

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SUZHOU MOJAWA INTELLIGENT ELECTRONIC CO., LTD.,

Petitioner,

v.

SHENZHEN SHOKZ CO., LTD.,

Patent Owner.

PTAB Case No. IPR2025-00842

Patent No. 11,197,084 B2

**DECLARATION OF MICHAEL SCORDILIS, PH.D. IN SUPPORT OF
PATENT OWNER'S RESPONSE TO PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 11,197,084 B2**

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I. INTRODUCTION

1. I, Michael Scordilis, have been retained by Patent Owner Shenzhen Shokz Co., Ltd. ("Patent Owner") to investigate and opine on certain issues relating to United States Patent No. 11,197,084 B2 ("the '084 patent") in connection with the *Inter Partes* Review (IPR) proceeding. The Petition, filed by Suzhou Mojawa Intelligent Electronic Co., Ltd. ("Petitioner") requests that the Patent Trial and Appeal Board ("PTAB" or "Board") review and cancel claims 1-10 and 12-20 of the '084 patent.

2. The opinions set forth in this declaration are based on my personal knowledge, my professional judgment, and my analysis of the materials and information referenced in this declaration and its exhibits.

3. I am being compensated for consulting services including time spent testifying at any hearing that may be held. I am also reimbursed for reasonable and customary expenses associated with my work in this case. I receive no other forms of compensation related to this case. My compensation does not depend on the outcome of this IPR proceeding or the co-pending district court litigation, and I have no other financial interest in this post-grant review.

4. I understand that the '084 patent has been assigned to Shenzhen Shokz Co., Ltd.

5. This declaration is based on the information currently available to me. To the extent that additional information becomes available, I reserve the right to continue my investigation and study, which may include a review of documents and information that may be produced, as well as testimony from depositions that have not yet been taken.

6. In forming my opinions, I have relied on information and evidence identified in this declaration, including the '084 Patent, the prosecution history of the '084 Patent, and prior art references including the listed Exhibits to the Petitioner's IPR Petition on the '084 Patent (Paper 1 of IPR2025-00842, hereafter "IPR Petition" or "Petition"). I have also considered the IPR Petition and the Declaration of Dr. Chris Kyriakakis (Ex. 1003 of IPR2025-00842). I have also relied on my own experience and expertise in the relevant technologies and systems. I have provided and cited to additional evidence in this declaration beyond the evidence in the Petitioner's IPR Petition on the '084 Patent.

II. SUMMARY OF OPINIONS

7. Based on my review and analysis, it is my opinion that the Petition has not shown that any one of the Challenged Claims of the '084 patent is obvious under any of the Petition's Grounds.

III. QUALIFICATIONS AND EXPERIENCE

A. Education and Work Experience

8. My curriculum vitae, including my education and work experience, is attached to this declaration as Appendix A. In this section, I will summarize some aspects of my education, employment, teaching, and research experience.

9. I have over 40 years of experience in the areas of acoustics, electronics, and signal processing. I started building electronic radio circuits in 1977. That hands-on approach to investigating technical problems continued during my undergraduate studies at the Royal Melbourne Institute of Technology, where I built circuits such as voice scrambling radio transmitters and during my summer work experience where I programmed and built control circuits for farming applications. My practical experience continued during my work as Technical Officer at LM Ericsson where I evaluated, repaired, and modified telephone exchange electronic systems for voice communications.

10. I have over 30 years of academic experience. First at the University of Melbourne (1990-1995) where, as tenured lecturer, I developed and taught several courses in electronics, acoustics, digital signal processing digital speech and audio processing, and supervised several masters theses and doctoral dissertations in the areas of communications and audio and speech processing. I have had visiting scientist positions at Bell Communication Research (Bellcore)

(1994) working on speech analysis and synthesis, at Sun Microsystems (1994) working on microphone arrays for speech recognition, and at the University of Patras, Greece (1995-96) working on acoustics and audio processing research. My academic career continued at the University of Miami (1997-2021) where, as associate professor, I developed and taught several undergraduate and graduate courses in electrical circuits, electronics, linear systems, digital signal processing, electrical and computer design, digital speech and audio processing, and engineering acoustics. I also supervised many senior projects, masters theses, and doctoral dissertations in the areas of audio and speech signal processing, speech and speaker recognition, speech and audio signal enhancement, and audio watermarking.

11. I am also the author of numerous academic research publications that focus on various aspects of electronic devices, machine learning, speaker identification, speech recognition, affective speech processing, speech enhancement, audio watermarking, acoustic filtering, and other audio-related technical areas. In addition, I am the named inventor on at least one United States patent focused on audio watermarking.

12. I have experience with several aspects of audio electronics and structure-borne sound. That experience includes research into speech and hearing signals realized through vibration processes, such as electroglottographic and

otoacoustic emission signal processing, and development of audio detection enhancement in real-world acoustic noise conditions. My research experience includes noise suppression, loudness estimation and acoustic analysis of audio signals in varying acoustic environmental conditions.

13. Numerous projects I have worked on have included: the design of multi-microphone long probe for otoacoustic emissions acquisition, acoustic compensation of miniature speakers in hearing diagnosis and hearing aid applications, and auxiliary channel masking in audio signals which led to the issuing of a patent.

B. Curriculum Vitae

14. A copy of my curriculum vitae is attached as Appendix A to this declaration.

C. Compensation

15. I am being compensated at my standard consulting rate for the services I am providing in this case. The compensation is not contingent upon my performance, the outcome of this *inter partes* review or any other proceeding, or any issues involved in or related to this *inter partes* review.

D. Materials Reviewed

16. The documents on which I rely for the opinions expressed in this declaration are documents and materials identified in this declaration, including

the '084 Patent, patents in the same family as the '084 Patent, the prosecution history for the '084 Patent and the prosecution history for patents in the priority chain of the '084 Patent, the prior art references and information discussed in this declaration, and any other references specifically identified in this declaration, in their entirety, even if only portions of these documents are discussed here in an exemplary fashion.

17. I have also relied on my own experience and expertise in acoustics, signal processing, electrical, electronic and audio circuit design, and acoustic transducer research.

IV. STATEMENT OF LEGAL PRINCIPLES

33. I am not an attorney. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my analysis and opinions.

A. Claim Construction

34. I understand that words of a claim are generally given their ordinary and customary meaning, as understood by a person of ordinary skill in the art ("POSITA") at the time of the invention, while construing to preserve validity in case of ambiguity.

35. With respect to means-plus-function claim terms, I am informed that use of the word "means" in a claim element creates a rebuttable presumption that

the term is a means-plus-function claim term. The presumption is rebutted if the claim term as properly construed recites sufficiently definite structure.

36. I understand that the presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim. Under claim differentiation, there is an especially strong presumption that an independent claim does not require a limitation that is the only meaningful difference between that claim and its dependent claim; otherwise the dependent claim would be superfluous.

B. Written Description

37. I have been informed by counsel that the application for the '084 patent must satisfy the written description requirement of 35 USC § 112. I have been informed that, to satisfy the written description as to a given claim, the disclosure must convey with reasonable clarity to those skilled in the art that, as of the filing date of the patent, the inventor was in possession of the invention as claimed. The written description requirement is satisfied if the later-claimed subject matter is exactly described in the original disclosure, but it does not have to be described exactly if one skilled in the art, reading the original disclosure, would discern the limitation at issue in the claims. A satisfactory description may be found in originally filed claims or any other portion of the originally-filed specification. The subject matter of a claim need not be described literally (i.e.,

using the same terms) in order for the disclosure to satisfy the description requirement. However, the claim must be supported in the specification through express, implicit, or inherent disclosure. The adequacy of the written description is analyzed from the standpoint of one of ordinary skill in the art. Information which is well known in the art need not be described in detail in the specification. However, sufficient information must be provided to show that the inventor had possession of the invention as claimed. My opinion regarding the written description requirement of 35 U.S.C. §112 is based upon this understanding.

C. Enablement

38. I have been informed that a claimed invention is enabled under 35 U.S.C. §112 if the specification teaches those of ordinary skill in the art how to make and use the invention as broadly as it is claimed, without undue experimentation. I have been advised that the assessment of undue experimentation is based on the level of skill in the art as of the effective filing date of the application on which the patents-in-suit claim priority. My opinion regarding 35 U.S.C. §112 enablement is based upon this understanding.

39. I understand that whether one reasonably skilled in the art could make or use the invention from disclosures in the patent must consider the information known in the art. I understand that a patent need not teach what is already well

known. My opinion regarding 35 U.S.C. §112 enablement is based upon this understanding.

D. Indefiniteness

40. I have been informed that patent claim is invalid for indefiniteness if its claim, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.

E. Anticipation

41. I have been informed that in order to anticipate a patent claim, a single prior art reference must explicitly or inherently disclose every feature of the claim. I understand that a prior art reference merely capable of being modified so as to operate in the same manner as the patented device does not anticipate. I understand that, to establish inherency, the missing characteristic must be necessarily present in the single reference, and that it would be so recognized by persons of ordinary skill in the art. I also understand that the missing descriptive material cannot merely be probably or possibly present. I further understand that obviousness is not inherent anticipation, and that it is insufficient that a missing limitation is so similar to a limitation actually disclosed in the reference that one of ordinary skill in the art would see the substitution as obvious. I also understand that, if it is necessary to reach beyond the boundaries of a single reference to provide missing

disclosure of the claimed invention, the proper ground for asserting invalidity is not anticipation, but obviousness.

F. Obviousness

42. I have been informed that an Asserted Claim may be found invalid, although not identically disclosed or described, if the claimed invention is obvious. I understand that an Asserted Claimed invention is obvious when the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains.

43. I have been informed that a patent claim is invalid because it is “obvious” under 35 U.S.C. § 103 if the claimed subject matter would have been obvious to a POSITA at the time the application for patent was filed, based upon one or more prior art references. I understand that an obviousness analysis should take into account (1) the scope and content of the prior art; (2) the differences between the claims and the prior art; and (3) the level of ordinary skill in the pertinent art.

44. I further understand that, in some circumstances, objective evidence or secondary considerations of non-obviousness (such as unexpected results, commercial success, long-felt but unsolved needs, failure of others, copy by others,

licensing, and skepticism of experts) can rebut a prima facie showing of obviousness, but if prima facie obviousness showing is strong enough, the evidence on secondary considerations may be inadequate. I understand that this objective evidence or secondary considerations of non-obviousness is relevant to the issue of obviousness and must be considered.

45. I have been informed that a conclusion of obviousness may be based upon a combination of prior art references. However, I understand that a patent composed of several elements may not be proved obvious merely by demonstrating that each of its elements was independently known in the art. I further understand that there must be an appropriate articulation of a reason to combine the elements from the prior art in the manner claimed, and obviousness cannot be based on a hindsight combination of components selected from the prior art using the patent claims as a roadmap.

46. I have been informed that the following exemplary rationales may lead to a conclusion of obviousness: the combination of prior art elements according to known methods to yield predictable results; the substitution of one known element for another to obtain predictable results; the use of known techniques to improve similar devices in the same way; and some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference teachings to arrive at the claimed invention.

However, a claim is not obvious if the improvement is more than the predictable use of prior art elements according to their established functions. Similarly, a claim is not obvious if the application of a known technique is beyond the level of ordinary skill in the art. Furthermore, when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is not obvious.

47. I have been informed that a prior art reference must be considered in its entirety, i.e. as a whole, including portions that would lead away from the claimed invention.

48. I have been informed that if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the Asserted Claims *prima facie* obvious.

49. I have been informed that when considering a disclosure or reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.

G. Priority Date of the Claims

50. I have been informed that a U.S. patent application may claim the benefit of the filing date of an earlier patent application if the earlier patent

application disclosed each limitation of the invention claimed in the later-filed U.S. patent application. I have also been informed that priority is determined on a claim-by-claim basis so that certain claims of a patent may be entitled to the priority date of an earlier-filed patent application even if other claims of the same patent are not entitled to that priority date.

51. I have also been informed that a patented claim is invalid if the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention, or the claimed invention was described in an issued patent or a published patent application that was effectively filed before the effective filing date of the claimed invention.

V. LEVEL OF ORDINARY SKILL IN THE ART

52. I am not an attorney and offer no legal opinions. I have been informed about certain aspects of the law for purposes of my analyses and opinions.

53. I understand that in analyzing questions of invalidity and infringement, the perspective of a person having ordinary skill in the art ("POSITA") is often implicated, and the Court may need assistance in determining that level of skill.

54. I understand that the claims and written description of a patent must be understood from the perspective of a POSITA. I have been informed that the following factors may affect the level of skill of a POSITA: (1) the educational level

of the inventor; (2) the type of problems encountered in the art; (3) the prior-art solutions to those problems; (4) the rapidity with which innovations are made; (5) the sophistication of the technology; and (6) the educational level of active workers in the field. A person of ordinary skill in the art is also a person of ordinary creativity in the art.

55. Petitioner and Dr. Kyriakakis assert that a person of ordinary skill in the art would have had “a Bachelor’s degree in electrical or computer engineering, or a comparable field of study, plus approximately two to three years of professional experience with acoustic technology. Additional graduate education could substitute for professional experience, and significant experience in the field could substitute for formal education.” Petition, 5; Ex. 1003, ¶¶34-36. For the purpose of this IPR, I adopt the definition proposed by Petitioner. I am at least a POSITA according to this definition, and would have been so at the time of the invention.

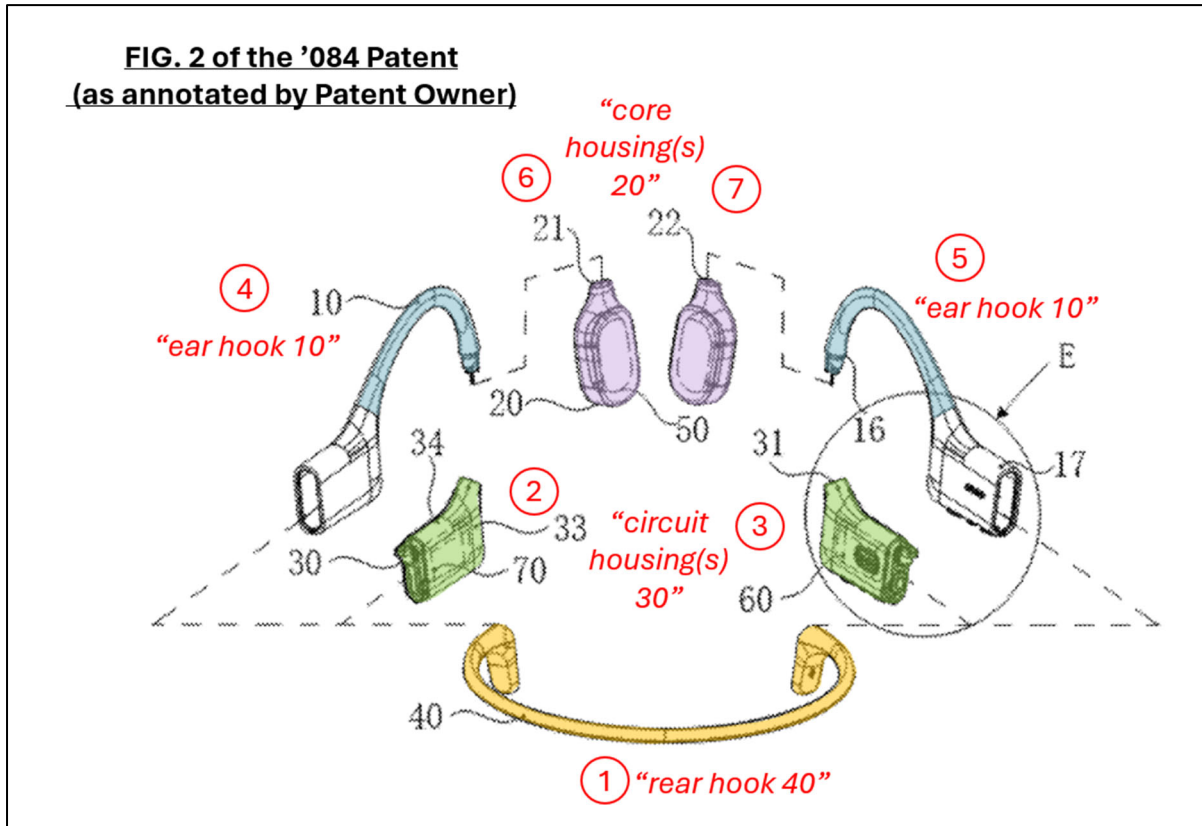
VI. BACKGROUND OF THE CHALLENGED PATENT

A. The '084 Patent

56. The '084 Patent teaches a loudspeaker apparatus, such as an earphone, which may use bone conduction technology. Ex. 1001, Abstract, 5:66-6:1. The '084 Patent notes a desire to provide earphones with a waterproof function so that such earphones can be used in special situations such as swimming and on rainy days. *Id.*, Abstract, 1:14-32. The loudspeaker devices described and claimed by the '084

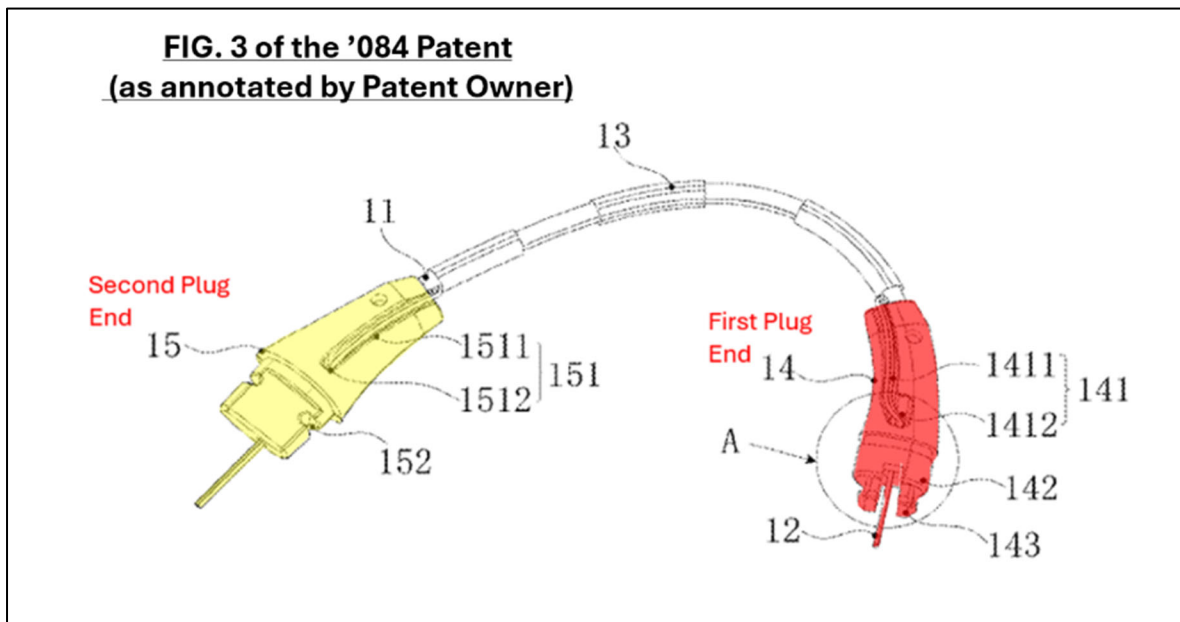
Patent improve upon several aspects of prior bone conduction devices based on (1) a reduction in mold sizes needed for manufacturing due to segmentation and separation of an ear hook component from a core housing component, (2) waterproofing achieved by a protective sleeve “elastically abut[ing] against the core housing,” and (3) sound quality improvement by adjusting the angle between the normal line of the earphone’s panel and the driving force generated by driving device. *Id.*, 36:13-36. These improvements are further described below.

57. The first improvement relates to providing a highly segmented device composed of many (e.g., **seven**) connectable components. *See, e.g.*, Ex. 1001, FIG. 2 (annotated below to show the seven components). Notably, the core housings 20 are segmented and separated from the ear hooks 10, which are also in turn segmented and separated from the circuit housings 30. *Id.*, Abstract, 8:44-9:4, FIG. 2. The rear hook 40 is also a separate component that connects the two halves of the device via the circuit housings 30. *Id.*



58. The '084 Patent describes that the benefits of this highly segmented device lie in each component, such as the ear hook 10 and the core housing 20, being formed with a corresponding mold. Ex. 1001, 11:66-12:3. Specifically, the molds for individual components in this highly segmented design are smaller than a mold for multiple integrated/combined components. *Id.* These smaller molds mean that “the difficulty of mold process” is reduced. *Id.*, 12:2-3. Additionally, as updates or modifications to specific features are needed, “it is sufficient to adjust the mold corresponding to the [specific] structure instead of adjusting the mold of another structure, so as to reduce the cost of production.” *Id.*, 12:3-9.

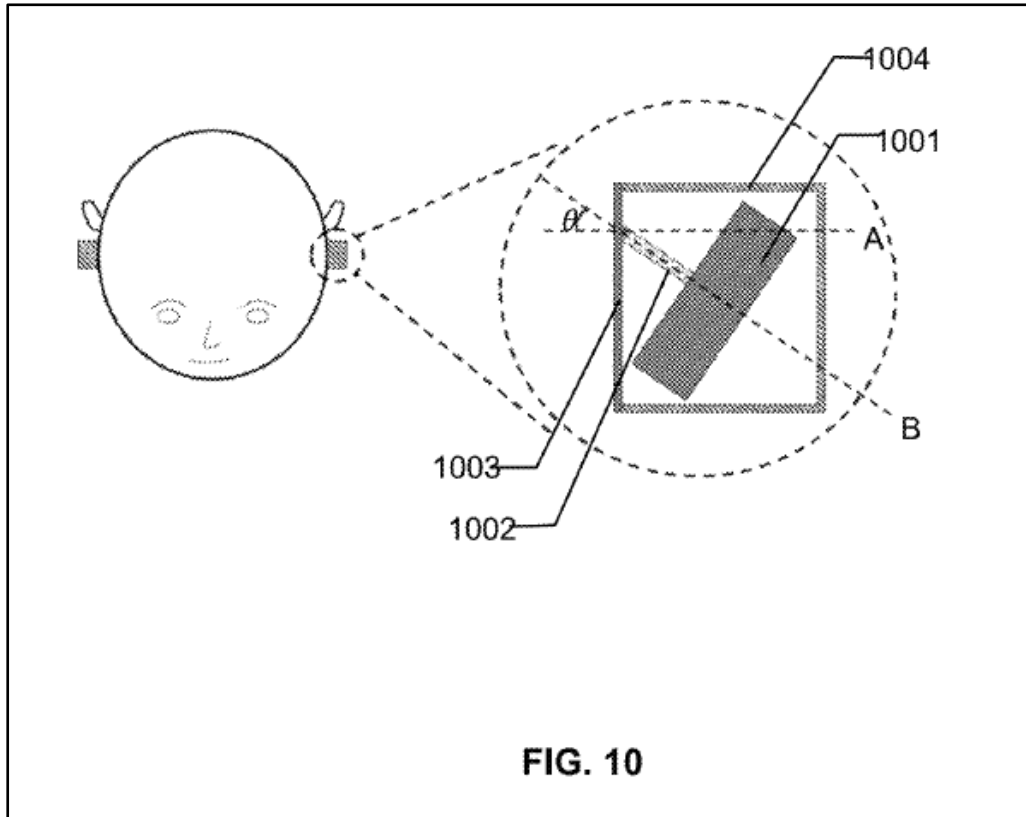
59. In segmenting out an ear hook component for the above-described benefits, the '084 Patent describes an ear hook structure comprising a first plug end 14 (annotated in red in FIG. 3 below) connectable to a core housing and a second plug end 15 (annotated in yellow in FIG. 3 below) connectable to a circuit housing. Ex. 1001, 9:5-9, FIGs. 2, 3, 5.



60. The second improvement relates to waterproofing aspects of the earphone device. The '084 Patent explains that normal earphone devices no longer meet the needs of users “in some special scenes (e.g., swimming, rainy days, etc.)” and seeks to provide earphones with waterproofing function, which are becoming “more popular with consumers.” Ex. 1001, 1:27-30. The '084 Patent explains the need for waterproofing in view of the segmented design of the earphone device, and particularly for the connection location between the ear hook 10 and the core housing

30 (i.e., the first plug end). *See, e.g., id.*, 13:12-67. For instance, the '084 Patent describes the elastic abutment of an ear hook's protective sleeve against the core housing, where the elastic expansion of the protective sleeve *fills and seals* the connection space. *Id.*; *see also* Ex. 1001, 36:13-17.

61. The third improvement relates to sound quality that can be achieved based on “adjusting the angle between the normal line A of the panel or the normal line A' of the contact surface contacting human skin of the panel and the line B of the driving force generated by the driving device.” Ex. 1001, 36:21-26, FIG. 10 (reproduced below). Specifically, this angling of a housing panel with respect to a loudspeaker driver improves the frequency response by improving the sensitivity of the low frequency signals. *Id.*, 22:15-57.



62. Each of the above three improvements is reflected in the claims of the '084 Patent:¹

63. (1) improved manufacturability is reflected in at least elements [1a] and [1c] which recite the segmentation/separation of the ear hook and the core housing;

64. (2) improvements in waterproofing function are reflected in at least elements [1b] and [1c], and particularly with [1c]'s elastic abutment of the protective sleeve and the core housing; and

¹ I am using Petitioner's labels to identify individual limitations of claim 1. *See* Petition, *vi*.

65. (3) sound quality improvements are reflected in at least element [1d]'s housing panel and the driving force generated by the earphone vibration that is not parallel to a normal line of the housing panel.

B. Claim Interpretation

66. I understand that claim terms generally are read in accordance with the ordinary and customary meaning they would have to a POSITA at the time of the invention in light of the claim language, the specification, and the prosecution history. I understand that dictionaries and other extrinsic evidence may be considered as well, though such evidence is typically regarded as less significant than the intrinsic record in determining the meaning of the claim language.

67. Element [1c] of claim 1, which is the only independent claim of the '084 patent, recites:

*[1c] a core housing for accommodating an earphone core,
the core housing being fixed to the first plug end and
elastically abutted against the protective sleeve.*

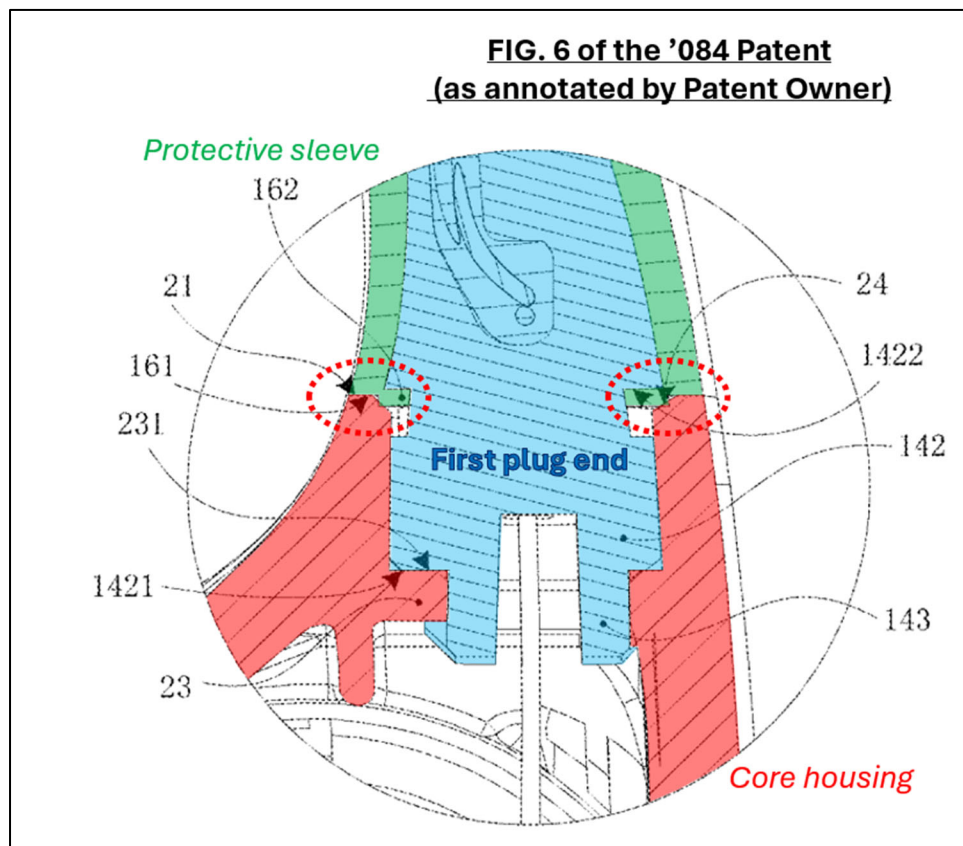
Ex.1001, 36:23-25.

68. This element includes the term “elastically abutted against” in describing that core housing’s connection to the protective sleeve. While I believe that this term should be given its plain and ordinary meaning, based on my review of Dr. Kyriakakis’ deposition testimony and the Board’s decision granting institution, it appears to me that both Dr. Kyriakakis and the Board have interpreted this term in

ways that are inconsistent with the plain and ordinary meaning of the term. For example, Dr. Kyriakakis testified at his deposition that he would understand *any* contact between an elastic material and another surface to be elastically abutting. Ex. 2021, 43:8-48:22. Meanwhile, the Board's Institution Decision appeared to suggest that the term could mean "covering" a portion of an outside surface. *See* Institution Decision ("ID"), 60. Therefore, the Board and Dr. Kyriakakis appear to interpret this term differently, and in my opinion both interpretations fail to account for the actual words in this limitation.

69. The claim itself uses the adverb "elastically" to modify the verb "abutted." Therefore, in my opinion a person of ordinary skill in the art would understand that the claimed "abut[ing]" must be elastic. This is distinct and independent from if the claim had used the adjective "elastic" to refer to one of the components, *e.g.*, the elastic protective sleeve. In other words, it is not enough according to the plain language of the claim that two surfaces are merely in contact if one or both is elastic; they must be elastically abutted as well. In my opinion, a person of ordinary skill in the art would understand that two surfaces are *elastically* abutted when the surfaces are abutted together in a way that causes elastic deformation of one or both surfaces. In this case, claim 1 in an earlier limitation (element [1b]) explains that the protective sleeve is elastic.

70. My understanding is consistent with the descriptions in the specification of the '084 Patent itself, which repeatedly describes the significance of elastic deformation between the core housing and protective sleeve. For example, in Fig. 6, the '084 Patent shows that a portion of the protective sleeve (annular abutting surface 161 and annular boss 162 – annotated in green in FIG. 6 below) fills the space between an end surface 21 of the core housing 20 (annotated in red in FIG. 6 below) and the annular plug surface 1422 of first plug end (annotated in blue in FIG. 6 below) when the first plug end is at least partially inserted into the core housing 20. *Id.*



See also *id.*, 13:14-31 (“***the protective sleeve 16 may be at least partially filled in the space between the annular table surface 1422 and the outer end surface 21 of the core housing 20, and elastically abut against the core housing 20.*** ... the protective sleeve 16 ***forms an annular abutting surface 161*** on the outer end surface 21 of the annular table surface 1422 ***facing the outer end surface of the core housing 20. The annular abutting surface 161 may be the end surface of the protective sleeve 16 facing the core housing 20.***” (emphasis added)); 13:12-14 (“the protective sleeve 16 may extend to the side of the annular table surface 1422 ***facing the outer end surface 21 of the core housing 20.***” (emphasis added)); 13:54-58 (“Specifically, ***when the core housing 20 and the plug end 14 are plugged and fixed, the annular abutting surface 161 and the annular boss 162 may elastically abut against the outer end surface of the core housing 20*** and the connecting slope 24, respectively.” (emphasis added)).

71. The '084 Patent teaches that such elastic abutting improves the “waterproof effect” of the device because “it is difficult for external liquid to enter the core housing 20 from the junction of the protective sleeve 16 and the core housing 20, and further enter the earphone core 50, so as to improve the waterproof effect of the MP3 player, protect the inner functional structure, and extend the lifetime of the MP3 player.” Ex. 1001, 13:19-25, 13:54-67. A person of ordinary skill in the art would understand that this “waterproof effect” occurs because of the

elastic nature of the contact between the two surfaces which forms a seal, and not just because one of the surfaces happens to be elastic. Simply putting an elastic material in contact with another material would not necessarily form such a seal if the contact itself were not elastic.

72. It is also my opinion that not all contact is “abutting.” A person of ordinary skill in the art would understand that “abutting” is different than, for example, surrounding or covering. In the examples that I discussed above, abutting is a contact between an end surface of the housing with the protective sleeve. In my opinion, such description is consistent with how a person of ordinary skill in the art would understand the plain English meaning of “abutting” or “abutted.” The dictionary definition of “abut,” “to touch or end at one end or side,” is also consistent with my understanding. Ex. 2022.

73. Therefore, in my opinion, a person of ordinary skill in the art at the time of the invention, by examining the claim language itself and the accompanying written description, would understand that “the core housing being ... *elastically abutted* against the protective sleeve” describes an end surface of the core housing being in contact with the protective sleeve under an elastic force.

VII. GROUND 1 FAILS TO SHOW THAT CLAIM 1 IS UNPATENTABLE OVER LI AND FUJITA.

74. In my opinion, Petitioner’s Ground 1 fails to show that the claims are invalid as obvious for several reasons. Because the remaining grounds address

dependent claims that depend from claim 1 and rely on combinations that include Li and Fujita to teach the elements of Ground 1, it is also my opinion that the remaining grounds fail for the same reasons.

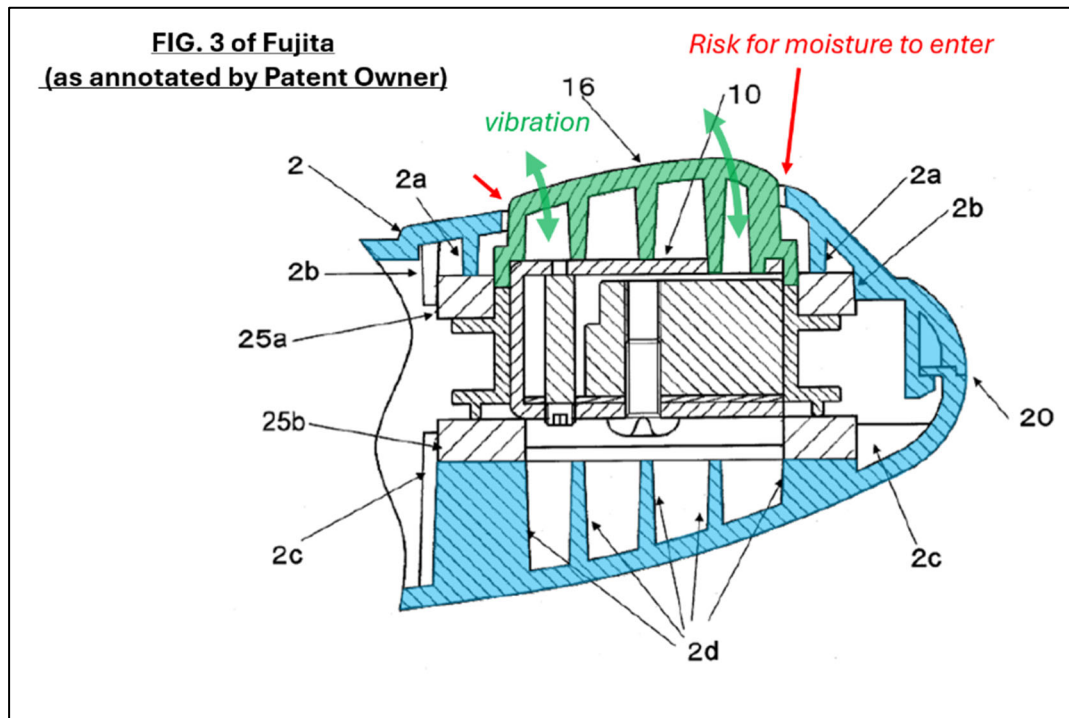
A. A POSITA Would Not Have Been Motivated To Combine Li and Fujita.

75. It is my opinion that a POSITA would not have been motivated to combine Li and Fujita. The Petition asserts that Fujita's speaker would be simply inserted into or used in Li's bone conduction earphone device because Li "lacks details on the bone conduction speaker design." *See* Petition, 20-22; *see also* Ex. 1003, ¶107. However, the Petition does not recognize the significant issues that would arise with such a combination. These issues would make the resultant device inoperable, or at a minimum, would dissuade a POSITA from making the combination. A POSITA also would not have found it obvious using their level of skill and knowledge to implement Fujita's speaker in Li's device.

76. To explain these issues, I first highlight the fact that Fujita's speaker cannot be implemented in Li's device without a fairly substantial ring-shaped gap disconnecting it from any housing. I then explain how this gap would be detrimental to resultant device and how it would have deterred a POSITA from attempting the combination.

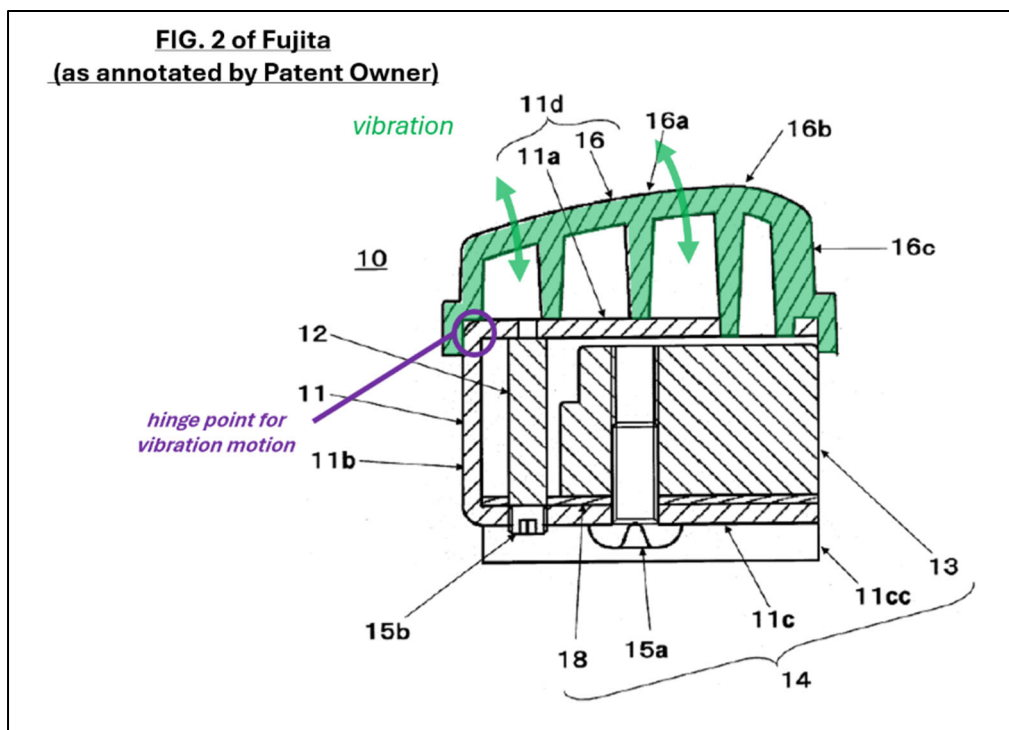
1. Fujita's speaker must be disconnected from Li's housing.

77. In Fujita's disclosure, Fujita's speaker is disconnected from its surrounding housing in order to freely vibrate, and Fujita's speaker must remain freely disconnected to operate even when implemented in Li's device.



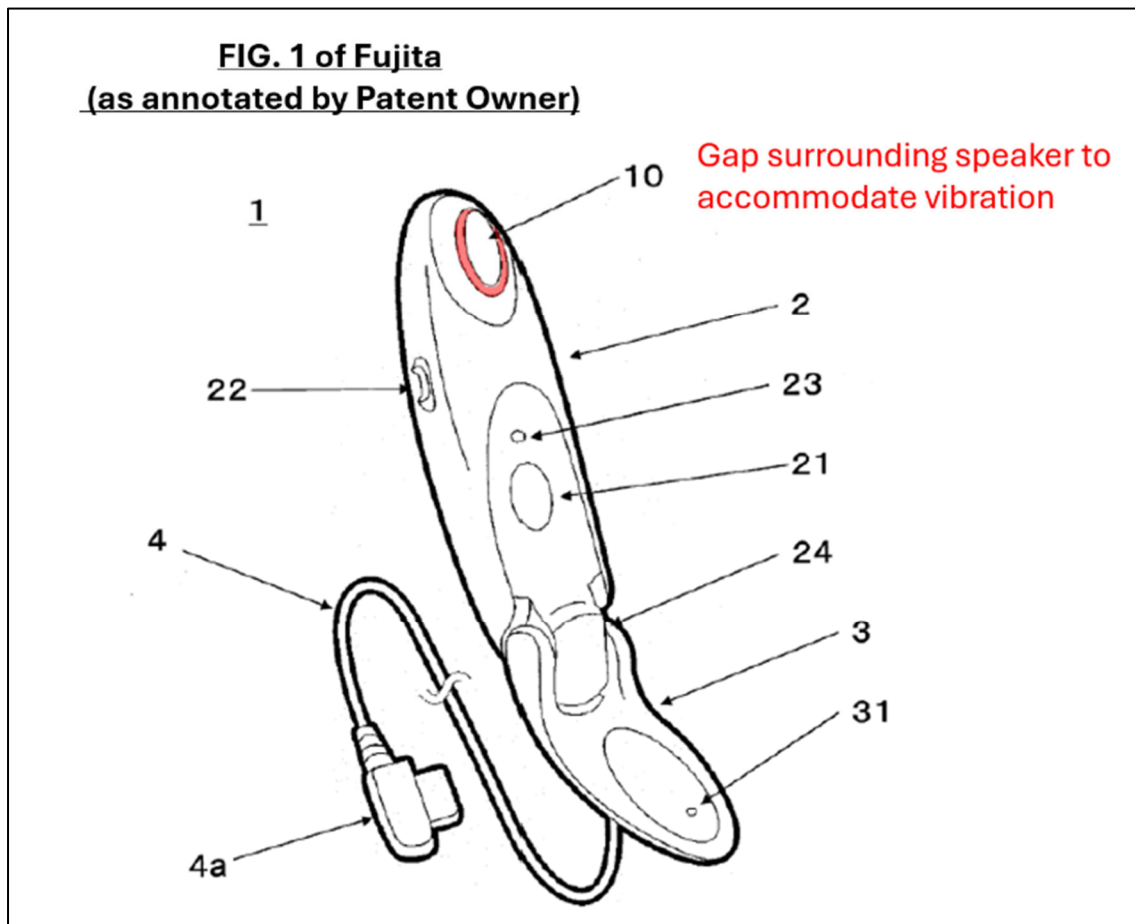
78. Fujita's speaker includes a vibrating cushion (16) that protrudes out of the surrounding casing (2) in order to make contact with the user's skin. Fujita, FIG. 3, ¶28. Because the vibrating cushion (16) needs to vibrate to transmit sound, the vibrating cushion (16) cannot be connected to the surrounding casing (2). *See id.* In particular, as annotated Figure 3 (above) shows, the vibration motion of cushion (16) necessitates a gap between the edges of the cushion (16) (green) and the surrounding casing (2) (blue). *Id.* The vibration motion of cushion (16) is hinge-

like which supports rotational vibration. *Id.*, ¶¶27, 41, FIG. 2 (reproduced below with annotation). In Fujita, during operation the sound projecting cushion (16) needs to vibrate in a manner that is unhindered by the casing (2) which is an integral part of a handheld receiver. For this reason, the cushion cannot be enclosed by the casing and Fujita specifies a gap surrounding the vibrating cushion so that the cushion pivots freely. Petitioner's combination of Li with Fujita must therefore allow for the movement of the cushion (16) and necessarily a gap between the cushion (16) and the earphone's housing (2). *Id.*



79. Because Fujita's speaker must be freely disconnected from its surrounding housing, there would be a substantial gap between Fujita's speaker and its surrounding housing. Put differently, a housing for Fujita's speaker would need

a large hole through which Fujita's speaker cushion protrudes, but Fujita's speaker cushion would not completely fill the large housing hole and leave a gap. FIG. 1 of Fujita (annotated below) shows this substantial gap between Fujita's speaker (10) and the surrounding housing or casing. This gap would also be necessarily present when Fujita's speaker is inserted into Li's core housing.



2. Fujita's speaker being freely disconnected from its housing leads to significant issues when combined with Li.

80. A POSITA would have recognized this gap as a significant waterproofing vulnerability that would be beyond their skill and knowledge to

overcome. Clearly, this gap space would allow moisture to enter the interior portions of the casing compromising the operation of the piezoelectric speaker. Without careful waterproofing, moisture will diminish the acoustic performance of the loudspeaker and it can further crack the ceramic parts of the transducer and corrode the metal parts of the assembly. In particular, water could affect the moving components of the loudspeaker, leading to affected driving precisions and reduced efficiency. In addition, for Fujita's design, maintaining the gap between the cushion and the casing and ensuring the free pivotal vibration of the cushion would deter a POSITA from attempting effective waterproofing for Fujita's speaker.

81. Fujita does not offer any remedy for this; this gap space does not come with any waterproofing solutions, and the vulnerability is simply accepted in Fujita. It is significant to me that Fujita is dated over a decade earlier than Li and is directed to a completely different type and application of audio device. The Fujita audio device is an accessory that is connected via wire to a mobile phone and requires a user to actively hold it by hand. Fujita, ¶¶22-23, 40 (disclosing a connecting wire 4 via which the earpiece device receives electrical signals from a mobile phone), FIG. 8 (showing the earpiece device being held by hand up to the user's head). Fujita's handheld receiver does not work alone but it was designed to be physically connected and controlled by an external device, such a mobile phone, which requires a dry, moisture-free environment. Such arrangements are not suitable for use by

persons moving or exercising in rainy conditions or in water. Adding such functionality would mean waterproofing not only Fujita's receiver but also the wire and its plugs and the connected mobile phone, which is beyond its intended use. These "handset" applications did not prioritize water resistance or waterproofing and contrast with more specialized and later-developed applications, such as swimming or exercise, in which waterproofing requirements arose. I do not believe that Fujita's device was intended for any specialized applications that required waterproofing. Therefore, the entry of moisture through the gap space was not a practical scenario or a design feature that Fujita considered.

82. On the other hand, Li's device appears to be configured for water resistance or waterproofing for use in specialized applications. For instance, Li's device includes wireless capabilities and included ear hooks (Li, Abstract, ¶38) that enabled hands-free use and other applications where waterproofing were needed, as evidenced by Li's disclosure which repeatedly points to waterproofing features such as an elastic coating layer, waterproof screens and waterproof lining boards. *See e.g., id.*, ¶37 (... the first elastic coating layer 1132 is fixed and wrapped around the second housing 112 by injection molding, and covers the through hole 1121, which has a better waterproof effect); *see also, id.*, ¶¶56, 71, 73, 75, Claim 14.

83. As such, by importing Fujita's speaker design into Li's device, the Petition is proposing to change Li's device from a specialized waterproof device to

a non-waterproof device that would not meet the requirements for its intended applications. This would have been illogical and arbitrary to a POSITA. I also note that waterproofing is part of the limitations of claim 1, at least with element [1b] (“the protective sleeve being made of an elastic waterproof material”). So, waterproofing was important and relevant to a POSITA’s consideration if the POSITA were to combine Li and Fujita.

84. I also note that Li’s device includes sound holes in its core housing, but the gap around Fujita’s speaker presents a more difficult and unique waterproofing issue. Li discloses strip-shaped or rectangular sound holes positioned along the core housing, and Li discloses that these sound holes can be covered with “waterproof and dustproof filter screens [that] can prevent dust outside the bone conduction earphone and prevent water from entering the earphone and damaging the bone conduction speaker.” Li, ¶¶51-53, 56, FIG. 8. While Li’s sound holes can be easily covered with a waterproof filter screen, the gap around Fujita’s speaker could not benefit from such a solution. Uniquely, the gap around Fujita’s speaker borders upon a moving and vibrating element (the speaker itself) and is also ring-shaped. A screen would not be suitable for covering this gap, because the screen could not be secured to the vibrating speaker and would also impede the vibration of the speaker. Any other solution for covering the gap around Fujita’s speaker would be well beyond the POSITA’s skill and knowledge.

85. Despite the fact that a POSITA would have immediately recognized this gap issue, the Petition does not address it and provides only superficial benefits to combining Fujita, such as the ability to make “accurate contact with the face” or to contact similar locations on a user’s head. *See* Petition, 21; *see also* Ex. 1003, ¶110. These superficial benefits are mentioned within the context of Fujita’s ***hand-held*** device but have significantly less relevance or no relevance to Li’s ear-secured and hands-free device. Specifically, in contrast to a user continuously holding Fujita’s device by hand during operation, Li’s device simply rests via the ear hooks on the users ear and is less susceptible to moving around. A POSITA would not identify a significant risk with Li’s device missing or losing contact.

86. Moreover, a POSITA would have weighed these superficial benefits against the significant waterproofing issues presented by the Li-Fujita combination. It is my opinion that a POSITA would not sacrifice the waterproofing of Li’s device by incorporating Fujita’s speaker for the sake of making “accurate contact with the face.”

87. It is also my opinion that, as another factor, importing Fujita into Li requires complex sound leakage mitigation considerations that were not obvious to a POSITA. A POSITA would have recognized that the open gap between vibrating speaker and surrounding casing would also lead to unpredictable sound leakage. Given at least the shape of the open gap and the presence of a moving speaker

disposed within the open gap, it would be well beyond the POSITA's ordinary skill and knowledge to manage the leakage acoustic effects from the open gap.

88. For instance, a POSITA with their Bachelor's degree and "approximately two to three years of professional experience with acoustic technology" would face significant difficulties in determining what leakage effects would occur, whether those leakage effects could be mitigated with other sound leakage solutions (e.g., sound holes), whether those leakage effects would disturb or interfere with other sound leakage solutions, and more. I find it notable that the Petition does not discuss sound quality deterioration or sound leakage concerns at all when proposing the importation of Fujita's speaker into Li's device.

89. For these reasons, it is my opinion that a POSITA would not have been motivated to and would not have found it obvious to combine Li and Fujita.

B. Li Fails to Teach or Suggest a First Plug End or the Second Plug End at the Claimed Locations, and Neither does Any of Petition's Interchangeable Modularity Prior Art

90. Claim 1 of the '084 Patent contains several elements relating to the structure of an "ear hook" having first and second "plug ends" in a specific configuration. I have highlighted these elements below in the claim:

1. A loudspeaker apparatus, comprising:

[1a] **an ear hook including a first plug end and a second plug end,**

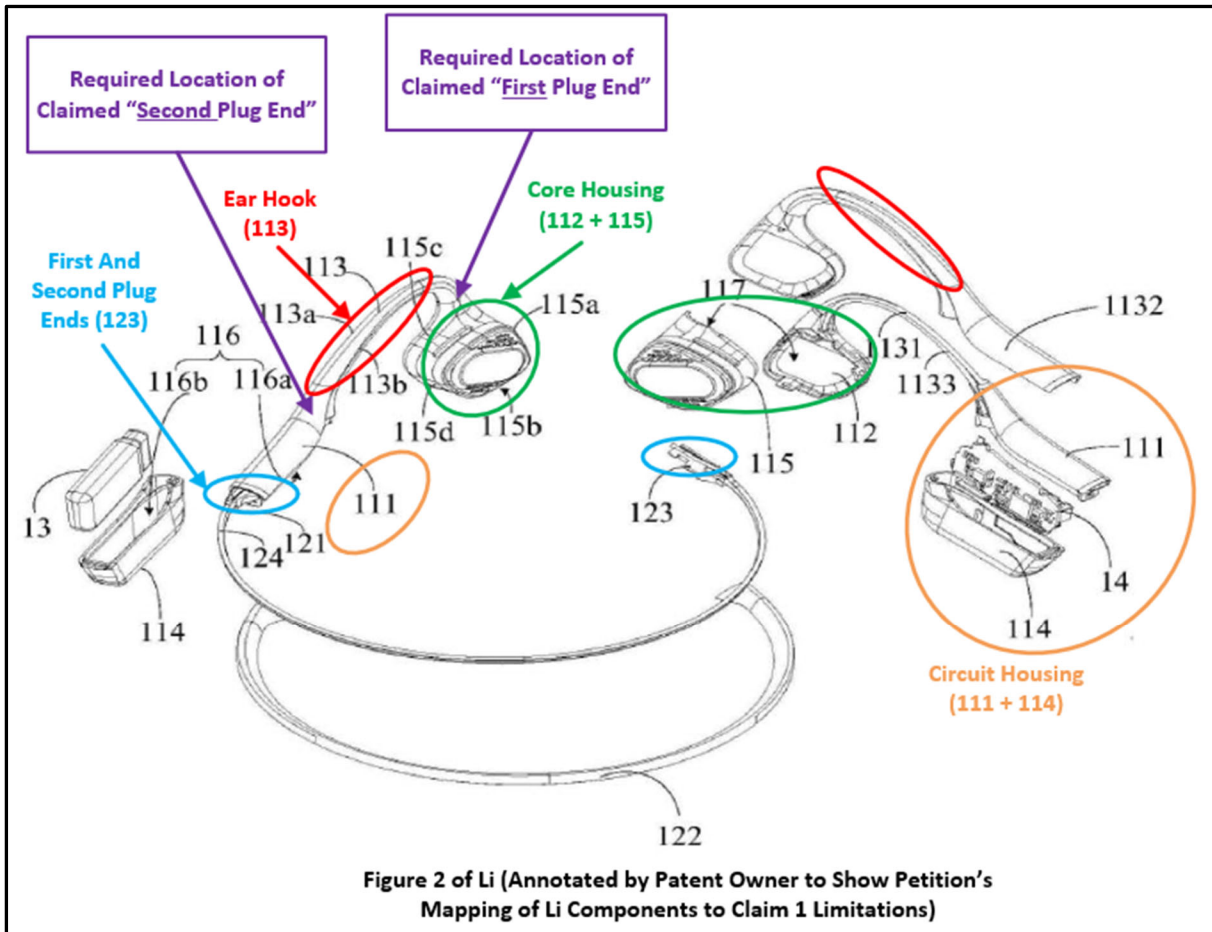
[1b] the ear hook being surrounded by a protective sleeve, the protective sleeve being made of an elastic waterproof material;

[1c] a core housing for accommodating an earphone core, **the core housing being fixed to the first plug end** and elastically abutted against the protective sleeve; and

[1d] a circuit housing for accommodating a control circuit or a battery, **the circuit housing being fixed to the second plug end**, the control circuit or the battery driving the earphone core to vibrate, the vibration of the earphone core generating a driving force to drive a housing panel of the core housing to vibrate, the driving force being not parallel to a normal line of the housing panel.

91. Therefore, when the claim elements are read in combination, these elements recite (among other things) a specific structure with plug ends at both ends of an ear hook, one of which is fixed to a core housing and the other of which is fixed to a circuit housing. Li does not teach or suggest these elements either individually or in combination, nor would this specific inventive combination be taught by the Petitioner's interchangeable prior art references.

92. The annotation below shows how Petitioner maps various components of Li to the requirements of claim 1 of the '084 Patent. *See* Petition, 24-30, 32-35; *see also* Ex. 1003, ¶¶117-121.



93. As shown above, Li does not teach the “plug ends” having the required configuration. The “plug ends” that Petitioner points to are not on an ear hook, but rather on a “rear hook” or “rear suspension assembly” 12. This “rear hook” or “rear suspension assembly” connects the two sides of the headset. Li, ¶69. It is not an ear hook. Meanwhile, Petitioner identifies a “connecting component” 113 as the ear hook; however, this component does not have plug ends. Rather, the ends of the connecting component 113 that Petitioner identifies as the “ear hook” are permanently joined to the housings at both ends that Petitioner identifies as the “core housing” (112 + 115) and “circuit housing” (111 + 114) by injection molding.

94. The Petition appears to acknowledge these shortcomings but asserts that “it would have been obvious for a POSITA to add an ear hook including a first plug [and a second plug] end to Li [at the claimed locations] ... given that modular speaker portions of headsets were well-known as of the priority date of the '084 Patent.” *See* Petition, 27, 28. I disagree. As a general matter, a person of ordinary skill in the art would not simply jump from the general idea that some headsets used modular speaker portions to the specific configuration claimed by the '084 Patent. The mere possibility of creating a modular headset does not explain why a person of ordinary skill in the art would duplicate the plug-in portions taught by Li into particular locations.

95. Nor would the reasons for Li's use of plug-in portions 123 at the ends of the rear suspension assembly apply at other parts of the headset. The plug-in portions connect the assemblies on each ear with the much longer band that connects the two assemblies on opposite sides of the user's head together. A person of ordinary skill in the art would recognize that some type of joining structure at that location is necessary due to the size of the entire headset and the impracticality of forming the entire headset as a single injection-molded unit. That rationale does not apply with the same force to the individual ear assemblies; indeed, Li itself teaches that the connecting hook 113 and the assemblies on either side of it can be formed as a single injection-molded unit. *See, e.g.,* Li, ¶29.

96. While '084 patent explains that the cost of such a structure could be reduced with the patented plug structure to reduce the size of injection molding assemblies, that rationale is not even hinted at in either Li or any of the other prior art cited by Petitioner.

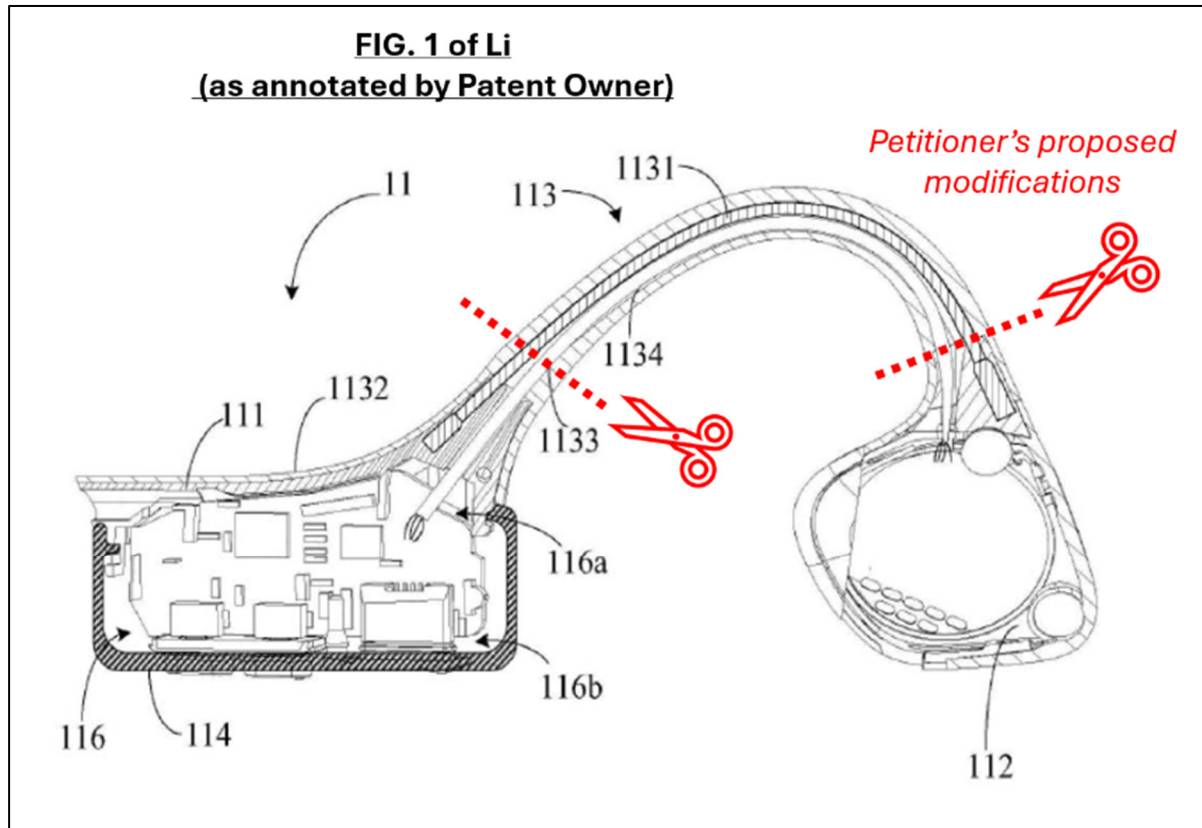
97. Petitioner's assertions are flawed for several additional reasons as further explained below.

1. A POSITA would not have found it obvious to add additional segmentations to Li's configuration in contradiction to Li's teachings related to structural stability of its design.

98. In my opinion, a person of ordinary skill in the art would not have been motivated to substantially redesign Li's compact and lightweight structure to add plug ends in different portions. The question is not just whether some headsets had some type of modular design, but whether a person of ordinary skill in the art would have had any reason to modify Li's headset in the particular way that is described in the claims. In my opinion, a person of ordinary skill in the art would have looked at all of Li's teachings. As I discussed above, Li emphasizes structure integrity and expressly teaches that its intent is a strong, lightweight integrated design, not a "modular" design that would add bulk, complexity, and expense.

99. The Petition's proposed modification to Li's earphone design would have required, on each side of the earphone, to cut the connecting component 113—

an integrated single-piece component—into three segments, as illustrated in FIG. 1 of Li below.



100. Li already describes how the relevant components can be connected to achieve its desired goals of a strong, compact, lightweight structure: “***the first housing 111 and the second housing 112 are fixedly connected to both ends of the first elastic metal wire 1131 by injection molding.***” Li, ¶29 (emphasis added). As Li explains, this type of integrated design improves the structural stability of the earphone. *Id.*, ¶34 (“...the first housing 111 and the second housing 112 are ***formed by injection molding and fixed to the two ends of the first elastic metal wire 1131*** arranged in a flat shape ... ***making the first elastic metal wire 1131 and the first***

housing 111 and the second housing 112 more stably fixed to each other.”

(emphasis added)).

101. In my opinion, a person of ordinary skill in the art would have recognized that improving structural stability of the bone conduction earphone was a significant theme through Li, and would have had this goal in mind when evaluating whether to make significant structural modifications to Li's design. Li, ¶26 (“...effectively enhance the bending performance and **structural stability** of the bone conduction earphone...”), ¶29 (“...makes the connection ... more stable, and enhances **the sense of unity** and texture of the bone conduction earphone...”), ¶35 (“making the first elastic metal wire 1131 and the first housing 111 and the second housing 112 **more stably** fixed to each other”), ¶62 (“...enhancing the **structural stability** of the bone conduction earphone”).

102. In my opinion, neither the Petition nor Dr. Kyriakakis provides a coherent explanation why a person of ordinary skill in the art would disregard these teachings of Li to break Li's unitary structure into three segments. *See* Petition, 24-30, 32-35; *see also* Ex. 1003, ¶¶117-121. In my opinion, a person of ordinary skill in the art would have understood that breaking up Li's unitary structure into three modules on both the left and right side of the headphones would introduce a number of challenges to proper operation of the device. Breaking the unitary, continuous molding and connecting the resulting sections using plugs would weaken the unit's

structural integrity by making the constituent parts prone to relative displacement. This is a particular risk when the user is involved in physical activity such as jogging, running or swimming, which are some typical uses of such headphones. The resulting shaking would present serious challenges to the structural integrity of a modular structure. Further, it could affect the electrical connectivity of the modular parts therefore introducing parasitic noise or even sound breaks. Therefore, in my opinion, the mere knowledge of modular designs in general would not have made it obvious to a POSITA to arbitrarily add additional junctions and create multiple segments in Li's connecting component 113. Indeed, none of the Petition's interchangeable modular prior art (i.e., the additional references in Exhibits 1011, 1012, 1013, 1014, 1015, 1016, and 1019 of the Petition) teaches or even suggests segmentation of an earphone at the claimed locations. Therefore, in my opinion, a person of ordinary skill in the art would not have modified Li's design in the manner suggested without the benefit of hindsight from the '084 Patent itself.

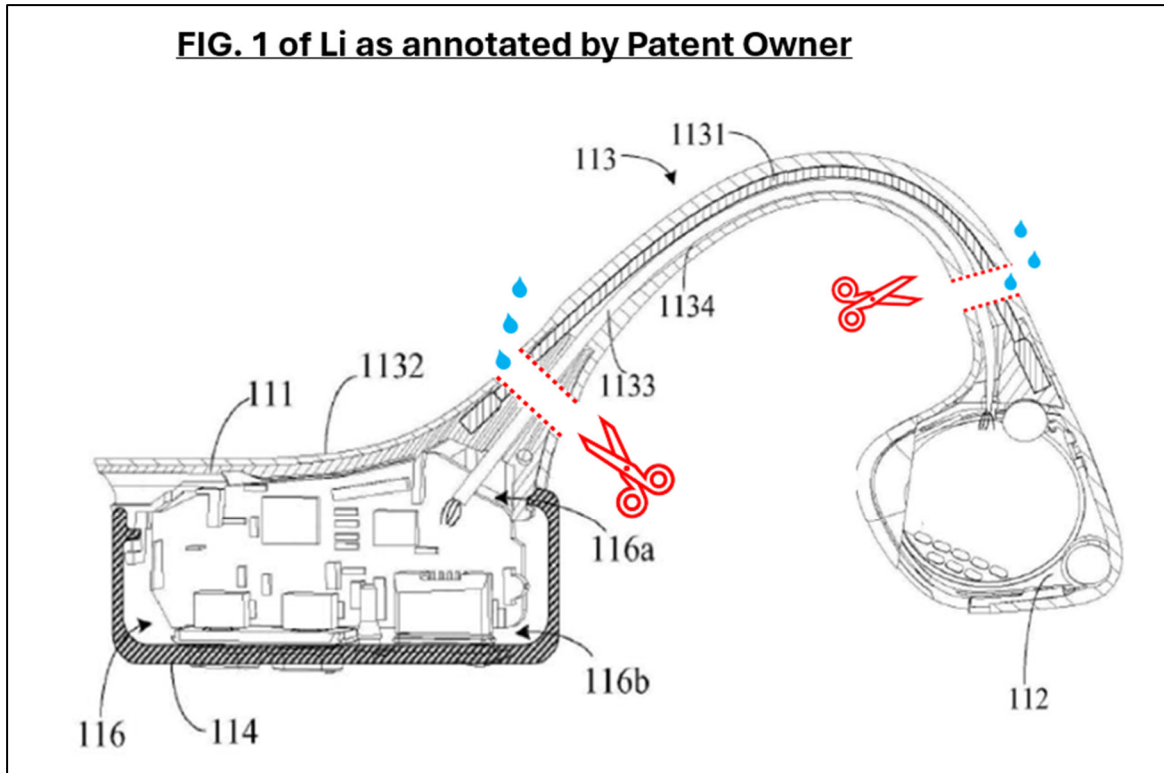
2. A POSITA would not have found it obvious to add additional segments to Li's configuration because of waterproofing concerns.

103. In my opinion, separation of an integrated structure into multiple components, as the Petition proposes, would have run contrary to Li's teachings to create a waterproof or water-resistant device because the added component junctions would have increased the number of openings and points from which water could

have entered the internal portions of the structure. Any gaps or junctions between components create additional risk in a waterproof or water-resistant design because each such point is another possible entry point for water. Li teaches minimizing the number of such entry points by integrally forming the covering over large portions of the structure.

104. Specifically, Li teaches advantages of the unitary design of its elastic coating layer 1132 that “fixedly wrapped around the first elastic metal wire 1131 by injection molding” (Li, ¶29), further covering the surfaces of the housings 111 and 112 (*id.*, ¶36), and providing a waterproofing mechanism. *Id.*, ¶37; *see also id.*, FIG. 1 (showing uniform coverage of coating layer 1132 over Li’s entire hook assembly and adjacent housings); *see also*, Petition, 35 (“Li acknowledges the benefits of having a coating of the protective sleeve ***over the entirety*** of the ear hook and the core housing, such as wear-resistance”).

105. Again, the Petition’s proposed modifications would have segmented the one-piece design of element 113 to produce three separate sections, as shown in Patent Owner’s annotations to FIG. 1 of Li below. These modifications, however, would have necessarily created multiple seams in the elastic coating layer 1132, which would have increased the risk of water or moisture to seep through into the electronic components of the earphone.



106. This problem is even more acute when considering that the Petition's justifications for modifying Li's structure revolve around making the structure "interchangeable" or "modular," *i.e.* making so that pieces or components of the structure can be taken apart, put back together, swapped out, replaced, etc. *See* Petition, 25-27; *see also* Ex. 1003, ¶118. The risk that I discussed above of seams or interfaces between components allowing water to enter is significantly greater when those interfaces are taken apart and put back together again. It is notable that none of the seven "interchangeable" references cited by the Petition relate to a waterproof device or how their modular components might be waterproofed. None describe segmentation of an earphone at the claimed locations or address waterproofing issues that result from such modifications.

107. In my opinion, the adverse effects of a Petitioner's proposed segmented structure would have been even more pronounced in Petitioner's purported combination of Li with Fujita, where Li's housing 112 would contain Fujita's piezo-based speaker. *See* Petition, 20-22.

108. As I have discussed above, Fujita's speaker relies on a speaker design that necessarily creates a gap in the speaker itself between the "hinge" portion of the speaker driven by a piezoelectric element and the casing of the speaker. Fujita, ¶¶25-27. In my opinion, water entering into Li's housing 112 would have affected the conduction of signals for Fujita's piezoelectric element. Furthermore, because Fujita's speaker relies on a specific hinge-like vibration motion driven by the piezoelectric element (Fujita, ¶¶36-38), moisture within the speaker housing 112 would have dampened the vibration motion and affected the speaker's sound quality.

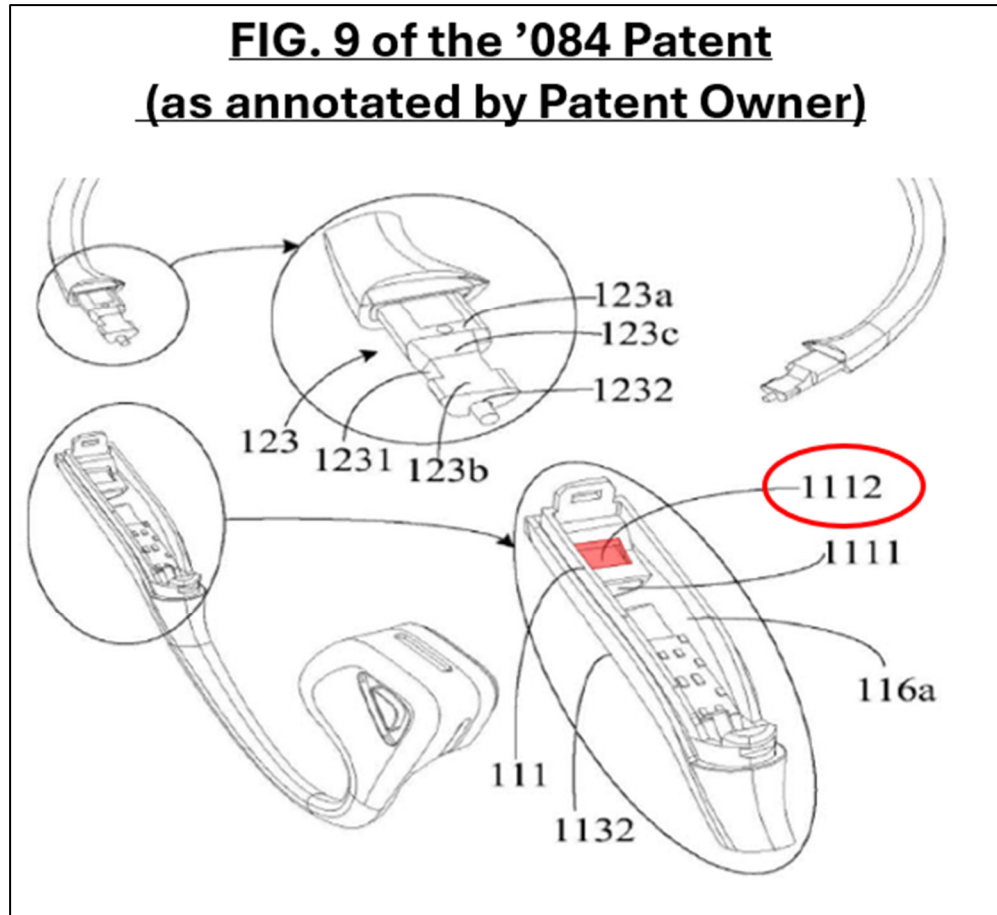
109. Accordingly, it is my opinion that the Petition fails to show that a person of ordinary skill in the art would have had a motivation to add the necessary additional "plug ends" into Li's waterproof structure.

3. Li's preference for a fixed and unitary structure is incompatible with the general benefits of interchangeable modularity.

110. It is my understanding that the Petition uses the seven references to demonstrate the general concept of interchangeable modularity. For instance, I note that Dr. Kyriakakis stated in his deposition that this was his intention and that the

analysis in his original declaration does not rely upon any of the seven references for a specific plug connection and location. Ex. 2021, 77:4-13, 81:24-82:15. However, it is my opinion that this general concept of interchangeability of modular portions is incompatible with Li, which teaches permanent connections fixed at assembly.

111. As explained above, a major theme throughout Li's description is structural stability. Li mentions "fixedly connected," "more stably fixed," "formed by injection molding and fixed," and more. *See* Li, ¶¶29, 34 (emphasis added); *see also id.*, ¶¶26, 35, 62. Consistent with this theme, Li discloses permanently securing its plug connections with adhesives and locking pieces. *See id.*, ¶¶60, 61. Specifically, Li discloses an opening (1112) in the housing (111) receiving the plug-in portion (123) "to allow the application of adhesive or the installation of a locking piece ... into the plug-in hole 1111 from the outside via the opening 1112, so that the plug-in portion 123 is fixed in the plug-in hole 1111 under the action of adhesive or locking piece." *Id.*; *see also id.*, FIGs. 9-10 (annotated below).



112. Teachings of adhesives and locking pieces is inherently inconsistent with the principle of interchangeability, which encourages the freedom to swap modular components with whatever and whenever. Part of the interchangeability principle is reversibility of connections to allow for the freedom to swap whenever and later, but Li does not teach (nor would a POSITA understand) that the application of adhesives and locking pieces for its plug connection would be reversible.

113. Therefore, it is my opinion that a POSITA would not have found it obvious and would not have added more plug connections at more locations in the Li device based on deriving an understanding of interchangeability from Li.

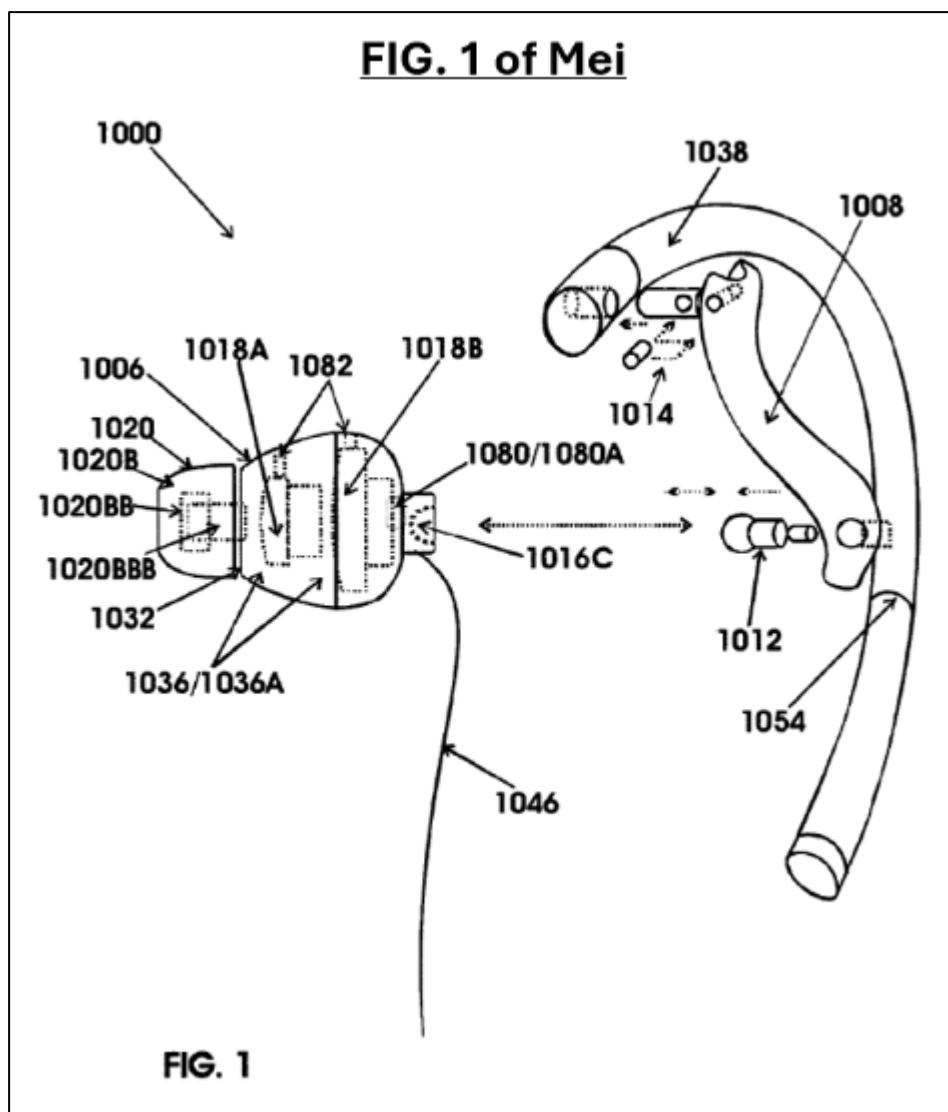
4. None of the interchangeable modularity prior art describe end plugs at the claimed locations.

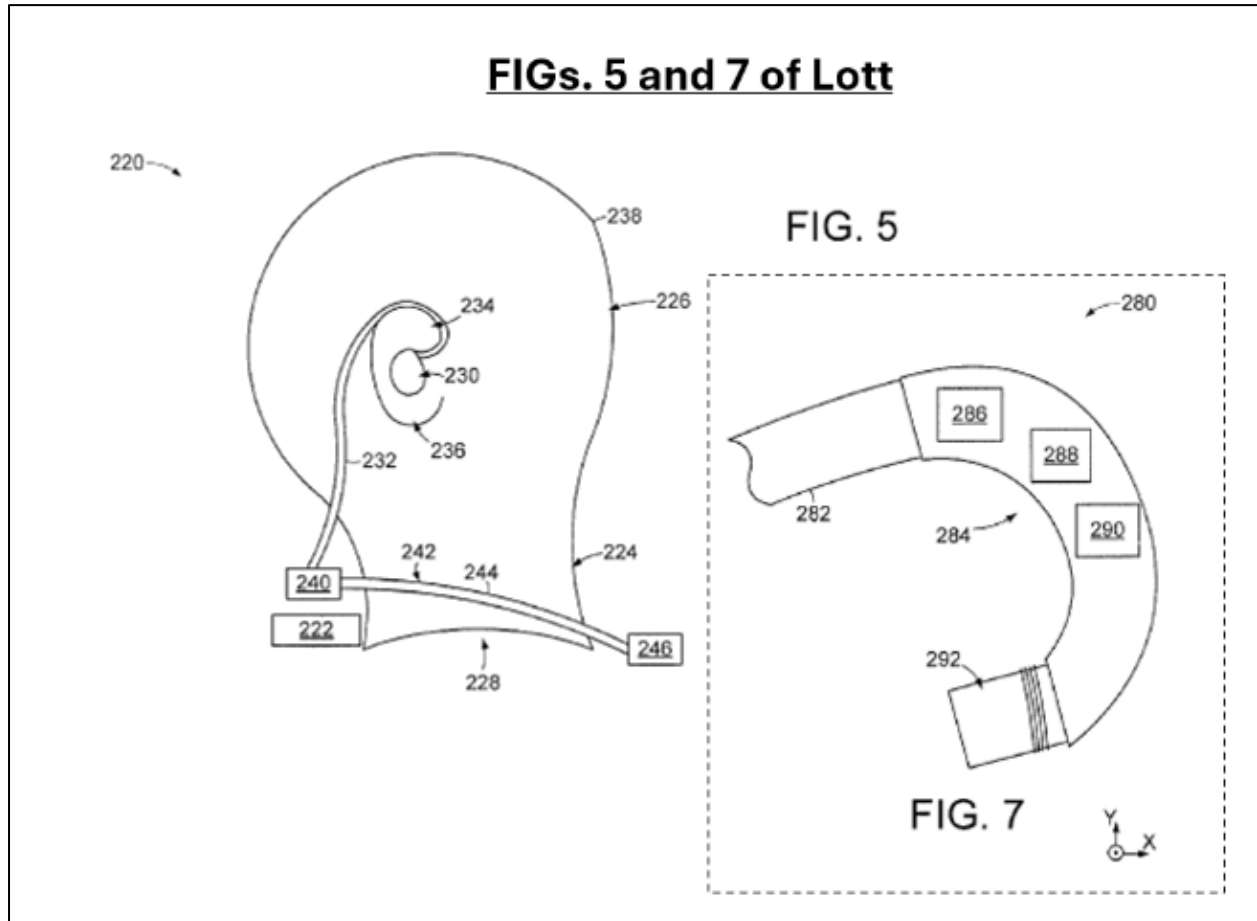
114. It is also my opinion that the Petition fails to show plug ends at the locations required by the claims, *i.e.* at opposite ends of an ear hook joining the ear hook to a core housing and a circuit housing. The Petition and Dr. Kyriakakis rely on very general assertions that the general principle of modularity was purportedly well-known. *See, e.g.*, Petition, 19-20, 25-30; *see also* Ex. 1003, ¶118. For example, the Petition, in connection with some of the “interchangeable” prior art references, argues as follows “The speaker portions were modular for various reasons, such as component replacements and removability, upgrades, and reducing manufacturing and production costs due to the simple shape of components.” Petition, 26. But the Petition does not explain whether or how those considerations apply to or would improve Li’s earphone design, and does not rely on any of the interchangeable prior art references to show the claimed invention: an ear hook component separated on both ends from a core housing and a circuit housing. Petitioner merely argues that “speakers were modular for various reasons” and that “control circuit and/or battery portions were modular for various reasons.” *See id.*, 19-20, 25-30. None of these

“various reasons” explains why a person of ordinary skill in the art would have chosen to place a specific type of plug at a particular location, as Petitioner argues.

115. It is my opinion that none of the “interchangeable” references discloses the claimed “plug ends” at the required locations. Petitioner does not even appear to argue that they do; however, I will explain why they do not. Of the seven “interchangeable” prior art references, five of the references fail to disclose any component that even resembles an ear hook component at all: Hupkes (Ex. 1011) and Dyer (Ex. 1012) are directed to in-ear earbuds; Chen (Ex. 1014) and Bellas (Ex. 1016) are directed to over-ear headphone earcups; and Eggebraaten (Ex. 1019) is directed an audio cable input jack.

116. Of the two remaining references, Mei (Ex. 1013) discloses an ear band unit (1038), and Lott (Ex. 1015) discloses an auxiliary ear hook extension (280). *See* Mei, FIG. 1 (reproduced below); Lott, FIGs. 5, 7 (reproduced below).





117. Neither Mei's ear band unit nor Lott's ear hook extension teach the claimed configuration of a separate ear hook component with opposite plug ends fixed to adjacent housings. Mei's in-ear speaker connects to an ear hook via a socket junction 1012 at the middle of the ear hook, which is only used for support. Mei's ear hook does not connect a circuit housing and a core housing at opposite ends, nor does it provide an electrical connection between them. As for Lott, the only embodiment with an ear hook 280 simply ends in a wire 282 rather than a plug connecting to a circuit housing. It is significant to me that although the Petition makes sweeping statements about how well-known modular components of headsets

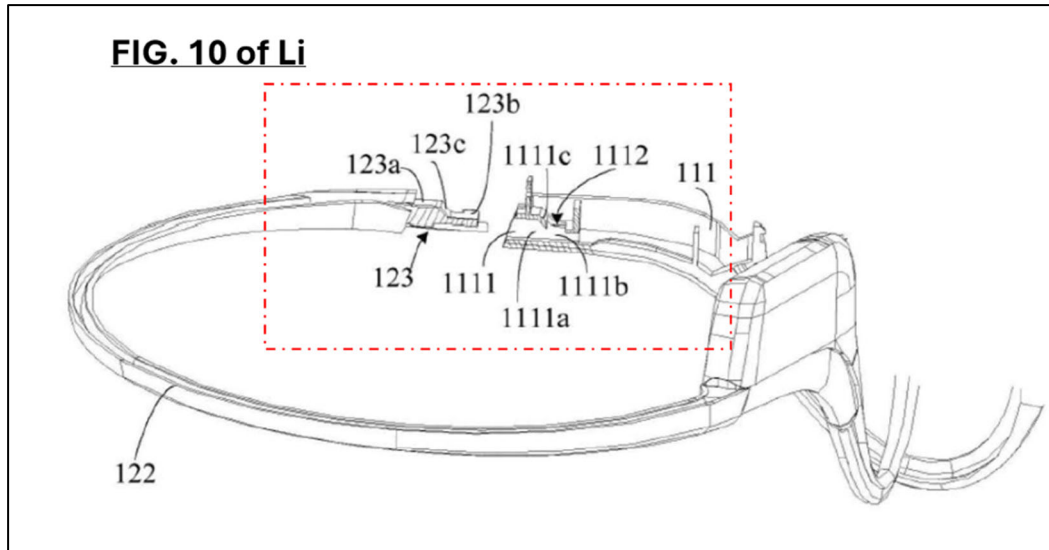
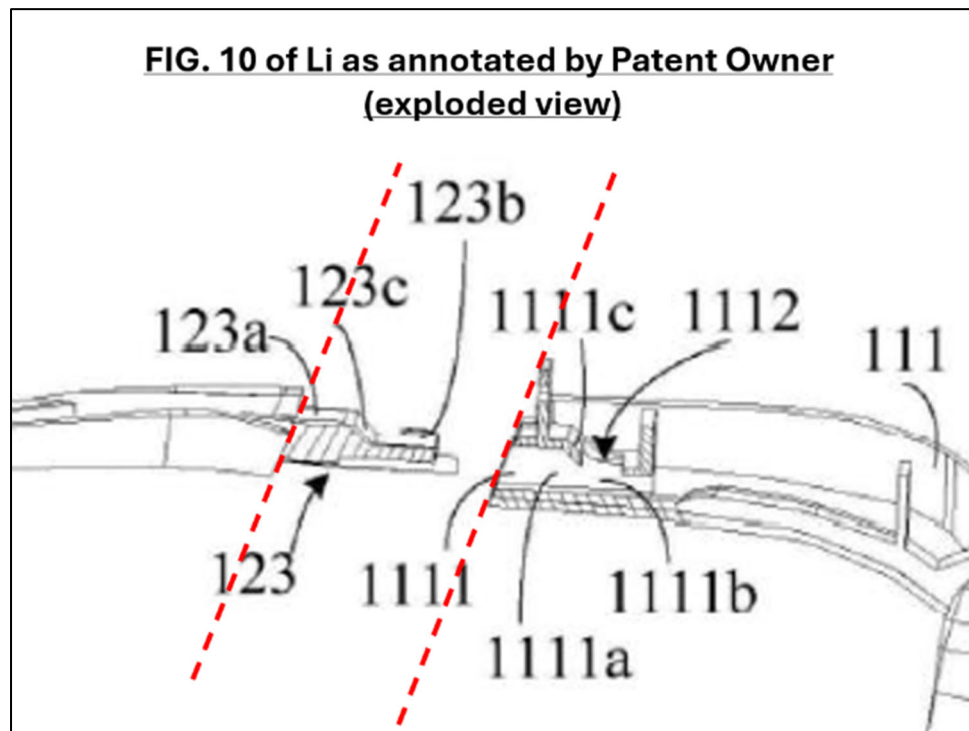
purportedly were, **none** of the “interchangeable” references that the Petition and Dr. Kyriakakis identified teach that structure.

C. Li Does Not Teach Element [1c]: “The Core Housing Being ... Elastically Abutted Against the Protective Sleeve.”

118. Li does not teach element [1c], which recites “a core housing for accommodating an earphone core, the core housing being fixed to the first plug end and elastically abutted against the protective sleeve.” I have explained the plain and ordinary meaning of this element above in Section VI.B, with a specific emphasis on the “elastically” and “abutted” words. The Petition refers to different aspects of Li for element [1c] (as each addressed in the below subsections), but these aspects of Li do not teach “elastically” or “abutted” between a protective sleeve and a housing.

1. Li does not teach or suggest that its rear plug connection is “elastically abutted.”

119. Li discloses a rear hook assembly with plug-in portions for connecting a rear hook assembly to two behind-ear housings of a bone conduction earphone. Ex. 1004, FIG. 10 (reproduced below, including an exploded view of the red dotted rectangle), ¶58. The rear hook assembly has an elastic coating layer 122 up to the plug-in portions 123, which remain uncovered. *Id.* There is nothing within Li that suggests that the elastic coating layer 122 is elastically compressed against the end surface of the housing 111 when the plug-in portion 123 is inserted.



120. For instance, I have reviewed each of Li's figures. None of the figures depict or suggest that the elastic coating layer 122 would be pushed or compressed against the end surface of the housing 111 in an elastic manner. *See, e.g., Li, FIG. 2* (left plug inserted but without elastic coating layer present), *FIG. 9* (showing plug

123 separated from plug-in hole 1111), FIG. 10 (failing to show how far the plug 123 inserts into plug-in hole 1111). Many of Li's figures have exploded views of components, but these figures do not depict or suggest any configurations that would produce such an elastic abutment. Referring specifically to FIG. 10 (a magnified view with annotation provided above), the plug-in portion 123 is shown exploded or separated from the housing 111 into which it inserts. Nevertheless, this figure does not suggest that the elastic coating layer that extends up to the base of the plug-in portion 123 would be pushed or compressed against the end of the housing 111.

121. Also, I have been advised that patent figures are not drawn to scale and cannot be relied on to show particular sizes, unless the patent indicates otherwise. Therefore, my opinion is based on the general appearance of the figures.

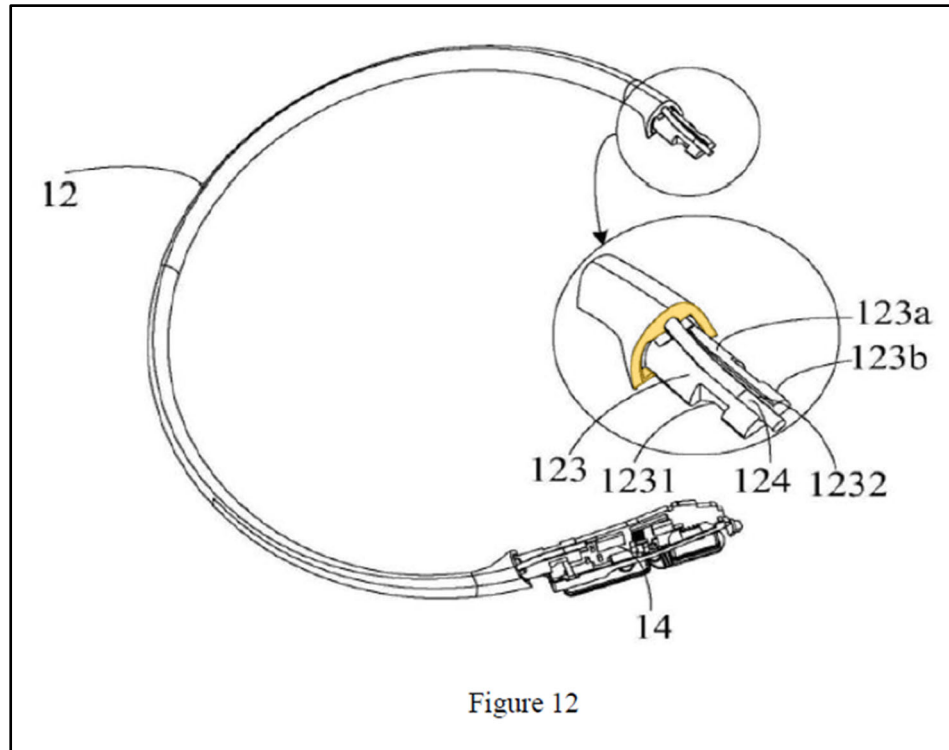
122. In addition to the figures, I have reviewed the specification of Li, which I have found to be also silent on the elastic coating layer 122 being "elastically abutted" against the housing when the plug-in portion 123 is fully inserted. *See* Li, ¶¶58-69. For example, while Li's detailed description explains that the depth of insertion of the plug-in portion can be between 6-11 mm (Li, ¶60), it has no explanations about the length of the unexposed plug end (123) to argue that the elastic coating layer would be elastically compressed upon insertion. Li also mentions an elastic convex portion that is located *inside* the plug-in hole 1111 and is compressed when the plug-in portion 123 is fully inserted. *Id.*, ¶60. But this

elastic convex portion is a component within the interior of the housing 111 (i.e., part of plug-in hole 1111) and anywhere in the range of 6-11mm inside of the housing 111, and it is not a part of the elastic coating layer 122. *Id.* Thus, this elastic convex portion should not be confused with the claimed elastic protective sleeve.

123. I also need to address the Board's statement that Li discloses "second elastic coating layer 122 with end portions ***extending over*** each plug-in portion 123." *See* ID, 59 (citing Li, FIG. 10) (emphasis added). As I explained above in Section VI.B, the term "elastically abutting" in the context of claim 1 means elastic contact at an end surface of the housing. As such, an elastic coating that surrounds, extends over, or covers the housing is different from an elastic coating pushed against the end surface of the housing. Therefore, an elastic coating layer that extends over the plug junction would not have the end surface of the housing elastically abutted against the elastic coating layer.

124. Moreover, Li does not clearly teach the elastic coating layer 122 "extending over" the plug-in portions 123. Instead, Li at FIG. 12 actually shows an end surface of the elastic coating layer 122 being approximately flat and not protruding past the base of the plug-in portion. *See* Li, FIG. 12 (annotated below to show a flat end surface of the elastic coating layer). To "extend over" the plug 123, the elastic coating layer 122 would extend beyond the base of the plug 123 up to some point along the plug's length, but that is not depicted in Li's figures. Li's

specification also does not describe that the elastic coating layer 122 extends over or extends past the plug-in portions.



125. It is also my opinion that a POSITA would not find it obvious to modify the plug-in portion 123 and the housing 111 to add an “elastically abutted” feature. I note that the Petition and Dr. Kyriakakis do not make such an argument, since the Petition (incorrectly) assumes that Li already discloses this “elastically abutted” feature. *See* Petition, 33-35; *see also* Ex. 1003, ¶¶132-133. Nevertheless, a POSITA would not have been inspired to add this “elastically abutted” feature to Li’s design. Li only mentions that its plug connection is designed for “the structural stability of the bone conduction earphone” by ensuring “a tight fit” between the rear hook assembly and the behind-ear housings. Li, ¶64. Li teaches structural considerations

but does not guide a POSITA towards adding a waterproof sealing feature as part of the plug connection via an “elastically abut[ting].” Li only provides a separate waterproofing discussion in relation to waterproof lining boards within the housings, but these specifically relate to protecting the keys and buttons provided with the housings. Li, ¶¶71-73. Besides, this type of waterproofing with a lining board is a different solution than the claimed via elastic abutting. There is no suggestion that button waterproofing would have inspired a POSITA to add waterproof sealing at its plug connections.

2. Li does not teach or suggest “elastically abutt[ing]” between an elastic sleeve and a housing.

126. In addition to pointing to Li’s rear hook assembly plugs, the Petition also briefly mentions the “forward” portion of the Li device, where Li’s core housing is covered by an elastic coating layer. *See* Petition, 35. Specifically, to read the Petition’s position consistently across the different claim elements, the Petition is referring to its proposed modification of segmenting the one-piece ear hook assembly of Li to produce three segments and then adding a plug end to the middle ear hook segment that would connect to the core housing. *Id.*, 24-30.

127. One flaw with the Petition’s position is that this modification would, at best, only result in an elastic-sleeve-against-elastic-sleeve contact, but not in a contact between an elastic sleeve and the core *housing*. The Petition itself acknowledges that Li’s “core housing is covered *by the same first elastic coating*

layer 1132 of connecting component 113.” See Petition, 35. The Petition’s modification adds a cut through this unitary elastic coating, and it would only be the two separated portions of the elastic coating contacting each other across the cut. It is my opinion that this elastic-against-elastic contact is not an abutment between an elastic sleeve and a core housing.

128. I have annotated Li’s FIG. 1 below to demonstrate this. Again, the Petition’s modification to Li is making a cut that would separate the unitary elastic coating into the blue segment on the ear hook side and the green segment on the core housing side. After implementing a plug and a receptor, the blue segment and the green segment (being both elastic coatings) that are on opposite sides of the cut would be brought into contact with each other, but the blue segment would not be abutted against the end surface of the core *housing* that is under the green segment.

FIG. 1 of Li as annotated by Patent Owner

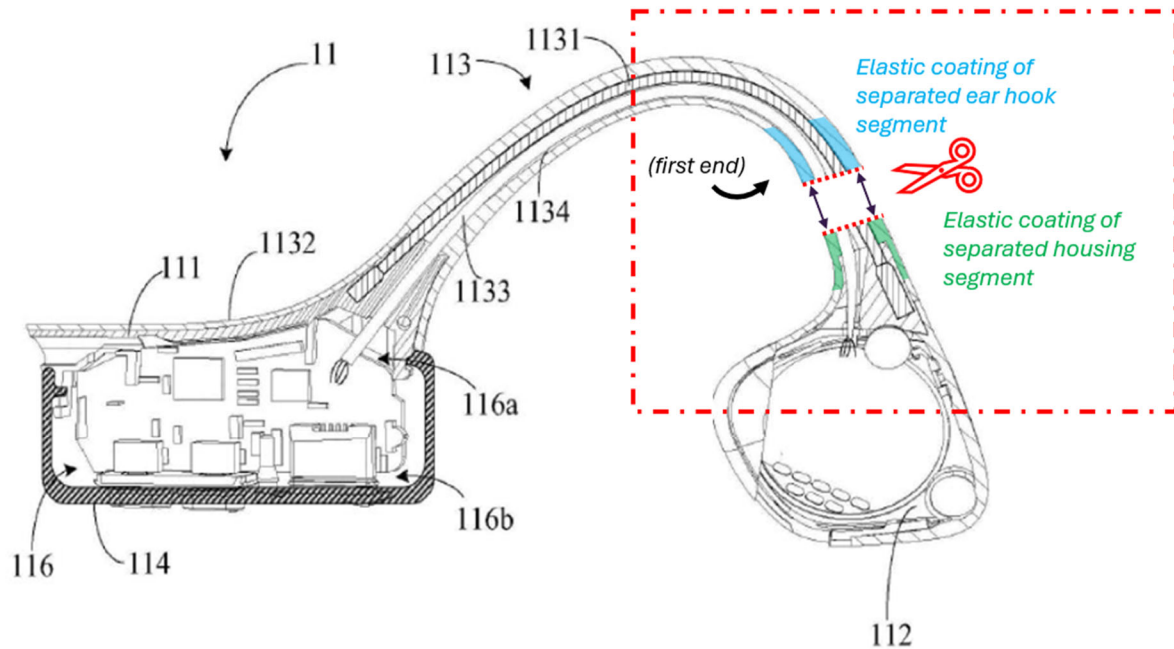
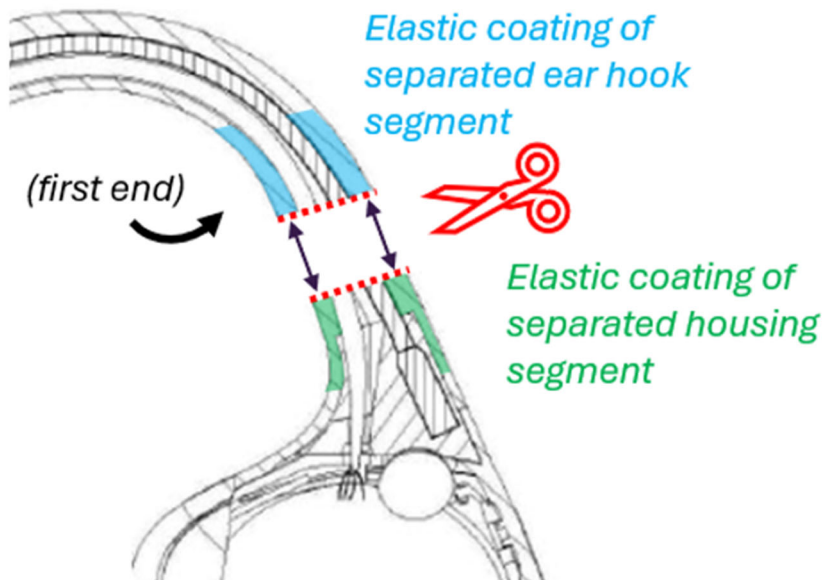


**FIG. 1 of Li as annotated by Patent Owner
(exploded view)**



129. It is therefore my opinion that Li does not disclose or teach element [1c], and that the Petition has also failed to show otherwise.

**VIII. GROUNDS 2-5 FAIL TO SHOW THAT THE CHALLENGED
DEPENDENT CLAIMS ARE UNPATENTABLE.**

130. In this section, I address deficiencies and errors with the grounds presented by the Petition and Dr. Kyriakakis for the purported obviousness of the challenged dependent claims.

**A. GROUND 2: Li in view of Fujita and Fukuda (US9253563)
Allegedly Rendering Claims 12-15 Obvious.**

**1. The Petition does not establish a motivation to combine
Fukuda with the Li-Fujita combination.**

131. Ground 2 adds Fukuda (Ex. 1023) to the Li-Fujita combination to challenge dependent claims 12-15. Petition, 42.

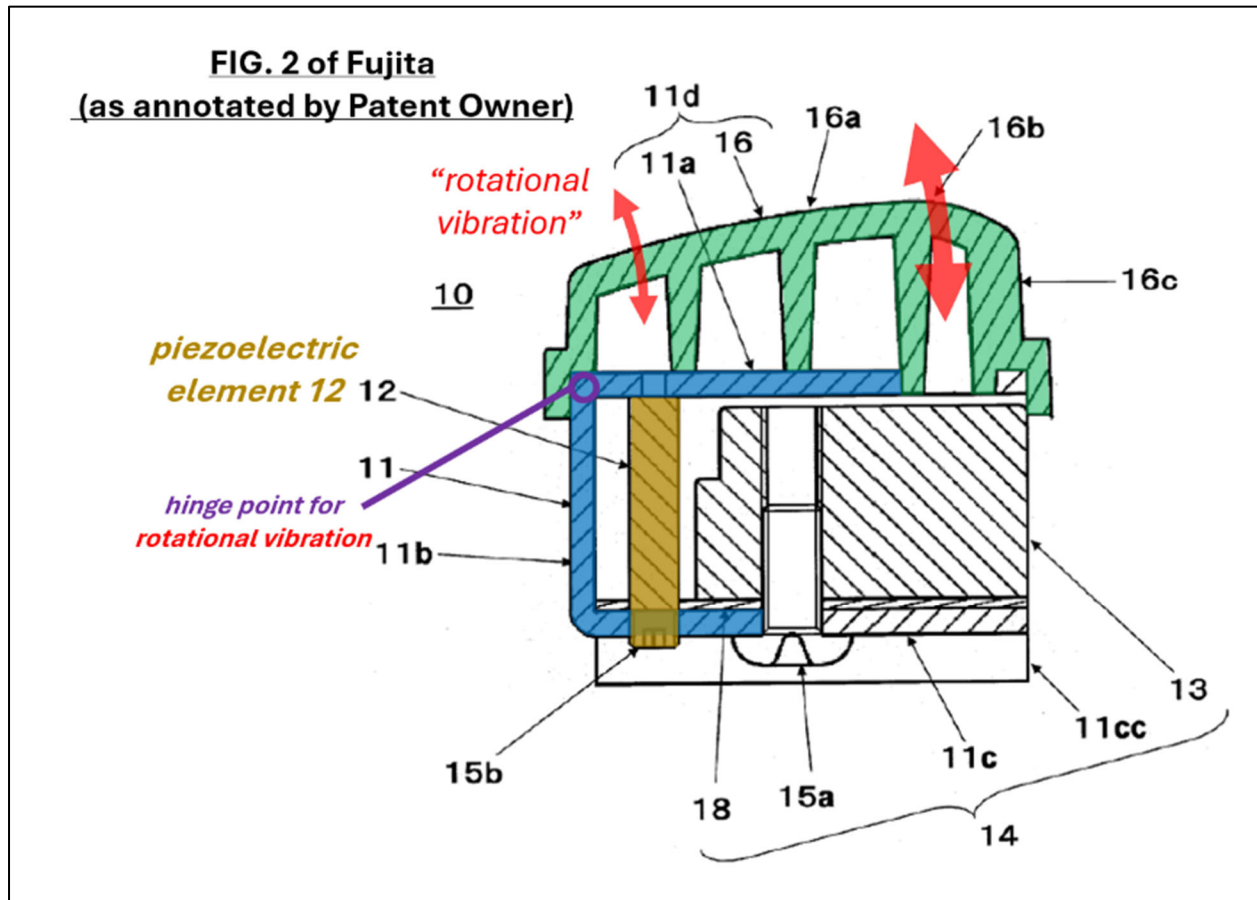
132. First, it is unclear to me how the Petition proposes to combine Fukuda with the Li-Fujita combination, or simply what components are present or not present in the proposed Li-Fujita-Fukuda combination. The Petition does not explain whether it is the entire Fujita speaker save for the convex cushion (16) being replaced with Fukuda's magnetic driver system, or whether it is only the piezoelectric element (12) in Fujita that is being replaced by Fukuda's magnetic driver system, or something else where only some components in Fujita's speaker (e.g., base weight 13) are being replaced. For instance, the Petition states that Fukuda's magnetic circuit system vibration mechanism would be inserted "in place

of Fujita's piezoelectric mechanism" (Petition, 42), but I cannot determine whether "Fujita's piezoelectric mechanism" refers only to the actual piezoelectric element (12) or the entire piezoelectric-driven mechanism, which includes a U-shaped frame (11) and base weight (13). This is exacerbated by the Petition mentioning that the "Fujita's piezoelectric mechanism" being replaced includes "base weight 13." Petition, 43. Dr. Kyriakakis does not offer more to resolve this uncertainty. Ex. 1003, ¶¶145-150.

133. The Petition also refers to advantages provided by Fukuda's invention as a whole, but this does not help in ascertaining what the Petition's proposed combination actually is. *See* Petition, 43-44. For instance, the Petition points to Fukuda's system being "simple in construction" (*id.*), but this is a system-level benefit that does not explain what parts of Fukuda are being combined and what parts of Fujita are being replaced.

134. I therefore address two different possibilities as to what the Petition may be proposing for its Li-Fujita-Fukuda combination: replacing the entire speaker design under the convex cushion (16), or replacing only the piezoelectric element (12). In either scenario, the Petition does not sufficiently explain why a POSITA would turn from Fujita's specialized piezoelectric mechanism to a magnetic speaker driver such as that disclosed in Fukuda.

135. I note first that Fujita's piezoelectric mechanism serves a specific and essential purpose in Fujita's speaker. Fujita derives its speaker design, including its convex cushion (16), all from a rotational or hinged vibration motion. *See* Fujita, FIG. 3 (annotated below to show the rotational or hinged vibration motion).



136. Fujita teaches that the vibration motion of its bone conduction speaker is a rotation around a rotation center on side of the speaker. *Id.*, ¶27, FIG. 2. As illustrated in FIG. 2, the bone conduction speaker includes a “U-shaped frame 11 structure” (annotated in blue), and a piezoelectric element 12 (annotated in brown) is wedged between the top and bottom prongs of the U-shaped frame. *Id.* The

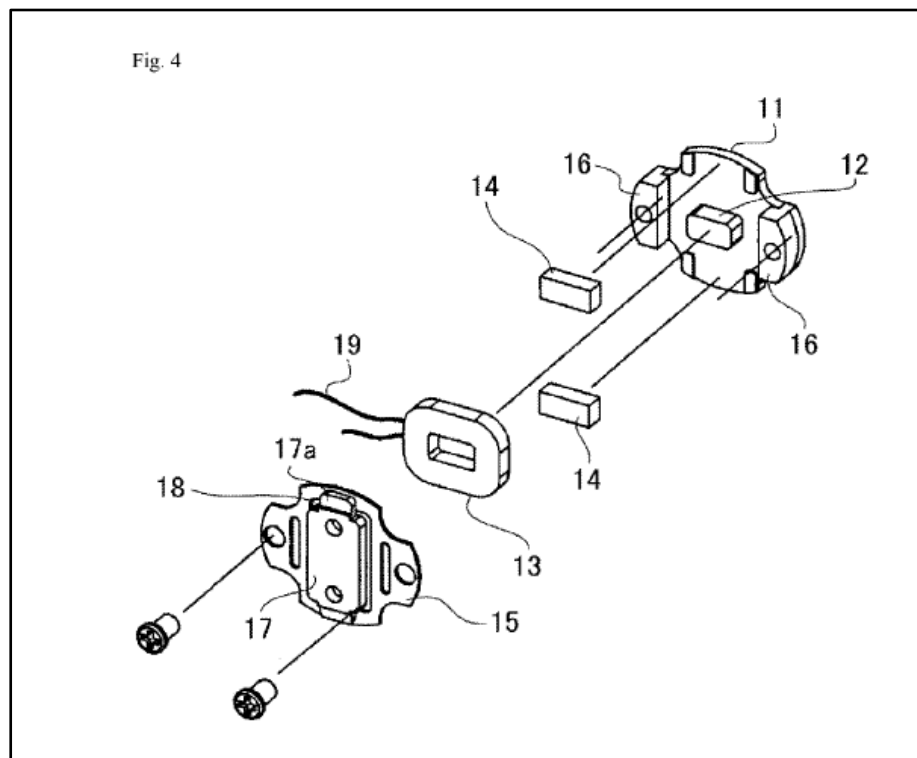
piezoelectric element 12 pushes the top prong (11a) up, and this displacement hinges by virtue of the top prong's connection to the vertical frame part (11b). *Id.* Fujita also describes this as a lever motion. *Id.*, ¶¶27, 36.

137. This rotational (or hinging or levering) motion forms the central purpose of Fujita by optimizing the transmission of sound signals from the convex contact surface to the user. Specifically, Fujita teaches that with the rotational motion, the vertex or peak of the convex surface is displaced more than the lower parts of the convex surface. *Id.*, ¶¶34, 37. Combined with the increased contact pressure at the vertex, this allows “the vibration of the bone conduction speaker 10 [to] be more effectively transmitted to the perception part of the user.” *Id.*, ¶37.

138. Thus, Fujita specifically proposes the convex shape of the cushion in connection with the rotational motion, and the speaker would lose its effectiveness if the convex cushion does not vibrate with the rotational motion. The rotational motion is needed to displace portions of the convex contact surface more than other portions.

139. Replacing “Fujita’s piezoelectric mechanism” with Fukuda’s magnetic driver would forfeit the sound transmission benefits that Fujita discusses, because Fukuda’s magnetic driver only provides linear displacement (not rotational motion). In each of its illustrations, Fukuda depicts the components of the magnetic driver, such as the voice coil 13, a pair of magnets 14, and the elastic cover 3 (held against

plate yoke 17), being vertically aligned. *See* Fukuda, FIGs. 1-4. This is consistent with the general and common usage of magnetic speaker drivers where the vibration is linear and aligned. The operation disclosed in Fukuda does in fact describe a linear displacement output, where the elastic cover 3 would vibrate up-and-down (in the orientation shown in FIG. 3) due to the same up-and-down linear movement of the voice coil below it.



140. As such, a POSITA would not have been motivated to use Fukuda's linear magnetic driver in place of Fujita's speaker mechanism including its base weight and the U-shaped frame. Picturing Fukuda's linear magnetic driver in place of the components below Fujita's convex cushion (16), it would be clear that Fujita's convex cushion (16) would linearly vibrate up-and-down, but this would not actually

displace the apex point of the convex cushion more than the non-apex portions. Thus, replacing Fujita's rotational piezoelectric mechanism with Fukuda's linear magnetic driver would destroy the entire premise of Fujita as it relates to effective sound transmission.

141. The other possible combination that the Petition may be proposing—replacing only the piezoelectric element 12 with Fukuda's magnetic driver—also suffers from these issues. I again note that the Petition implies more so that its proposed combination is the entire mechanism of Fujita being replaced rather than only the individual piezoelectric element. *See* Petition, 43 (“a POSITA would have looked to Fukuda to improve the speaker in the Li-Fujita earphones with a magnetic circuit system vibration mechanism in place of Fujita's piezoelectric mechanism ***including the multilayer columnar piezoelectric element 12 and base weight 13***” (emphasis added)). Nevertheless, a POSITA would not have been motivated to replace just the piezoelectric element (12) with Fukuda's magnetic driver.

142. Fujita discloses that the piezoelectric element 12 has “displacement in the length direction” and is fixed between the two “prongs” of the U-shaped frame. Fujita, ¶¶25, 40 (“Based on the electrical signal, the stacked columnar piezoelectric element 12 performs expansion and contraction changes (displacement) along a long axis direction in accordance with the signal). Although piezoelectric element 12

expands and contracts along its length axis, this action is immediately converted and transformed by means of the U-shaped frame into the rotational motion. *Id.*, ¶36.

143. Because the piezoelectric element's length-wise displacement is immediately transformed, and because it is the U-shaped frame providing the rotational motion, there would be no reason to substitute the piezoelectric element with another linear driver such as Fukuda's magnetic driver. It would not matter which of the two types of drivers is pushing the U-shaped frame, just that the U-shaped frame is being pushed and produces the rotational motion. The usefulness and benefit of magnetic speaker drivers such as Fukuda's lie in their linear vibration output, and this usefulness is negated if applied for non-linear vibration outputs. The Petition confirms this by stating, "[m]agnetic circuit systems were commonly found ... in order to provide *efficient, high-quality sound*." Petition, 42. The innate efficiency assumed in using Fukuda's magnetic speaker driver for linear vibration is not realized when the linear vibration is being physically converted anyways to a rotational vibration, which exerts different amounts of pressure at different contact locations. Instead, the efficiency in Fujita's speaker design would be controlled by more dominant components and characteristics, such as the U-shaped frame itself and its flexibility. Fukuda's magnetic speaker driver would be *blunted* by the conversion rotational vibration output, and a POSITA would not consider Fukuda's

magnetic speaker driver as a direct improvement over the piezoelectric element within the Fujita speaker for the stated efficiency reasons.

144. For these reasons, it is my opinion that a POSITA would not have been motivated to use Fukuda's magnetic driver system "in place of Fujita's piezoelectric mechanism." *See* Petition, 43. Furthermore, these issues are also relevant to whether making the proposed changes would have been within a POSITA's capabilities. Understanding that the rotational vibration is necessary for effective sound transmission as taught by Fujita, a POSITA would find it well beyond their skill and knowledge to successfully adapt and transform a linear magnetic driver to realize that rotational vibration.

145. It is significant to me that the Petition has ignored this square-in-a-round-hole problem—where Fukuda's linear magnetic driver is being fit into Fujita's rotational or hinging speaker—presented in its combination, which is at least evident by the lack of any discussion or explanation related to Fujita's rotational vibration by the Petition and Dr. Kyriakakis. *See* Petition, 42-45; *see also* Ex. 1003, ¶¶145-150. The explanations that the Petition provides as to the motivation to combine Fukuda with Fujita are also inaccurate and mischaracterized, as discussed below.

146. The Petition includes several pages arguing why a POSITA would have been motivated to combine Fukuda with the Li-Fujita combination (Petition, 42-45),

but these arguments mischaracterize the sections of the references that they cite, and are untethered to the proposed modifications.

147. **Alleged Improvement in Sound Quality**: The Petition asserts that magnetic circuits in bone conduction speakers were known to provide “high-quality sound” and “high-density permanent magnets” in bone conduction speaker achieve better sound quality,” while citing to Ex. 1005, ¶¶52, 53, 143, 145, 148-152, 171, and FIGs. 11, 18-A, 18-B, 22-A. Petition, 42-43. These sections of Ex. 1005 (Liao), however, ***do not*** compare the specific system of Fujita (or any piezoelectric-based system) with Fukuda’s (or any other) magnet-based system.

148. For instance, Liao at ¶52 explains “[t]he energy conversion methods of the energy conversion device include but are not limited to ***dynamic coil, electrostatic, piezoelectric, dynamic iron, pneumatic, electromagnetic***, etc.” Liao, ¶52 (emphasis added). Liao then provides an example of “***a dynamic coil energy conversion device***, [where] the wound cylindrical coil is connected to the vibrating plate” (*id.*), and explains “[f]or example, ***using high-density permanent magnets, more ideal vibrating plate materials, and designs can achieve better sound quality***.” *Id.*, ¶52 (emphasis added). Reading the full paragraphs of Liao reveals that the purported improvement in sound quality is not described in the context of comparison with a piezoelectric system, and is in connection with a magnetic-coil-based system described in the preceding paragraph ¶52. And even then, the

supposed improvement is attributed to the type of magnets, i.e., *high-density* magnets, in combination with other elements, i.e., *vibrating plate materials, and designs*. *Id.* The remaining paragraphs of Liao cited by the Petition merely describe the operation of the speaker, and do not provide further insight into the alleged improvements over piezoelectric-based speakers.

149. **Alleged Improvement in electromechanical conversion efficiency:**

The Petition points to ¶¶2, 3 of Xu (Ex.1009), Nielsen (Ex.1010) at 4:1-12, and Abstract, Fig. 2(b), and ¶¶16-29 of Nakada (Ex.1018) for the assertion that “magnetic steels in the middle of the voice coil” in a loudspeaker “significantly improv[es] the electromechanical conversion efficiency.” Even if Petitioner’s assertion is correct, such improvement is not described in comparison to a piezoelectric system (let alone Fujita’s specific system).

150. Notwithstanding a lack of such comparison, reading ¶¶2, 3 of Xu reveals that Xu’s improvement is *over an existing magnetic-based system* (i.e., an “existing micro loudspeaker comprises a vibration system and a magnetic circuit system,” Ex. 1005, ¶2). *Id.*, ¶¶2, 3. Similarly, Nielsen’s description on pages 3 and 4 makes clear that the new system of Nielsen provides improvements *over existing magnet based systems*. Nielsen, 3:15-4:12. Turning to Nakada, this reference also describes improvements *over a prior magnetic based speaker design* (“Conventionally, the magnetic circuit of a speaker,” Ex. 1018, ¶2) having a

configuration that “reduces the volume of the magnet and results in low magnetic flux density within the magnet ... leading to low output efficiency and large size.” *Id.*, ¶3. The sections of Nakada cited in the Petition further describe the new design of Nakada, with no discussions about piezoelectric based systems. *Id.*, Abstract, ¶¶16-29, FIG. 2(b).

151. Accordingly, given that Xu, Neilsen, and Nakada all describe improvements over prior magnetic-based systems, the Petition’s reliance on those references (and alleged improvement of electromechanical efficiency) is unrelated to a POSITA’s motivation to replace Fujita’s piezo-electric system.

152. **Alleged Improvements Provided by Fukuda:** The Petition purports that a “POSITA would have looked to Fukuda to improve the speaker in the Li-Fujita earphones ... in order to provide the benefits of a magnetic circuit system, such as efficient, high-quality sound, and simple construction,” while citing to Fukuda’s 3:6-28 that explains its bone conduction system is “simple in construction, allowing the manufacturing cost to be held at a minimum, and yet is completed as an independent unit with minimized sound leakage.” Petition, 43.

153. However, the improvements achieved by Fukuda are attributable to Fukuda’s *entire* system, and not to the Petitioner-proposed modification of Fujita, which includes replacing Fujita’s piezoelectric transducer (only) in claims 14 and 15—the only challenged claims where Fukuda’s combination appears to be relevant.

154. Indeed, the entire section of Fukuda that Petitioner points to (Ex. 1023, 3:6-28) is under the title “Advantages of the Invention,” and describes various components of Fukuda’s system (not just the magnetic elements). *See also id.*, FIGs. 3 and 4. I have reproduced the full relied-upon section of Fukuda below:

The present invention is as described above, providing an advantage that, at the time of the bone conduction speaker unit being not in use, when no pressing force is applied to the elastic cover, a gap is always held between the bottom face of the contact and the top face of the elastic plate, or between the bottom face of the thick-wall part and the top face of the plate yoke, thereby it being reliably prevented that a vibration is unnecessarily transmitted to the elastic cover to cause generation of a voice vibration, resulting in sound leakage, *and when in use, the elastic cover is pressed against a side face of the head, or the like, the contact or the thick-wall part which is supported by the elastic cover being pushed in toward the inside to be brought into plane contact with the plate yoke, thereby the vibration of the diaphragm being reliably transmitted to the elastic cover to cause the functions of the bone conduction speaker to be sufficiently exerted.*

Further, the bone conduction speaker in accordance with the present invention is simple in construction, allowing the manufacturing cost to be held to a minimum, and yet is completed as an independent unit with

minimized sound leakage, allowing it to be incorporated, as it is, in a casing of mobile phones, and the like. (*Id.*, 3:4-28 (emphasis added).)

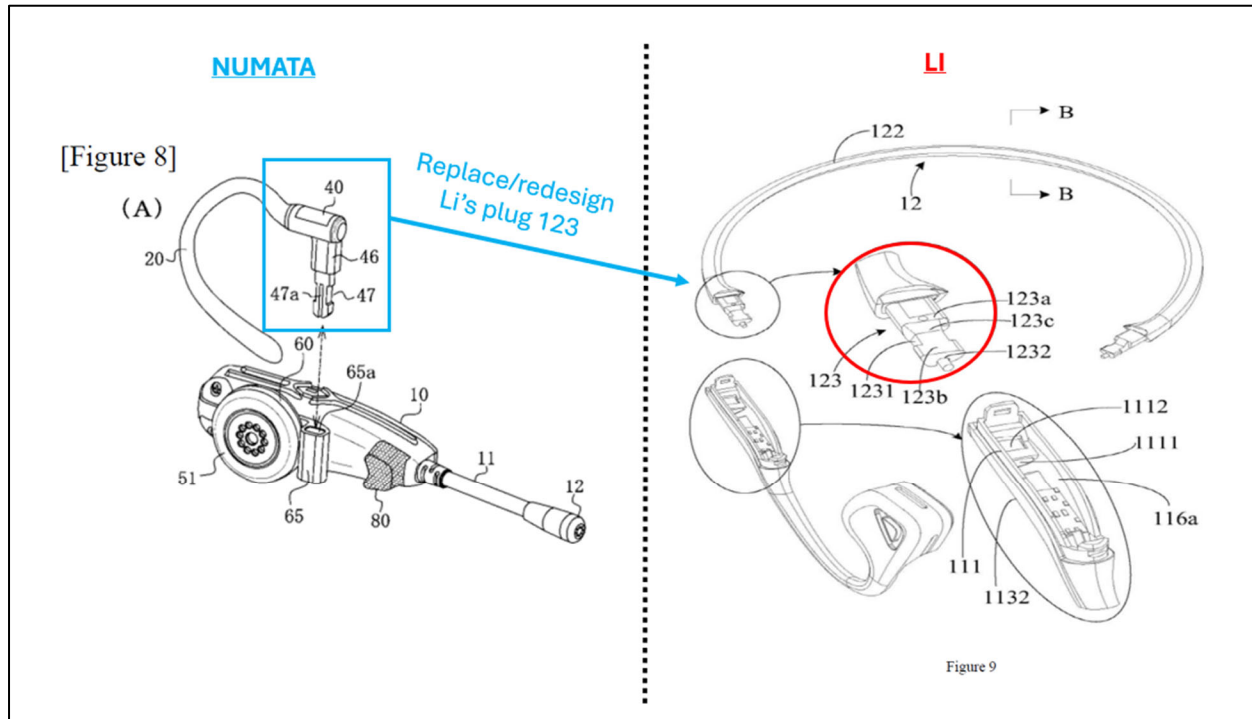
155. The emphasized sections appear to focus on the “thick-wall part” that is “brought into contact with the plate yoke” that allows reliable transmission of the vibrations. Not only are Fukuda’s purported benefits associated with its system as a whole, nothing in the above section (or any other section of Fukuda) inform (or make obvious to) a POSITA that Fukuda’s magnet circuit would be advantageous compared to a piezoelectric system configured for a rotational vibration.

156. Therefore, it is my opinion that a POSITA would not have been motivated or found it obvious to import Fukuda’s linear magnetic speaker into Fujita’s speaker configured for rotational vibration, and the Petition does not establish otherwise.

**B. GROUND 4: Li in view of Fujita and Numata (JP2008294872A)
Allegedly Rendering Claims 7-10 Obvious.**

157. It is my opinion that a POSITA would not have been motivated to combine Numata (Ex. 1007) with the Li-Fujita combination as the Petition proposes. The Petition proposes that the insertion part disclosed in Numata would be included on the plug ends disclosed in Li, or essentially, that Li’s plug ends be redesigned to replicate Numata’s insertion part. I disagree. The Petition’s stated motivation based on “Numata’s convenient bi-directional plugging” is actually a detriment when used

in place of Li's plug ends, and a POSITA also would not have considered Numata's insertion part as suitable for the electrical connectivity function inherent to Li's plug ends.

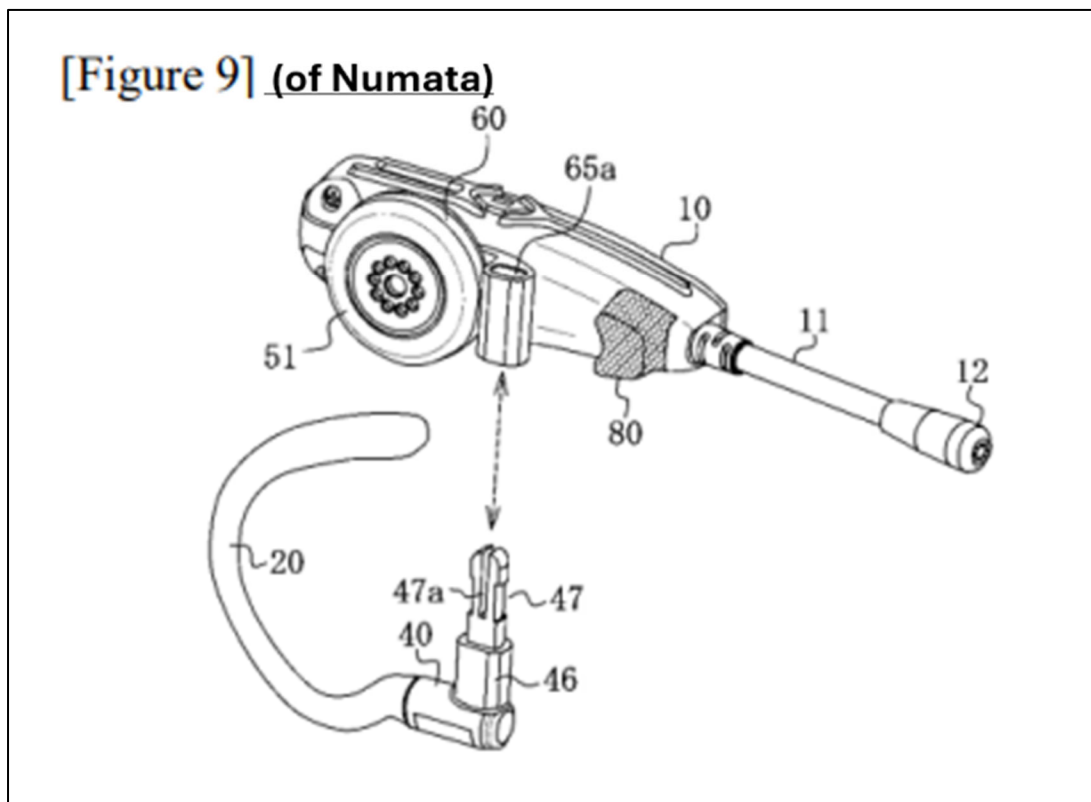


1. Numata's bi-directional plugging would not have motivated a POSITA to add Numata's insertion part to Li.

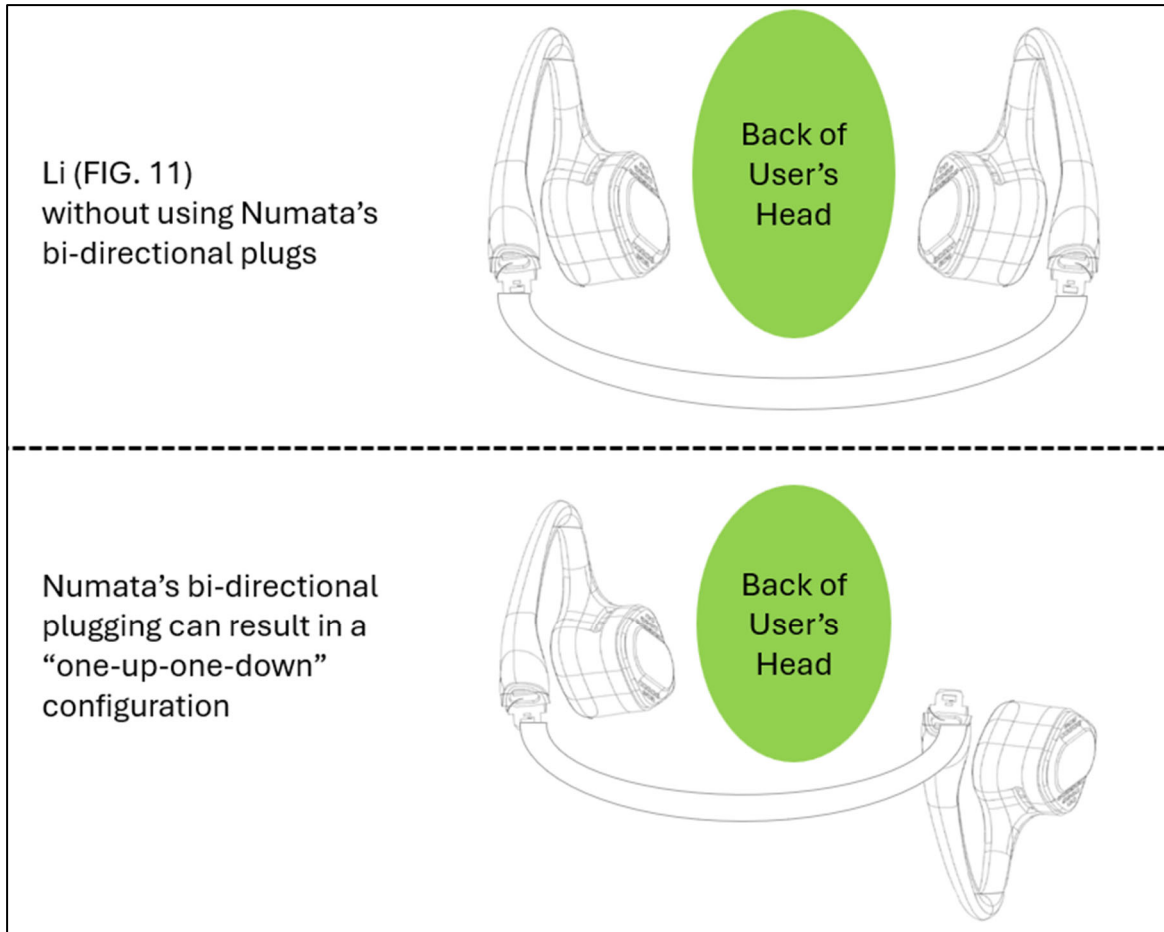
158. Numata discloses bi-directional plugging because Numata is directed to a single-ear device, but this feature—which the Petition relies upon for the reason to combine Numata—would actually risk making Li's dual-ear device permanently unusable.

159. Numata teaches that the ear hook for a single-ear earpiece has an insertion part 47 can be inserted from above the receiving cylinder (65) for *left-ear wearing* or from below the receiving cylinder for *right-ear wearing*. Numata, ¶¶33-

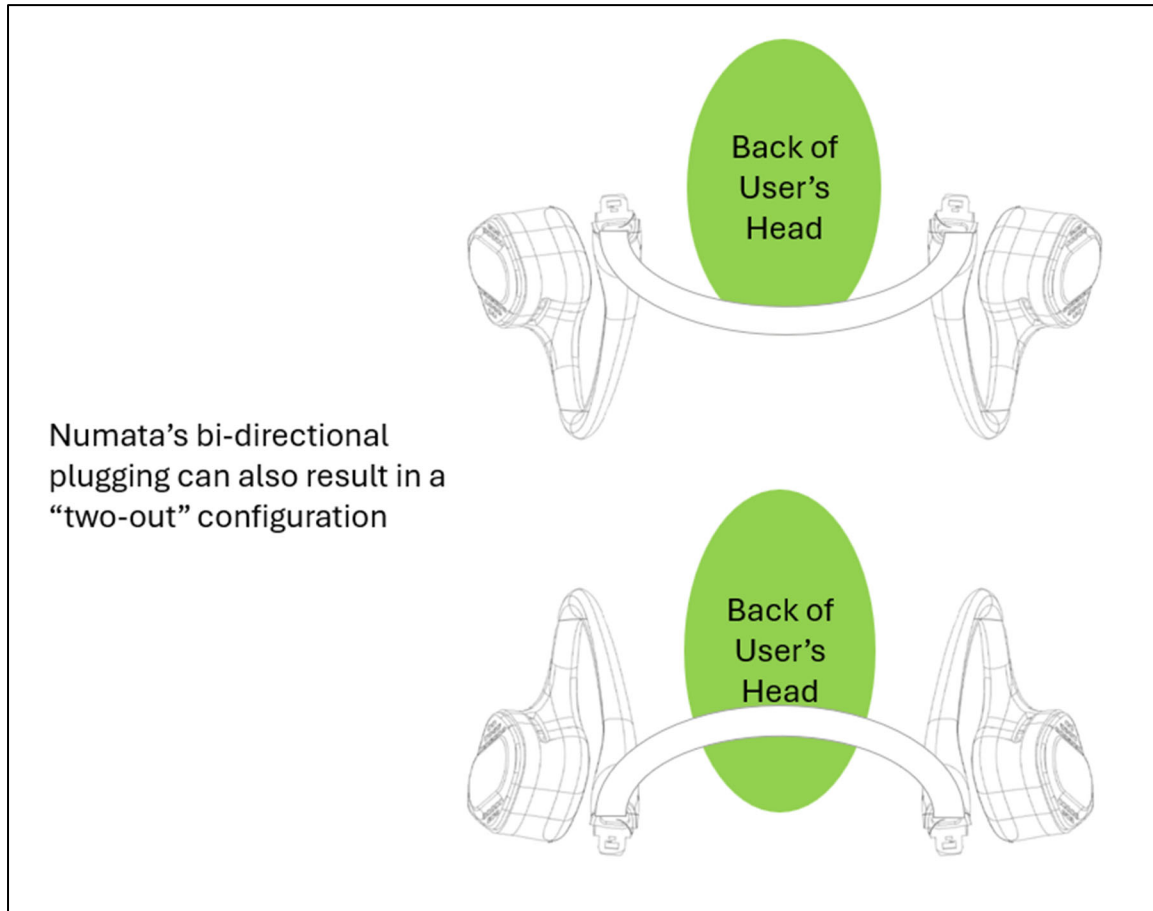
34, FIGs. 8-9. That is, Numata's bi-directional connection is designed to allow both *upside-down* and *right-side-up* orientations. Not only that, Numata teaches that a user can switch between these orientations at their whim through removal and reattachment of the insertion part. *Id.*, ¶17. For instance, Numata discloses that the engagement of the insertion part "can be easily released *by inserting a tool from the opening in the opposite direction of the relevant insertion part 47 of the through-hole 65A* to reduce the slit 47A, so the above assembly is easy to attach and detach and change." *Id.*, ¶34 (emphasis added). As such, Numata's bi-directional plugging requires the ability to switch between the two directions or orientations.



160. Bi-directional plugging would be significantly problematic for dual-ear bone conduction earphones such as that disclosed in Li. Li only teaches one way to insert its plugs into the corresponding sockets, and this fixed plugging orientation would ensure that the correct speaker panels would be contacting the user's head. *See, e.g.,* Li, FIG. 10 (showing the fixed orientation of the plug fitting into its corresponding socket). If however Li's plugs were redesigned to possess Numata's bi-directionality, the plugs would allow for a "one-up-one-down" configuration of Li's dual-ear earphone device where one of the ear hook assemblies is inverted. In this configuration, the entire device would be unwearable because the inverted ear hook could not hang over an ear and the bone conduction speaker would be off-target. The below figures show this scenario.



161. But also, if Numata's bi-directional connections were inserted incorrectly on both sides, the bone conduction speakers would point outwards, as shown below, and not make contact with the user's face. *Id.*



162. Therefore, there is not a single scenario where redesigning Li's plugs to have bi-directional connection would improve the wearability of Li's dual-ear device. Furthermore, these unwearable and unusable configurations would be *permanent* once assembled. The Petition's proposed combination would have Numata's plugs inserted *into Li's housings* (i.e., an enclosed space) which did not have and could not have such an accessible through-hole to allow the release of the plug. In other words, in the proposed combination, once Numata's plugs were inserted into the core housing, it would not have been possible to remove the plugs. Therefore, for a plug that had been inserted in the wrong direction (as illustrated

above), there would have been no way to detach or remove the plug, rendering the earphones permanently useless.

163. The risk of permanently unusable configurations due to irreversible bi-directional plugging would significantly complicate and increase waste during the assembly and manufacturing process. In particular, additional checks and validations would need to be added to ensure that the dual-ear devices are not being assembled in the unwearable configurations, and any units assembled in the unusable configuration would likely need to be disposed.

164. Therefore, the Petition relies upon a motivation to combine Numata that would actually have resulted in an inferior product prone to misconnections and user confusion, and a POSITA would not have been motivated to replace Li's plugs with Numata's insertion part.

2. Numata's insertion part would not be suitable for the electrical connectivity function of Li's plug ends.

165. It is also my opinion that a POSITA would not have found Numata's insertion part as suitable for replacing the plugs disclosed in Li because a POSITA would immediately conclude that Numata's insertion did not provide electrical connectivity across its connection.

166. According to Petitioner's proposed combination, Numata's insertion part would be inserted into a socket in Li's core housing. Petition, 83. Without the proposed modification, Li discloses a wire set 1133 that passes through the ear hook

section and into the core housing. Li, ¶¶39-40. Li's explicit disclosure of this wire set, as well as the general understanding that speaker components in a core housing would require wired electrical connections, reflect the requirement that a plug connection to the core housing must be able to pass wiring or provide some electrical connection.

167. However, as implemented in Numata's design, the insertion part 47 does not pass wiring and is not used whatsoever to establish electrical connectivity across both sides of the structural connection. *See, e.g.*, Numata, FIGs. 8-9. Numata discloses that, one side of the connection, the main unit part 10 contains all the necessary circuitry such as communication circuits, amplification circuits, and power circuits, but on the other side of the connection, the earhook part 20 is devoid of any circuitry. *Id.*, ¶18. As such, Numata's insertion part 47 did not provide electrical connectivity when inserted into the receiving cylinder 46, nor was there any need for Numata's insertion part 47 to do so.

168. Furthermore, Numata's insertion part 47 fits and connects with the device's main unit based on the insertion part 47 having two sides that are divided by a slit and are pushed together during the insertion action. Numata, ¶¶33-34. It would not have been obvious to a POSITA how these moving and dynamic parts of Numata's insertion part 47 would accommodate any necessary wiring. For instance, passing wiring through the slit dividing the two sides of the insertion part 47 could

possibly obstruct the two sides and preclude the insertion part 47 from being inserted into the holly cylinder 65.

169. Therefore, a POSITA would not have found Numata's insertion part functionally suitable to replace the plugs in Li's device.

3. Numata does not teach claim 9.

170. Element [9a] recites: "*the inserting portion is partially inserted into the first socket,*" and element [9b] recites: "*an exposed part of the inserting portion is arranged in a stepped manner to form an annular table surface spaced apart from the outer end surface of the core housing.*" Numata fails to teach these elements.

171. The partial insertion (element [9a]) and the spacing apart (element [9b]) produces the junction space within which the protective sleeve is abutted against the core housing in an elastic manner (element [1c]). Ex. 1001, 12:62-13:25, FIGs. 4, 6 (annotated below). For instance, the '084 Patent explains that "the protective sleeve 16 may be at least partially filled in the space between the annular table surface 1422 and the outer end surface 21 of the core housing 20, and elastically abut against the core housing 20." *Id.*, 13:16-19; *see also id.*, FIGs. 4 and 6 (annotated below, where FIG. 4 shows the plug end by itself and FIG. 6 shows the plug end that is inserted into the core housing's socket).

FIG. 4 of the '084 Patent
(as annotated by Patent Owner)

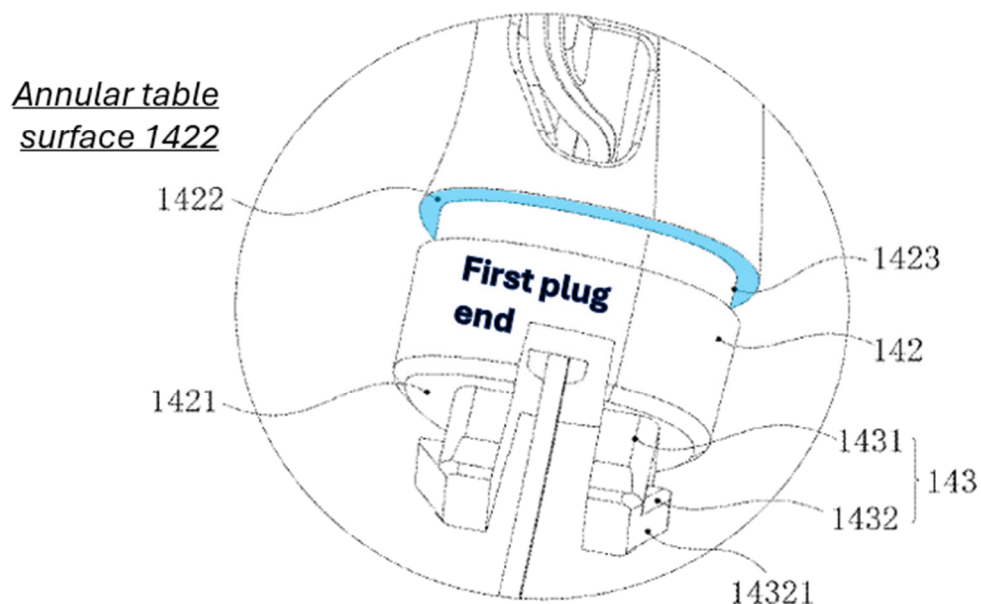
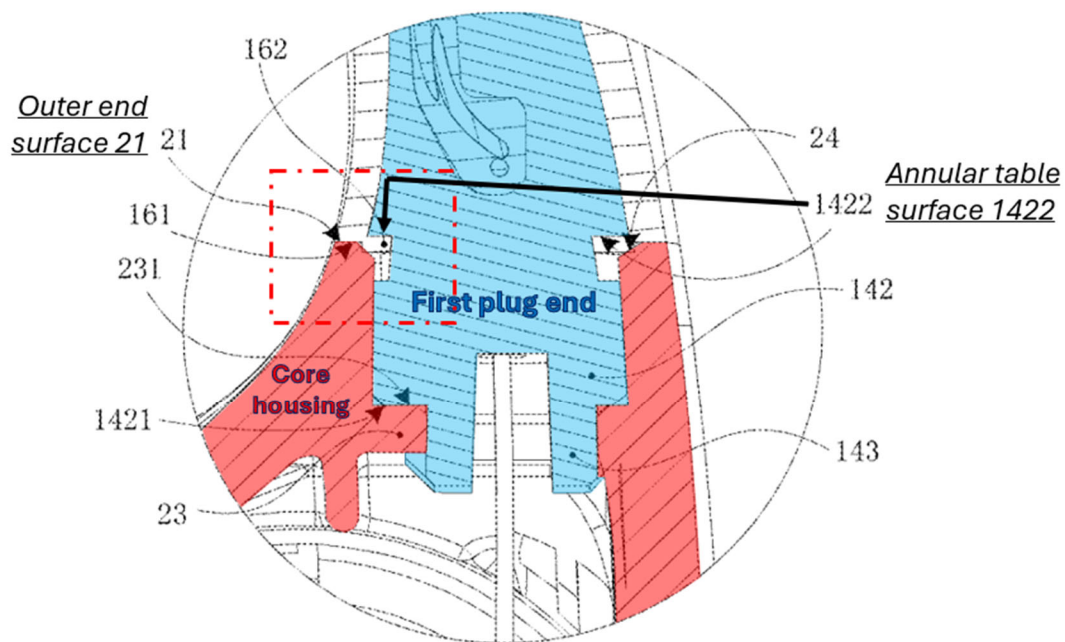
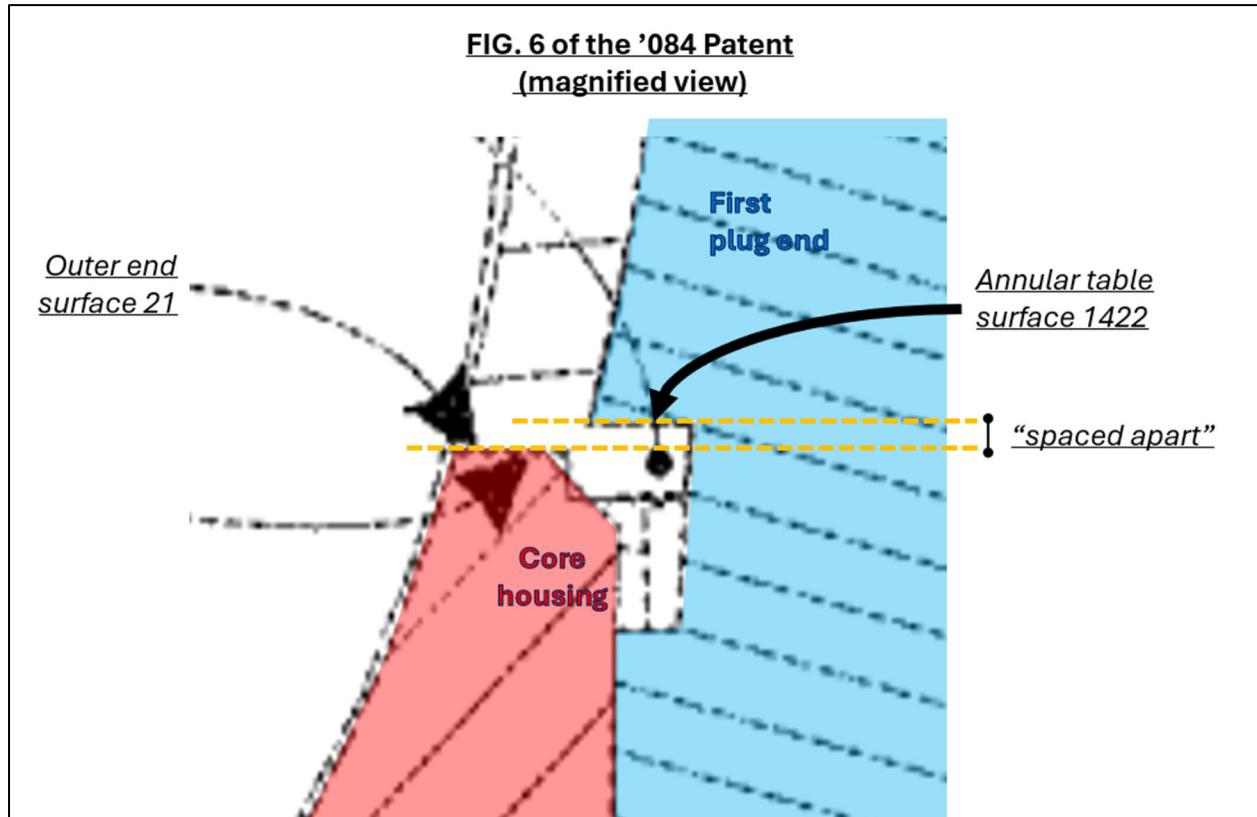


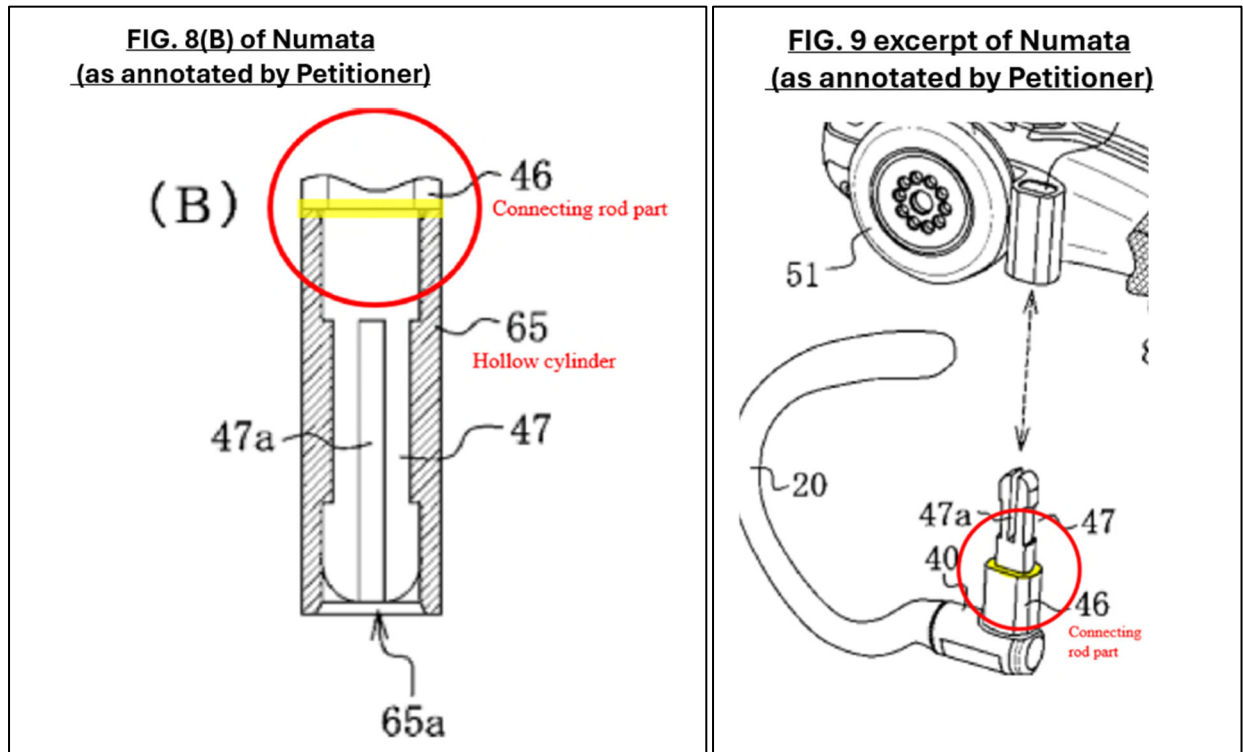
FIG. 6 of the '084 Patent
(as annotated by Patent Owner)





172. The Petition focuses on Numata for element [9b], but Numata does not describe the claimed features. *See* Petition, 95-97. Specifically, Numata does not disclose an arrangement in which a surface of an inserting portion is “spaced apart” from the outer end surface of the socket. Numata actually teaches the opposite, where the inserting surface sits flush against the socket. This is clearly shown in the figures of Numata, which is what the Petition relies upon; there also is no explanation in Numata’s specification that teaches or suggests the “spaced apart” limitation. As shown below, Numata’s FIGs. 8(B) and 9 depict the surface of the connecting rod part 46 (supposedly “the exposed part of the inserting portion”) is flush against the end surface/rim of the hollow cylinder 65 (supposedly “the outer end surface of the

core housing”). *Id.* Numata’s FIG. 8(B) clearly does not show any space between the two opposing surfaces; the yellow highlighted surface is merely a uniform, flat surface that is flush against the socket surface, with no indication that this flat surface is “spaced apart” from the socket surface. *See* Numata, FIG. 8(B).



173. Therefore, to the extent that there is an *annular table surface* in Numata, Numata does not teach or suggest the “spaced apart” arrangement with respect to the outer end surface of the core housing as required in element [9b].

4. Li does not teach claim 10.

174. Element [10a] recites: “*the protective sleeve further extends to a side of the annular table surface facing the outer end surface of the core housing,*” and

element [10b] recites: “*when the core housing and the first plug end are fixed, the protective sleeve elastically abuts against the core housing to realize sealing.*”

175. As I discussed above in Section VII.C.2, the Petition can only show at best, with respect to element [1c], that two elastic sleeves abut against each other, but that Li does not teach an elastic sleeve abutting against ***a housing***.

176. This issue follows here. The Petition’s arguments against element [10b] refer back to element [1c] and Li’s rear assembly plugs, and the Petition explicitly admits that Li discloses an elastic-sleeve-against-elastic-sleeve abutment but not an elastic-sleeve-against-housing abutment:

As shown in Figure 2, ***the second elastic coating layer 122 abuts the first elastic coating layer 1132 at the plug-in portion 123. Because Li’s first elastic coating layer 1132 abuts the second elastic coating layer 122***, Li teaches when the circuit housing and the plug end are fixed, the protective sleeve elastically abuts against the circuit housing to realize sealing. (Petition, 100 (emphasis added); *see also id.*, 98-99).

177. Similar to element [1c], element [10b] here requires that “the protective sleeve elastically abuts against the core housing.” Because Li does not teach an elastic-sleeve-against-housing abutment, the Li-Fujita-Numata combination fails to teach or suggest dependent claim 10.

C. GROUND 5: Li in view of Fujita, Wang (CN205356672U), Xu (CN205017577U), and Nielsen (WO2009/086838) Allegedly Rendering Claims 16-20 Obvious.

1. The magnetic drivers of Wang, Xu, and Nielsen destroy Fujita's key benefit which requires rotational or hinged vibration.

178. For similar reasons that a POSITA would not have been motivated to combine Fukuda with the Li-Fujita combination, it is also my opinion that a POSITA would not have been motivated to combine Wang (Ex. 1008), Xu (Ex. 1009), and Nielsen (Ex. 1010) with the Li-Fujita combination. Similar to Fukuda, Wang, Xu, and Nielsen are all directed to linear magnetic drivers, and as discussed above in Section VIII.A.1, a POSITA would not have replaced Fujita's piezoelectric driver with a linear magnetic driver.

179. For instance, the Petition's assertion that the magnetic drivers of Wang, Xu, and Nielsen provide higher sound quality than Fujita's piezoelectric driver has no basis as a motivation to combine. Fujita requires a rotational hinge-like vibration motion that the linear magnetic drivers of Wang, Xu, and Nielsen cannot provide. Even if replacing only the individual piezoelectric element in Fujita, the substituted linear magnetic drivers would have their output immediately transformed into the rotational motion, which would blunt their efficiency benefits.

180. Therefore, it is my opinion that there would be no reason to implement the magnetic driver of Wang, Xu, and Nielsen for Fujita's piezoelectric-based mechanism.

IX. CONCLUSION

181. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear for cross examination within the United States during the time allotted for cross examination.

182. I hereby 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 18 U.S.C. § 1001.

183. I declare under the penalty of perjury that the foregoing is true and correct.

DECLARATION OF MICHAEL SCORDILIS
IN SUPPORT OF PATENT OWNER'S RESPONSE

Executed February 11, 2026 in Miami, Florida.

A handwritten signature in black ink, appearing to read "M. Scordilis", written over a horizontal line.

Michael Scordilis, Ph.D.

Michael S. Scordilis, Ph.D.miscordilis@gmail.com

Miami, Florida, 33156-7794

Expertise

- | | |
|---------------------------------------|--|
| ▪ Electrical and Computer Engineering | ▪ Automatic Speech and Speaker Recognition |
| ▪ Engineering Acoustics | ▪ Natural Language Processing |
| ▪ Digital Signal Processing | ▪ Machine Learning and AI |
| ▪ Speech and Audio Processing | ▪ Biometrics, Watermarking & Security |
-

Professional Summary

Dr. Michael Scordilis retired from his academic position at the Department of Electrical and Computer Engineering at the University of Miami, Florida in May 2021. He holds a Ph.D. in Electrical and Computer Engineering from Clemson University (1990). He has also held academic positions at Universities in Australia and Greece and visiting scientist positions at Bell Communications Research and Sun Microsystems Laboratories. He has supervised several Master and Ph.D. projects in acoustics, digital speech and audio processing research and statistical language learning. He was associate editor of the Journal of the Franklin Institute, has served in the Audio Technical Group of the MPEG Standards Committee, the International Coordinating Committee for Speech Databases and Assessment and in the organization and technical committees of numerous conferences. He holds patents in the area of audio watermarking. His expertise, research and consulting experience include artificial intelligence and machine learning, acoustics, digital signal processing, speech and audio coding, speech synthesis, speech and speaker recognition, intelligent man-machine interfaces, natural language processing, multimedia signal processing, telecommunications, computer networking and security, digital watermarking, and biometrics.

Education

<u>Year</u>	<u>College/University</u>	<u>Degree</u>
1990	Clemson University	Ph.D. in Electrical and Computer Engineering
1986	Clemson University	M.S. in Electrical Engineering
1983	Royal Melbourne Institute of Technology	Bachelor of Engineering in Communications Engineering

Employment History

From:	1997	University of Miami
To:	2021	Coral Gables, FL
Position:	<i>Associate Professor, Research Professor and Associate Professor of Practice</i> Teaching and research in electrical and computer networks; real time digital signal processing, acoustics, speech, audio and music processing, pattern recognition, machine learning, speech recognition and synthesis, biometrics, digital watermarking, immersive audio for telepresence applications; communication systems; engineering acoustics.	
From:	1995	University of Patras
To:	1996	Greece
Position:	<i>Visiting Senior Scientist</i>	
From:	1990	The University of Melbourne
To:	1995	Melbourne, Australia
Position:	<i>University Lecturer</i>	

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1994 **Sun Microsystems Laboratories**, Chelmsford, MA
Position: *Visiting Senior Scientist, Speech Recognition Group*
Adapting speech recognizers to new acoustic environmental conditions

From: 1994 **Bell Communications Research (Bellcore)**
Morristown, NJ
Position: *Visiting Senior Scientist, Speech Analysis and Synthesis Group*
Improving the ORATOR speech synthesis system

From: 1984 **Department of Electrical and Computer Engineering**
To: 1990 Clemson, SC
Position: *Graduate Research Fellow and Teaching Assistant*
Neural networks and speech processing research

From: 1982 **LM Ericsson**
To: 1984 Melbourne, Australia
Position: *Technical Officer*
Production and Testing of the AXE and ASB900 Digital Telephone Exchanges and
Centers and Computer communication modems

From: 1980 **CompuServe**
To: 1981 Newcastle, Australia
Position: *Computer Hardware Developer (summer intern)*

Consulting History (supported parties are in bold)

2025 **Law Firm of Perkins Coie LLP**
Structure-borne sound bone conduction headphones; IPRs and District Court patent
infringement case for **Shenzhen Shokz Co. Ltd.**

2024-25 **Law Firm of Willkie Farr & Gallagher LLP**
Speech recognition, Biometrics, large language models, AI; District Court case of the
State of Texas v. **Google**

2024 **Law Firm of WilmerHale LLP**
Speech recognition, natural language processing, AI; patent infringement case for **Intel**

2022-23 **Law firms of Greenberg Traurig and Alston & Bird LLP**
IPR Expert Declarations on smart audio devices, automatic speech recognition and
speaker recognition/identification in Roku v. **Universal Electronics**

2022-23 **Law firm of Fish & Richardson P.C.**
Voice detection and noise suppression in Jawbone Innovations v. **Apple**

2022 **Law firm of Arnold & Porter**
Expert Reports and patent invalidity analysis on two-microphone audio processing for
noise cancellation in headset and cellular phone devices, District Court case of Jawbone
Innovations v. **Samsung**

2022 **Law firm of Dykema Gossett**
Expert Reports on **Honeywell's** speech recognition and biometric technologies as related
to the Illinois Biometric Information Privacy Act (BIPA)

2022 **Law firms of Wolf Greenfield and Perkins Coie LLP**
IPR Expert Declaration on audio watermarking in MZ Audio Sciences, v. **Sony and
Verance**

2022 **Law firm of Fisch Sigler**
5G architecture and physical layer, technical analysis of three IPR Declarations for
5G IP Holdings

2020 **Law firm of Baker & Hostetler**
Expert Report: Computer network security & watermarking in patents infringement in
Blue Spike v. **Comcast**

2018 **Law firm of Fisch Sigler LLP**
IPR Expert Declarations on Computer network security & watermarking in patents
infringement Blue Spike v. **Juniper Networks**

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- 2017 **Law firm of Fisch Sigler LLP**
IPR Expert Declarations on multisource 3D spatial audio processing in Broadcom v. **Amazon**
- 2017 **Law firm of Colson Hicks Eidson**
Expert report on physical injuries caused by electric burns (**private**)
- 2016 **Law firm of Greenspoon Marder**
Expert Report on electrical circuit and prediction analysis of physical injuries caused by electrical burns in **Nico Goodman** v Ningbo Litesun Electric Co., Ltd.
- 2015 **Law firm of Cooley LLP, Law firm of Upshaw LLP**
Expert Report and analysis of patents, standards, algorithms, source code for digital communications and speech coding in mobile telephony and devices applications for:
SLC v **HTC** (Law firm of Upshaw PLLC)
SLC v **Motorola** (Law firm of Cooley LLP)
SLC v **ZTE** (Law firm of Upshaw PLLC)
- 2015 **Law firm of Colson Hicks Eidson**
Analysis and evaluation of electrical systems involved in a pool electrocution (**private**)
- 2013 **Soundmouse, London, U.K.**
Audio watermark development for Digital Rights Management
- 2011 **Patent portfolio evaluation for Alcatel-Lucent**
EVRC speech coding and communication protocols (3GPP2) patents analyses and technical reports
- 2008 **Patent portfolio evaluation for Alcatel-Lucent**
MPEG-2 and MPEG-4) patents analyses and technical reports
- 2007 **Patent portfolio evaluation for Alcatel-Lucent**
AAC audio coding patents analyses and technical reports
- 2007 **Patent portfolio evaluation for Alcatel-Lucent**
MP3 audio coding European patents analyses and technical reports
- 2005 **SunnComm, Phoenix, AZ**
Audio watermark development
- 2003 **TradeHarbor, St. Luis, MO**
Robust Speech Recognition and Speaker Verification
- 2003 **US Department of Justice**
Forensic Audio Signal Analysis
- 2001 **KNOWLEDGE, S.A., Greece**
Speech Synthesis
- 1988-1996 **Several private companies and public institutions, Australia and the U.S.**
Project Consultant and Software Developer: Digital signal processing, data security, analog and digital modem design, speech, and audio research projects, engineering in-house training, speech pathology issues, aids for the handicapped, development of a Greek speech synthesizer for the blind
- 1995 **Robotron, Melbourne, Australia**
R&D for the world's first Greek text-to-speech speech synthesis
- 1994 **Sun Microsystems Laboratories, Chelmsford, MA**
Automatic speech recognition systems
- 1993 **Analog Devices, Norwood, MA and Melbourne, Australia**
Professional development and seminars on digital signal and speech processing for Analog Devices; R&D into real-time enhanced stereo systems
- 1993 **EDL, Melbourne, Australia**
R&D of digital audio coding. Modem design.
- 1992 **Australia National Acoustic Laboratories, Melbourne, Australia**
Evaluation of acoustic phonetics from speech pathology practitioners using digital signal processing techniques for speech analysis, feature display and evaluation
- 1992 **Royal Eye & Ear Hospital, Melbourne, Australia**
Software development for ocular melanoma growth monitoring using an ultrasound

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Court Case Support - Deposition Experience

- 2023 Client: **Law firm of Greenberg Traurig**
Expert Deposition in Roku v. **Universal Electronics**
Case No. IPR2022-01289
Subject: Protocols for voice-enabled smart remote-control devices, speech recognition engines.
- 2023 Client: **Law firm of Perkins Coie**
Expert Deposition in MZ Audio Sciences, v. **Sony and Verance**
Case No. IPR2022-01544
Subject: Audio watermarking.
- 2023 Client: **Law firm of Greenberg Traurig**
Expert Deposition in Roku v. **Universal Electronics**
Case No. IPR2022-00943
Subject: Speech recognition and audio signal conditioning for voice-enabled smart remote-control devices.
- 2022 Client: **Law firm of Arnold & Porter**
Expert Deposition in Jawbone Innovations v. **Samsung**
Case No. NO. 2:21-CV-0186-JRG-RSP
Subject: Microphone arrays for noise suppression in headset and cellular phone devices.
- 2021 Client: **Law firm of Greenspoon Marder**
Expert Deposition in **Nico Goodman** v Ningbo Litesun Electric Co., Ltd., a Chinese Company.
Subject: Physical injuries caused by electrocution.

Patents

<u>Patent Number</u>	<u>Date Issued</u>	<u>Title</u>
US 7,079,633 B2	07/18/2006	Coding a masked data channel in a radio signal
US 6,996,521	02/07/2006	Auxiliary channel masking in an audio signal

Publications

1. Iliev, A.I. and Scordilis, M.S., "Spoken Emotion Recognition using Glottal Symmetry," EURASIP Journal on Advances in Signal Processing – Special Issue on Emotion and Mental State Recognition from Speech, 2012
2. Nocito, C.D., Scordilis, M.S., "Monitoring jitter and packet loss in VoIP networks using speech quality features," Proceedings of the 8th Annual IEEE Consumer Communications and Networking Conference - Work in Progress (Short Papers), January 9-12, 2011, Las Vegas, NV, (CCNC2011), pp. 685-686
3. Jin W., Liu, X., Scordilis, M.S., Han L., "Speech Enhancement Using Harmonic Emphasis and Adaptive Comb Filtering," IEEE Transactions on Audio, Speech and Language Processing, Volume 18 (2), Feb. 2010, pp. 356 - 368
4. Scordilis, M.S., Iliev, A.I., Papa, J.P., Falcão, A.X., "Spoken emotion recognition through optimum-path forest classification using glottal features," Journal of Computer Speech and Language - Special Issue on Emergent Artificial Intelligence Approaches for Pattern Recognition in Speech and Language Processing, 24 (2010) 445-460

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5. He, X., Scordilis, M.S., "Psychoacoustic Music Analysis Based on the Discrete Wavelet Packet Transform," Research Letters in Signal Processing, Volume 2008, Article ID 346767, 5 pages
6. He, X., Scordilis, M.S., "'Efficiently Synchronized Spread Spectrum Audio Watermarking,'" Research Letters in Signal Processing, Volume 2008, Article ID 251868, 5 pages
7. Zhang, Y., Scordilis, M.S., "Effective Online Adaptation of Gaussian Mixture Models and its Application to Speech Classification," Pattern Recognition Letters, (Addendum to the Special Issue on Advances in Pattern Recognition for Speech and Audio Processing), 2008, vol. 29, pp. 735-744
8. Zhang, Y., Scordilis, M.S., "Online Acoustic and Pronunciation Adaptation Techniques in Automatic Speech Recognition," in Sorokin, V.N. (ed.), *Speech Communication at the Leading Edge*, ISBN 1-60021-786-0, Nova Science Publishers, 2008
9. Iliev, I.A., Scordilis, M.S., "Emotion Recognition in Speech using Inter-Sentence Glottal Statistics," Proceedings of the 15th International Conference on systems, Signals and Image Processing, IWSSIP 2008, Bratislava, Slovakia, June 25-28, 2008, pp. 465-468
10. Iliev, I.A., Zhang, Y., Scordilis, M.S., "Spoken Emotion Classification Using ToBI Features and GMM," Proceedings of the 14th International Workshop on Signals and Image Processing 2007 and the 6th EURASIP Conference focused on Speech and Image Processing, Multimedia Communications and Services, IWSSIP 2007, Maribor, Slovenia, June 27-30, 2007, pp. 495-498
11. Scordilis, M.S., He, X., "Spread Spectrum for Digital Audio Watermarking," in Cvejic, N. and Seppanen, T. (eds.), *Digital Audio Watermarking Techniques and Technologies: Applications and Benchmarks*, ISBN 978-1-59904-513-9, Information Science Reference, Hershey, PA, 2007, pp. 11-49
12. Jin W., Scordilis, M.S., "Speech Enhancement by Residual Domain Constrained Optimization," Journal of Speech Communication, Vol. 8 (10), October 2006, pp.1349-1364
13. He, X., Scordilis, M.S., "A Psychoacoustic Model Based on the Discrete Wavelet Packet Transform," Journal of the Franklin Institute, Volume 343, Issue 7, November 2006, pp. 738-755
14. Abdou, S., Scordilis, M.S., "Beam Search Pruning in Speech Recognition Using a Posterior Probability-Based Confidence Measure," Journal of Speech Communication, Vol. 423-4, 2004, pp. 409-428, (University of Miami, College of Engineering 2005 Research Paper Award Finalist for Eliahu I. Jury Award for Excellence in Research, November 2005)
15. Jin, W., Scordilis, M.S., "Single Channel Speech Enhancement by Frequency Domain Constrained Optimization and Temporal Masking," Proceedings of the International Conference on Spoken Language Processing, INTERSPEECH 2006, Pittsburgh, PA, USA, September 17-21, 2006, pp. 1411-1414
16. Jin, W., Scordilis, M.S., "Speech Enhancement by Residual Domain-Constrained Optimization," Proceedings of the 5th European Signal Processing Conference (EURASIP2005) on Speech and Image Processing, Multimedia Communications and Services, Smolenice, Slovakia, June 29-July 2, 2005, pp. 234-239
17. Jin, W., Scordilis, M.S., "Speech Enhancement by Kalman Filtering with Residual Noise Clipping," Proceedings of the IEEE Southeast Conference, Fort Lauderdale, FL, April 8-10, 2005, pp. 225-228
18. He, X., Scordilis, M.S., "Improved Spread Spectrum Digital Audio Watermarking Based on a Modified Perceptual Entropy Psychoacoustic Model," Proceedings of the IEEE Southeast Conference, Fort Lauderdale, FL, April 8-10, 2005, pp. 283-286
19. He X., Li, G, Scordilis, M.S., "A Novel VQ-based Speech Recognition Approach for Mobile Terminals," Proceedings of the IEEE Southeast Conference, Fort Lauderdale, FL, April 8-10, 2005, pp. 433-436
20. Zhang, Y., Scordilis, M.S., "Robust Voiced/Unvoiced/Mixed/Silence Classifier with Maximum A Posteriori Channel/Background Adaptation," Proceedings of the IEEE Southeast Conference, Fort Lauderdale, FL, April 8-10, 2005, pp. 229-232
21. Iliev, I.A., Scordilis, M.S., "Multilevel High Capacity Data Hiding Technique for Stereo Audio," Proceedings of the 2004 Asilomar Conference, Pacific Grove, California, November 7-10, 2004, pp. 1793-1797

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22. Jin, W., Scordilis, M.S., Iliev, I.A., "Comparison and implementation of a 16-bit fixed point audio resampler," Proceedings of the 2004 Asilomar Conference, Pacific Grove, California, November 7-10, 2004, pp. 1798-1800
23. Bergman, D.A., Scordilis, M.S., "High-Ordered Adaptive FIR Filters for Acoustical Echo Cancellation," Proceedings of the Audio Engineering Society's (AES) 117th Convention, San Francisco, October 28-31, 2004
24. Zhang, Y., Scordilis M.S., "Optimization of GMM Training for Speaker Verification," Proceedings of ODYSSEY 2004, the IEEE Speaker and Language Recognition Workshop, Toledo, Spain, May 31 – June 4, 2004, pp. 231-236
25. He, X., Iliev, I.A., Scordilis, M.S., "A High Capacity Watermarking Technique for Stereo Audio," Proceedings of the IEEE International Conference on Acoustics Speech and Signal Processing, ICASSP2004, Montreal, Canada, May 2004, vol. 5, pp. 393-396
26. Zhang, Y., Fahmy, A.I., Scordilis M.S., "Speaker Verification Using Speaker-Specific Prompts," Proceedings of the 17th International Artificial Intelligence Research Symposium, FLAIRS 2004, Miami, Florida, May 17-19, 2004, pp. 826-832
27. Abdou, S., Scordilis, M.S., "An Efficient, Fast Matching Approach Using Posterior Probability Estimates in Speech Recognition," Proceedings of the 8th European Conference on Speech Communication and Technology, EUROSPEECH 2003, Geneva, Switzerland, September 1-4, 2003
28. Veprek, P., Scordilis, M.S., "Analysis, Enhancement and Evaluation of Five Pitch Determination Techniques," Elsevier Science Journal of Speech Communication, Vol. 37, July 2002, pp. 249-270 (Best Research Paper Award; University of Miami College of Engineering 2003 Eliahu I. Jury Award for Excellence in Research. Most downloaded paper from the Elsevier website in 2002)
29. Iliev, I., Scordilis, M.S., "Binaural Phase Masking Experiments in Stereo Audio," Presentation at the First Pan-American/Iberian Meeting on Acoustics, Cancun, Mexico, December 2-6, 2002
30. Abdou, S., Scordilis, M.S., "Dynamic Tuning of Language Model Score in Speech Recognition Using a Confidence Measure." Seventh International Conference on Spoken Language Processing. ICSLP 2002, Denver, Colorado, 16-20 September 2002
31. Abdou, S., Scordilis, M.S., "Confidence Measures as a Speech Guide in Speech Recognition," Proceedings of the 2002 IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP2002, Orlando, Florida, Utah, May 13-17, 2002, vol. IV, pp. 4162
32. Abdou, S., Scordilis, M.S., "Integrating Multiple Knowledge Sources for Improved Speech Understanding," Proceedings of the 7th European Conference on Speech Communication and Technology, EUROSPEECH 2001, Aalborg, Denmark, August 3-7, 2001
33. Jin, W., Scordilis, M.S., "Scalable Audio Coding for ATM Environments," Proceedings of the 2001 IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP2001, Salt Lake City, Utah, May 7-11, 2001
34. Abdou, S., Scordilis, M.S., "Multilevel Classification Trees for Initiative Tracking in Dialog Systems," Proceedings of the 2001 IEEE International Conference on Acoustics, Speech and Signal Processing, ICASSP2001, Salt Lake City, Utah, May 7-11, 2001
35. Jin, W., Scordilis, M.S., "A Scalable Subband Audio Coding Scheme for ATM Environments," Proceedings of the 2001 IEEE Southeast Conference, SECON2001, Clemson, S.C., March 3-April 1, 2001, pp. 271-275
36. Abdou, S., Scordilis, M.S., "Improved Speech Understanding Using Dialogue Expectation in Sentence Parsing," Proceedings of the 6th International Conference on Spoken Language Processing, ICSLP-2000, Beijing, Oct 2000
37. Grayden, D.B., Scordilis, M.S., "Using the Vowel Triangle in Automatic Speech Recognition," Proceedings of the Sixth Australian International Conference on Speech Science and Technology, SST-96, Adelaide, Dec 1996, pp. 313-318
38. Veprek, P., Scordilis, M.S., "A Constrained DTW-Based Procedure for Speech Segmentation," Proceedings of the Sixth Australian International Conference on Speech Science and Technology, SST-96, Adelaide, Dec 1996, pp. 545-550
39. Veprek, P., Scordilis, M.S., "Enhanced Speech Classification and Pitch Detection," Proceedings of the Sixth Australian International Conference on Speech Science and Technology, SST-96, Adelaide, Dec 1996, pp. 521-526

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40. Jenkin, K.L., Scordilis, M.S., "Automatic Syllable Stress Classification Methods," Proceedings of the Sixth Australian International Conference on Speech Science and Technology, SST-96, Adelaide, Dec 1996, pp. 31-36
41. Jenkin, K.L., Scordilis, M.S., "Development and Comparison of Three Syllable Stress Parsers," Proceedings of the 1996 International Conference on Spoken Language Processing, ICSLP, Philadelphia, 3-6 Oct 1996, Vol. 2, pp. 733-736
42. Scordilis, M.S. "A neuronal formant synthesizer," Journal of Mathematics and Computers in Simulation, Special Issue on "Neural Networks/ Neurocomputing," Vol. 40, Nos. 5-6, May 1996, pp. 615-622
43. Grayden, D.B., Scordilis, M.S., "Phoneme Recognition in Fluent Speech using Time-Delay and Fully Interconnected Neural Networks: A Comparison," Australian Journal of Intelligent Information Processing Systems, Vol.3, No.3, Spring 1996, pp. 5-8
44. Scordilis, M.S., "Current Speech Technology and the Need for Robust Processing," Australian Speech Science and Technology Association Bulletin, No. 12, September 1995, pp. 3-4
45. Scordilis, M.S., Gowdy, J. N., "A Neural Network-based Control Strategy for a Speech Formant Synthesizer," Journal of Artificial Neural Networks, Vol. 2, No. 3, 1995, pp. 195-103
46. Grayden, D.B. and Scordilis, M.S., "ASOR: A Continuous Phoneme Recognition System Integrating Neural Networks and Phonetic Knowledge," Proceedings of the International Conference on Neural Networks and Signal Processing, ICNNSP'95, Vol. 1, Beijing, Dec. 1995, pp. I.788-I.791
47. Scordilis, M.S., Adams, S., "Experiments in Multi-microphone Speech Enhancement for Recognition," Proceedings of the Fifth Australian International Conference on Speech Science and Technology, SST-94, Perth, Australia, 6-8 Dec. 1994, pp. 63-68
48. Grayden, D. B., Scordilis, M.S., "A Hierarchical Approach to Phoneme Recognition of Fluent Speech," Proceedings of the Fifth Australian International Conference on Speech Science and Technology, SST-94, Perth, Australia, 6-8 Dec. 1994, pp. 473-478
49. Jenkin, K.L., Scordilis, M. S. "Automatic methods of Syllable Stress Classification in Continuous Speech," Proceedings of the Fifth Australian International Conference on Speech Science and Technology, SST-94, Perth, Australia, 6-8 Dec. 1994, pp. 731-736
50. Grayden, D. B., Scordilis, M.S., "Phonemic Segmentation of Fluent Speech," Proceedings of the 1994 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP94), pp. V.73-76
51. Jenkin, K.L., Scordilis, M. S. "A Continuous Speech Syllable Classifier Using Neural Networks," Proceedings of the Australian and New Zealand Conference on Intelligent Information Systems, ANZIIS-93, Perth, Australia, 1-3 Dec. 1993, pp.249-253
52. Grayden, D. B., Scordilis, M.S., "Recognition of Obstruent Phonemes in Speaker-Independent Fluent Speech Using a Hierarchical Approach," Proceedings of the 1993 European Speech Communication Conference, EUROSPEECH'93, Berlin, 21-23 Sept. 1993, pp. 855-859
53. Lim T.S., Scordilis, M.S., "New and Improved Pitch Determination for the IMBE Vocoder," Proceedings of the Fourth Australian International Conference on Speech Science and Technology, SST-92, Brisbane, Australia, 1-3 Dec. 1992, pp. 375-380
54. Grayden, D. B., Scordilis, M.S., "TDNN vs. Fully Interconnected Multilayer Perceptron: A Comparative Study on Phoneme Recognition," Proceedings of the Fourth Australian International Conference on Speech Science and Technology, SST-92, Brisbane, Australia, 1-3 Dec. 1992, pp. 214-219
55. Scordilis, M.S., Gowdy, J. N., "Speech Synthesis of Phonemic Triplets through a Neural Network-Controlled Formant Synthesizer," Proceedings of the International Joint Conference in Neural Networks 1991, Seattle, USA, (IJCNN'91 SEATTLE), Vol II, p A-1007
56. Scordilis, M.S., "A Neural Network Cluster for the Control of a Speech Synthesizer," in Tzafestas, S.G. (ed.), Engineering Systems with Intelligence: Concepts, Tools and Applications, Kluwer Academic Publishers 1991, pp. 229-235
57. Scordilis, M.S., Gowdy, J. N., "Neural Network Control for a Cascade/Parallel Formant Synthesizer," Proceedings of the 1990 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP90), Albuquerque, NM, USA, 2-5 April 1990, pp. (S6a.1) 297-300

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58. Scordilis, M.S., Gowdy, J. N., "Effects of the Vocal Tract Area Function on the Spectral Tilt of the Glottal Pulse Waveform," Proceedings of the 1990 IEEE Southeast Conference, New Orleans, USA, 1-4 April 1990, pp.86-89
59. Scordilis, M.S., Gowdy, J. N., "Neural Network-based Generation of Fundamental Frequency Contours," Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP89), May 24, Glasgow, Scotland, 1989, pp. (S16.S5.2) 219-222
60. Scordilis, M.S., Gowdy, J. N., "Text Processing for Speech Synthesis Using Parallel Distributed Models," Proceedings of the IEEE Southeast Conference, Columbia, S.C., USA, April 1989
61. Scordilis, M.S., Gowdy, J. N., "A Phoneme-Dependent Voicing Source for Speech Synthesis," Proceedings of the IEEE Southeastern Symposium on Systems Theory, Charlotte, NC, USA, 1988
62. Scordilis, M.S., Gowdy, J. N., "Comparison of Computerized Speech Synthesis Techniques," Proceedings of the IEEE Southeast Conference, Richmond, VA, USA, April 1986

Dissertations and Masters Theses Advised

- Iliev, I. Alex, "Emotion Recognition Using Glottal and Prosodic Features", Ph.D. Dissertation, University of Miami, 2009
- Jin, Wen, "Speech Enhancement by Linear Transformation and Constraint Optimization", Ph.D. Dissertation, University of Miami, 2006
- Zhang, Yongxin, "Acoustic Model and Pronunciation Adaptation in Automatic Speech Recognition", Ph.D. Dissertation, University of Miami, 2006
- He, Xing, "Psychoacoustic Modeling for Perceptual Audio Coding and Watermarking with Improved Synchronization", Ph.D. Dissertation, University of Miami, 2006
- Abdou, Sherif, "Confidence Measures and a Search Guide in Speech Recognition", Ph.D. Dissertation, University of Miami, 2003
- Grayden, David, "An Integrated Knowledge-Based Approach to Unrestricted Speech Recognition", Ph.D. Dissertation, University of Melbourne, 1999
- Nocito, Carlos, "Network Condition Estimator for Voice Over IP Objective Quality Assessment", Master Thesis, University of Miami, 2011
- Lu, Guipeng, "Prosodic Modifications in Speech Synthesis and the Effects of Pitch Errors", Master Thesis, University of Miami, 2004
- Fahmy, Adel, "Text Prompted Speaker Verification Using Isolated Whole Word Hidden Markov Models", Master Thesis, University of Miami, 2002
- Veprek, Peter, "Framework for the Development of Speech Synthesizers", Master Thesis, University of Melbourne, 1996
- Jenkin, Karen, L., "Automatic Stress Syllable Classifiers and their Application in Continuous Speech", Master Thesis, University of Melbourne, 1995

Honors & Awards

- University of Miami, College of Engineering 2005 Research Paper Award Finalist for the Eliahu I. Jury Award for Excellence in Research, November 2005
- University of Miami Invention Recognition Award - UM04-23 for "High Capacity for Monophonic Audio Signals Using Differential Encoding in the Short-Phase Spectrum," November 2004
- The University of Miami, College of Engineering 2003 Winner of the Eliahu I. Jury Award for Excellence in Research, November 2003 for "Veprek, P., Scordilis, M.S., "Analysis, Enhancement and Evaluation of Five Pitch Determination Techniques," most downloaded paper from the Elsevier website in 2002)"
- University of Miami Invention Recognition Award, "Auxiliary Channel Masking in Audio Signals," February 2001
- NCR Research Fellowship; 1984 – 1986

APPENDIX A

Selected Funded Projects

“Spoken database collection and channel modeling for automatic speech recognition retraining”, 12/15/2006-12-14/2007, IBM Corporation, December 2006 – August 2008

“SGER: Music Telepresence”, 11/12005-10/31/2006, National Science Foundation (NSF), November 2005.

“Multi-microphone long probe for otoacoustic emissions (OAE) acquisition”, The National Institutes of Health (NIH), May 2005

“Auxiliary channel masking in audio signals”, Watermark Technologies, May 2001

“Acoustic Compensation of Miniature Speakers in Hearing Diagnosis and Hearing Aid Applications”; Summer Award in Natural Sciences and Engineering, The University of Miami; Principal Investigator; Summer 2000

“High Speed, ATM Networking for Improving Quality of Service (QoS) in Multimedia Communications”; The National Science Foundation (NSF); Principal Investigator; June 1997 – May 1999
