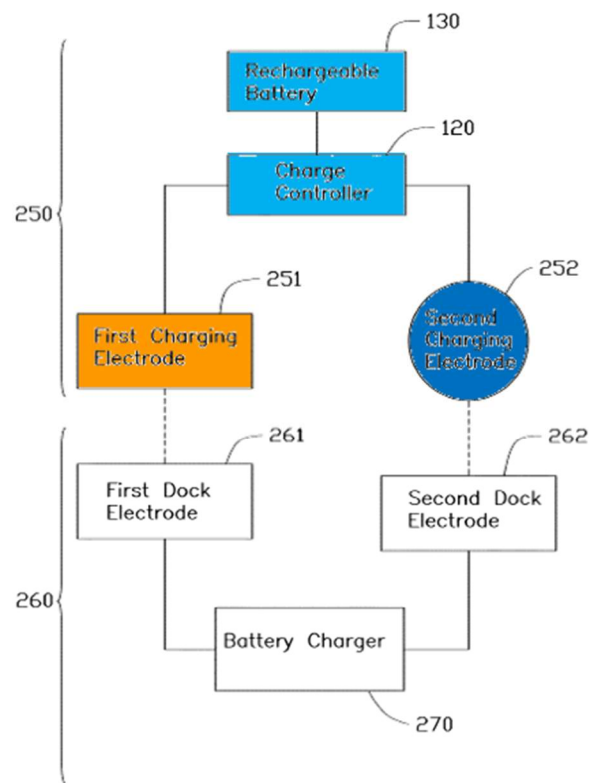


FIG. 5

Ex. 1005, Figs. 5, 6B, 7A.

**5. [13]**

102. Chen discloses that the at least one arcuate contact (“**electrode 252**”) is configured to communicate power and one or more information signals.

103. Chen describes that “[t]he **first charging electrode 251** and the **second charging electrode 252** are coupled to the cathode or the anode of the charge controller 120.” Ex. 1005, [0027]. As such, the “**second charging electrode 252**” is configured to communicate power from “second charging module 260” to “rechargeable battery 130.” Ex. 1005, [0027]-[0028].

104. Further, Chen describes that “the **second charging electrode 252** could be a closed-loop antenna electrode to provide communication functions,” including via “BLUETOOTH and WI-FI.” Ex. 1005, [0031], [0011]-[0012]. Chen discloses a “switching module” that can selectively “make the antenna electrode work as a charging electrode or as an antenna.” Ex. 1005, [0017]. When in “communication mode,” the **electrode 252** “receive[s] electromagnetic wave[s], convert [them] into electrical power, and deliver[s] the electrical power to a transceiver module” for communicating information signals. Ex. 1005, [0012], [0020].

**6. [20]**

**a. [20a]**

105. Chen discloses that the hearing device comprises a first charging interface

(“**electrode 251**” and “**electrode 252**”) comprising the electrode arrangement, wherein the circuitry (“**rechargeable battery 130**,” “**charge controller 120**,” and associated wiring) of the hearing device comprises charging circuitry coupled to the electrode arrangement:

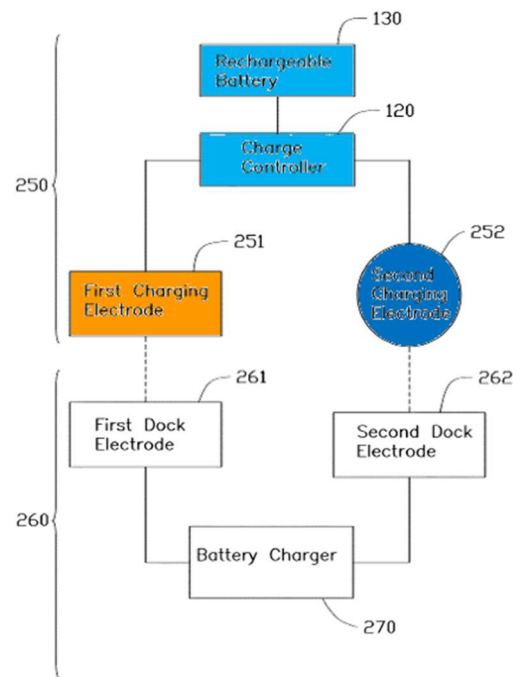


FIG. 5

Ex. 1005, Figs. 5, 6B, 7A, [0027-28]; *id.* Cls. 1, 12.

106. The “**electrode 251**” and “**electrode 252**” are a “first charging interface” because they interface with the electrodes of the “second charging module 260” and the wireless earphone 300’s circuit comprises “charging circuitry” because it is used for charging “**rechargeable battery 130**.” *Id.* This circuitry is coupled to the

electrode arrangement, as I explain above. *See* §X.A.4.

**b. [20b]**

107. Chen discloses that the charging interface of the charging module (“**electrode 261**,” “**electrode 262**,” and “**electrode 263**”) defines a second charging interface configured to detachably couple with the first charging interface (“**electrode 251**” and “**electrode 252**”) of the hearing device:

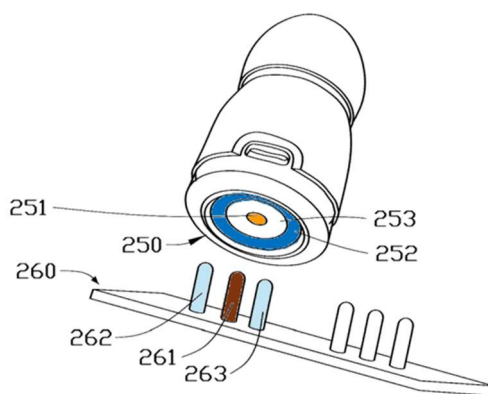


FIG. 7A

Ex. 1005, Figs. 5, 6B, 7A.

108. The “first charging module 250” and the “second charging module 260” “electrically couple[]” with “first charging electrode 251”, and “second charging electrode 252” when a user places the rechargeable wireless earphone into the charging case. Ex. 1005, [0028], [0030]-[0031]. These surfaces “detachably” couple because wireless earphones 300 (which include the “first charging module 250”), are removed from the charging case (which includes the “second charging module

260”) when the earphones 300 are worn by the user. Ex. 1005, [0027]-[0028], [0030]-[0031]; Cls. 1, 6, 12, 15-16.

**c. [20c]**

109. Chen discloses that the charging module (“second charging module 260”) further comprises charging circuitry (“**battery charger 270**”) coupled to the second charging interface (“**electrode 261**,” “**electrode 262**,” and “**electrode 263**”).

110. A POSA would understand that the “**battery charger 270**” comprises charging circuitry because Chen teaches that “**battery charger 270**” is part of a charging circuit:

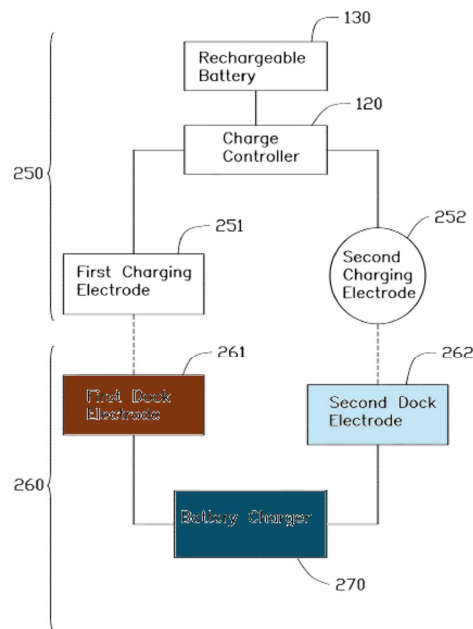


FIG. 5

Ex. 1005, Figs. 5, 6B, 7A; [0027-28]; Cls. 1, 6, 12, 15-16.

111. Consistent with this fact is that Chen describes that the “**first dock electrode 261**” and “**second dock electrode 262**” “are coupled to the cathode or the anode of the **battery charger 270**.” Ex. 1005, [0027].

d. [20d]

112. Chen discloses that the charging module (“second charging module 260”) is configured to charge a rechargeable power source (“**rechargeable battery 130**”) of the hearing device that is coupled to the first charging interface (“**electrode 251**” and “**electrode 252**”).

113. Chen describes that “[t]he **rechargeable battery** is coupled to the **charge controller**” and “[t]he **charge controller** is coupled to both the **first charging electrode** and the **second charging electrode**.” Ex. 1005, [0028]. Further, Chen discloses that “**first charging electrode 251**” and “**second charging electrode 252**” are electrically connected to the “**first dock electrode 261**” and “**second dock electrode 262**,” respectively. Ex. 1005, [0028]. Figure 5 of Chen, reproduced below, shows that the “first charging module 250” delivers power from an external power source to the “rechargeable battery 130.”

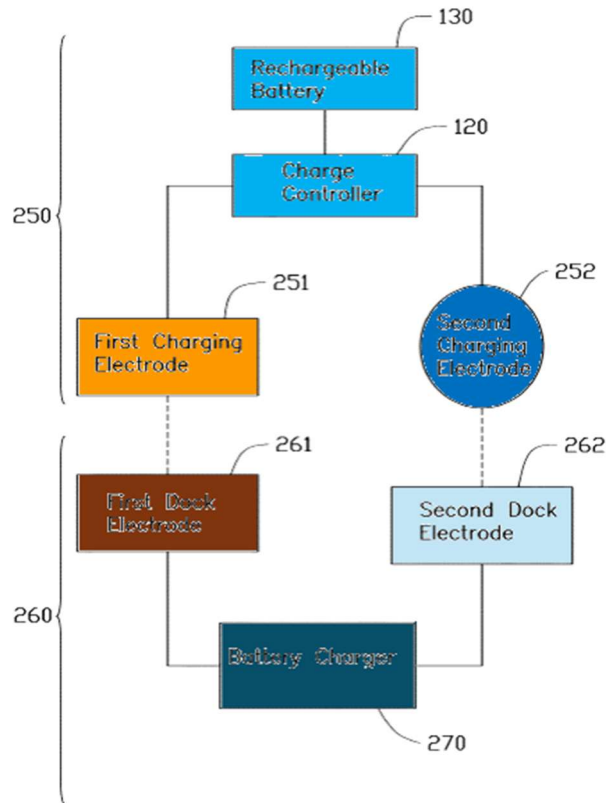


FIG. 5

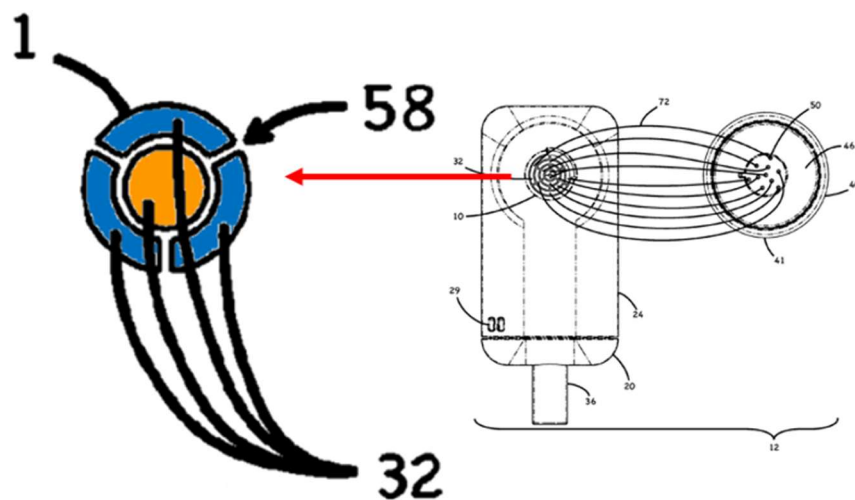
Ex. 1005, Figs. 5, 6B, 7A, [0027]-[0028] (“The dotted lines shown in FIG. 5 indicate electrical connections between the **first charging electrode 251** and the **first dock electrode 261**, and electrical connections between the **second charging electrode 252** and the **second dock electrode 262** when a charging circuit is complete.”), [0031]; Cls. 1, 12.

## B. Ground 2: Chen Combined With Thiers Renders Obvious Claims 1-21

### 1. Motivation To Combine

114. In my opinion, a POSA would have been motivated to combine Chen and

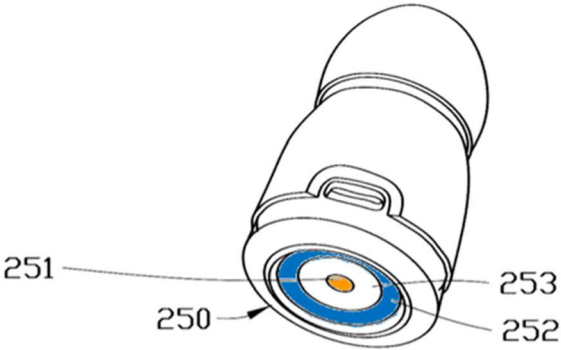
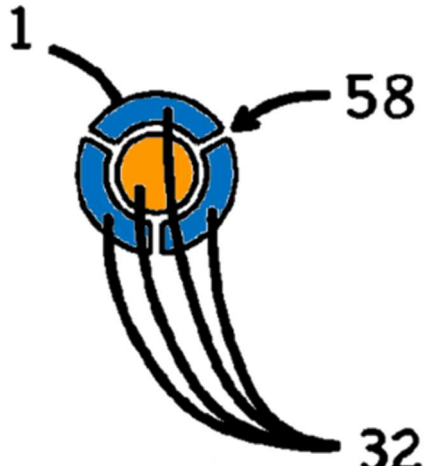
Thiers. Thiers discloses a multi-contact charging interface for a rechargeable electronic device. Ex. 1008, Figs. 1, 2, [0044]-[0045].



Ex. 1008, Figs. 2-3 (excerpted).

115. In my opinion, a POSA would have been motivated to substitute Chen's charging interface with Thiers' charging interface.

116. For example, below is a visual example of the combination:

| Chen                                                                                                                                                                                                                                                 | Thiers                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>A perspective view of a cylindrical device. Label 250 points to the front face, 251 to the outer rim, 252 to the central opening, and 253 to the inner rim.</p> |  <p>A perspective view of a cylindrical device. Label 1 points to the top rim, 32 to the bottom rim, and 58 to the central opening.</p> |
| Chen + Thiers                                                                                                                                                                                                                                        |                                                                                                                                                                                                                           |
|  <p>A perspective view of a cylindrical device, likely a combination of the two above. It shows a central opening with a blue ring and an orange center.</p>     |                                                                                                                                                                                                                           |

Ex. 1005, Figs. 7A (top left) (excerpted); Ex. 1008, Fig. 3 (top right) (excerpted);  
Ex. 1005, Figs. 7A (bottom) (excerpted).

117. Thiers discloses that a “need in the art for a connecting system for an electronic device that allows a conductor dense connection” but which “provides the same speed of charging and data transmission.” Ex. 1008, [0013]. It was known in the art, as Thiers discloses, that dense, multi-contact arrangements were also desirable because the “consumer electronic industry is moving toward fewer connector ports on devices by combining the functions of what previously took multiple connectors into one,” including “data and power” transmission. *Id.* [0002], [0006]. Hearing devices, like Chen, have a relatively small and constrained faceplate surface area, and are particularly suitable for conductor-dense connections like those provided by Thiers.

118. A POSA would have understood that a charging interface with Thiers’ four contacts (central “**trace 32**” and outer “**traces 32**”) had known advantages over a two-contact interface, like the one disclosed by Chen. It was known in the art to implement dense, multi-contact arrangements for charging and data transmission in place of older conventions that used separate ports for the same functions, due to fabrication and packaging costs, and because external cable/port interfaces impose mechanical and electrical constraints that can limit compactness, signal integrity, charging efficiency, and integration as compared to a short, integrated contact interface. § V.

119. A POSA would have been motivated to combine Chen and Thiers based on several other design incentives, too. For example, Chen’s faceplate presents a circular geometry and a concentric three-arc arrangement taught by Thiers is a geometrically natural solution that exploits the rotational symmetry of the circular faceplate surface, ensuring reliable contact with the charging device regardless of the angular orientation when it is inserted into the charging cradle.

120. In addition, expanding Chen’s central-and-surrounding-ring contact interface to Thiers’ central-and-three-surrounding-arcs arrangement would have resulted in the known advantages of increasing electrical contacts: ease of manufacturing and robustness/stability of design, faster charging, reliability through redundancy, allowing power and data to be transmitted over distinct contacts, and available rotational symmetry. § V. Thiers’ concentric configuration achieves this increase in electrical paths within the same limited surface area, making it particularly well-suited for the constrained form factor of a hearing-device faceplate. Ex. 1008, [0044].

121. POSAs would also have understood that Thiers’ central “**trace 32**” and three outer “**traces 32**” were compatible with (1) Chen’s dock electrodes 261, 262, and 263 or (2) the “contacts 50” on Thiers’ “dock interface assembly 40” (*i.e.*, the charging interface on the charging module of both references), and would have been

motivated to use either charging interface in the combination. Interfacing Thiers' central "**trace 32**" and three outer "**traces 32**" with Chen's "second charging module 260" would ensure central "**trace 32**" always contacts middle "electrode 261" and at least one outer "**traces 32**" always contacts outer "electrode 262" or "electrode 263." Ex. 1005, Figs. 7A; [0027]-[0028], [0031].

122. A POSA would also have been motivated to modify Chen's "second charging module 260" to use Thiers' "dock interface assembly 40" because it is designed for use with Thiers' electrode arrangement with central "**trace 32**" and three outer "**traces 32**." Ex. 1008, [0037-38], [0043-44], Fig. 2. For example, a POSA would have been motivated to align four "contacts 50" from Thiers' "dock interface assembly 40" with the four "traces 32" from "connector 1" to provide four distinct "electrical paths...from each respective contact 50 to each corresponding trace 32," for the reasons I explain above. Ex. 1008, [0043-45].

123. A POSA would have had a reasonable expectation of success making this combination. Chen and Thiers have similar electrode geometry; *i.e.*, a central electrode surrounded by one more arcuate electrodes arranged in a circle. Substituting Thiers' electrodes for Chen's simply involved using a known technique (dividing an annular ring contact into several arcuate contacts) to improve a similar device in the same way. Further, Thiers emphasizes that its charging system applies

“generally to electronic devices,” which includes electronic hearing devices like those disclosed by Chen. Ex1008, [0001]. A POSA would understand that, in the combination, Thiers’ charging interface would be coupled to Chen’s circuitry, including its charge controller and dock-electrode architecture to utilize the additional electrical paths.

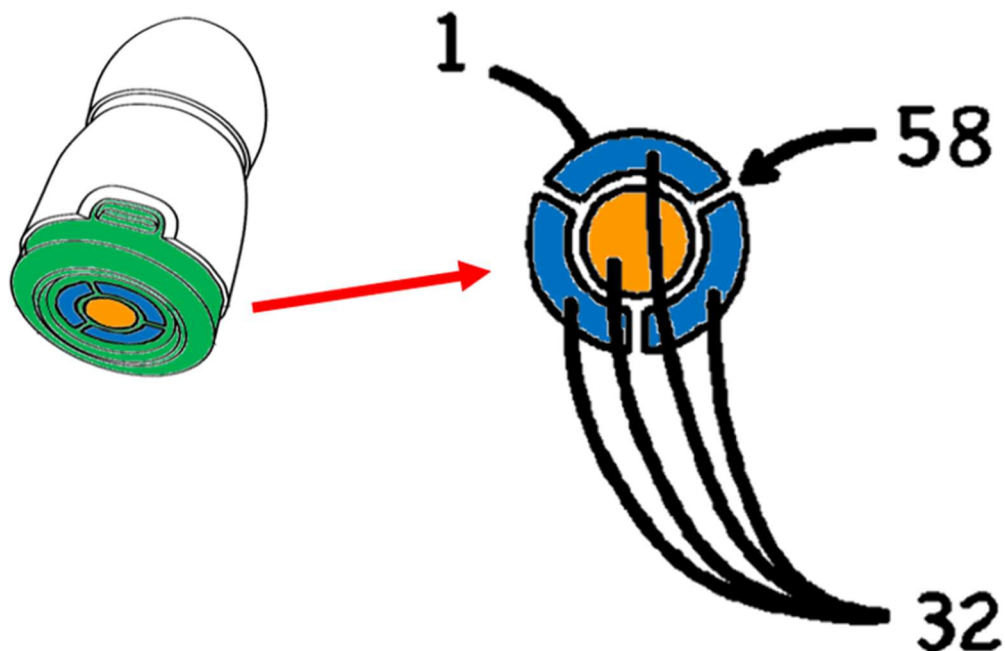
**2. [1]/[14]**

**a. [1pre]/[14a]/[1a]/[14b]/[1b]/[14c]/[1c]/[14d]/[14pre]**

124. Chen discloses these limitations, as I explain above (*See* Section §§X.A.1.a-d, -g), and Chen combined with Thiers also discloses these limitations.

**b. [1d]/[14e]**

125. The combination of Chen and Thiers discloses these limitations. Chen combined with Thiers has an electrode arrangement (Thiers’ “connector 1”) disposed in an outer surface of the faceplate (Chen’s **faceplate**), the electrode arrangement comprising a central contact (central “**trace 32**”) and at least one arcuate contact (outer “**traces 32**”) that extends around at least a portion of the central contact:



Ex. 1005, Fig. 7A (modified); Ex. 1008, Fig. 3 (excerpted).

126. Thiers discloses that “[c]onnector 1 includes four traces: one in the center with the surface in the form of a circle, and three traces that form a ring around the circle and axis of rotation.” Ex. 1008, [0045]. Chen teaches disposing its electrodes in the outer surface of its faceplate, and POSAs would have been motivated to similarly dispose Thiers’ electrodes in the outer surface of Chen’s faceplate. §§ X.A.1.e, V. Thiers further discloses “in Figure 3, the nonconductive separating spaces 58 may divide the otherwise annular shaped traces 32 into a multitude of smaller traces, as for example to fit more electrical path 72 into a limited space. The nonconductive separating spaces 58 may comprise...a nonconductive separating material such as plastic and other insulators.” A person of skill in the art would have recognized

Chen's faceplate could thus act as the nonconductive separating spaces 58 and would have been motivated to dispose Thiers' electrode arrangement in the outer surface of Chen's faceplate for the ease of manufacturing and stability of design benefits discussed previously. §§ X.B.1, V.

**c. [1e]/[14f]**

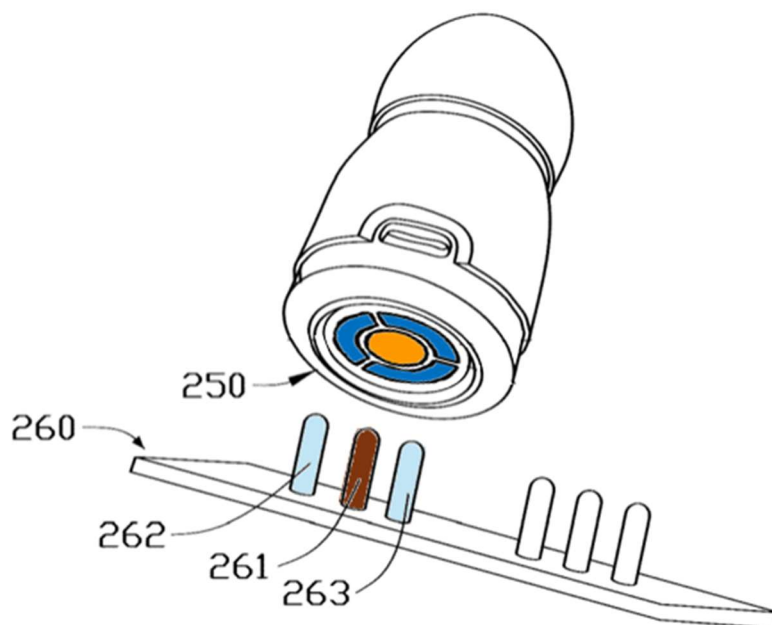
127. Chen combined with Thiers discloses these limitations. Chen combined with Thiers has circuitry (Chen's "rechargeable battery 130," "charge controller 120," and associated wiring) disposed in the internal volume (space within Chen's "device housing") and coupled to the conductive electrode arrangement (Thiers' "connector 1"). *See* §§ X.A.1.b, X.B.2.b.

**d. [14g]**

128. Chen discloses this limitation and Chen combined with Thiers discloses this limitation. Chen combined with Thiers has a charging module (Chen's "second charging module 260") comprising a charging interface (Chen's electrodes 261-263 or Thiers' contacts 50) that comprises: a central charging contact and a plurality of charging contacts equidistant to the central contact.

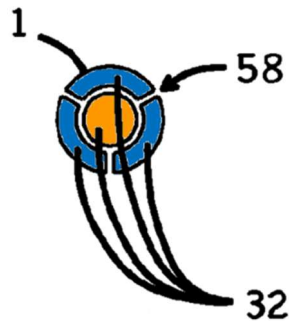
129. For example, Chen's electrodes 261-263 comprise a central charging contact ("electrode 261") and a plurality of charging contacts ("electrode 262" and "electrode 263") equidistant to the central contact (Thiers' central "trace 32"), at

least when Chen's earphones are docked:



Ex. 1005, Fig. 7A (modified). “**Electrode 262**” and “**electrode 263**” also are equidistant to “**electrode 261**,” as shown in Fig. 7A. See §X.A.1.h.

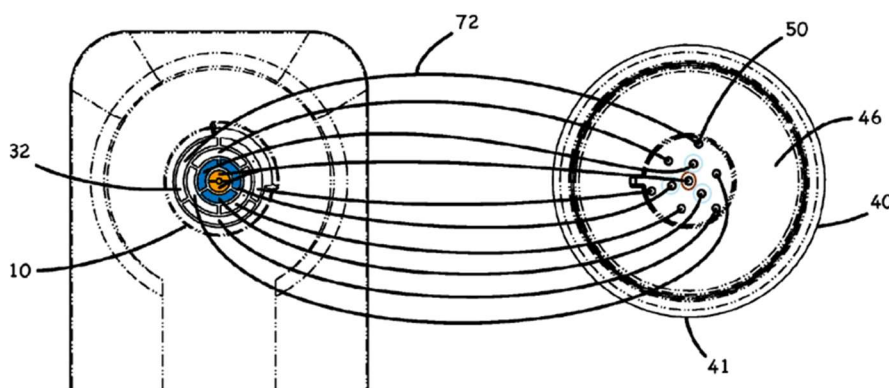
130. In addition, Thiers’ “contacts 50” comprise a central charging contact (middle-most “contact 50”) and a plurality of charging contacts (three surrounding “contacts 50”) equidistant to the central contact (central “**trace 32**”), at least when Chen’s earphones are docked. Ex. 1008, Figs. 1-3. Fig. 3 of Thiers shows outer “**traces 32**” are equidistant to central “**trace 32**” and Thiers describes that “contacts 50” of the “dock interface assembly 4” “may be arranged in such a manner that each one of the contacts 50 is aligned with a conductive trace 32.” Ex. 1008, [0037]-[0039], [0043]-[0045].



Ex. 1008, Fig. 3 (excerpted).

131. As such, Thiers' discloses that three outer "contacts 50" to are equidistant to (1) a middle "**contact 50**" and (2) central "**trace 32**" when docked so that each trace 32 aligns with a corresponding contact 50.

132. As Thiers shows in Fig. 1, an embodiment with more than four traces 32 and contacts 50 includes three outer "**contacts 50**" are equidistant to middle "**contact 50**" and central "**trace 32**" when the interfaces are docked.



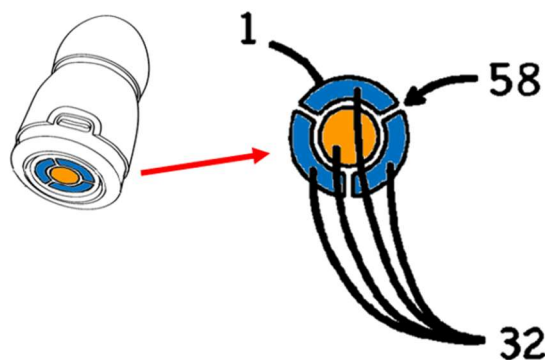
Ex. 1008, Fig. 2 (excerpted).

133. Even if Thiers somehow did not disclose this limitation (a proposition I do not

agree with), it is my opinion that it nonetheless would have been obvious to a POSA to configure Thiers such that three outer “**contacts 50**” are equidistant to (1) middle “**contact 50**” or (2) central “**trace 32**” when docked. A POSA would have found such obvious in order for each trace 32 to align with a contact 50 in order to create four “electrical path[s]” for charging and data transmission, as Thiers explicitly teaches and suggests, as discussed above. Ex. 1008, Fig. 2, [0043-45]; *see also* §X.B.1.

### 3. [2]/[15]

134. In my opinion, Chen combined with Thiers renders obvious claims 1 and 14 (§X.B.2), and the limitations of these claims. Chen combined with Thiers discloses the least one arcuate contact (Thiers’ outer “**traces 32**”) comprises an annular contact, at least to the extent that this claim encompasses a plurality of arcuate contacts which collectively form an annular shape:

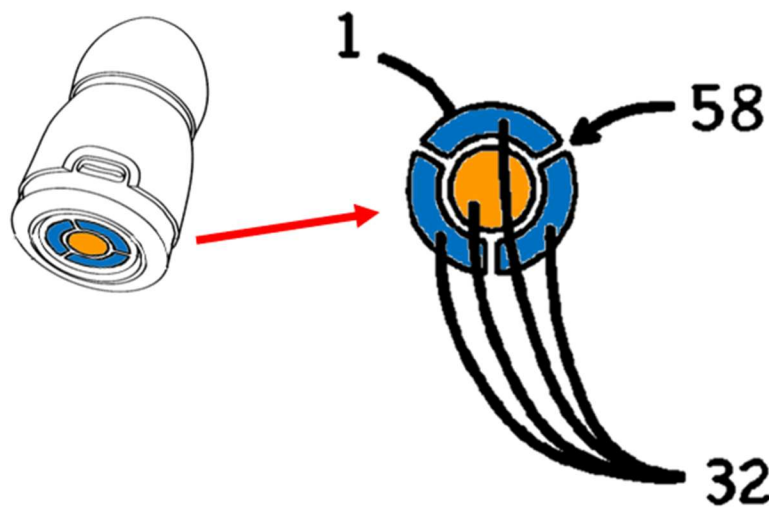


Ex. 1005, Fig. 7A (modified); Ex. 1008, Fig. 3 (excerpted).

135. Thiers discloses that **outer traces 32** “form a ring” and that “nonconductive separating spaces 58 may divide the otherwise *annular* shaped traces 32 into a multitude of smaller traces.” Ex. 1008, [0044-45] (emphasis added).

#### 4. [3]/[16]

136. In my opinion, Chen combined with Thiers renders obvious claims 1 and 14 (§X.B.2), and the limitations of these claims. Chen combined with Thiers discloses the at least one arcuate contact comprises a plurality of arcuate contacts (Thiers’ three outer “**traces 32**”):

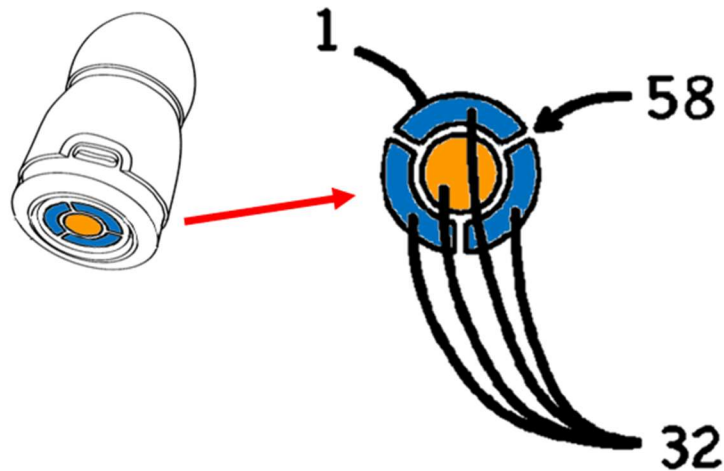


Ex. 1005, Fig. 7A (modified); Ex. 1008, Fig. 3 (excerpted), [0044-45].

#### 5. [4]

137. In my opinion, Chen combined with Thiers renders obvious claim 3 (§X.B.4) and the limitations of claim 4. Chen combined with Thiers has a plurality of arcuate

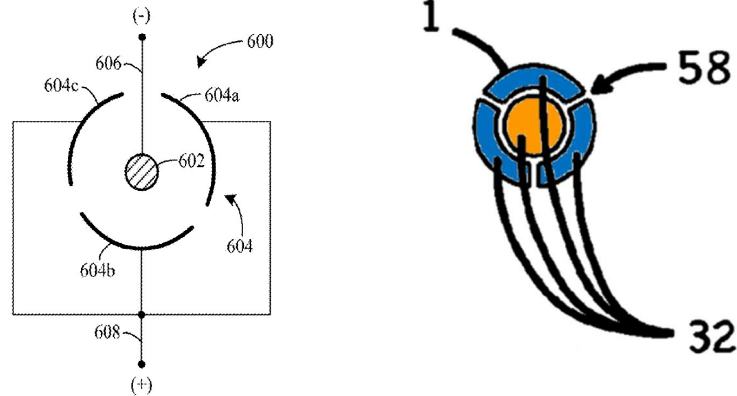
contacts (Thiers' three outer "**traces 32**") that have a concentric tri-trace configuration:



Ex. 1005, Fig. 7A (modified); Ex. 1008, Fig. 3 (excerpted).

138. Thiers' outer "**traces 32**" are a "concentric tri-trace configuration" (at least to the same extent as disclosed in the '553 Patent) because there are three of them and they surround central **trace 32**, which is the configuration '553 Patent specification describes as a "concentric tri-trace configuration":

**Figure 6**



Ex. 1001, Fig. 6 (left), 15:3-21; Ex. 1008, Fig. 3 (right) (excerpted), [0045].

## 6. [7]/[21]

139. In my opinion, Chen combined with Thiers renders obvious claims 1 and 14 (§X.B.2), and the limitations of these claims. Chen renders obvious one of more **microphone ports** (ports for “microphone 140”) disposed in the outer surface of the **faceplate** and a **receiver outlet** (outlet for “speaker 145”) disposed in the **shell**:

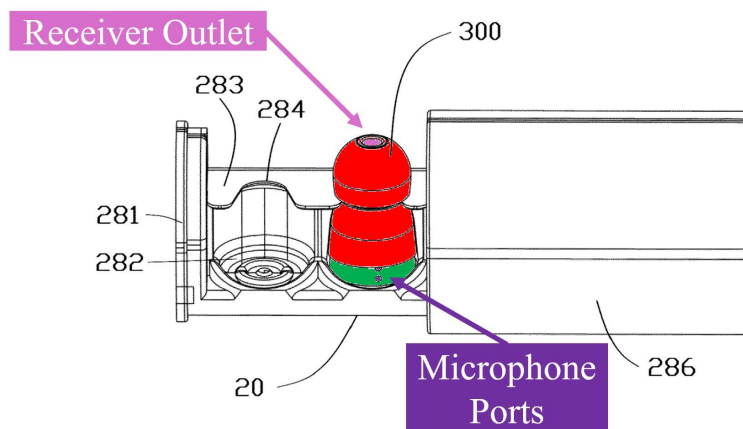


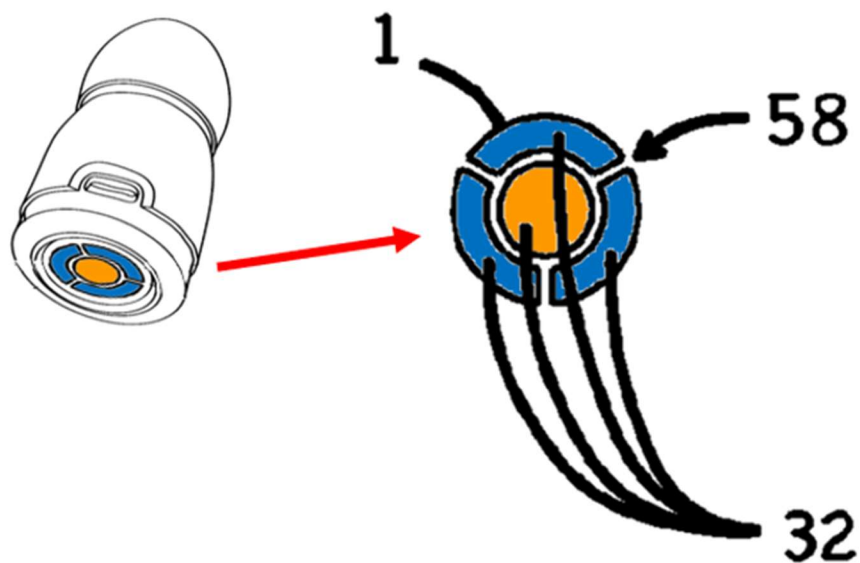
FIG. 6A

Ex. 1005, Fig. 6A, [0025].

140. Chen discloses a “microphone 140” and “speaker 145,” but does not expressly describe the location of their ports in the housing. Ex. 1005, [0025]. However, as shown above, Chen’s Fig. 6A shows an outlet on the shell and two ports on the faceplate. A POSA would understand these structures to be a receiver outlet and microphone ports. And, in any event, it also would have been obvious to use these structures as a receiver outlet and microphone ports. *Id.* POSAs would be motivated to dispose a receiver outlet in the shell, as shown above, to most directly deliver quality sound to a user’s ear drum via speaker 145. *Id.*; Ex. 1005, [0025]. A POSA would also be motivated to dispose ports for Chen’s microphone 140 in Chen’s faceplate to create an unobstructed channel for capturing “environmental sound or the user’s voice,” thereby “delivering high[er] quality sound.” *Id.*

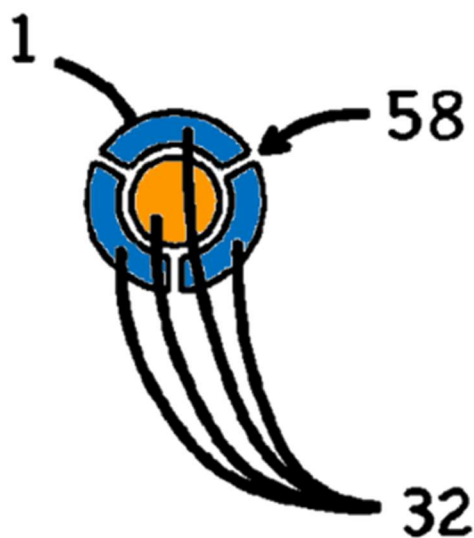
## 7. [5]/[6]/[17]

141. As I explain above, in my opinion, Chen combined with Thiers renders obvious claims 3 and 16 (§X.B.4), and the limitations of these claims. Chen combined with Thiers has a plurality of arcuate contacts (Thiers’ outer “**traces 32**”) arranged around a central contact (Thiers’ central “**trace 32**”) wherein each of the plurality of contacts is arranged the same distance from the central contact as each other contact of the plurality of arcuate contacts. The plurality of arcuate contacts (Thiers’ **contacts**) defines a circle:



Ex. 1005, Fig. 7A (modified); Ex. 1008 Fig. 3 (excerpted).

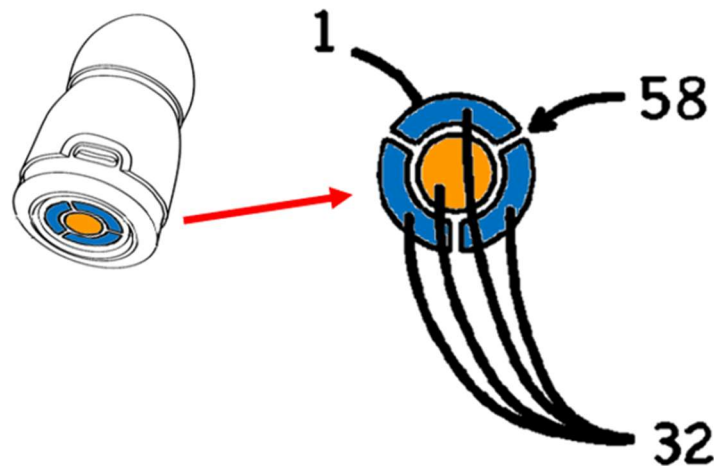
142. Thiers' Fig. 3 shows outer “**traces 32**” are equidistant to central “**trace 32**” and Thiers discloses outer **traces 32** “form a ring around” central **trace 32**:



Ex. 1008, Fig. 3, [0044-45]; §X.B.2.b.

8. [8]/[19]/[9]/[18]

143. As I explain above, in my opinion, Chen combined with Thiers renders obvious claims 1 and 14 (§X.B.2), and the limitations of these claims. Chen combined with Thiers discloses the central contact (Thiers' central "trace 32") comprises an annular shape and the at least one arcuate contact comprises a plurality of (three) arcuate contacts (Thiers' three outer "traces 32") each arranged at substantially the same distance from the central contact:



Ex. 1005, Fig. 7A (modified); Ex. 1008, Fig. 3 (excerpted). Thiers discloses that the central "trace 32" is "in the form of a circle," which is annular, and that the outer "three traces [32] form a ring around the circle and axis of rotation." Ex. 1008, ¶¶ [0045]; §X.B.7.

9. [10]

144. In my opinion, Chen combined with Thiers renders obvious claim 1 (§X.B.2)

and the limitations of claim 10. Chen combined with Thiers discloses the central contact (Thiers' central "**trace 32**") defines a cathode contact and the at least one arcuate contact (Thiers' outer "**traces 32**") defines an anode contact. As I explain above (*see* §X.A.3), Chen discloses an embodiment in which central "**first charging electrode 251**" is a cathode and surrounding "**second charging electrode 252**" is an anode and a POSA would have been motivated to maintain that arrangement in the combination with Thiers. And at a minimum, it would have been obvious to try given the limited number of arrangements of cathode and anode contacts in a four-contact arrangement like Thiers.

## 10. [11]

145. In my opinion, Chen combined with Thiers renders obvious claim 1 (§X.B.2) and the limitations of claim 11. Chen combined with Thiers renders obvious a plurality of arcuate contacts (Thiers' outer "**traces 32**") (§X.B.4), wherein a first arcuate contact of the plurality defines a cathode contact and a second arcuate contact of the plurality defines an anode contact. A POSA designing a charging interface with Thiers's four traces would have been motivated to assign one of Thiers' three outer "**traces 32**" as an anode and another as a cathode in order to complete Chen's charging circuit, which requires an anode and cathode connection. It also would have been obvious to try this arrangement because it is one of the limited number of ways to arrange the anode and cathode in a four-contact arrangement. Therefore, Chen

combined with Thiers renders obvious a plurality of arcuate contacts (Thiers' outer "**traces 32**") (§X.B.4), wherein a first arcuate contact of the plurality defines a cathode contact and a second arcuate contact of the plurality defines an anode contact.

## 11. [12]

146. In my opinion, Chen combined with Thiers renders obvious claim 1 (§X.B.2) and the limitations of claim 12. Chen combined with Thiers has charging circuitry (Chen's "rechargeable battery 130," "charge controller 120," and associated wiring) that is coupled to the electrode arrangement (Thiers' "connector 1"). *See* §§X.B.1, X.B.2.c, X.B.9-10. A POSA would have understood that the "rechargeable battery 130," "charge controller 120," and associated wiring comprise charging circuitry because Chen discloses that "rechargeable battery 130" and "charge controller 120" is part of a charging circuit. Ex. 1005, [0027].

## 12. [13]

147. In my opinion, Chen combined with Thiers renders obvious claim 1 (§X.B.2) and the limitations of claim 12. Chen combined with Thiers has an arcuate contact (Thiers' outer "**traces 32**") that is configured to communicate power and one or more information signals. Further, as I explain above (*see* §X.B.10), when combined, Thiers' outer "**traces 32**" are coupled to Chen's charging controller 120 and configured to communicate power to "rechargeable battery 130." Ex. 1005, [0027]-

[0028].

148. Further, when combined with Chen, at least one of Thiers' outer **"traces 32"** function as an "antenna electrode to provide communication functions," including via "BLUETOOTH and WI-FI." Ex. 1005, [0031], [0011]-[0012]; §X.A.5. Indeed, Chen confirms its antenna electrode can be a "closed loop antenna" or an "open loop antenna," as the case may be when using Thiers outer "traces 32" as an antenna electrode. Ex. 1005, [0023]. Chen also discloses a "switching module" that can selectively "make the antenna electrode work as a charging electrode or as an antenna." Ex. 1005, [0017], [0012], [0020]; §X.B.2.

### **13. [20]**

149. In my opinion, Chen combined with Thiers renders obvious claim 14 (§X.B.2) and the limitations of claim 20.

#### **a. [20a]**

150. Chen combined with Thiers discloses a first charging interface (Thiers' "traces 32" of "connector 1") comprising the electrode arrangement, wherein the circuitry (Chen's "rechargeable battery 130," "charge controller 120," and associated wiring) of the hearing device comprises charging circuitry coupled to the electrode arrangement, as explained above. §§X.B.2.c, X.B.11-12; Ex. 1005, Figs. 5, 6B, 7A, [0027-28]; Cls. 1, 12. Thiers' "traces 32" are a "first charging interface"

because, in the combination with Chen, they interface with Chen’s “second charging module 260” and are coupled to the charging circuit used to charge Chen’s “rechargeable battery 130.” *Id.*; §X.B.1.

**b. [20b]**

151. Chen combined with Thiers discloses that the charging interface of the charging module (Chen’s electrodes 261-263 or Thiers’ contacts 50) defines a second charging interface configured to detachably couple with the first charging interface (Thiers’ “traces 32”) of the hearing device. Chen’s electrodes 261-263 are a second charging interface and Thiers’ contacts 50 are a second charging interface because either is configured to detachably couple with Thiers’ “traces 32.” *See* §X.B.1; Ex. 1005, [0027]-[0028], [0030]-[0031]; Cls. 1, 6, 12, 15-16; Ex. 1008, Fig. 3, [0037]-[0038], [0045].

**c. [20c]**

152. Chen combined with Thiers discloses that the charging module (Chen’s “second charging module 260”) further comprises charging circuitry (Chen’s “rechargeable battery 130,” “charge controller 120,” and associated wiring) coupled to the second charging interface (Chen’s electrodes 261-263 or Thiers’ contacts 50). A POSA would readily understand that the “battery charger 270” comprises charging circuitry. *See* §X.A.6.c. In the combination, Chen’s electrodes 261-263 or Thiers’ contacts 50 are coupled to Chen’s “battery charger 270”. §X.B.1; Ex. 1005,

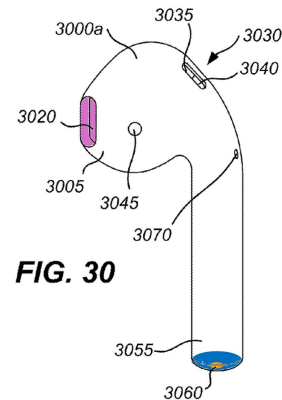
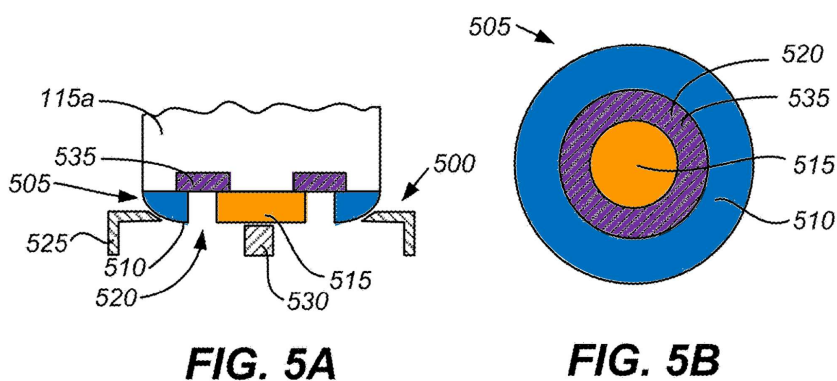
Figs. 5, 6B, 7A; [0027-28].

**d. [20d]**

153. Chen combined with Thiers discloses that the charging module (Chen's "second charging module 260") is configured to charge a rechargeable power source (Chen's "rechargeable battery 130") of the hearing device that is coupled to the first charging interface (Thiers' "traces 32"). When Chen and Thiers are combined, Thiers' "traces 32" are coupled to Chen's "rechargeable battery 130," which is charged by "battery charger 270" via Thiers's corresponding trace/contact interface. Ex. 1005, Figs. 5, 6B, 7A; [0027-28]; §§ X.B.1, X.B.11-13, X.B.2.d.

**C. Ground 3: Chen Combined With Thiers and Wagman Renders Obvious Claims 7 and 21**

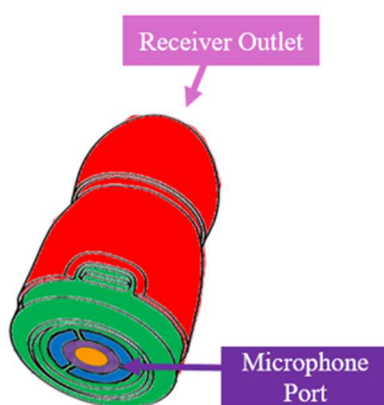
154. Chen discloses a microphone 140 and speaker 145, but does not expressly teach the location of their ports in the earphone housing. Ex. 1005, [0025]. However, Wagman discloses a **microphone 535** port in the surface of the earbud (between contacts **510** and **515**) and a **directional sound port 3020** on the end of the earbud that is inserted into the wearer's ear, as was conventional in the art. Ex. 1009, 25:23-26, 40:65-67.



155. In my opinion, a POSA would have been motivated to further modify the Chen-Thiers combination with these teachings from Wagman so that 1) microphone 140's port forms an opening in the faceplate between Thiers's central "trace 32" and outer "traces 32" and 2) speaker 145's port is on the Chen's shell, which is inserted into a wearer's ear. A POSA would have been motivated to position the microphone port on Chen's faceplate such that it faces outward, or away from the user's ear canal, to best capture environmental sound or the user's voice. A POSA also would have been motivated to place the microphone between central "**trace 32**" and outer "**traces 32**", as taught by Wagman, because it is a space-efficient way to arrange the microphone port and on the faceplate. Further, POSAs would have been motivated to include a receiver port on Chen's shell, which is inserted into a wearer's ear, so that the wearer can clearly hear sound from the speaker 145. POSAs would have had a reasonable expectation of success incorporating these feature into Chen, and doing so would have merely required applying a known arrangement to improve a similar

device in the same way.

156. Therefore, Chen combined with Thiers renders obvious claims 1 and 14 (§X.B.2), and Chen combined with Thiers and Wagman teach a **microphone port** (port for “microphone 140”) disposed in the outer surface of Chen’s **faceplate** and a **receiver outlet** (port for “speaker 145”) disposed in Chen’s **shell**:

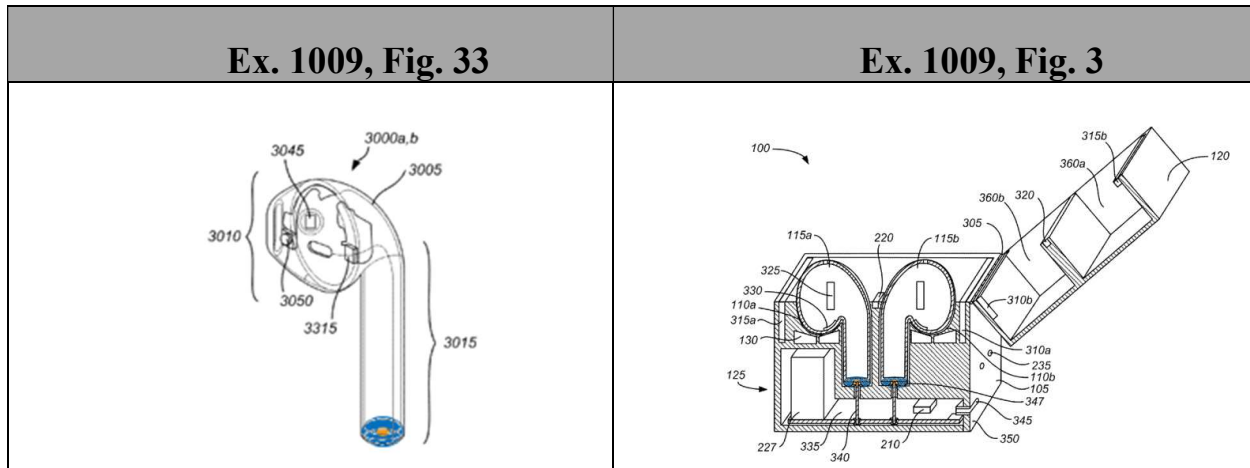


Ex. 1005, Fig. 7A (modified), [0025]; §§X.B.1; X.A.1.c-d.

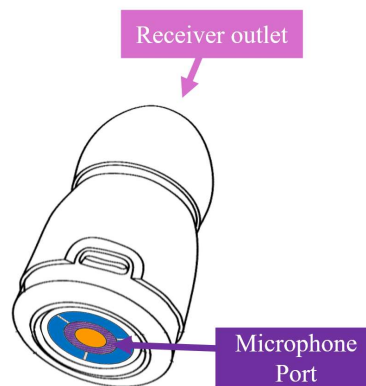
#### **D. Ground 4: Chen Combined With Wagman Renders Obvious Claims 1-21**

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

157. In my opinion, a POSA would have been motivated to combine Chen and Wagman. Wagman discloses a wireless earbud with an electrode arrangement including a **central contact** surrounded by one or more **outer arcuate contacts** and a case with electrical contacts that interface with them, as shown below. *See, e.g.*, Ex. 1009, 24:56-65, 25:9-49, claims 1-17.



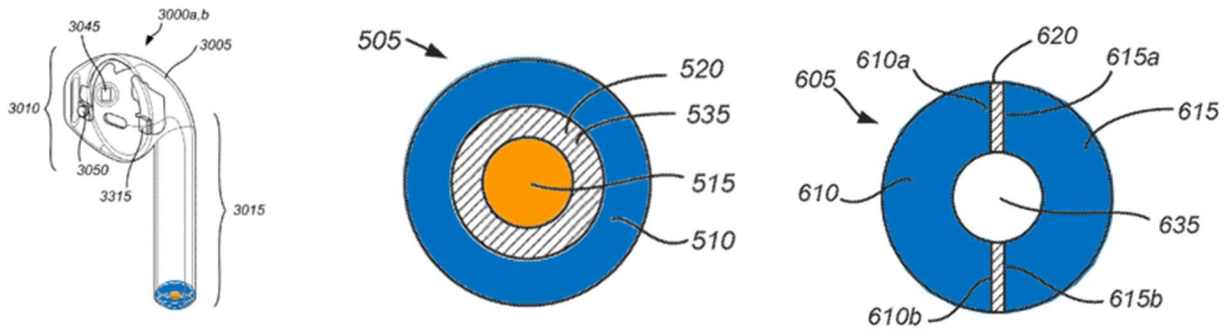
158. A POSA would have been motivated to modify the electrical interface between Chen's earphones 300 and case 20 with a **central contact** surrounded by three **outer arcuate contacts**, as taught by Wagman. Wagman discloses a **microphone port** (e.g., 535, 635) arranged between the **central** and **outer contacts**, as well as a **receiver outlet** 3020 on the end of the earbud inserted into a wearer's ear. Ex. 1009, claims 7, 12, 25:23-26, 40:65-67, Figs. 5-5B, 30. As an example, it is my opinion that a POSA would have been motivated to combine these features with Chen as shown below:



Ex. 1005, Fig. 7A (modified).

**a. Charging Interface**

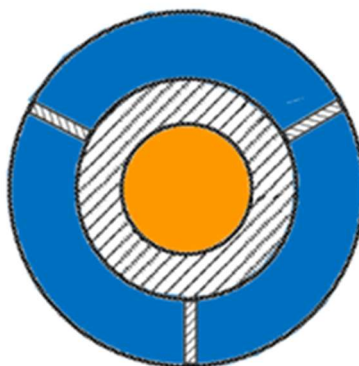
159. Wagman discloses several arrangements of electrical contacts, including arrangements with a **central contact**, and arrangements with one or more **outer arcuate contacts**:



Ex. 1009, Figs. 33, 5B, 6B (excerpted); *see id.*, 24:56-65, 25:9-49, claims 1-17, Figs. 4A-6B, 8A-8B, 36-40.

160. The figures above show two electrical contacts, and Wagman discloses that “[i]n various embodiments other connector configurations can be used that have ***more than two contacts***.” Ex. 1009, 24:63-65. Wagman further explains that “[w]hile FIG. 6B [(above on the right)] illustrates each of **contacts 610**, 615 as half rings, in other embodiments the contacts ***can include shorter length arcs*** and/or have different opposing shapes altogether.” *Id.* 25:46-49. Wagman discloses that one reason for these additional contacts is so that “separate power and data contacts can be used” rather than running power and data through the same contacts. Ex. 1009,

20:49-55. Accordingly, Wagman discloses or, at the very least, suggests an electrode configuration with a number of arcuate contacts, e.g., **three arcuate contacts**, surrounding a **central contact**:



Ex. 1009, Fig. 5B (modified).

161. In my opinion, a POSA would have been motivated to modify Chen to use Wagman's electrode arrangement, as shown below:



Ex. 1005, Fig. 7A (modified). When combined, the modified electrode arrangement would be coupled to the internal circuitry of Chen's earphones to perform charging and data transfer functions.<sup>2</sup>

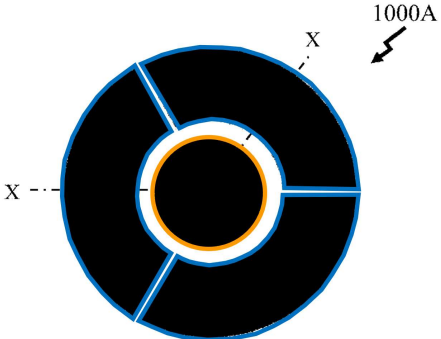
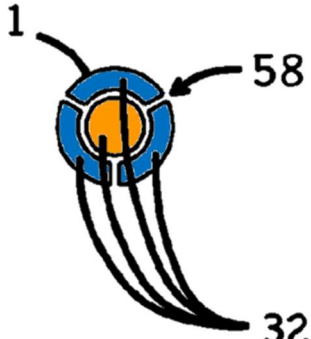
162. A POSA would have been motivated to make this modification for the known advantages of increasing the number of contacts in power and data transmission. Wagman's electrode arrangement is a space-efficient way of increasing the number of electrical contacts (from two to four) between Chen's earphones 300 and case 20. For example, this would allow "separate power and data contacts [to] be used," rather than running power and data through a single contact, as taught by Wagman. Ex. 1009, 20:49-55. Further, as Wagman describes, the geometry of Wagman's contacts improve the reliability of electrical connections by "enabl[ing] a contact wiping motion each time the earbuds are inserted within and drawn out of the receptacle connector, creating a reliable interconnect." Ex. 1009, 29:1-4.

163. A POSA also would have been motivated to modify Chen's electrode arrangement because electrode arrangements with a central contact surrounded by a plurality of arcuate contacts were widely used in power and data transmission applications in the prior art. §V. For example, Thiers and Murison (Ex. 1014) used

---

<sup>2</sup> I refer to the contacts resulting from dividing Wagman's contact 510 as 510'.

an arrangement with three outer arcuate contacts for charging electronic devices:

| Ex. 1014, Fig. 10 (excerpted)                                                     | Ex. 1008, Fig. 3 (excerpted)                                                       |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|  |  |

164. In my opinion, the extensive use of this electrode arrangement in the prior art would have also supplied a POSA with a reasonable expectation of success. Chen’s and Wagman’s electrodes have similar geometry: a central electrode surrounded by one more arcuate electrodes arranged in a circle. Substituting Chen’s electrodes with Wagman’s would have merely involved using a known technique (dividing an annular ring contact into several arcuate contacts) to improve a similar device in the same way.

165. A POSA would have understood that Wagman’s central **contact 515** and three outer arcuate **contacts 510'** were compatible with (1) Chen’s dock electrodes 261-263 or (2) “contact 525” and “contact 530” on Wagman’s “connector 500” (*i.e.*, the charging interface on the charging module of both references), and would have been motivated to use either charging interface in the combination. For example, engaging

166. In my opinion, POSAs would have been also motivated to substitute Chen's charging electrodes 261-263 with Wagman's charging "connector 500," which includes "contact 525" and "contact 530" because it is designed for use with Wagman's electrode arrangement having central contact 515 and three outer contacts 510':



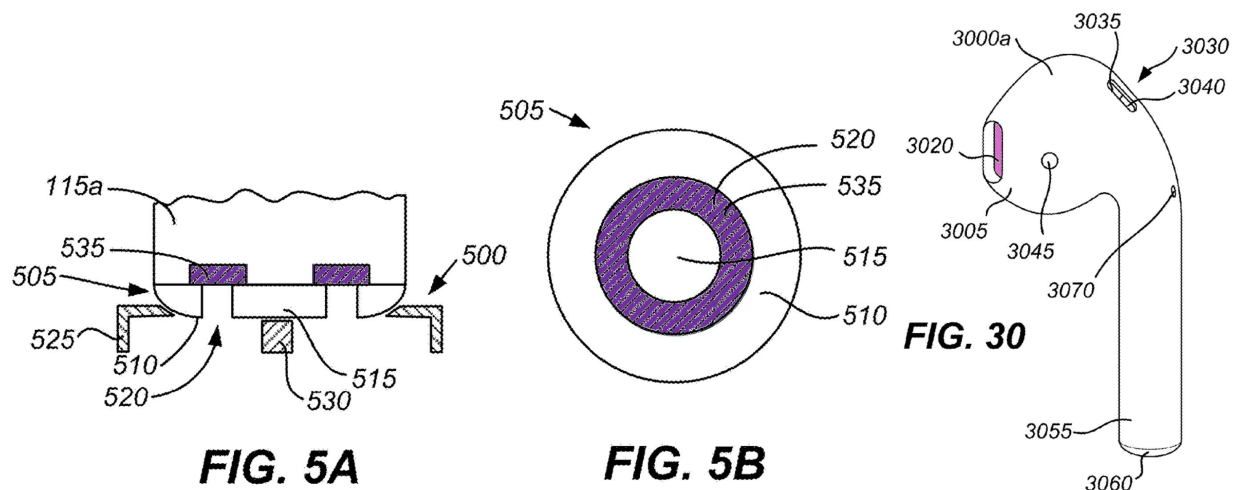
167. In addition, a POSA also would have been motivated and found it obvious to divide Wagman's **contact 525** into three segments so that they correspond and align

with the three arcuate contacts formed by dividing Wagman's **contact 515**, as I explain above. As Thiers describes, this arrangement comes with the benefit so that there are distinct "electrical paths...from each respective contact [on the charger] to each corresponding trace" on the device. Ex. 1008, [0043-45]. A POSA would have readily recognized that these were alternative design choices and would have been motivated to use either depending upon the application (including, for example, how many independent data/power lines are desired).

168. A POSA would have had a reasonable expectation of success implementing either design choice, particularly because Wagman already demonstrates a charging interface with a ring-central contact arrangement and Thiers successfully implemented one with four contacts on each side. §X.B.2.d. When modified, this interface would be coupled to the internal circuitry of Chen's "second charging module 260" to perform charging and data transfer functions.

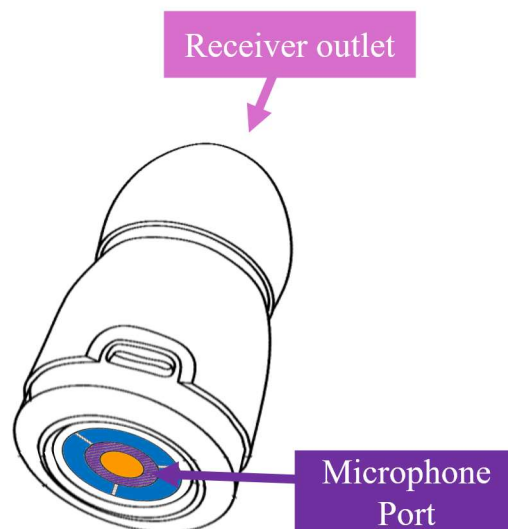
#### **b. Microphone and Receiver**

169. In my opinion, a POSA would have been motivated to modify Chen with Wagman's microphone and receiver ports. Chen discloses a microphone 140 and speaker 145 but does not expressly describe the location of their ports in the earphone housing. Ex. 1005, [0025]. Wagman discloses a **microphone 535** port at the base of the earbud (between contacts 510 and 515) and a **directional sound port 3020** on the end of the earbud that is inserted into the wearer's ear.



Ex. 1009, 25:23-26, 40:65-67, Figs. 5A-5B, 30.

170. A POSA would have been motivated to modify Chen so that 1) microphone 140's port forms an opening in the housing between Wagman's **outer contacts** and **central contact** and 2) speaker 145's outlet is on Chen's shell, which is inserted into a wearer's ear:



Ex. 1005, Fig. 7A (modified).

171. In my opinion, a POSA would have been motivated to position the microphone port on Chen's faceplate such that it faces outward, or away from the user's ear canal, to best capture environmental sound or the user's voice. POSAs also would have been motivated to place the microphone between the **three arcuate contacts** surrounding a **central contact**, as taught by Wagman, because it is a space-efficient way to arrange the microphone port and on the faceplate. Further, POSAs would have been motivated to include a receiver outlet on Chen's shell, which is inserted into a wearer's ear, so that the wearer can clearly hear sound from the speaker 145. A POSA would have had a reasonable expectation of success incorporating these feature into Chen, and doing so would have merely required applying a known arrangement to improve a similar device in the same way.

**2. [1]/[14]**

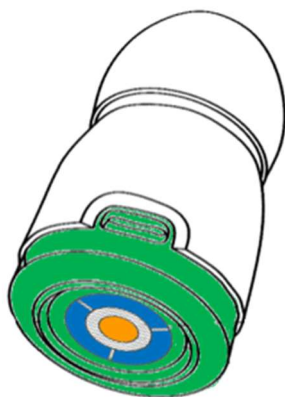
**a. [1pre]/[14a]/[1a]/[14b]/[1b]/[14c]/[1c]/[14d]/[14pre]**

172. Chen discloses these limitations and Chen combined with Wagman discloses these limitations. §X.A.1.a-d, -g.

**b. [1d]/[14e]**

173. Chen combined with Wagman discloses these limitations. Chen combined with Wagman discloses or renders obvious an electrode arrangement (Wagman's **contacts 510'** and **contact 515**) disposed in an outer surface of the faceplate (Chen's **faceplate**), the electrode arrangement comprising a **central contact 515** and at least

one **arcuate contact 510'** that extends around at least a portion of the central contact:



Ex. 1005, Fig. 7A (modified); §§X.D.1.a, X.A.1.d.

174. Wagman discloses or renders obvious an electrode configuration with three arcuate contacts 510' surrounding a central contact 515. Ex. 1009, Fig. 5B (modified); §X.D.1.a. Wagman's **Contacts 510'** are "arcuate" because they are arcs (approximately 120-degrees), around the central contact, and because they have "an arcuate peripheral contact surface." Ex. 1009, Cls. 2, 4, 26:9-13.

175. Chen teaches disposing its electrodes in the outer surface of its faceplate, and POSAs would have been motivated to similarly dispose Wagman's electrodes in the outer surface of Chen's faceplate. §§ X.A.1.e, V. Wagman further discloses that its contacts are "flush with an exterior surface" of the housing and have "an arcuate peripheral contact surface," which "enable[s] a wiping motion each time the earbuds are inserted...creating a reliable interconnect." Ex. 1009, Cls. 2, 4, 26:9-13, 28:37-

40, 29:1-4. Wagman further discloses, in embodiments with arcuate outer contacts, the contacts “can be separated from each other by an insulator 620.” Ex. 1009, 25:50-53. A person of skill in the art would have recognized Chen’s faceplate could thus act as the nonconductive insulator 620 and would have been motivated to dispose Wagman’s electrode arrangement in the outer surface of Chen’s faceplate for the ease of manufacturing and stability of design benefits discussed previously. §§ X.D.1.a, V.

**c. [1e]/[14f]**

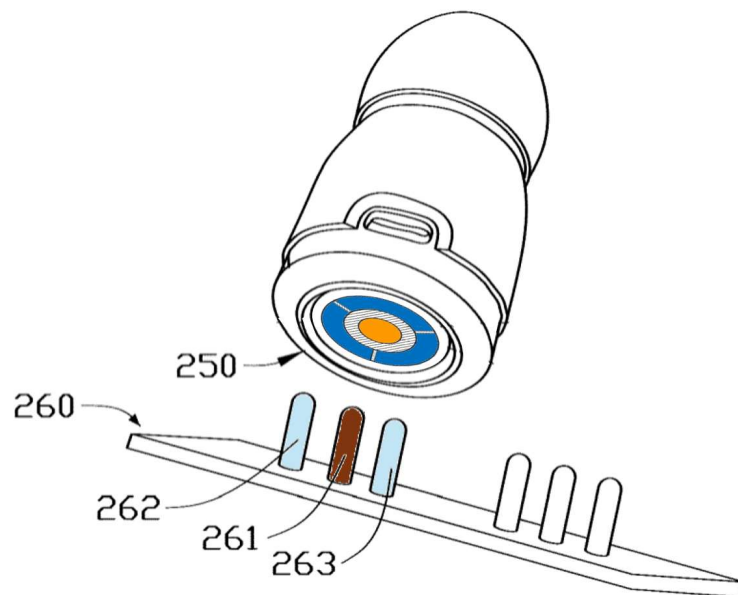
176. Chen combined with Wagman discloses these limitations. Chen combined with Wagman has circuitry (Chen’s “rechargeable battery 130,” “charge controller 120,” and associated wiring) disposed in the internal volume (space within Chen’s “device housing”) and coupled to the electrode arrangement (Wagman’s three arcuate contacts and central contact). §X.D.1; *see also* §§X.A.1.b, X.A.1.f.

**d. [14g]**

177. Chen discloses these limitations and Chen combined with Wagman discloses these limitations. Chen combined with Wagman has a charging module (Chen’s “second charging module 260”) comprising a charging interface (Chen’s electrodes **261-263** or Wagman’s **contact 530** and **contact(s) 525**) that comprises a central charging contact and an annular ring charging contact or a plurality of charging contacts equidistant to the central contact. Ex. 1009, Fig. 2, 3, 5A, 19:4-30, 20:44-

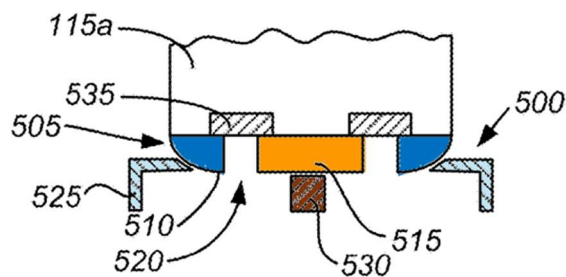
21:11. This limitation is met by these references in several respects. §X.D.1.a.

178. For example, Chen's electrodes 261-263 comprise a central charging contact ("electrode 261") and a plurality of charging contacts ("electrode 262" and "electrode 263") equidistant to the central contact (Wagman's "contact 515"), at least when Chen's earphones are docked:



Ex. 1005, Fig. 7A (modified). "Electrode 262" and "electrode 263" also are equidistant to "electrode 261," as shown in Fig. 7A. §X.A.1.h.

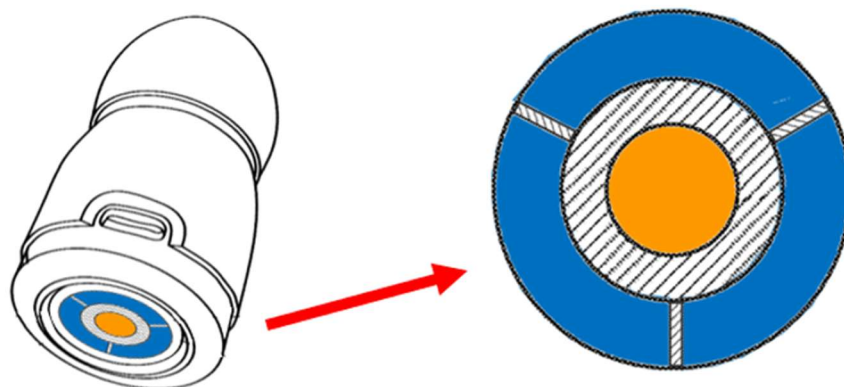
179. In addition, when Chen's electrodes 261-263 are substituted with Wagman's connector 500 (as described in §X.D.1.a), Wagman's contact 530 is a central charging contact and its contact 525 is an annular ring charging contact, as illustrated in the cross-sectional view in Wagman's Fig. 5A:



Ex. 1009, Fig. 5A, 25:9-27. Similarly, when Wagman's **contact 525** is divided into three segments (§X.D.1.a), they are plurality of charging contacts (Wagman's modified **contacts 525**) equidistant to Wagman's **contact 515** and **contact 530** when the earphones are docked, as shown above.

### 3. [2]/[15]

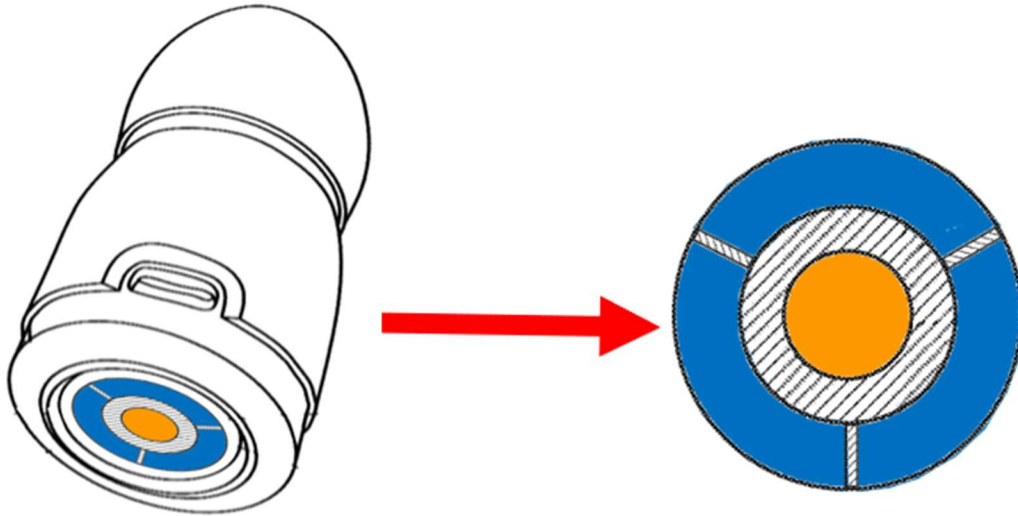
180. In my opinion, Chen combined with Wagman renders obvious claims 1 and 14 (§X.D.2), and the limitations of these claims. Chen combined with Wagman discloses the least one arcuate contact (Wagman's **contacts 510'**) comprises an annular contact, at least to the extent that this claim encompasses a plurality of arcuate contacts which collectively form an annular shape:



Ex. 1005, Fig. 7A (modified); Ex. 1009, Fig. 5B(modified); §X.D.1.a. Wagman similarly describes its divided ring contacts as partially “annular.” Ex. 1009, Fig. 6B, 9:28-49 (“The first and second external contacts can each have a partial annular shape”), 25:41-49 (“[E]ach of earbud contacts 610 and 615 can have a partial annular shape (*i.e.*, a partial ring)”), Cl. 8.

#### 4. [3]/[16]

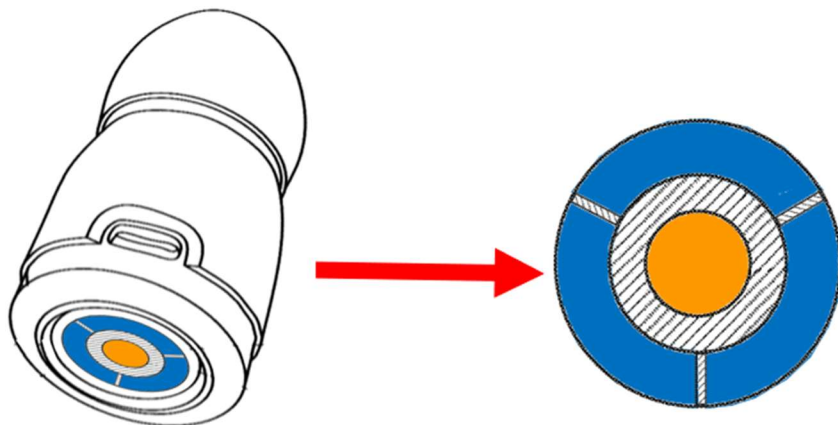
181. In my opinion, Chen combined with Wagman renders obvious claims 1 and 14 (§X.D.2), and the limitations of these claims. Chen combined with Wagman discloses the at least one arcuate contact comprises a plurality of arcuate contacts (Wagman’s **contacts 510'**):



Ex. 1005, Fig. 7A (modified); Ex. 1009, Fig. 5B(modified); §X.D.1.a; Ex. 1009, 24:63-65, 25:46-49, 20:49-55.

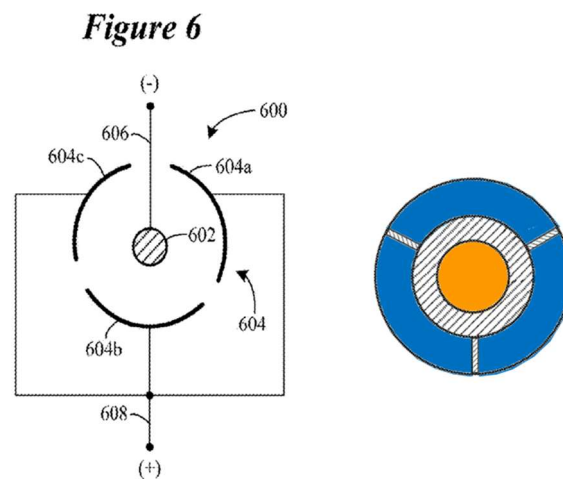
## 5. [4]

182. In my opinion, Chen combined with Wagman renders obvious claim 3 (§X.D.4) and the limitations of claim 4. Chen combined with Wagman has a plurality of arcuate contacts (Wagman's **contacts 510'**) that have a concentric tri-trace configuration:



Ex. 1005, Fig. 7A(modified); Ex. 1009, Fig. 5B(modified); §X.D.1.a.

183. Wagman's modified **contacts 510'** are a "concentric tri-trace configuration" because there are three of them and they surround Wagman's **contact 515**, which is a similar configuration to Fig. 6 of the '553 Patent, which the specification describes as a "concentric tri-trace configuration":

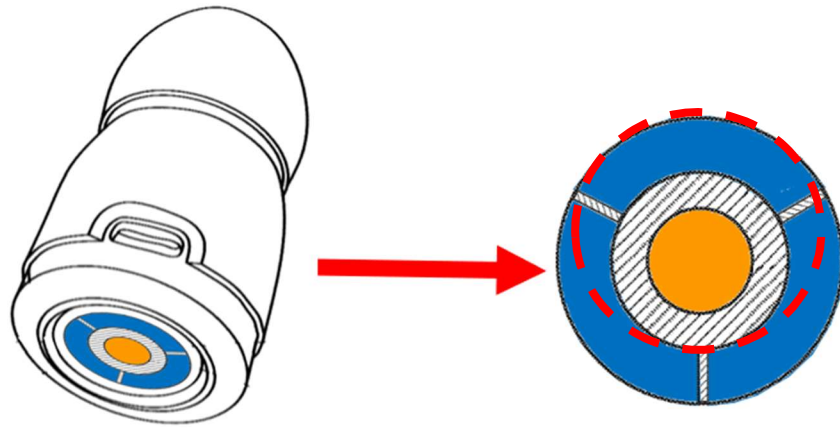


Ex. 1001, Fig. 6 (left), 15:3-21; Ex. 1009, Fig. 5B (modified) (right).

## 6. [5]/[6]/[17]

184. In my opinion, Chen combined with Wagman renders obvious claims 3 and 16 (§X.D.4) and the limitations of these claims. Chen combined with Wagman has a plurality of arcuate contacts (Wagman's **contacts 510'**) arranged around a central contact (Wagman's **contact 515**) wherein each of the plurality of contacts is arranged the same distance from the central contact as each other contact of the

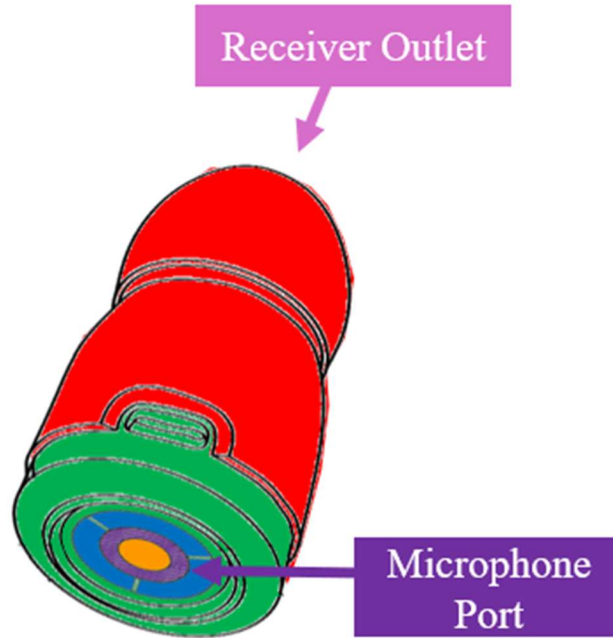
plurality of arcuate contacts. The plurality of arcuate contacts (Wagman's **contacts 510'**) defines a circle:



Ex. 1005, Fig. 7A(modified); Ex. 1009, Fig. 5B(modified). As illustrated above, the **contacts 510'** form a circle around the **contact 515**, and each **contact 510'** is the same distance to it as every other **contact 510'**. §X.D.2.d; Ex. 1009, 25:46-49 (describing “contacts 610, 615 as half rings”).

## 7. [7]/[21]

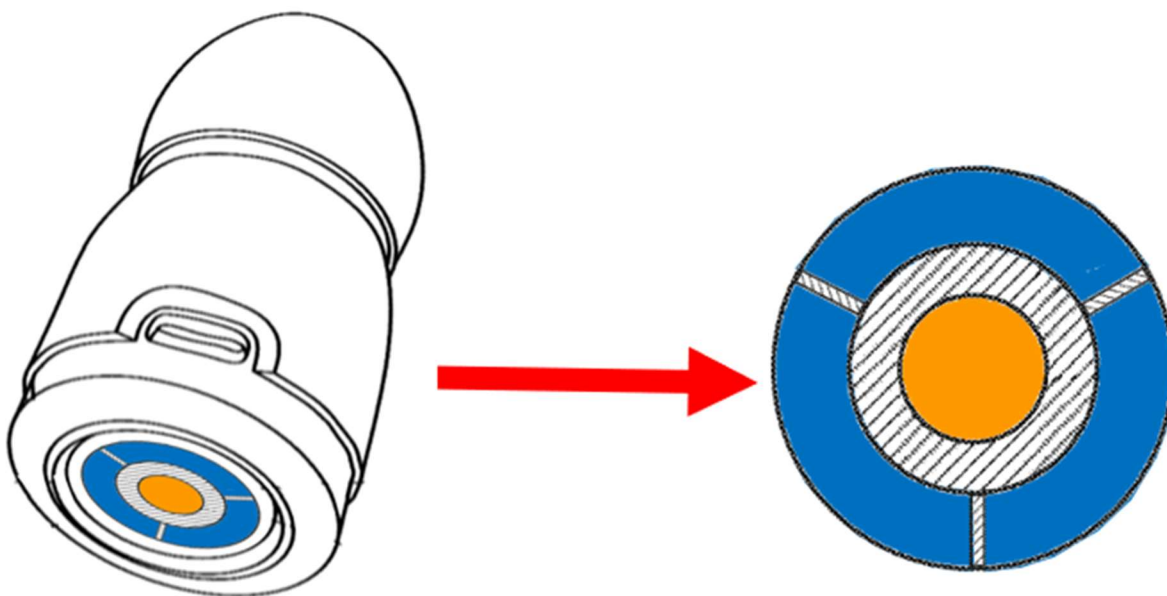
185. In my opinion, Chen combined with Wagman renders obvious claims 1 and 14 (§X.D.2), and the limitations of these claims. As discussed above, Chen combined with Wagman, as modified, discloses a microphone port (port for “**microphone 140**”) disposed in the outer surface of Chen’s **faceplate** and a receiver outlet (outlet for “**speaker 145**”) disposed in Chen’s **shell**:



Ex. 1005, Fig. 7A(modified), [0025]; §§X.D.1; X.A.1.c-d.

**8. [8]/[19]/[9]/[18]**

186. In my opinion, Chen combined with Wagman renders obvious claims 1 and 14 (§X.D.2) and the limitations of claims 8 and 19. Chen combined with Wagman discloses the central contact (Wagman's **contact 515**) comprises an annular shape and the at least one arcuate contact comprises a plurality of/three arcuate contacts (Wagman's **contacts 510'**) each arranged at substantially the same distance from the central contact:



Ex. 1005, Fig. 7A(modified); Ex. 1009, Fig. 5B(modified). Wagman discloses that **contact 515** is “circular” and **contact 510** (unmodified) is “ring shaped”. Ex. 1009, Fig. 5B, 25:13-21; §X.D.6.

## 9. [10]

187. In my opinion, Chen combined with Wagman renders obvious claim 1 (§X.D.2) and the limitations of claim 10. Chen combined with Wagman discloses the central contact (Wagman’s “**contact 515**”) defines a cathode contact and the at least one arcuate contact (Wagman’s “**arcuate contacts 510'**”) define an anode contact. As I explain above (§X.A.3), Chen discloses an embodiment in which central “**first charging electrode 251**” is a cathode and surrounding “**second charging electrode 252**” is an anode and POSAs would be motivated to maintain that arrangement in the combination with Wagman. And at a minimum, it would

have been obvious to try given the limited number of arrangements of cathode and anode contact arrangements in a four-contact arrangement.

**10. [11]**

188. In my opinion, Chen combined with Wagman renders obvious claim 1 (§X.D.2) and the limitations of claim 11. Chen combined with Wagman has a plurality of arcuate contacts (Wagman’s “**arcuate contacts 510**”) (§X.D.4), wherein a first arcuate contact of the plurality defines a cathode contact and a second arcuate contact of the plurality defines an anode contact. In my opinion, POSA would have motivated to design one of Wagman’s outer “**arcuate contacts 510**” as an anode and another as a cathode to fulfill Chen’s charging functionality via its circuit. Further, a POSA also would have been obvious to try this arrangement because it is one of a limited number of ways to arrange the anode and cathode in a four-contact arrangement. Therefore, Chen combined with Wagman renders obvious a plurality of arcuate contacts (Wagman’s outer “**arcuate contacts 510**”) (§X.D.4), wherein a first arcuate contact of the plurality defines a cathode contact and a second arcuate contact of the plurality defines an anode contact.

**11. [12]**

189. In my opinion, Chen combined with Wagman renders obvious claim 1 (§X.D.2) and the limitations of claim 12. Chen combined with Wagman has charging circuitry (Chen’s “rechargeable battery 130,” “charge controller 120,” and

associated wiring) that is coupled to the electrode arrangement (Wagman's **contacts 510'** and **contact 515**). *See* §§X.D.1.a, X.D.9-10.

190. A POSA would understand that the “rechargeable battery 130,” “charge controller 120,” and associated wiring comprise charging circuitry because Chen discloses that “rechargeable battery 130” and “charge controller 120” are part of a charging circuit. Ex. 1005, [0027].

## 12. [13]

191. In my opinion, Chen combined with Wagman renders obvious claim 1 (§X.D.2) and the limitations of claim 13. Chen combined with Wagman has an arcuate contact (one of Wagman's **contacts 510'**) that is configured to communicate power and one or more information signals. As discussed in §X.D.10, when modified, Wagman's **contacts 510'** are coupled to Chen's charging controller 120 and configured to communicate power to “rechargeable battery 130.” Ex. 1005, [0027]-[0028]. Further, when combined with Chen, at least one of Wagman's **contacts 510'** function as “an antenna electrode to provide communication functions,” including via “BLUETOOTH and WI-FI.” Ex. 1005, [0031], [0011]-[0012]; §X.A.5. Indeed, Chen confirms its antenna electrode can be a “closed loop antenna” or an “open loop antenna,” as the case may be when using Wagman's **contacts 510'** as an antenna electrode. Ex. 1005, [0023]. Chen discloses a “switching module” that can selectively “make the antenna electrode work as a charging

electrode or as an antenna.” Ex. 1005, [0017], [0012], [0020]; §X.D.2.

**13. [20]**

192. In my opinion, Chen combined with Wagman renders obvious claim 14 (§X.D.2) and the limitations of claim 20.

**a. [20a]**

193. Chen combined with Wagman discloses a first charging interface (Wagman’s contacts 510' and contact 515) comprising the electrode arrangement, wherein the circuitry (Chen’s “rechargeable battery 130,” “charge controller 120,” and associated wiring) of the hearing device comprises charging circuitry coupled to the electrode arrangement. §§X.D.2.c, X.D.11; Ex. 1005, Figs. 5, 6B, 7A, [0027-28]; *id.* Cls. 1, 12. Wagman’s contacts 510' and contact 515 are a “first charging interface” because they interface with Chen’s “second charging module 260” and are coupled to the charging circuit used to charge Chen’s “rechargeable battery 130.” *Id.*; §X.D.1.

**b. [20b]**

194. Chen combined with Wagman discloses that the charging interface of the charging module (Chen’s electrodes 261-263 or Wagman’s contact 530 and contact(s) 525) defines a second charging interface configured to detachably couple with the first charging interface (Wagman’s contacts 510' and contact 515) of the

hearing device. Chen's electrodes 261-263 are a second charging interface and Wagman's contact 530 and contact(s) 525 are a second charging interface because either is configured to detachably couple with Wagman's contacts 510' and contact 515." Ex. 1005, Fig. 5, 6B, 7A, [0027]-[0028], [0030]-[0031]; Cls. 1, 6, 12, 15-16; Ex. 1009, Fig. 2, 19:22-27, 25:18-23; §X.D.1.a.

**c. [20c]**

195. Chen combined with Wagman discloses the charging module (Chen's "second charging module 260") further comprises charging circuitry (Chen's "rechargeable battery 130," "charge controller 120," and associated wiring) coupled to the second charging interface (Chen's electrodes 261-263 or Wagman's contact 530 and contact(s) 525). A POSA would understand that the "battery charger 270" comprises charging circuitry, as explained above. *See* §X.A.6.c. In the combination, Chen's electrodes 261-263 or Wagman's contact 530 and contact(s) 525 are coupled to Chen's "battery charger 270". *See* §§X.D.1, Ex. 1005, Figs. 5, 6B, 7A; [0027-28].

**d. [20d]**

196. Chen combined with Wagman discloses that the charging module (Chen's "second charging module 260") is configured to charge a rechargeable power source (Chen's "rechargeable battery 130") of the hearing device that is coupled to the first charging interface (Wagman's contacts 510' and contact 515). When Chen and Wagman are combined, Wagman's contacts 510' and contact 515 are coupled to

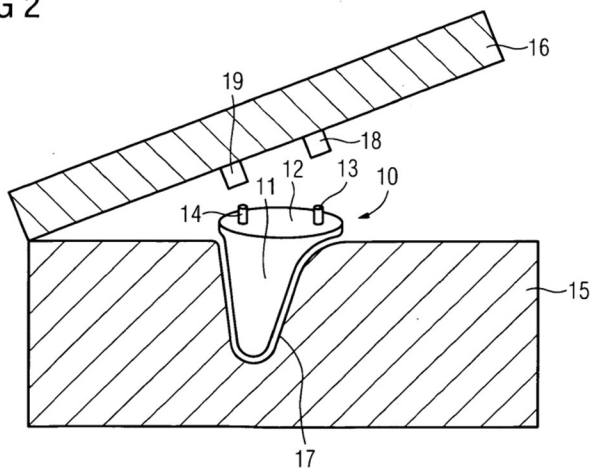
Chen's "rechargeable battery 130," which is charged by "battery charger 270." Ex. 1005, Figs. 5, 6B, 7A; [0027-28]; §§X.D.9-12, X.D.2.d, X.D.1.a.

**E. Ground 5: Dannemann Combined With Thiers Renders Obvious Claims 1-6, 8-20**

**1. Motivation to Combine**

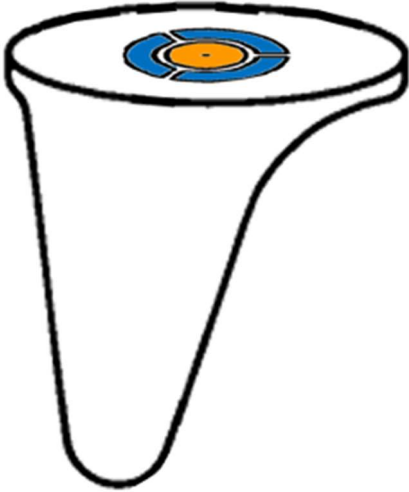
197. In my opinion, a POSA would have been motivated to combine Dannemann and Thiers. Dannemann discloses an ITE hearing device with two charging contacts 13, 14 arranged on the faceplate 12, which are connected to an integrated accumulator (battery) for recharging. Ex. 1006, [0027].

FIG 2



Ex. 1006, Fig. 2.

198. A POSA would have been motivated to substitute Danneman's charging interface with Thiers' charging interface, for example as shown below.

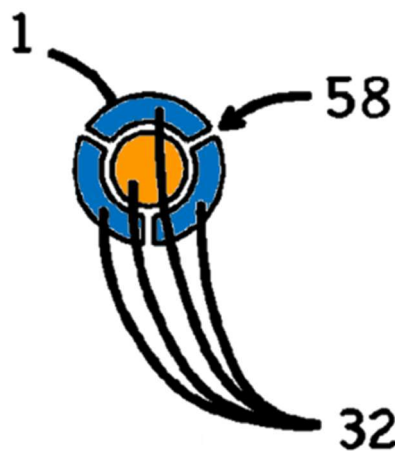


Ex1006, Fig. 2(modified).

199. A POSA would have been motivated to make this modification for the known advantages of increasing the number of contacts in power and data transmission (§X.B.1). Dannemann itself acknowledges these advantages, expressly contemplating that its charging device “may however also be equipped with more than two positioning units 20, 21, in order to produce additional contacts to the hearing device for signal transmissions for instance.” Ex. 1006, [0033]. A POSA would have understood that there was a recognized need for additional electrical contacts at the hearing-device-to-charger interface, and would have been motivated to look to the prior art for a space-efficient multi-contact solution suitable for the constrained form factor of an ITE hearing device faceplate.

200. Thiers describes a solution to that need. Thiers discloses that there was a “need in the art for a connecting system for an electronic device that allows a conductor

dense connection...” but which “provides the same speed of charging and data transmission.” Ex. 1008, [0013]. Thiers discloses that dense, multi-contact connectors were also desirable because the “consumer electronic industry is moving toward fewer connector ports on devices by combining the functions of what previously took multiple connectors into one,” including “data and power” transmission. *Id.* [0002], [0006]. POSAs would have understood that a charging interface with Thiers’ four contacts (central “**trace 32**” and outer “**traces 32**”) enables the simultaneous transmission of power and data through dedicated conductive paths in a compact footprint. Ex. 1008, [0043], [0048].



Ex. 1008, Fig. 3

201. In my opinion, a POSA would have been motivated to substitute Dannemann’s two-contact charging interface (charging contacts 13, 14) with Thiers’s four-trace concentric configuration and to couple Thiers’s electrode

arrangement to Dannemann's internal accumulator circuitry. This modification would have been prompted by several converging design incentives recognized by a POSA. First, because Dannemann's faceplate presents a circular geometry, a concentric trace arrangement of the type taught by Thiers is a geometrically natural solution: it exploits the rotational symmetry of the circular faceplate surface, ensuring reliable contact with the charging device regardless of the angular orientation of the hearing device when it is inserted into the charging cradle. Second, expanding Dannemann's two-contact interface to Thiers's four-trace arrangement would have provided additional electrical paths for power delivery and signal transmission—an advantage that Dannemann itself contemplated. Ex. 1006, [0033]; Third, Thiers's concentric configuration achieves this increase in electrical paths within the same limited surface area, making it particularly well-suited for the constrained form factor of a hearing-device faceplate where space is at a premium. Ex. 1008, [0044].

202. In my opinion, would have been motivated to substitute the charging interface on Danneman's "charging device" with four charging "contacts 50" from Thiers' "dock interface assembly 40" and couple to them to the charging circuitry of the "charging device" for the same reasons. Thiers' "dock interface assembly 40" provides a compatible charger-side electrode configuration for use with the device-side electrode arrangement described above. Ex. 1008, [0037-38], [0043-44], Fig. 2.

For example, a POSA would have been motivated to align four “contacts 50” from Thiers’ “dock interface assembly 40” with the four “traces 32” from “connector 1” to provide four distinct “electrical paths...from each respective contact 50 to each corresponding trace 32” for the reasons explained above. Ex. 1008, [0043-45].

203. A POSA would have had a reasonable expectation of success in making this combination. Thiers states its charging system applies “generally to electronic devices,” which includes electronic hearing devices like those disclosed by Dannemann. Both Dannemann and Thiers employ the same contact architecture of electrodes arranged around a central axis for delivering electrical power through a detachable interface. Dannemann’s existing two contacts 13, 14 are already arranged on the circular faceplate surface in a manner compatible with a concentric geometry; incorporating additional concentric traces and nonconductive separating spaces from Thiers into that same faceplate surface would have amounted to no more than using a known technique to improve a similar technology in the same way. A POSA would be motivated to rely on Dannemann’s existing accumulator and internal wiring architecture to route the additional electrical paths provided by Thiers’ configuration because Dannemann already teaches that electricity is routed from the contact surfaces through the charging contacts to the integrated accumulator. Ex. 1006, [0031]. The combination of Danneman and Thiers amounts to the simple application of a conventional concentric electrode geometry—widely used across the electronic-

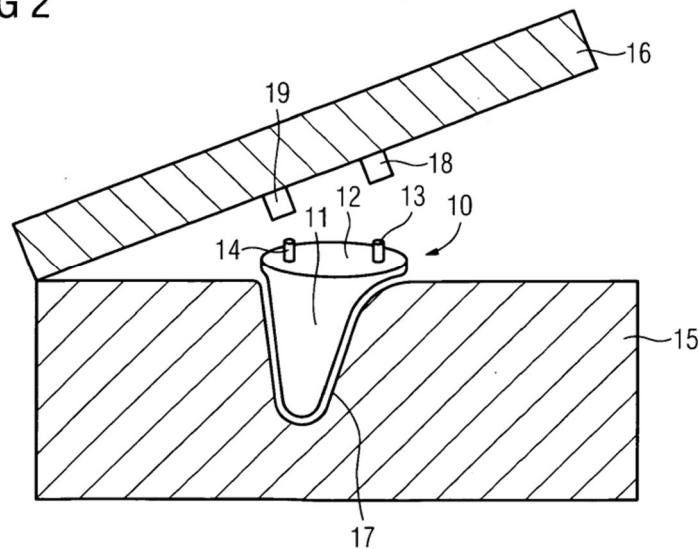
device charging art—to a hearing device that already uses electrode-based charging at its faceplate, well within the skill of a POSA.

2. [1]/[14]

a. [1pre]/[14a]

204. Dannemann discloses these limitations and Dannemann combined with Thiers discloses these limitations. Dannemann discloses a hearing device (“ITE hearing device 10”):

FIG 2



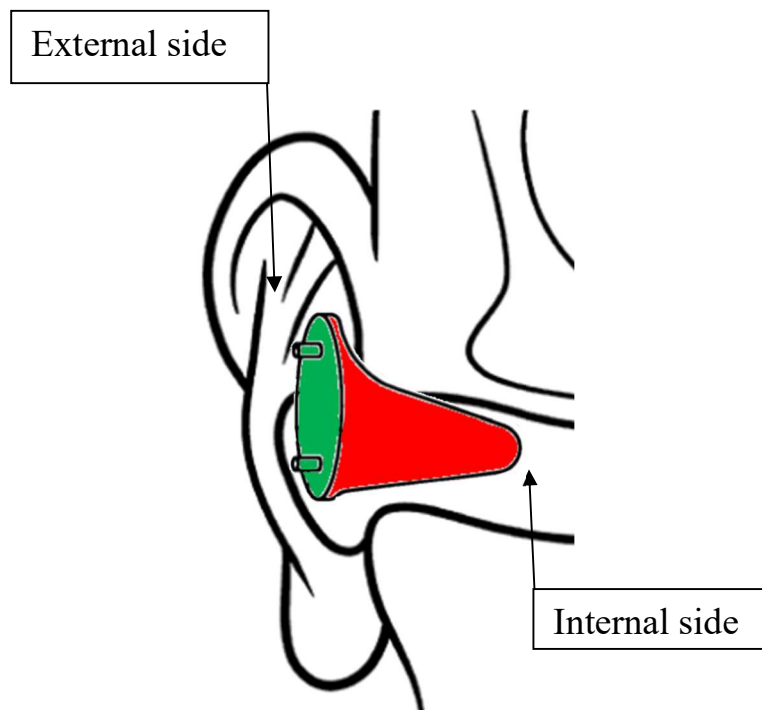
Ex. 1006, Fig. 2; [0003]-[004], [0027]. Dannemann discloses that “[h]earing devices are wearable hearing apparatuses which are used to assist the hard-of-hearing.” Ex. 1006, [0003]. Further, Dannemann discloses “[t]he key components of hearing devices are principally an input converter, an amplifier and an output converter,”

where “[t]he input converter is normally a receiving transducer e.g., a microphone.”

Ex. 1006, [0004].

**b. [1a]/[14b]**

205. Dannemann discloses these limitations and Dannemann combined with Thiers discloses these limitations. Dannemann discloses a housing (“**ITE shell 11**” and “**faceplate 12**”) that encloses an internal volume (space within “**ITE shell 11**” and “**faceplate 12**”) and extends from an internal side (ear-facing surface) to an external side (outward-facing surface):

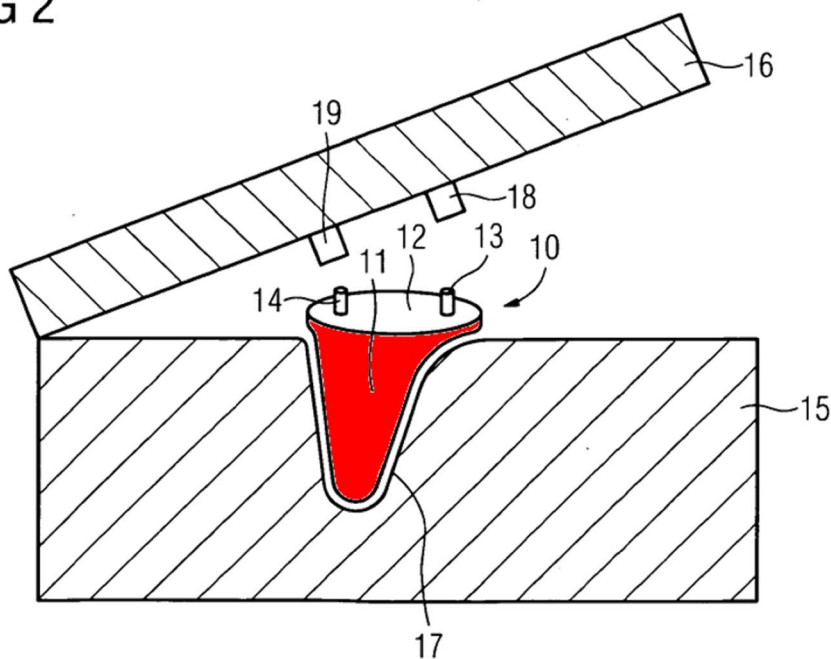


Ex. 1006, Fig. 2, [0027].

**c. [1b]/[14c]**

206. Dannemann discloses these limitations and Dannemann combined with Thiers discloses these limitations. Dannemann discloses a shell (“**ITE shell 11**”) arranged at the internal side (ear-facing surface), and the internal side (ear-facing surface) is configured to be inserted in the wearer’s ear canal.

FIG 2



Ex. 1006, Fig. 2, [0027].

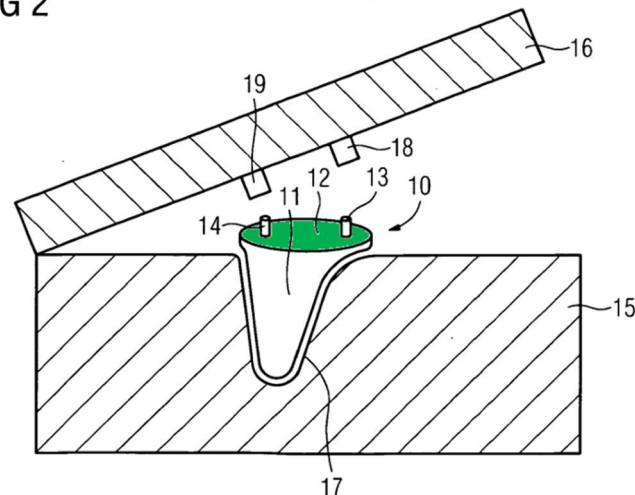
207. Dannemann’s “**ITE shell 11**” is “individually manufactured” and “individually molded” to fit into a wearer’s ear canal. Ex. 1006, Fig. 2; [0019], [0027]-[0028]; Dannemann discloses that “in-the-ear (ITE) hearing devices,” like “**ITE shell 11**,” are “worn...in the auditory canal” and thus “have an individually shaped hearing device shell” that is “individually produced for the hearing device

wearer.” Ex. 1006, [0003], [0005], [0006].

**d. [1c]/[14d]**

208. Dannemann discloses these limitations and Dannemann combined with Thiers discloses these limitations. Dannemann discloses a faceplate (“**faceplate 12**”) arranged at the external side (outward-facing surface), and the external side (outward-facing surface) is configured to face away from the wearer.

FIG 2

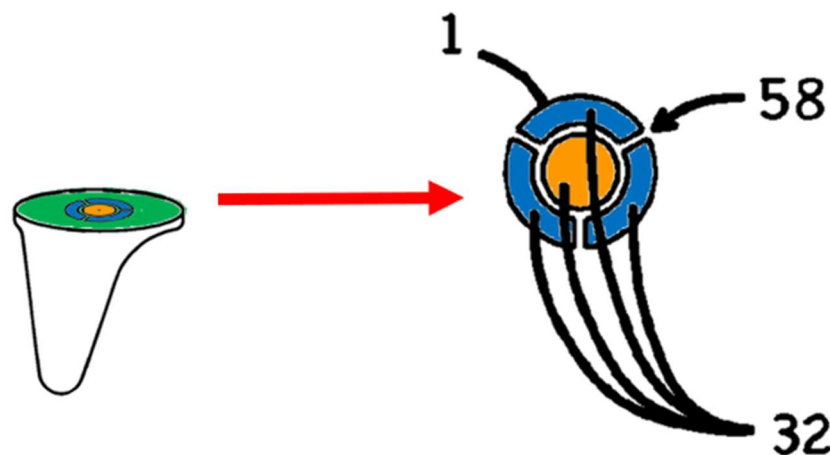


Ex. 1006, Fig. 2, [0027]. Dannemann states “[a]s the hearing device contacts 13, 14 ... are arranged on the faceplate 12, they do not contact the skin of the hearing device wearer when the ITE hearing device 10 is being worn.” Thus, a POSA would understand Dannemann’s faceplate 12 is arranged at the device’s external side because it is opposite of the end that is configured to be inserted into a wearer’s ear

canal, and thus faces away from the wearer when being worn. Ex. 1006, Fig. 2, [0027]-[0028].

e. [1d]/[14e]

209. Dannemann combined with Thiers discloses these limitations. Danneman combined with Thiers has an electrode arrangement (Thiers' central "trace 32" and outer "traces 32") disposed in an outer surface of the faceplate (Danneman's "faceplate 12"), the electrode arrangement comprising a central contact (central "trace 32") and at least one arcuate contact (outer "traces 32") that extends around at least a portion of the central contact:



Ex. 1006, Fig. 2(modified); Ex. 1008, Fig. 3; §X.E.1. Thiers discloses that "[c]onnector 1 includes four traces: one in the center with the surface in the form of a circle, and three traces that form a ring around the circle and axis of rotation." Ex. 1008, [0045]. Dannemann teaches electrodes in its faceplate, and POSAs would have

been motivated to dispose Thiers' electrodes in the outer surface of Dannemann's faceplate. §§ X.E.1, V. Thiers further discloses "in Figure 3, the nonconductive separating spaces 58 may divide the otherwise annular shaped traces 32 into a multitude of smaller traces, as for example to fit more electrical path 72 into a limited space. The nonconductive separating spaces 58 may comprise...a nonconductive separating material such as plastic and other insulators." A person of skill in the art would have recognized Dannemann's faceplate could thus act as the nonconductive separating spaces 58 and would have been motivated to dispose Thiers' electrode arrangement in the outer surface of Dannemann's faceplate for the ease of manufacturing and stability of design benefits discussed previously. §§ V, X.E.1.

**f. [1e]/[14f]**

210. Dannemann combined with Thiers discloses these limitations. Dannemann combined with Thiers has circuitry ("accumulator" and its associated components and wiring) disposed in the internal volume (space within Dannemann's "ITE shell 11" and "faceplate 12") and coupled to the electrode arrangement (Thiers' "connector 1"). §§X.E.1, X.E.2.b.

**g. [14pre]**

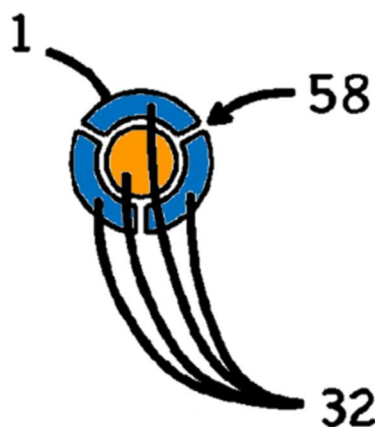
211. To the extent claim 14's preamble is limiting, Dannemann discloses it and Dannemann combined with Thiers discloses it. Dannemann discloses a system including a "charging device for a hearing apparatus and a hearing device system,"

both of which are incorporated in the combination with Thiers. Ex. 1006, [0009].

**h. [14g]**

212. Dannemann combined with Thiers discloses these limitations. Dannemann combined with Thiers has a charging module (Dannemann’s “charging device”) comprising a charging interface (Thiers’ contacts 50) that comprises a central charging contact (Thiers’ middle “**contact 50**”) and a plurality of charging contacts (Thiers’ three outer “**contacts 50**”) equidistant to the central contact (Thiers’ central “**trace 32**”). §X.E.1; Ex. 1008, Fig. 2, [0043]-[0045].

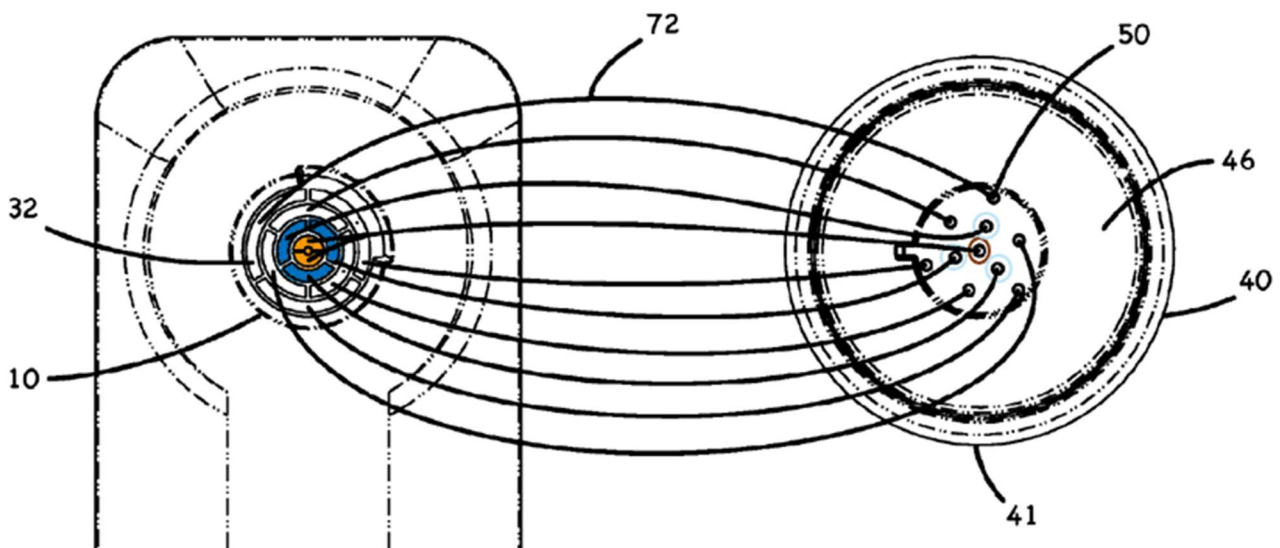
213. Fig. 3 of Dannemann shows that outer “**traces 32**” are equidistant to central “**trace 32**” and Thiers teaches “contacts 50” of the “dock interface assembly 4” “may be arranged in such a manner that each one of the contacts 50 is aligned with a conductive trace 32.” Ex. 1008, [0037]-[0039], [0043]-[0045].



Ex. 1008, Fig. 3 (excerpted).

214. As such, Thiers' discloses that three outer "contacts 50" to are equidistant to (1) a middle "contact 50" and (2) central "trace 32" when docked so that each trace 32 aligns with a contact 50.

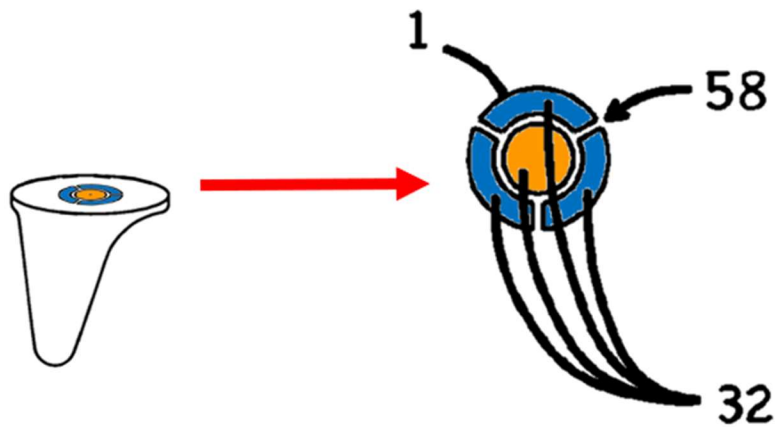
215. In fact, Thiers shows an alternative embodiment with more than four traces 32 and contacts 50, and shows the three outer "contacts 50" are equidistant to middle "contact 50" and central "trace 32" when the interfaces are docked.



Ex. 1008, Fig. 2. Even if Thiers did not teach this limitation (a proposition I do not agree with), it also nonetheless would have been obvious to configure Thiers such that three outer "contacts 50" are equidistant to (1) middle "contact 50" or (2) central "trace 32" when docked so that each trace 32 aligns with a contact 50 to create four "electrical path[s]" for charging and data transmission, as encouraged by Thiers. Ex. 1008, Fig. 2, [0043-45]; §X.E.1.

### 3. [2]/[15]

216. In my opinion, Dannemann combined with Thiers renders obvious claims 1 and 14 (§X.E.2), and the limitations of these claims. Danneman combined with Thiers discloses the least one arcuate contact (Thiers' outer "**traces 32**") comprises an annular contact, at least to the extent that this claim encompasses a plurality of arcuate contacts which collectively form an annular shape:

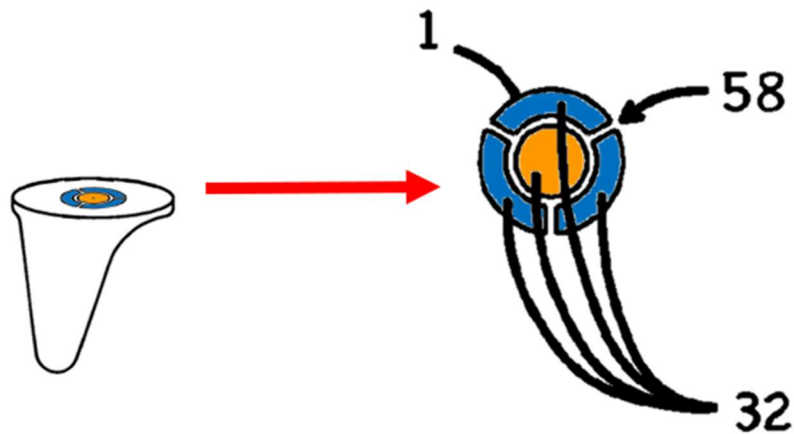


Ex. 1006, Fig. 2 (modified). Thiers discloses that **outer traces 32** “form a ring” and that “nonconductive separating spaces 58 may divide the otherwise *annular* shaped 32 into a multitude of smaller traces.” Ex. 1008, ¶¶[0044-45] (emphasis added).

### 4. [3]/[16]

217. In my opinion, Dannemann combined with Thiers renders obvious claims 1 and 14 (§X.E.2), and the limitations of these claims. Danneman combined with Thiers discloses the at least one arcuate contact comprises a plurality of arcuate

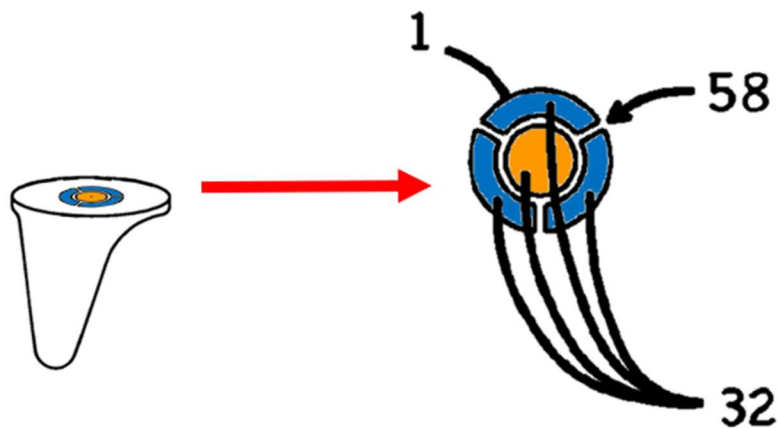
contacts (Thiers' three outer "traces 32"):



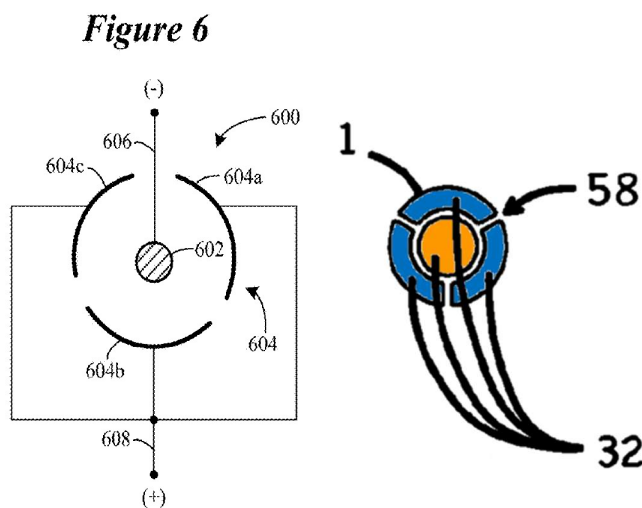
Ex. 1006, Fig. 2(modified); Ex. 1008, ¶¶[0044-45];

## 5. [4]

218. In my opinion, Dannemann combined with Thiers renders obvious claim 3 (§X.E.4) and the limitations of claim 4. Dannemann combined with Thiers has a plurality of arcuate contacts (Thiers' three outer "traces 32") that have a concentric tri-trace configuration:



Ex. 1006, Fig. 2(modified); Thiers' outer "**traces 32**" are a "concentric tri-trace configuration" because there are three of them and they surround central **trace 32**, which is a similar configuration to Fig. 6 of the '553Patent, which the specification describes as a "concentric tri-trace configuration:"

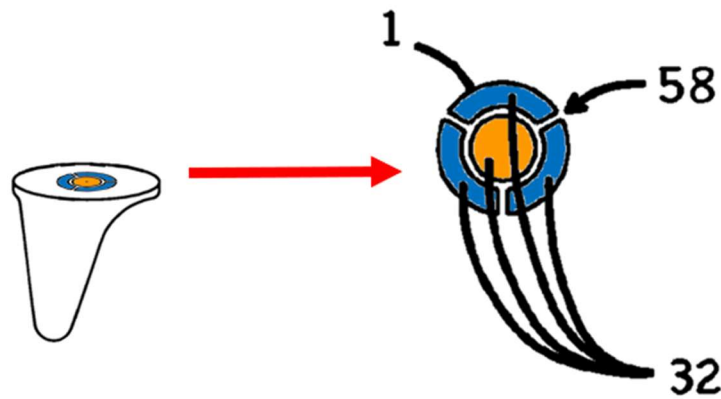


Ex. 1001, Fig. 6 (left), 15:3-21; Ex. 1008, Fig. 3 (right). Thiers further discloses that the three outer **traces 32** "form a ring" and are centered around an "axis of rotation" shared with the central **trace 32**. Ex. 1008, ¶[0045].

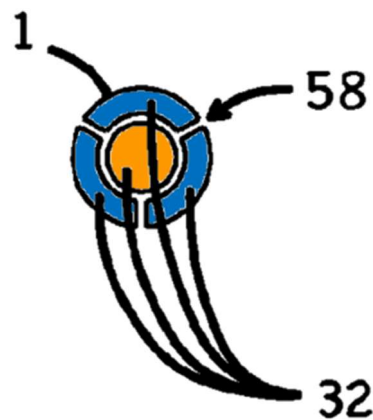
## 6. [5]/[6]/[17]

219. Dannemann combined with Thiers renders obvious claims 3 and 16 (§X.E.4) and the limitations of these claims. Dannemann combined with Thiers has a plurality of arcuate contacts (Thiers' outer "**traces 32**") arranged around a central contact (Thiers' central "**trace 32**") wherein each of the plurality of contacts is arranged the

same distance from the central contact as each other contact of the plurality of arcuate contacts. The plurality of arcuate contacts (Thiers' outer "**traces 32**") defines a circle:



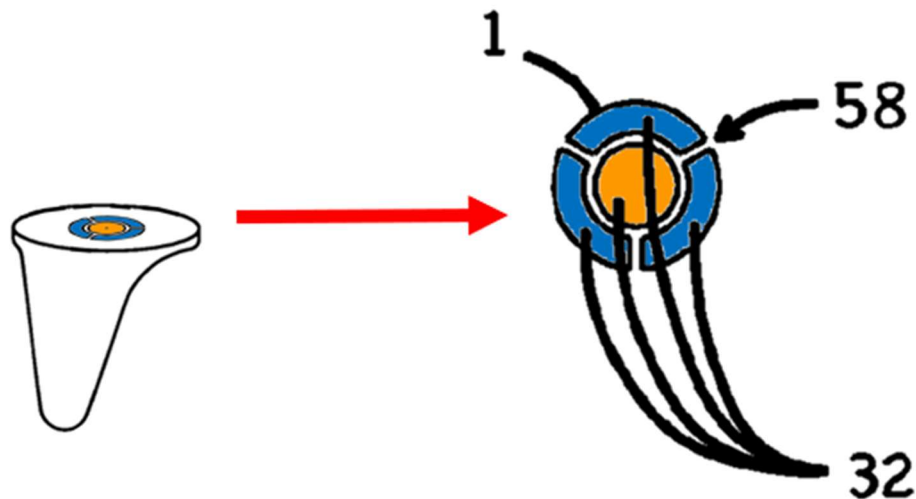
Ex. 1006, Fig. 2(modified); Thiers' Fig. 3 below shows outer "**traces 32**" are equidistant to central "**trace 32**" and Thiers discloses outer **traces 32** "form a ring around" central **trace 32**:



Ex. 1008, Fig. 3, [0044-45]; §X.E.2.d.

7. [8]/[19]/[9]/[18]

220. Dannemann combined with Thiers renders obvious claims 1 and 14 (§X.E.2) and the limitations of these claims. Dannemann combined with Thiers discloses the central contact (Thiers' central “**trace 32**”) comprises an annular shape and the at least one arcuate contact comprises a plurality of/three arcuate contacts (Thiers' three outer “**traces 32**”) each arranged at substantially the same distance from the central contact:



Ex. 1006, Fig. 2(modified); Thiers discloses that the central “**trace 32**” is “in the form of a circle,” which is annular, and that the outer “three **traces 32** form a ring around the circle and axis of rotation.” Ex. 1008, ¶¶ [0045]; §X.E.6.

8. [10]

221. In my opinion, Dannemann combined with Thiers renders obvious claim 1

(§X.E.2) and the limitations of claim 10. Dannemann combined with Thiers discloses the central contact (Thiers' central “**trace 32**”) defines a cathode contact and the at least one arcuate contact (Thiers' outer “**traces 32**”) defines an anode contact. Dannemann teaches that its “device charging contacts 13, 14 ... are used to charge [the] accumulator” or battery. Ex. 1006, [0027]. Because the electrode arrangement is used for charging, a POSA would understand at least one of its contacts must be a cathode and at least one must be an anode in order to complete the charging circuit.

222. In the combination with Thiers, in my opinion, a POSITA would have been motivated to make the central contact a cathode and a surrounding arcuate contact an anode because there were a limited number of ways to arrange the anode and cathode in a four-contact arrangement, and all of them would have been obvious to try. A POSA would have had a reasonable expectation of success because Chen had already demonstrated the feasibility of having a central cathode contact and an outer anode contact. §X.A.3.

## 9. [11]

223. In my opinion, Dannemann combined with Thiers renders obvious claim 1. §X.E.2. Further, Dannemann combined with Thiers renders obvious claim 11 for the same reasons I explain above with respect to Chen combined with Thiers. §X.B.10.

## 10. [12]

224. In my opinion, Dannemann combined with Thiers renders obvious claim 1 (§X.E.2) and the limitations of claim 12. Dannemann combined with Thiers has charging circuitry (Danneman’s circuitry components and wiring associated with its “accumulator”) that is coupled to the electrode arrangement (Thiers’ “connector 1”). §§X.E.1, X.E.2.f, X.E.8-9.

225. A POSA would understand that Dannemann’s “accumulator” includes charging circuitry because Dannemann discloses that the “device charging contacts 13, 14 ... are used to charge [the] accumulator.” Ex. 1006, [0027]; *see* Ex. 1006, [0008] (“DE69300870T2 also discloses an apparatus for recharging an accumulator of a hearing device[.]”).

## 11. [13]

226. In my opinion, Dannemann combined with Thiers renders obvious claim 1 (§X.E.2) and the limitations of claim 13. Dannemann combined with Thiers has an arcuate contact (Thiers’ outer “**traces 32**”) that is configured to communicate power and one or more information signals. When combined, Thiers’ outer “**traces 32**” are coupled to Dannemann’s accumulator and configured to communicate power to the “accumulator.” §X.E.8-10; Ex. 1006, [0008], [0027]; Danneman discloses using the contacts between “ITE hearing device 10” and “charging device” “for signal transmissions” and Thiers discloses each of the traces in “connector 1” can “transmit

data and power.” Ex. 1006, [0033]; Ex. 1008, Fig. 8, [0031], [0040]-[0043], [0055].

## **12. [20]**

227. In my opinion, Dannemann combined with Thiers renders obvious claim 14 (§X.E.2) and the limitations of claim 20.

### **a. [20a]**

228. Dannemann combined with Thiers discloses a first charging interface (Thiers’ “traces 32” of “connector 1”) comprising the electrode arrangement, wherein the circuitry (Dannemann’s “accumulator” and associated wiring) of the hearing device comprises charging circuitry coupled to the electrode arrangement. Thiers’ “traces 32” are a “first charging interface” because, in the combination with Dannemann, they interface with Dannemann’s “charging device” and are part of a charging circuit used for charging Dannemann’s “accumulator.” Ex. 1008, [0043-0045]; §§ X.E.2.f, X.E.10.

### **b. [20b]**

229. Dannemann combined with Thiers discloses that the charging interface of the charging module (Thiers’ “contacts 50”) defines a second charging interface configured to detachably couple with the first charging interface (Thiers’ “traces 32”) of the hearing device. Thiers’ “contacts 50” are a second charging interface because they are configured to detachably couple with Thiers’ “traces 32,” through

which Dannemann’s “accumulator” is recharged. *Id.* §X.E.1; Ex. 1008, Fig. 3, [0037-38], [0043-45]; Ex. 1006, Fig. 2, [0027-29] (“When closing the cover 16, the charging contacts [] of the charging device then reliably contact the hearing device contacts....”).

**c. [20c]**

230. Dannemann combined with Thiers discloses that the charging module (Dannemann’s “charging device”) further comprises charging circuitry (circuitry within Dannemann’s “charging device”) coupled to the second charging interface (Thiers’ “contacts 50”). A POSA would have understood that Dannemann’s “charging device” includes charging circuitry because Dannemann teaches that “[d]uring the charging process, electricity [] introduced into the contact surface 28 for instance, is routed from there through the charging contact 18 to the hearing device contact 13 and is finally routed to the integrated accumulator in the ITE hearing device 10.” Ex. 1006, [0031]. In the combination, Thiers’ contacts 50 are coupled to the charging circuitry within Dannemann’s “charging device.” §X.E.1.

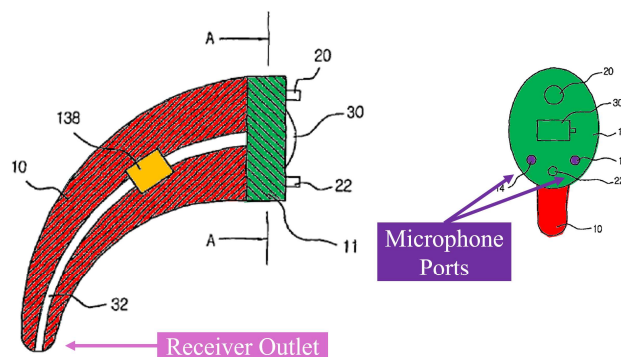
**d. [20d]**

231. Dannemann combined with Thiers discloses that the charging module (Dannemann’s “charging device”) is configured to charge a rechargeable power source (Dannemann’s “accumulator”) of the hearing device that is coupled to the first charging interface (Thiers’ “traces 32”). When Dannemann and Thiers are

combined, Dannemann’s “accumulator” is coupled to Thiers’ “traces 32,” and is charged by Dannemann’s “charging device.” §§X.E.8-10, X.E.2.d., X.E.1.

**F. Ground 6: Dannemann Combined With Thiers and Kwon Renders Obvious Claims 7 and 21**

232. Dannemann discloses an “ITE hearing device 10” with a “microphone” and a “miniature loudspeaker,” but does not expressly teach the location of their ports in the earphone housing. Ex. 1006, Figs. 2, 3, 3:56-59, 4:11-13. Kwon discloses one of more microphone ports (“**microphones 12, 14**” ports) disposed in the outer surface of the faceplate (“**faceplate 11**”) and a receiver outlet (**outlet** for “**receiver 138**”) disposed in the shell (“**shell 10**”):

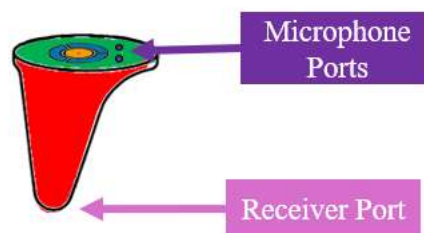


Ex. 1007, Figs. 2, 3 (excerpted), 3:56-59, 4:11-13.

233. In my opinion, a POSA would have been motivated to use Kwon’s teachings to further modify the Dannemann-Thiers combination so that 1) Dannemann’s microphone port forms an opening in the faceplate and 2) Dannemann’s “loudspeaker” outlet is on the shell, which is inserted into a wearer’s ear. POSAs

would have been motivated to position the microphone port on Dannemann's faceplate such that it faces outward, or away from the user's ear canal, to best capture environmental sound or the user's voice. Further, a POSA would have been motivated to include a receiver outlet on Dannemann's shell, which is inserted into a wearer's ear, so that the wearer can clearly hear sound from the speaker 145. POSAs would have had a reasonable expectation of success incorporating these feature into Dannemann, and doing so would have merely required applying a known arrangement to improve a similar device in the same way.

234. Therefore, Dannemann combined with Thiers renders obvious claims 1 and 14 (§X.E.2), and Dannemann combined with Thiers and Kwon teach a **microphone port** disposed in the outer surface of Dannemann's **faceplate** and a **receiver outlet** disposed in Dannemann's **shell**, as required by claims 7 and 21:



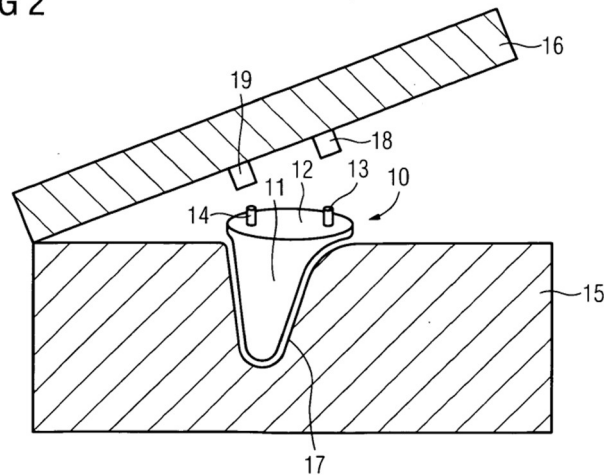
Ex. 1006, Fig. 2 (modified).

**G. Ground 7: Dannemann Combined With Wagman Renders Obvious Claims 1-21**

**1. Motivation to Combine**

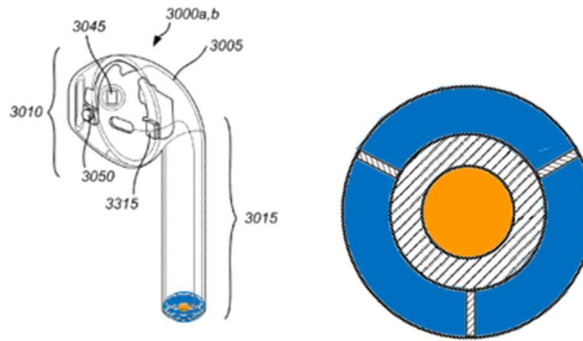
235. Dannemann discloses an ITE hearing device with two charging contacts 13, 14 arranged on the faceplate 12, which are connected to an integrated accumulator (battery) for recharging. Ex. 1006, [0027].

FIG 2



Ex. 1006, Fig. 2.

236. As I explain above in Ground 4 (§X.D.1), Wagman discloses or renders obvious an earbud electrode arrangement with central **contact 515** and three outer **contacts 510'** and a complimentary charger, as shown below.



Ex. 1009, Figs. 33, 5B (modified), 5A (modified).

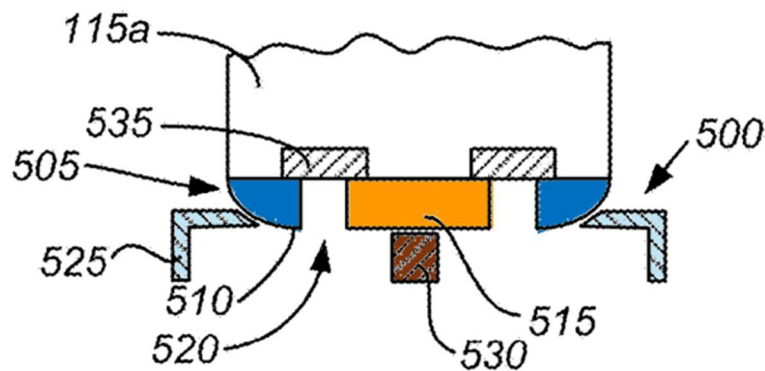
237. In my opinion, a POSA would have been motivated to substitute Danneman’s charging interface with Wagman’s charging interface. A POSA would have been motivated to make this modification for the known advantages of increasing the number of contacts in power and data transmission (§§X.B.1, V). Dannemann itself acknowledges these advantages, expressly contemplating that its charging device “may however also be equipped with more than two positioning units 20, 21, in order to produce additional contacts to the hearing device for signal transmissions for instance.” Ex. 1006, [0033]. A POSA would have understood that there was a recognized need for additional electrical contacts at the hearing-device-to-charger interface, and would have been motivated to look to the prior art ear-worn devices like Wagman’s earbuds for a space-efficient multi-contact solution suitable for the constrained form factor of an ITE hearing device faceplate.

238. In my opinion, a POSA would have been motivated to substitute

Dannemann's two-contact charging interface (charging contacts 13, 14) with Wagman's four-trace concentric configuration and to couple Wagman's electrode arrangement to Dannemann's internal accumulator circuitry. This modification would have been prompted by several converging design incentives recognized by a POSA. First, because Dannemann's faceplate presents a circular geometry, a concentric trace arrangement of the type taught by Wagman is a geometrically natural solution: it exploits the rotational symmetry of the circular faceplate surface, ensuring reliable contact with the charging device regardless of the angular orientation of the hearing device when it is inserted into the charging cradle. Second, expanding Dannemann's two-contact interface to Wagman four-trace arrangement would have provided additional electrical paths for power delivery and signal transmission—an advantage that Dannemann itself contemplated. Ex. 1006, [0033]; Third, Wagman's concentric configuration achieves this increase in electrical paths within the same limited surface area, making it particularly well-suited for the constrained form factor of a hearing-device faceplate where space is at a premium. Ex. 1009, 20:49-55.

239. In my opinion, a POSA would have been motivated to substitute the charging interface on Danneman's "charging device" with "**contact 525**" and "**contact 530**" from Wagman's "connector 500" and couple them to the charging circuitry of the "charging device" for the same reasons. Wagman's "**contact 525**" and "**contact**

**530**” are a compatible charger-side electrode configuration for use with the device-side electrode arrangement described above:



Ex. 1009, Fig. 5A, 25:9-27.

240. Alternatively, in my opinion, a POSA would also have been motivated to divide Wagman’s **contact 525** into three segments so that they correspond and align with the three arcuate contacts formed by dividing Wagman’s **contact 515**, as described above. For example, Thiers teaches this is beneficial so that there are distinct “electrical path[s]...from each respective contact [on the charger] to each corresponding trace” on the device. Ex. 1008, [0043-45]. A POSA would have recognized these alternative design choices and would have been motivated to use either depending upon the application (*e.g.*, how many independent data/power lines are desired). *See* §V.D.1.a.

241. A POSA would also have had a reasonable expectation of success in making this combination. Both Dannemann and Wagman employ the same contact architecture, with electrodes arranged around a central axis for delivering electrical power through a detachable interface. Dannemann's existing two contacts 13, 14 are already arranged on the circular faceplate surface in a manner compatible with a concentric geometry; incorporating additional concentric traces and nonconductive separating spaces from Wagman into that same faceplate surface would have amounted to no more than using a known technique to improve a similar technology in the same way. A POSA would have been motivated to rely on Dannemann's existing accumulator and internal wiring architecture to route the additional electrical paths provided by Wagman's configuration because Dannemann already teaches that electricity is routed from the contact surfaces through the charging contacts to the integrated accumulator. Ex. 1006, [0031]. The combination merely applies conventional, well-known concentric electrode geometry—widely used across the electronic-device charging art—to a hearing device that already uses electrode-based charging at its faceplate, and would have been well within the skill of a POSA.

2. [1]/[14]

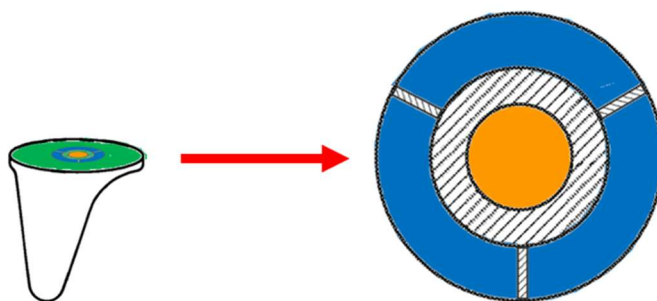
a. [1pre]/[14a]/[1a]/[14b]/[1b]/[14c]/[1c]/[14d]/[14pre]

242. In my opinion, Dannemann discloses these limitations and Dannemann

combined with Wagman discloses these limitations. *See* §X.E.2.a-d, -g;

**b. [1d]/[14e]**

243. Dannemann combined with Wagman discloses these limitations. Dannemann combined with Wagman has an electrode arrangement (Wagman’s **contacts 510'** and **contact 515**) disposed in an outer surface of the faceplate (Dannemann’s “**faceplate 12**”), the electrode arrangement comprising a central **contact 515** and at least one arcuate contact (**contacts 510'**) that extends around at least a portion of the central contact:



Ex. 1006, Fig. 2 (modified); Ex. 1009, Fig. 5B (modified); §X.G.1. Wagman discloses or renders obvious an electrode configuration with three arcuate **contacts 510'** surrounding a central **contact 515**. Ex. 1009, Fig. 5B (modified); §X.G.1. Wagman’s **Contacts 510'** are “arcuate” because they are arcs (approximately 120-degrees), around the central contact, and because they have “an arcuate peripheral contact surface.” Ex. 1009, Cls. 2, 4, 26:9-13.

244. Dannemann teaches electrodes in its faceplate, and POSAs would have been

motivated to dispose Wagman's electrodes in the outer surface of Dannemann's faceplate. §§ X.G.1, V. Wagman further discloses that its contacts are "flush with an exterior surface" of the housing and have "an arcuate peripheral contact surface," which "enable[s] a wiping motion each time the earbuds are inserted...creating a reliable interconnect." Ex. 1009, Cls. 2, 4, 26:9-13, 28:37-40, 29:1-4. Wagman also discloses, in embodiments with arcuate outer contacts, the contacts "can be separated from each other by an insulator 620." Ex. 1009, 25:50-53. A person of skill in the art would have recognized Dannemann's faceplate could thus act as the nonconductive insulator 620 and would have been motivated to dispose Wagman's electrode arrangement in the outer surface of Dannemann's faceplate for the ease of manufacturing and stability of design benefits discussed previously. §§ X.G.1, V.

**c. [1e]/[14f]**

245. Dannemann combined with Wagman discloses these limitations. Dannemann combined with Wagman has circuitry (Danneman's circuitry components and wiring associated with its "accumulator") disposed in the internal volume (Dannemann's "ITE shell 11" and "faceplate 12") and coupled to the electrode arrangement (Wagman's three arcuate contacts and central contact). Ex. 1006, [0027], [0031]; §X.G.1.

**d. [14g]**

246. Dannemann combined with Wagman discloses these limitations. Dannemann

combined with Wagman has a charging module (Dannemann's "charging device") comprising a charging interface (Wagman's **contact 530** and **contact(s) 525**) that comprises a central charging contact and an annular ring charging contact or a plurality of charging contacts equidistant to the central contact. Ex. 1009, Figs. 2, 3, 5A, 19:4-30, 20:44-21:11.

247. Wagman's **contact 530** is a central charging contact and its **contact 525** is an annular ring charging contact, as illustrated in the cross-sectional view in Wagman's Fig. 5A:

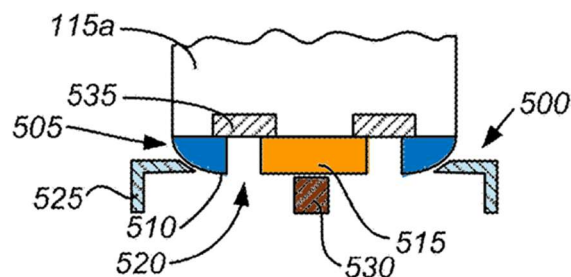


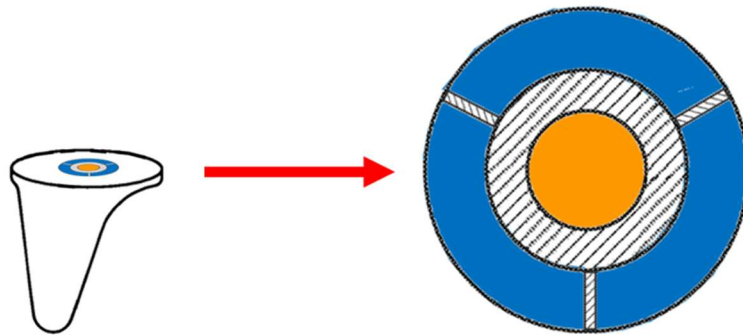
**FIG. 5A**

Ex. 1009, Fig. 5A, 25:9-27.

### 3. [2]/[15]

248. In my opinion, Dannemann combined with Wagman renders obvious claims 1 and 14 (§X.G.2), and the limitations of these claims. Dannemann combined with Wagman discloses the least one arcuate contact (Wagman's **contacts 510'**) comprises an annular contact, at least to the extent that this claim encompasses a

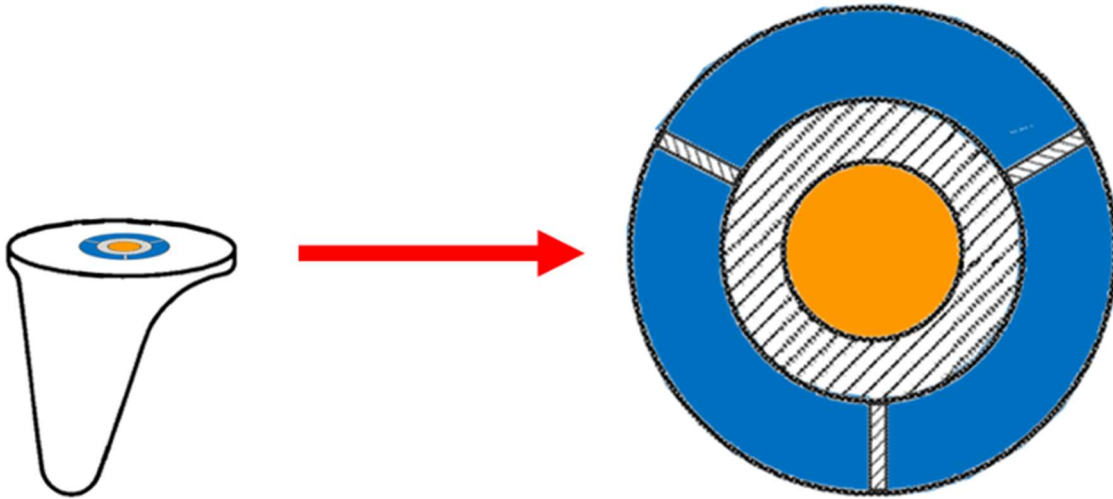
plurality of arcuate contacts which collectively form an annular shape:



Ex. 1006, Fig. 2 (modified); Wagman similarly describes its divided ring contacts as partially “annular.” Ex. 1009, Fig. 6B, 9:28-49 (“The first and second external contacts can each have a partial annular shape”), 25:46-49 (“[E]ach of earbud contacts 610 and 615 can have a partial annular shape (*i.e.*, a partial ring)”), Cl. 8.

#### 4. [3]/[16]

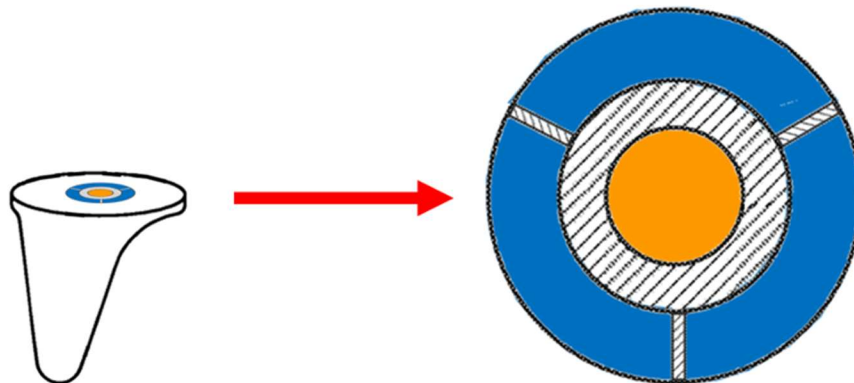
249. In my opinion, Dannemann combined with Wagman renders obvious claims 1 and 14 (§X.G.2), and the limitations of these claims. Dannemann combined with Wagman discloses the at least one arcuate contact comprises a plurality of arcuate contacts (Wagman’s three arcuate **contacts 510'**):



Ex. 1006, Fig. 2 (modified); §X.G.1; Ex. 1009, 24:63-65, 25:46-49, 20:49-55;

## 5. [4]

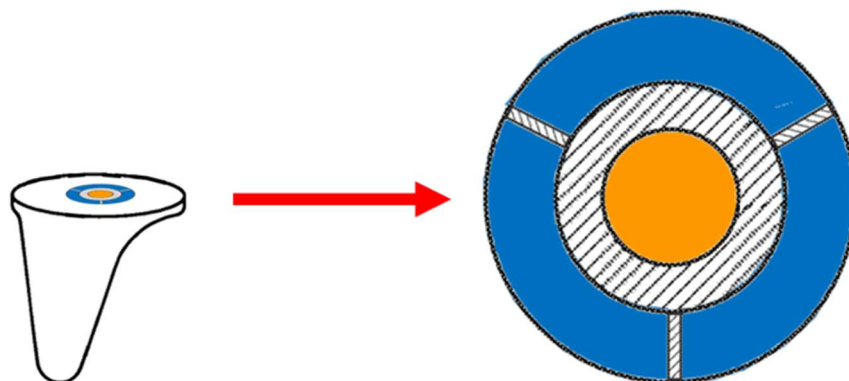
250. In my opinion, Dannemann combined with Wagman renders obvious claim 3 (§X.G.4), and the limitations of claim 4. Dannemann combined with Wagman has a plurality of arcuate contacts (Wagman's **contacts 510'**) that have a concentric tri-trace configuration:



Ex. 1006, Fig. 2 (modified).

6. [5]/[6]/[17]

251. In my opinion, Dannemann combined with Wagman renders obvious claims 3 and 16 (§X.G.4) and the limitations of these claims. Dannemann combined with Wagman has a plurality of arcuate contacts (Wagman's modified **contacts 510'**) arranged around a central contact (Wagman's **contact 515**) wherein each of the plurality of contacts is arranged the same distance from the central contact as each other contact of the plurality of arcuate contacts. The plurality of arcuate contacts (Wagman's modified **contacts 510'**) defines a circle:

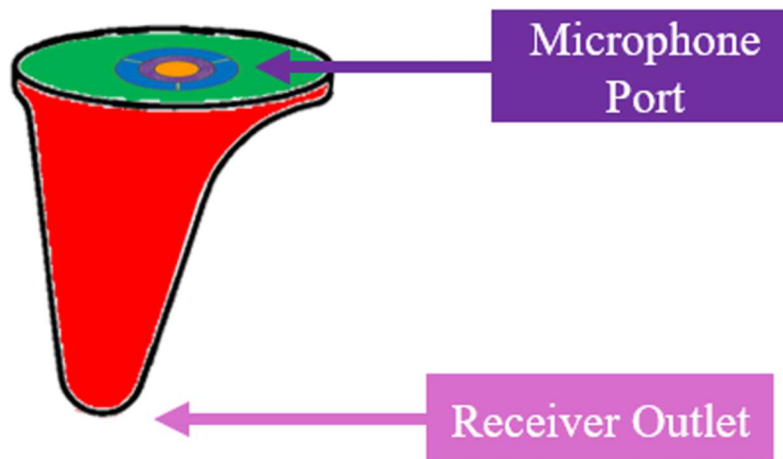


Ex. 1006, Fig. 2 (modified); Ex. 1009, Fig. 5B (modified).

7. [7]/[21]

252. In my opinion, Dannemann combined with Wagman renders obvious claims 1 and 14 (§X.G.2), and the limitations of these claims. Dannemann combined with Wagman discloses a **microphone port** (port for “microphone 2”) disposed in the outer surface of the Dannemann's “**faceplate 12**” and a **receiver outlet** (outlet for

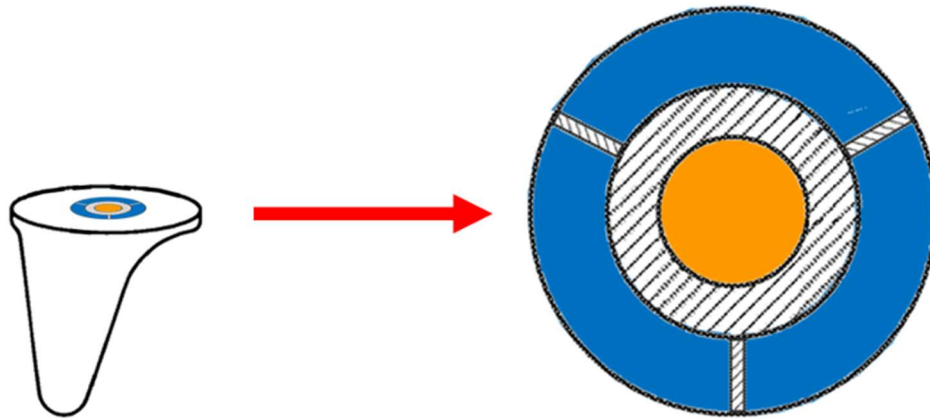
“loudspeaker or receiver 4”) disposed in Dannemann’s “**ITE shell 11**”:



Ex. 1006, Fig. 2 (modified); §X.G.1.

## 8. [8]/[19]/[9]/[18]

253. In my opinion, Dannemann combined with Wagman renders obvious claims 1 and 14 (§X.G.2), and the limitations of these claims. Dannemann combined with Wagman discloses the central contact (Wagman’s central **contact 515**) comprises an annular shape and the at least one arcuate contact comprises a plurality of/three arcuate contacts (Wagman’s **contacts 510'**) each arranged at substantially the same distance from the central contact:



Ex. 1006, Fig. 2 (modified).

## 9. [10]

254. In my opinion, Dannemann combined with Wagman renders obvious claim 1 (§X.G.2) and the limitations of claim 10. Dannemann combined with Wagman renders obvious a central contact (Wagman’s central “**contact 515**”) that defines a cathode contact and the at least one arcuate contact (Wagman’s outer “**contact 510**”) defines an anode contact. Dannemann teaches that its “device charging contacts 13, 14 ... are used to charge [the] accumulator” or battery. Ex. 1006, [0027]. Because the electrode arrangement is used for charging, a POSA would understand at least one of its contacts must be a cathode and at least one must be an anode in order to complete the charging circuit.

255. In the combination with Wagman, in my opinion, a POSITA would have been motivated to make the central contact a cathode and a surrounding arcuate contact an anode because there were a limited number of ways to arrange the anode and

cathode in a four-contact arrangement, and all of them would have been obvious to try. A POSA would have had a reasonable expectation of success because Chen had already demonstrated the feasibility of having a central cathode contact and an outer anode contact. §X.A.3.

## 10. [11]

256. In my opinion, Dannemann combined with Wagman renders obvious claim 1. §X.G.2. Further, Dannemann combined with Wagman renders obvious claim 11 for the same reasons I explain above with respect to Chen combined with Wagman. §X.D.10

## 11. [12]

257. In my opinion, Dannemann combined with Wagman renders obvious claim 1 (§X.G.2) and the limitations of claim 12. Dannemann combined with Wagman has charging circuitry (Danneman’s circuitry components and wiring associated with its “accumulator”) that is coupled to the electrode arrangement (Wagman’s **contacts 510'** and **contact 515**). *See* §§X.G.1, X.G.2.c, X.G.9-10.

258. A POSA would understand that Dannemann’s “accumulator” includes charging circuitry because Dannemann discloses that the “device charging contacts 13, 14 ... are used to charge [the] accumulator.” Ex. 1006, [0027]; *see* Ex. 1006, [0008] (“DE69300870T2 also discloses an apparatus for recharging an accumulator

of a hearing device[.]”).

## **12. [13]**

259. In my opinion, Dannemann combined with Wagman renders obvious claim 1 (§X.G.2) and the limitations of claim 13. Dannemann combined with Wagman has an arcuate contact (one of Wagman’s **contacts 510'**) that is configured to communicate power and one or more information signals. As discussed in §X.G.11, when modified, Wagman’s **contacts 510'** are coupled to Dannemann’s “accumulator” to provide power for recharging. Ex. 1006, [0008], [0027].

260. Further, Danneman discloses using the contacts between “ITE hearing device 10” and “charging device” “for signal transmissions” and Wagman’s **contacts 510'** can “carry[] both power and data signals.” Ex. 1006, [0033]; Ex. 1009, 20:49–55, 24:40–42.

## **13. [20]**

261. In my opinion, Dannemann combined with Wagman renders obvious claim 14 (§X.G.2) and the limitations of claim 20.

### **a. [20a]**

262. Dannemann combined with Wagman discloses a first charging interface (Wagman’s contacts 510' and contact 515) comprising the electrode arrangement, wherein the circuitry (Dannemann’s “accumulator” and associated wiring) of the

hearing device comprises charging circuitry coupled to the electrode arrangement. §§X.G.2.c, X.G.9-11. Wagman's contacts 510' and contact 515 are a "first charging interface" because they interface with Dannemann's "charging device" and are coupled to the charging circuit used to charge Dannemann's "accumulator." *Id.*; §X.G.1; Ex. 1009, Fig. 2, 19:22-27, 25:18-23.

**b. [20b]**

263. Dannemann combined with Wagman discloses that the charging interface of the charging module (Wagman's contact 530 and contact(s) 525) defines a second charging interface configured to detachably couple with the first charging interface (Wagman's contacts 510' and contact 515) of the hearing device. Wagman's contact 530 and contact(s) 525 are a second charging interface because they are configured to detachably couple with Wagman's contacts 510' and contact 515 for delivering power Danneman's hearing device. §X.G.1.a; Ex. 1009, Fig. 2, 19:22-27, 25:18-23; Ex. 1006, Fig. 2, [0027]-[0029] ("When closing the cover 16, the charging contacts 18, 19 of the charging device then reliably contact the hearing device contacts....").

**c. [20c]**

264. Dannemann combined with Wagman discloses that the charging module (Dannemann's "charging device") further comprises charging circuitry (circuitry within Dannemann's "charging device") coupled to the second charging interface (Wagman's contact 530 and contact(s) 525). A POSA would have understood that

Dannemann's "charging device" comprises charging circuitry. §X.G.11. In the combination, Wagman's contact 530 and contact(s) 525 are coupled to Dannemann's charging circuitry to provide power to Danneman's ITE hearing device. §X.G.1.a; Ex. 1006, Fig. 2, [0027]-[0029].

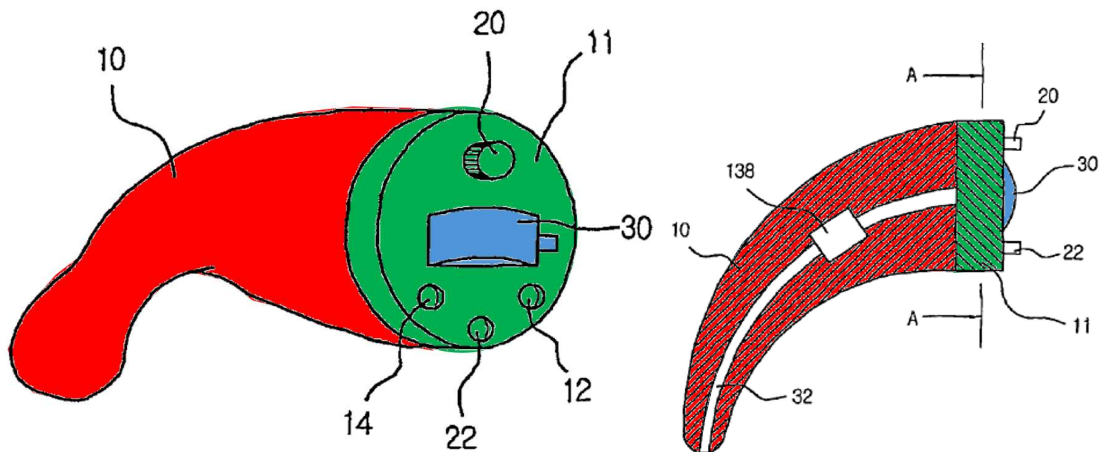
**d. [20d]**

265. Dannemann combined with Wagman discloses the charging module (Dannemann's "charging device") is configured to charge a rechargeable power source (Dannemann's "accumulator") of the hearing device that is coupled to the first charging interface (Wagman's contacts 510' and contact 515). When Chen and Wagman are combined, Wagman's contacts 510' and contact 515 are coupled to Dannemann's "accumulator," which is charged by Dannemann's "charging device." §§X.G.9-11, X.G.2.d, X.G.1.

**H. Ground 8: Kwon Combined With Wagman and Thiers Renders Obvious Claims 1-21**

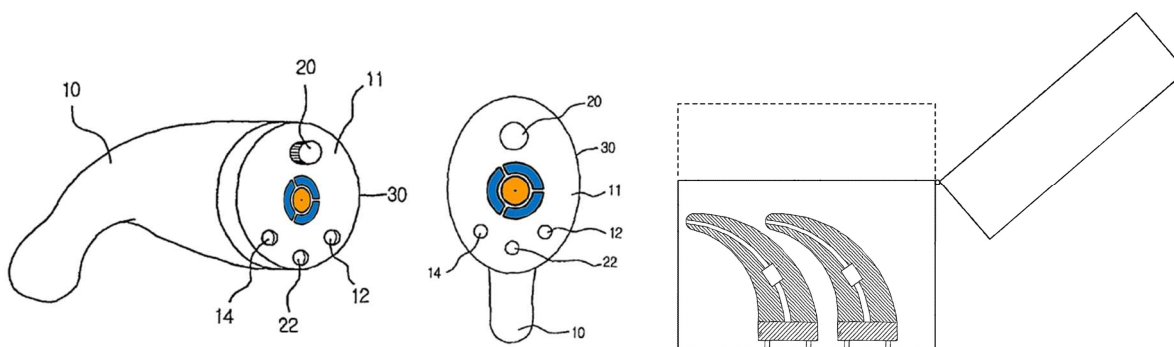
**1. Motivation to Combine**

266. In my opinion, a POSA would have been motivated to combine Kwon, Wagman, and Thiers. Kwon discloses an in-the-ear (ITE) hearing aid with a **shell 10** and a **faceplate 11** having a **cover 30** (battery door) for accessing a replaceable battery 26. Ex. 1007, Fig. 1, 3:54-4:19.



Ex. 1007, Figs. 1-2.

267. A POSA would have been motivated to replace Kwon's replaceable battery and battery cover 30 with Wagman's "rechargeable battery," charging case 204, and associated circuitry, and to use Thiers's multi-contact connectors as the interface between the hearing aid and the charging case, as shown below.



Ex. 1007, Fig. 1 (modified); Ex. 1007, Fig. 2 (modified); Ex. 1007, Fig. 3 (modified);  
Ex. 1009, Fig. 1(modified).

268. In my opinion, a POSA would have been motivated to convert Kwon into a

rechargeable hearing aid using Wagman’s rechargeable battery architecture. Rechargeable hearing devices were well known in the art and offered known advantages over replaceable batteries. §V. A POSA would have understood that rechargeable batteries avoid “time-consuming and costly replacement of the batteries” and enable the batteries to remain in the hearing device during charging. Ex. 1015, 1:22-24. The broad usage of rechargeable hearing devices in the prior art also would have given POSAs a reasonable expectation of success incorporating these features in Kwon.

269. The combination incorporates two elements taught by Wagman. For one, Wagman’s rechargeable battery architecture—in which a battery with limited capacity is recharged via an external connection rather than replaced. In the combination, Kwon’s replaceable battery 26 and battery door 30 are replaced with Wagman’s “rechargeable battery,” which is coupled via internal “circuitry” to a “case interface 270,” through which “power and/or data” is exchanged with “case 204.” (See below.)

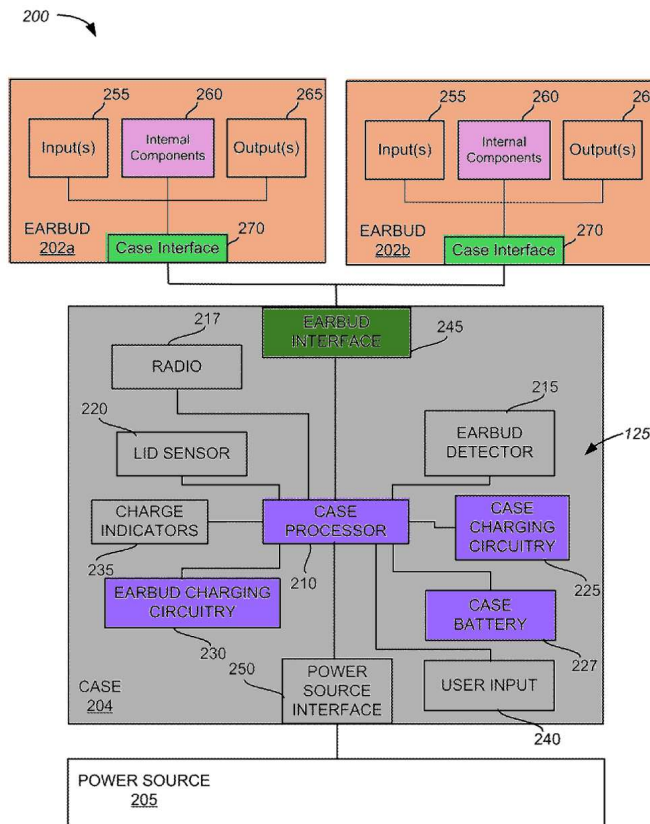


**FIG. 2**

Ex. 1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30.

270. In addition, the combination incorporates Wagman’s charging “**case 204**” as the external charging station for Kwon’s converted rechargeable hearing aid. The charging case includes a “**case battery 227**”, “**case charging circuitry 225**”, “**earbud charging circuitry 230**” for exchanging “power and/or data” through “**earbud interface 245.**” *Id.*

271. Further, in my opinion, a POSA would have been motivated to use Thiers’ concentric multi-contact interface in the combination with Kwon and Wagman. In the combination, as I explain above (§§X.B, X.F), a POSA would have been

motivated to use (1) Thiers’ four “traces 32” from “connector 1” as the “**case interface 270**” and (2) four corresponding “contacts 50” from Thiers’ “dock interface assembly 40” as the “**earbud interface 245**” between **case 204** between and Kwon’s **hearing aid**:

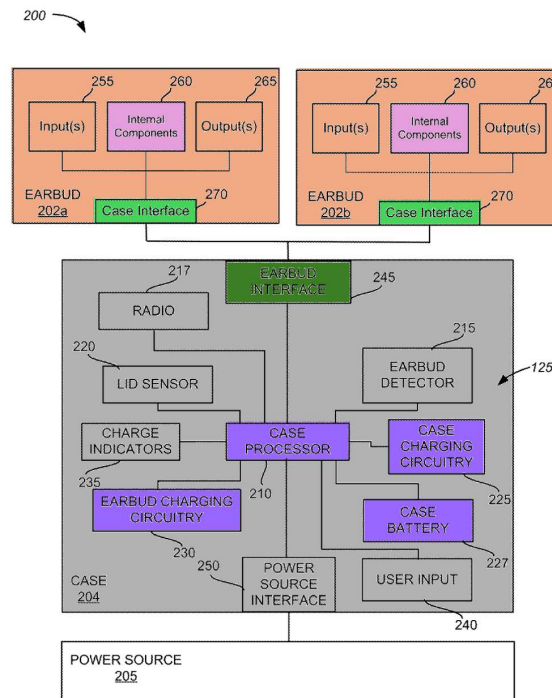


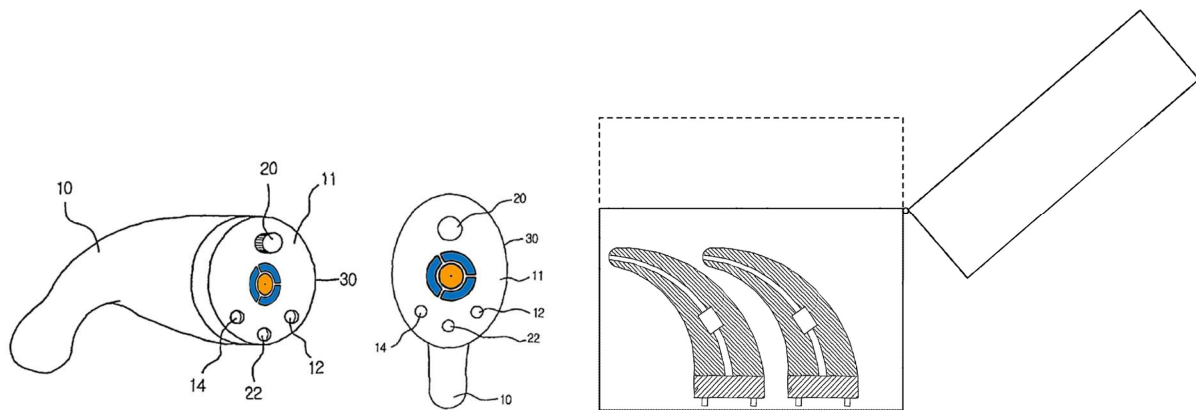
**FIG. 2**

Ex. 1009, Fig. 2. A POSA would have readily understood that Kwon’s outward-facing faceplate is a practical location for such a charging interface because that is already the location of Kwon’s battery door and such an arrangement would make it such that the electrical contacts “do not contact the skin of the hearing device wearer when the ITE hearing device [] is being worn,” as taught by Dannemann. Ex. 1006, [0027].

272. In my opinion, a POSA would have been motivated to adopt Thiers’s multi-contact concentric trace configuration for the rechargeable implementation because it provides a compact, space-efficient arrangement for transmitting power to the device—critical for the constrained form factor of a compact ITE hearing aid. Thiers’s configuration provides multiple isolated electrical paths for both power delivery and data transmission within a small footprint and redundant contact paths. Further, as discussed above, Wagman discloses or renders obvious an electrode configuration with three arcuate contacts surrounding a central contact that would have further encouraged a POSA to use this similar configuration from Thiers. §§X.B.2, X.D.2.

273. In my opinion, a POSA also would have had a reasonable expectation of success in making this combination because Wagman already discloses “**case interface 270**” and “**earbud interface 245**” to and Thiers merely provides a specific electrode interface through which Wagman’s data and power transmissions can occur. In the combination, Kwon’s battery accommodation space 28 and battery door 30 would be replaced with Wagman’s rechargeable battery and internal circuitry, and Thiers’s concentric conductive traces would be arranged on Kwon’s faceplate (the externally accessible surface of the ITE hearing aid) to receive charging power from Wagman’s charging case. This modification merely required applying known techniques—a rechargeable battery, an electrode arrangement with

concentric contacts, internal wiring, and a charging case with contacts—to a hearing device already designed with compact electronics and battery electrodes integrated into its faceplate structure:

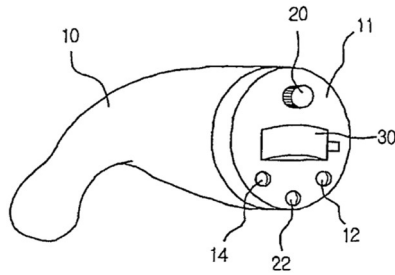


Ex. 1007, Fig. 1 (modified); Ex. 1007, Fig. 2 (modified); Ex. 1007, Fig. 3 (modified);  
Ex. 1009, Fig. 1(modified).

## 2. [1]/[14]

### a. [1pre]/[14a]

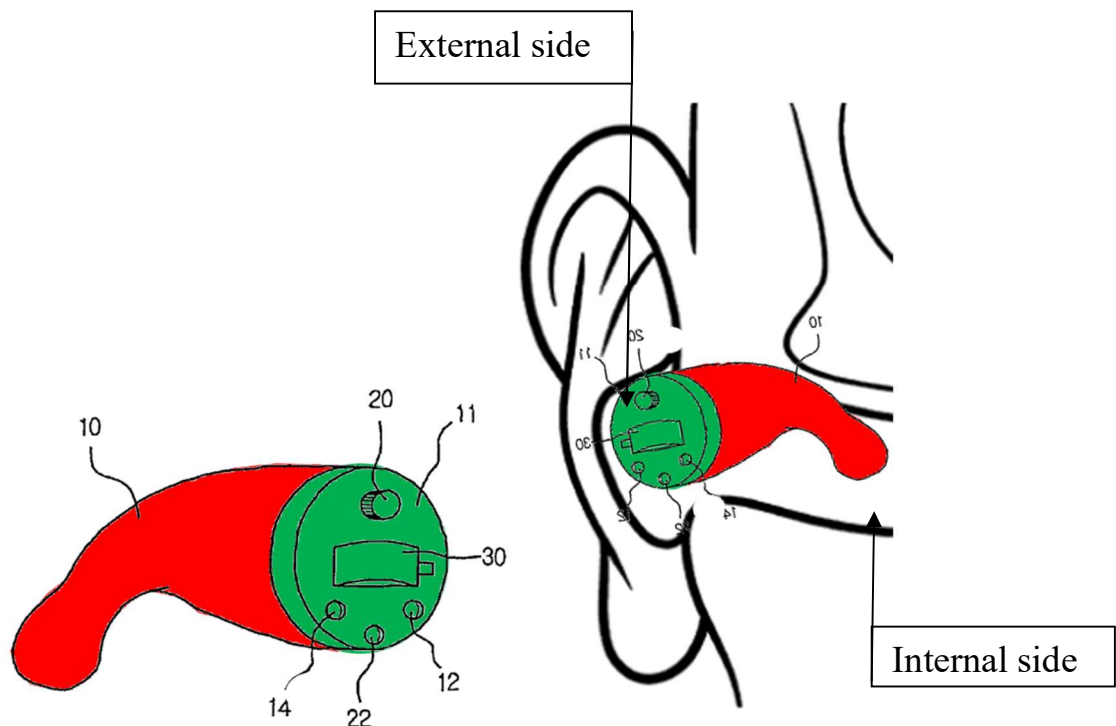
274. To the extent that the preamble is limiting, Kwon discloses a hearing device, as does its combination with Wagman and Thiers. Kwon is directed to In-The-Ear (ITE) hearing aids, including the “faceplate for an In-The-Ear (ITE) hearing aid.” Ex. 1007, Figs. 1, 2, Title, Abstract, 1:7-15; 1:41-51; 3:7-18. Further, Kwon discloses that its “faceplate” may include a “PCB (Printed Circuit Board)...including a receiver,” another “PCB...including microphones,” and “a battery:”



Ex. 1007, Fig. 1, 2:38-55.

**b. [1a]/[14b]**

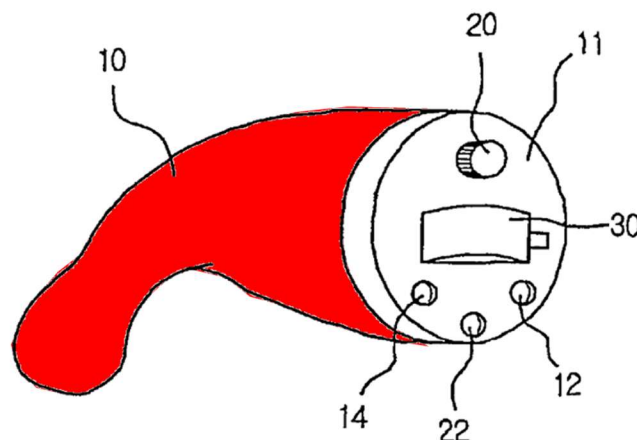
275. Kwon discloses this limitation, as does its combination with Wagman and Thiers. Kwon discloses a housing (“**shell 10**” and “**faceplate 11**”) that encloses an internal volume (space within the “**shell 10**” and “**faceplate 11**”) and extends from an internal side (ear-facing surface) to an external side (outward-facing surface), as shown below.



Ex. 1007, Fig. 1, Kwon discloses that the “**shell 10** [is] formed in a snail shape.” Ex. 1007, 3:54-57. When the hearing aid is worn by a user, as depicted above, its internal side is positioned inside a user’s ear canal, while its external side faces away the user’s ear canal.

**c. [1b]/[14c]**

276. Kwon discloses this limitation, as does its combination with Wagman and Thiers. Kwon discloses a **shell 10** arranged at the internal side (ear-facing surface), and the internal side (ear-facing surface) is configured to be inserted in the wearer’s ear canal:



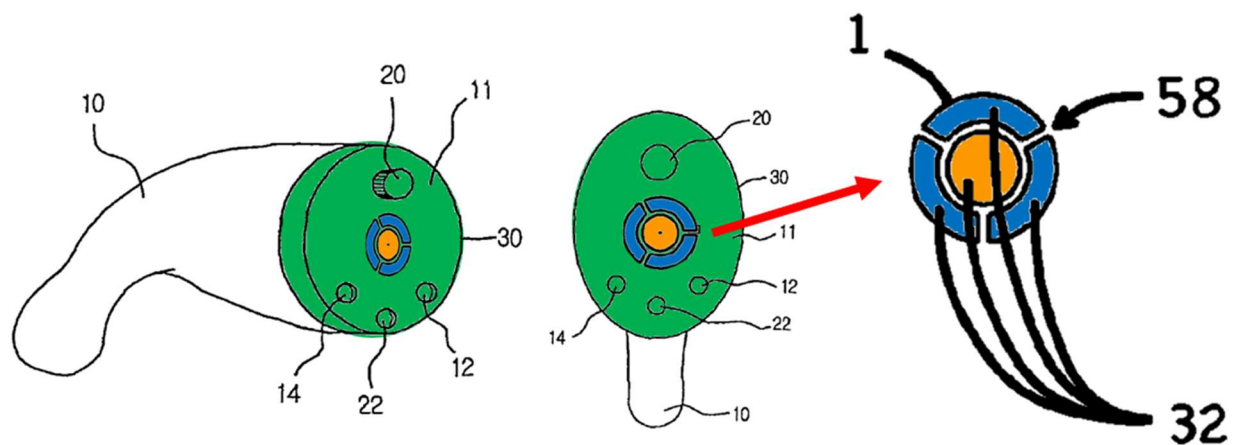
Ex. 1007, Fig. 1, For example, Kwon discloses that the “ITE hearing aid is inserted into the external auditory canal of an ear” and that the “**shell 10** [is] formed in a snail shape.” Ex. 1007, Fig. 1, 1:19-22, 3:54-57, 7:20-22, 8:11-12, 8:17-18. Thus, the ear-

**d. [1c]/[14d]**

e.  $[1d]/[14e]$

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combined with Thiers has an electrode arrangement (Thiers' central "trace 32" and outer "traces 32") disposed in an outer surface of the faceplate (Kwon's "faceplate 11"), the electrode arrangement comprising a central contact (central "trace 32") and at least one arcuate contact (outer "traces 32") that extends around at least a portion of the central contact:



Ex. 1007, Figs. 1, 3(modified); §§X.H.1.b. Thiers discloses that "[c]onnector 1 includes four traces: one in the center with the surface in the form of a circle, and three traces that form a ring around the circle and axis of rotation." Ex. 1008, [0045]. Kwon teaches a battery door on the outer surface its faceplate, and POSAs would have been motivated to dispose Thiers' electrodes in the outer surface of Kwon's faceplate, as was commonly done in prior art hearing devices. §§ X.H.1, V. Thiers further discloses "in Figure 3, the nonconductive separating spaces 58 may divide the otherwise annular shaped traces 32 into a multitude of smaller traces, as for example to fit more electrical path 72 into a limited space. The nonconductive

separating spaces 58 may comprise...a nonconductive separating material such as plastic and other insulators.” A person of skill in the art would have recognized Kwon’s faceplate could thus act as the nonconductive separating spaces 58 and would have been motivated to dispose Thiers’ electrode arrangement in the outer surface of Kwon’s faceplate for the ease of manufacturing and stability of design benefits discussed previously. § V.

**f. [1e]/[14f]**

279. Kwon combined with Wagman and Thiers discloses these limitations. Kwon combined with Wagman and Thiers has circuitry (Wagman’s “**rechargeable battery**” and associated “circuitry”) disposed in the internal volume and coupled to the electrode arrangement (Thiers’ “connector 1”). §X.H.1.

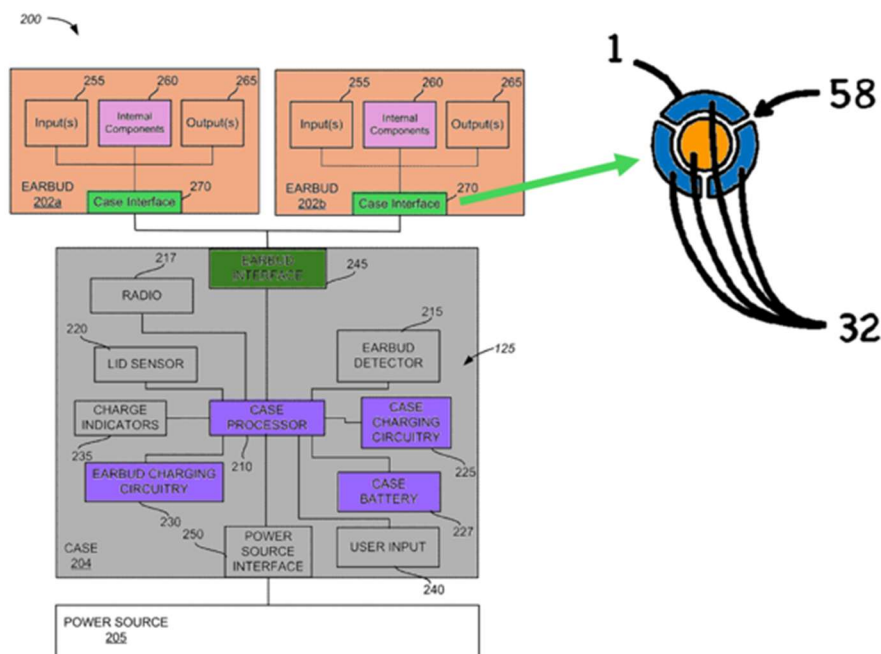


**FIG. 2**

Ex. 1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30; Ex1008, Fig. 3. Wagman's "internal components 260" include "a speaker, a microphone, a rechargeable battery, a processor, and/or other circuitry and components." Ex. 1009, 18:46-49.

**g. [14pre]**

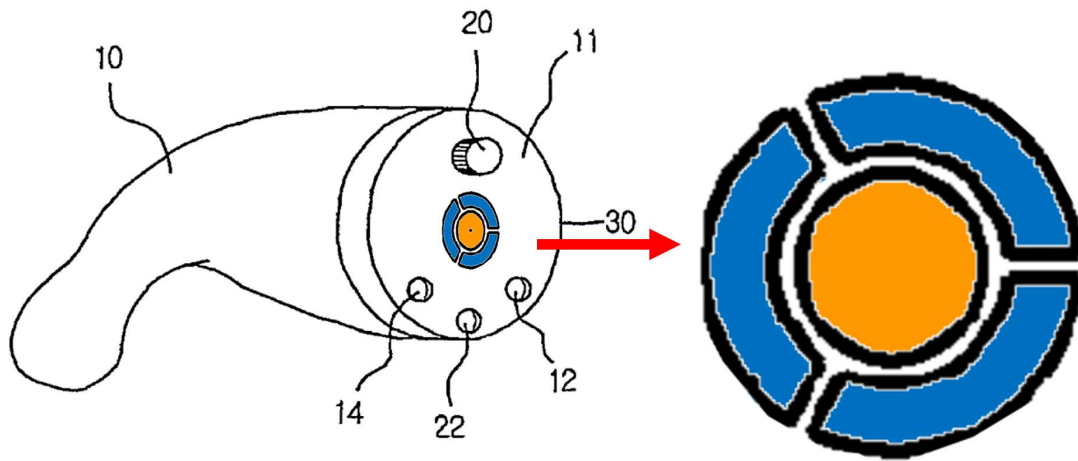
280. Kwon in combination with Wagman and Thiers discloses a system, to the extent the preamble is limiting. As modified, Kwon's "In-The-Ear (ITE) hearing aid" and Wagman's charging case 204 are a system. *See* §X.H.1.

**h. [14g]**

281. Kwon combined with Wagman and Thiers discloses these limitations. Kwon combined with Wagman and Thiers has a charging module (Wagman's "case 204") comprising a charging interface (Wagman's "earbud interface 245", which in the combination uses Thiers' "contacts 50") that comprises a central charging contact and a plurality of charging contacts equidistant to the central contact. Ex. 1008, Fig. 2, [0044]-[0045], 18:28-36, 18:46-49, 19:4-15, 19:22-30. For the reasons I explain above (§§X.B.2.d, X.E.2.h), Thiers teaches or at least renders obvious that three outer "contacts 50" are equidistant to (1) a middle "contact 50" and (2) central "trace 32" when docked so that each trace 32 aligns with a contact 50, satisfying this limitation under any interpretation of "the central contact."

### 3. [2]/[15]

282. In my opinion, Kwon combined with Wagman and Thiers renders obvious claims 1 and 14 (§X.H.2), and the limitations of these claims. Kwon combined with Wagman and Thiers discloses the least one arcuate contact (Thiers' outer "**traces 32**") comprises an annular contact, at least to the extent that this claim encompasses a plurality of arcuate contacts which collectively form an annular shape:

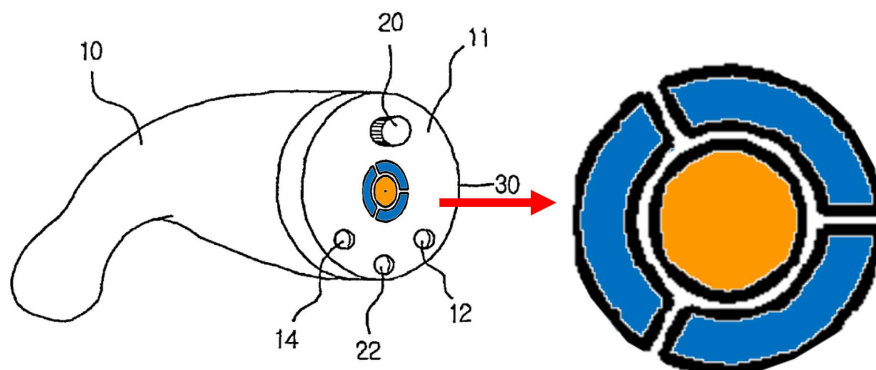


Ex. 1007, Fig. 1(modified). Thiers discloses that **outer traces 32** “form a ring” and that “nonconductive separating spaces 58 may divide the otherwise *annular* shaped 32 into a multitude of smaller traces.” Ex. 1008, ¶¶[0044-45] (emphasis added).

### 4. [3]/[16]

283. In my opinion, Kwon combined with Wagman and Thiers renders obvious claims 1 and 14 (§X.H.2), and the limitations of these claims. Kwon combined with Wagman and Thiers discloses the at least one arcuate contact comprises a plurality

of arcuate contacts (Thiers' three outer "**traces 32**"):

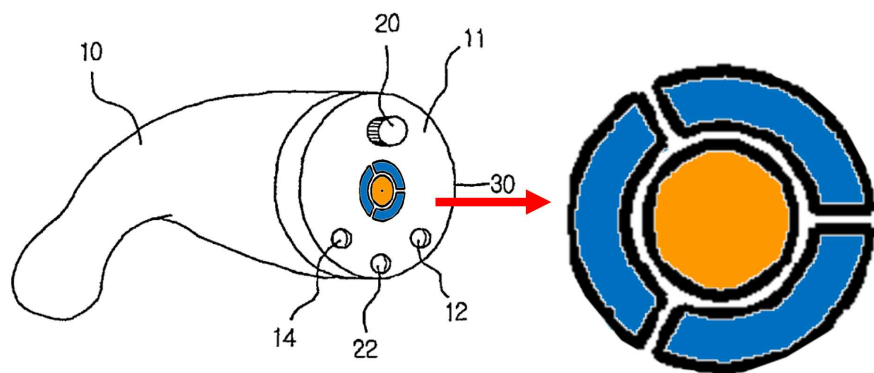


Ex. 1007, Fig. 1(modified); Thiers discloses that “nonconductive separating spaces 58 may divide the otherwise annular shaped 32 into a *multitude* of smaller traces.”

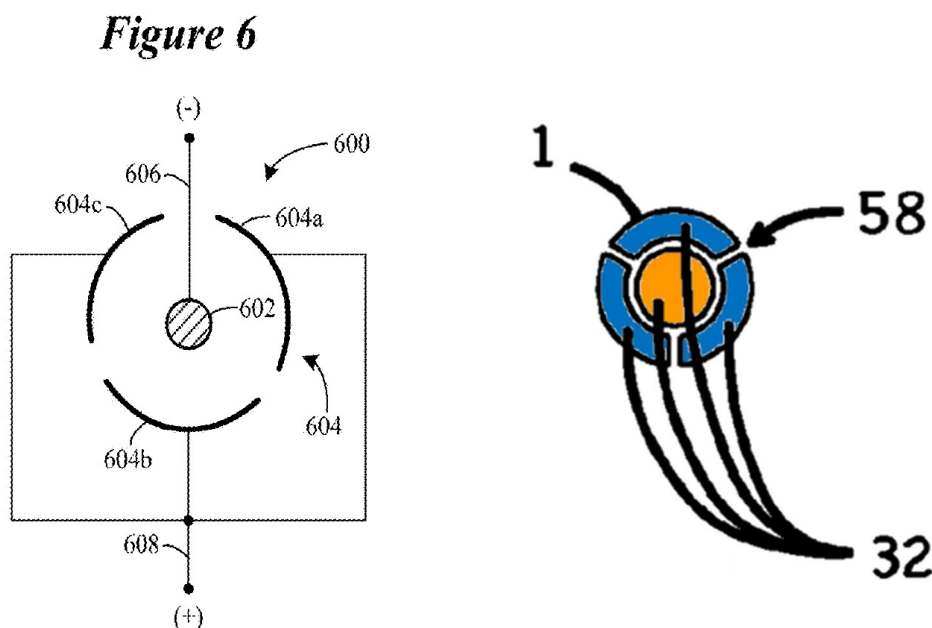
Ex. 1008, ¶ [0044] (emphasis added).

## 5. [4]

284. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 3 (§X.H.4), and the limitation of claim 4. Kwon combined with Wagman and Thiers has a plurality of arcuate contacts (Thiers' three outer "**traces 32**") that have a concentric tri-trace configuration:



285. Ex. 1007, Fig. 1(modified); Thiers' outer “**traces 32**” are a “concentric tri-trace configuration” because there are three of them and they surround central **trace 32**, which is a similar configuration to Fig. 6 of the '553Patent, which the specification describes as a “concentric tri-trace configuration:”

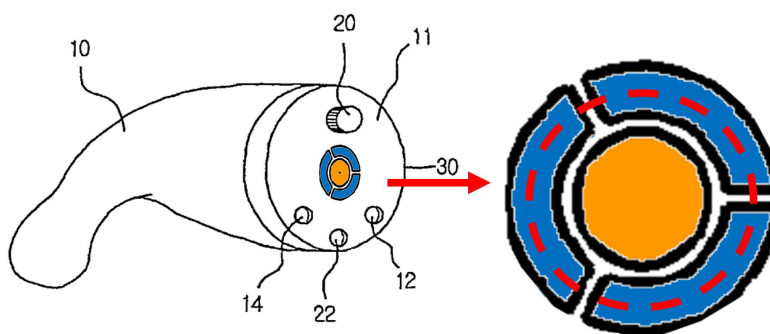


Ex. 1001, Fig. 6 (left), 15:3-21; Ex. 1008, Fig. 3 (right). Thiers further discloses that the three outer **traces 32** “form a ring” and are centered around an “axis of rotation” shared with the central **trace 32**. Ex. 1008, ¶[0045].

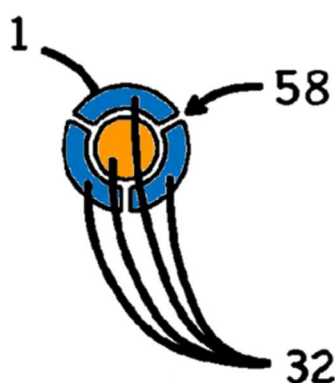
## 6. [5]/[6]/[17]

286. In my opinion, Kwon combined with Wagman and Thiers renders obvious claims 3 and 16 (§X.H.4), and the limitation of these claims. Kwon combined with Wagman and Thiers has a plurality of arcuate contacts (Thiers' outer “**traces 32**”)

arranged around a central contact (Thiers' central "trace 32") wherein each of the plurality of contacts is arranged the same distance from the central contact as each other contact of the plurality of arcuate contacts. The plurality of arcuate contacts (Thiers' outer "traces 32") defines a circle:



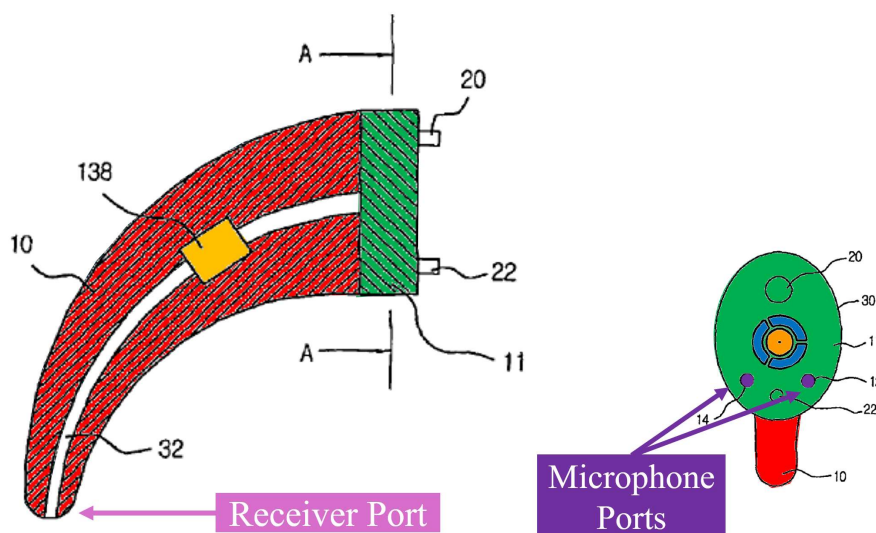
Ex. 1007, Fig. 1(modified); Thiers' Fig. 1 below shows outer "traces 32" are equidistant to central "trace 32" and Thiers discloses outer traces 32 "form a ring around" central trace 32:



Ex. 1008, Fig. 3, [0044-45]; §X.H.2.d.

## 7. [7]/[21]

287. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 1 (§X.H.2), and the limitations of these claims. Kwon discloses one of more microphone ports (“**microphones 12, 14**” ports) disposed in the outer surface of the faceplate (“**faceplate 11**”) and a receiver outlet (**outlet** for “**receiver 138**”) disposed in the shell (“**shell 10**”):

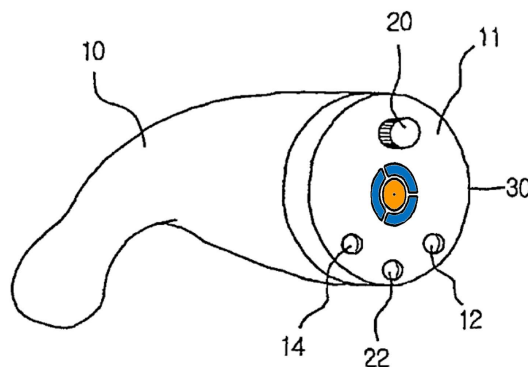


Ex. 1007, Figs. 2-3 (modified); Ex. 1009, Fig. 5. Kwon describes “**microphones 12 and 14** [] are installed on the **faceplate 11**.” Ex.1007, 3:56-59. Further, Kwon discloses “the **receiver 138** is disposed in the middle of the tube 32 in order to output the acoustic signal to an eardrum.” Ex. 1007, Figs. 2, 3, 3:56-59, 4:11-13.

## 8. [8]/[19]/[9]/[18]

288. In my opinion, Kwon combined with Wagman and Thiers renders obvious

claim 1 (§X.H.2), and the limitations of these claims. Kwon combined with Wagman and Thiers discloses the central contact (Thiers' central “**trace 32**”) comprises an annular shape and the at least one arcuate contact comprises a plurality of/three arcuate contacts (Thiers' three outer “**traces 32**”) each arranged at substantially the same distance from the central contact:



Ex. 1007, Fig. 1(modified); Thiers discloses that the central “**trace 32**” is “in the form of a circle,” which is annular, and that the outer “three **traces 32** form a ring around the circle and axis of rotation.” Ex. 1008, ¶¶ [0045]; §X.H.6.

## 9. [10]

289. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 1 (§X.H.2) and the limitations of claim 10. Kwon combined with Wagman and Thiers renders obvious a central contact (Thiers' central “**trace 32**”) that defines a cathode contact and the at least one arcuate contact (Thiers' outer “**traces 32**”) defines an anode contact. Wagman teaches that “[e]arbud interface 245 can transfer

power and/or data between case 204 and the earbuds via case transfer interface 270 in each earbud” and thereby “charge earbuds 202a, 202b.” Ex. 1009, 19:7-9, 19:22-27.

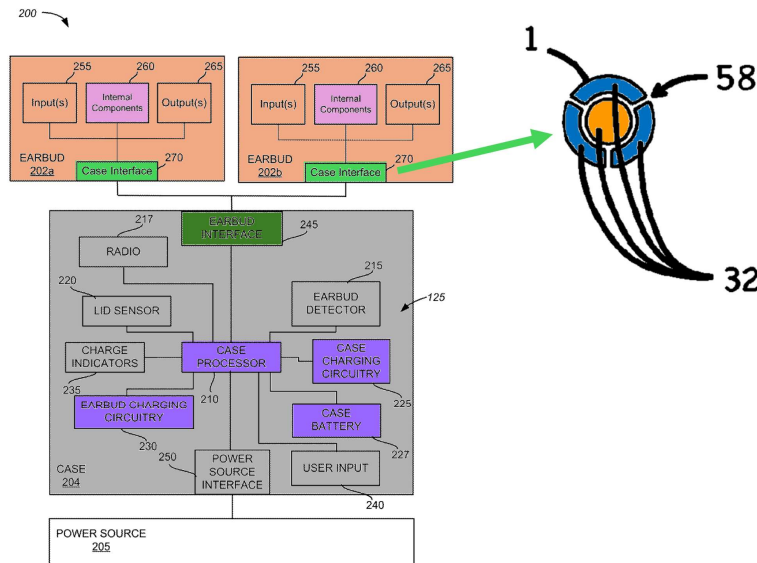


FIG. 2

Ex. 1008, Fig 3; Ex. 1009, Fig. 2; 18:28-36, 18:46-49, 19:4-15, 19:22-30.

290. Because Thiers’ central “trace 32” and outer “traces 32” act as case interface 270 in the combination with Kwon and Wagman, a POSA would have understood that at least one contact must be a cathode and at least one must be an anode in order to complete the charging circuit.

291. In the combination, a POSA would have been motivated to make the central contact a cathode and a surrounding arcuate contact an anode because there were a limited number of ways to arrange the anode and cathode in a four-contact

arrangement, and any of them would have been obvious to try. A POSA would also have had a reasonable expectation of success because Chen had already demonstrated the feasibility of having a central cathode contact and an outer anode contact. §X.A.3.

**10. [11]**

292. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 1. §X.E.2. Kwon combined with Wagman and Thiers renders obvious claim 11 for the same reasons as Chen combined with Thiers. *See* §X.B.10.

**11. [12]**

293. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 1 (IX.H.2) and the limitations of claim 12. Kwon combined with Wagman and Thiers has charging circuitry (Wagman’s “rechargeable battery” and associated “circuitry”) that is coupled to the electrode arrangement (Thiers’ “connector 1”). §§X.H.1, X.H.9-10. POSAs would understand the “circuitry” in Wagman’s earbuds includes charging circuitry because it used to charge a “rechargeable battery:”

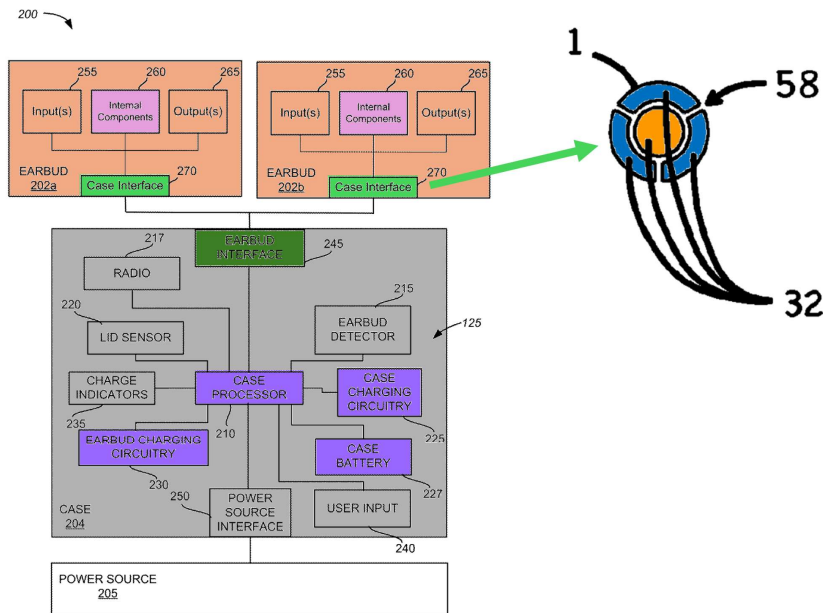


FIG. 2

Ex1008, Fig 3; Ex1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30, Cls. 1, 8, 17.

## 12. [13]

294. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 1 (§X.H.2) and the limitations of claim 13. Kwon combined with Wagman and Thiers has at least one arcuate contact (Thiers’ outer “**traces 32**”) that is configured to communicate power and one or more information signals. As I explained in §X.H.11, when modified, Thiers’ outer “**traces 32**” are coupled to Wagman’s “rechargeable battery” and “circuitry” and configured to communicate power to the “rechargeable battery.” Ex1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30, Cls. 1, 8, 17.

295. Further, Wagman discloses “[d]ata communication between earbud interface

245 and pair of earbuds,” including “transmit[ing] firmware updates to both case processor 210 and pair of earbuds 202a, 202b through the same contacts that are used to charge the devices.” Ex1009, 20:44-21:2, 24:40-42. Thiers also discloses “**traces 32**” could be used to “transmit data and power.” Ex1008, [0002]-[0005].

### 13. [20]

296. In my opinion, Kwon combined with Wagman and Thiers renders obvious claim 14 (§X.H.2) and the limitations of claim 20.

#### a. [20a]

297. Kwon combined with Wagman and Thiers teaches a first charging interface (Wagman’s “**case interface 270**,” which in the combination includes “traces 32” of Thiers’ “connector 1”) comprising the electrode arrangement, wherein the circuitry (Wagman’s “**rechargeable battery**” and associated “circuitry”) of the hearing device comprises charging circuitry coupled to the electrode arrangement. §§X.H.1, X.H.2.f, X.H.11.

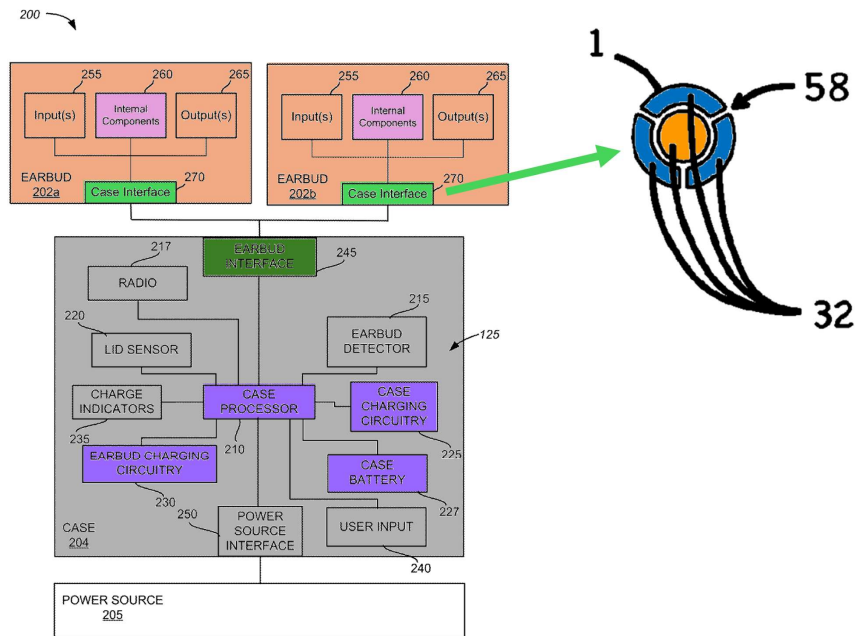


**FIG. 2**

Ex. 1008, Fig. 3 (excerpted); Ex. 1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30, Cls. 1, 8, 17.

**b. [20b]**

298. Kwon combined with Wagman and Thiers teaches the charging interface of the charging module (Wagman’s “**earbud interface 245**”, which in the combination includes Thiers’ “contacts 50”) defines a second charging interface configured to detachably couple with the first charging interface (Wagman’s “**case interface 270**”) of the hearing device:

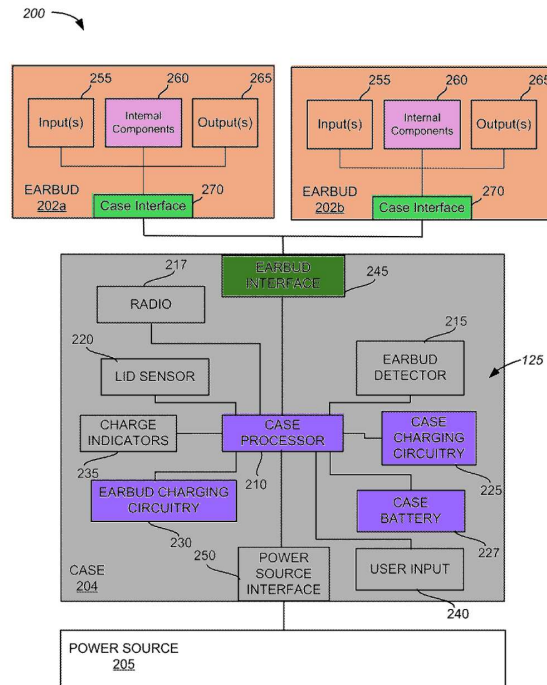
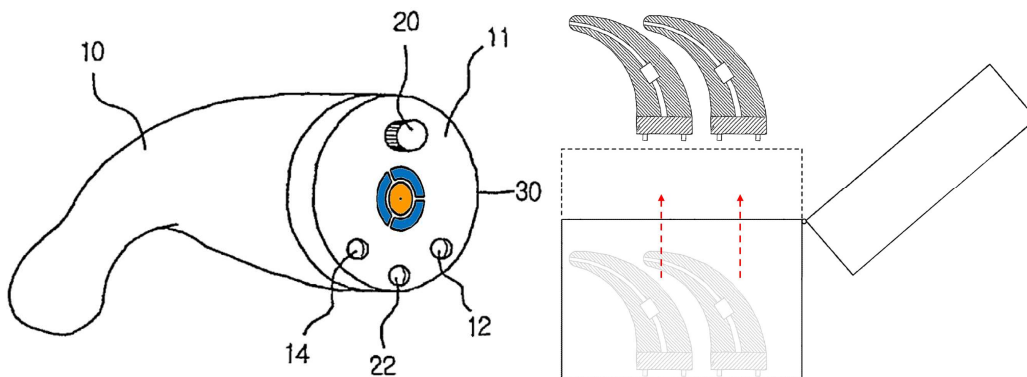


**FIG. 2**

Ex. 1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30; §X.H.1.

299. When combined with Kwon, these surfaces “detachably” couple because Kwon’s hearing aids (which include Wagman’s “**case interface 270**”) are removed from Wagman’s “**case 204**” (which includes Wagman’s “**earbud interface 245**”) when the hearing aid is worn by the user.



Ex. 1007, Figs. 1-2 (modified); Ex. 1009, Fig. 1(modified).

c. [20c]

300. Kwon combined with Wagman and Thiers teaches the charging module (Wagman’s “**case 204**”) further comprises charging circuitry (**case processor 210**, **earbud charging circuitry 230**, **case charging circuitry 225**, **case battery 227**, and associated wiring) coupled to the second charging interface (Wagman’s “**earbud interface 245**”):

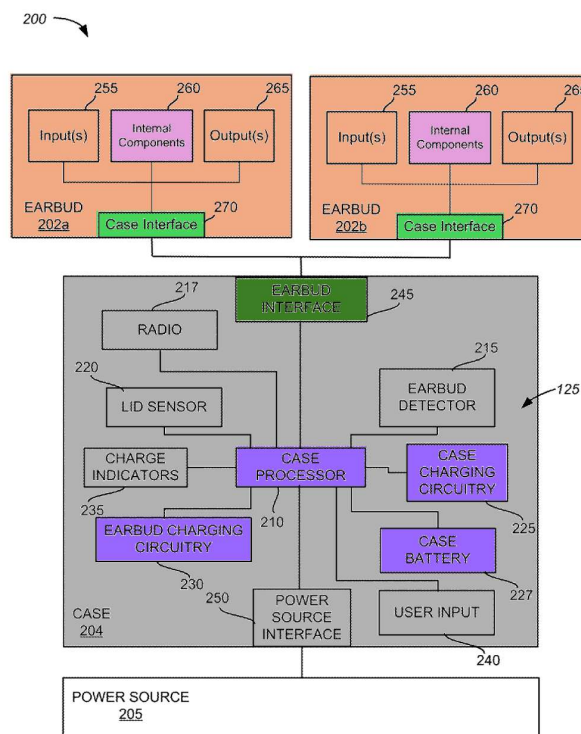


FIG. 2

Ex. 1009, Fig. 2; §X.H.1. Wagman teaches this circuitry works together to charge Wagman’s “**rechargeable battery**” through “**earbud interface 245**.” Ex. 1009, 19:4-15, 19:22-30, 21:43-22:53.

d. [20d]

301. Kwon combined with Wagman and Thiers teaches the charging module (Wagman’s “**case 204**”) is configured to charge a rechargeable power source (Wagman’s “**rechargeable battery**”) of the hearing device that is coupled to the first charging interface (Wagman’s “**case interface 270**”):

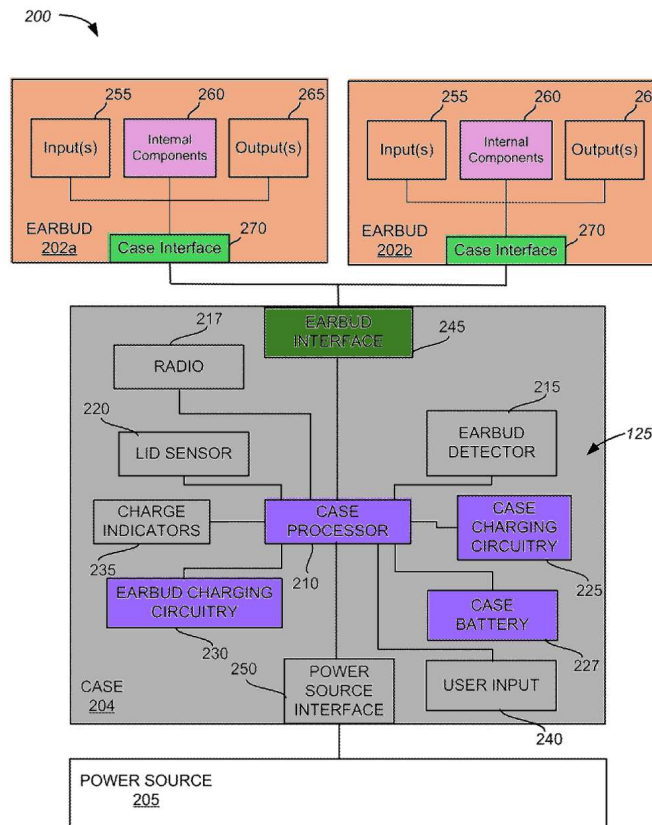


**FIG. 2**

Ex. 1009, Fig. 2, 18:28-36, 18:46-49, 19:4-15, 19:22-30, 21:43-22:53; §X.H.1.

**I. Ground 9: Claims 1-9 and 12-21 Lack Written Description**

302. In my opinion, claims 1-9 and 12-21 are invalid for failing to comply with the written-description requirement of Section 112(a). Independent claims 1 and 14 each

recite “a central contact; and at least one arcuate contact that extends around at least a portion of the central contact.” Except for claims 10 and 11, the claims themselves do not specify what sort of “contact[s]” are central and arcuate (e.g., which might be an anode or cathode), or their role in charging the claimed device. However, the specification consistently identifies that “central contact” creating an electrical-charging connection is a *cathode* contact. There is no disclosure in the ’553 Patent that the central contact is, or could be, an anode contact. In fact, the specification emphasizes that “facilitat[ing] electrical contact between the first and second cathode contacts prior to electrical contact between the first and second anode contacts.” Ex. 1001, Abstract. The specification repeatedly identifies the central cathode and cathode-first engagement as the architecture that constitutes the disclosed charging invention and produces its identified advantages.

303. Despite the claims generically claiming “central” and “arcuate” contacts, the patent’s specification consistently discloses that any central charging contact must be a specific type of electrical contact—a “*cathode* contact”—and that any “arcuate contact” that “extends around at least a portion of the central contact” includes the opposite type of electrical contact—an “*anode* contact.” Ex. 1001, 11:43-61. The patent defines a central “first *cathode* contact” in every embodiment in which the central contact is used for charging, and correspondingly shows a non-central “first anode contact [] spaced apart from the first cathode contact.” *See, e.g.* Ex. 1001,

11:43-61 (discussing Fig. 3, which shows central cathode contact 312 and “spaced apart” anode contacts 314); *see also id.* at 13:4-36 (disclosing, with respect to Fig. 4, central “first cathode contact 412” and non-central “second anode contacts 414, 416”); *id.* 14:57-60 (“When implemented on a hearing device, for example, a region of the *cathode* contact 502 (e.g., *central region*) can be recessed ....”); *id.* 15:3-21, 15:45-19:34, 20:65-21:10, 21:27-43, 22:3-20, 22:34-23:6, 23:25-37 (same disclosure for all remaining embodiments). Further, though the specification discloses embodiments in which outer contacts are “cathode or anode contacts,” the specification does not disclose the claimed “central contact” being an “anode contact” in those embodiments. Ex. 1001, 16:45-17:3, 18:52-67. The specification does not disclose other configurations of the claimed “central contact” as being an “anode contact.” As such, in my opinion, the ’553 Patent’s specification lacks a written-description basis for the Challenged Claims because there is no support for the central contact being an anode, which is captured by the broad scope of the claims.

304. I also note that the ’553 patent purports to “significantly reduce[] or minimize[] spurious electrical spikes in the circuitry, by ensuring that *the cathodes of the hearing devices and charger fixture are connected prior to connecting the anodes.*” Ex. 1001, 9:56-10:7 (emphasis added). Accordingly, the patent describes embodiments in which the “arrangement[s]” of “cathode contacts” enable

“displac[ing] at least a portion of the second cathode contact above the contact surface to facilitate electrical contact between the first and second cathode contacts prior to electrical contact between the first and second anode contacts.” *Id.* at 1:47-65; *see also id.* at 1:66-2:28 (same), 2:29-64 (describing “[a] biasing arrangement” to fulfill the same purpose). And for every embodiment that includes “arcuate contact[s]” (as required by the claims), the specification repeatedly describes the central “cathode contact” on either the “hearing device” or a complementary “charging module” that is “displaceable ... and proud relative to a contact surface of the anode contact.” *Id.* 15:22-34. This repeated arrangement in the specification “ensur[es] a ground (GND) contact *first*,” via the central cathode contacts.

305. Because the patent’s disclosure only discloses a central cathode contact and arcuate anode contacts for charging, and the scope of the Challenged Claims are broader than that disclosure, in my opinion, the claims are invalid for failing to comply with the written description requirement.

#### **J. Secondary Considerations Of Non-Obviousness**

306. I am unaware of any secondary considerations of non-obviousness that indicates that the claims of the ’553 Patent are not obvious. To the extent the patentee argues there are secondary considerations of non-obviousness, I reserve the right to respond.

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

A handwritten signature in cursive script, appearing to read "Sayfe Kiaei".

Signature: \_\_\_\_\_  
Dr. Sayfe Kiaei

Dated: Sept. 20, 2026