

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

Inter Partes Review No.: IPR2025-00842

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 11,197,084 UNDER 35 U.S.C. §§ 311-319
AND 37 C.F.R. §§ 42.1-100, ET SEQ**

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1005	CN106937222A (“Liao”) [Certified English Translation]
1006	CN202931524U (“Asaka”) [Certified English Translation]
1007	JP2008294872A (“Numata”) [Certified English Translation]
1008	CN205356672U (“Wang”) [Certified English Translation]
1009	CN205017577U (“Xu”) [Certified English Translation]
1010	WO 2009/086838 (“Nielsen”)
1011	US 2008/0279409 (“Hupkes”)
1012	US 7,672,469 (“Dryer”)
1013	US 8,515,103 (“Mei”)
1014	US 2016/0080853 (“Chen”)
1015	US 9,866,966 (“Lott”)
1016	US 2018/0316999 (“Bellas”)
1017	US 5,987,147 (“Nishimoto”)
1018	JP2007189269A (“Nakada”) [Certified English Translation]
1019	US 2014/0126742 (“Eggebraaten”)
1020	US 8,223,997 (“Wilson, II”)
1021	US 8,111,860 (“Retchin”)
1022	WO 2008/007666 (“Fujita”) [Certified English Translation]
1023	US9253563 (“Fukuda”)
1024	Stanley A. Gelfand, <i>Hearing: An Introduction to Psychological and Physiological Acoustics</i> (5th ed. 2010)
1025	CN107454492A (“Li”) [Original]
1026	CN106937222A (“Liao”) [Original]
1027	CN202931524U (“Asaka”) [Original]
1028	JP2008294872A (“Numata”) [Original]
1029	CN205356672U (“Wang”) [Original]
1030	CN205017577U (“Xu”) [Original]
1031	JP2007189269A (“Nakada”) [Original]
1032	WO 2008/007666 (“Fujita”) [Original]

CHART OF CLAIMS	
[1pre]	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.
[2pre]	The loudspeaker apparatus of claim 1,
[2a]	wherein the ear hook further includes: an elastic metal wire;
[2b]	a wire; and
[2c]	a fixed sleeve, the fixed sleeve fixing the wire on the elastic metal wire, the protective sleeve being formed, by injection molding, on periphery of the elastic metal wire, the wire, the fixed sleeve, the first plug end, and the second plug end.
[3pre]	The loudspeaker apparatus of claim 2, wherein
[3a]	the first plug end and the second plug end are formed, by injection molding, at both ends of the elastic metal wire respectively,
[3b]	the first plug end and the second plug end are arranged with a first wiring channel and a second wiring channel respectively, and
[3c]	the wire extends along the first wiring channel and the second wiring channel.
[4]	The loudspeaker apparatus of claim 3, wherein the wire passes through the first wiring channel and the second wiring channel.
[5pre]	The loudspeaker apparatus of claim 3, wherein
[5a]	the first wiring channel includes a first wiring groove and a first wiring hole connecting the first wiring groove and an outer end surface of the first plug end,
[5b]	the wire extends along the first wiring groove and the first wiring hole and is exposed on the outer end surface of the first plug end,
[5c]	the second wiring channel includes a second wiring groove and a second wiring hole connecting the second wiring groove and the outer end surface of the first plug end, and

CHART OF CLAIMS	
[5d]	the wire extends along the second wiring groove and the second wiring hole and is exposed on the outer end surface of the second plug end.
[6]	The loudspeaker apparatus of claim 2, wherein the ear hook includes at least two fixed sleeves spaced apart along the elastic metal wire.
[7pre]	The loudspeaker apparatus of claim 1, wherein
[7a]	the core housing is arranged with a first socket connecting with an outer end surface of the core housing,
[7b]	a stopping block is arranged on an inner sidewall of the first socket, and
[7c]	the first socket is connected to the first plug end.
[8pre]	The loudspeaker apparatus of claim 7,
[8a]	wherein the first plug end includes: an inserting portion being at least partially inserted into the first socket and abutting against an outer side surface of the stopping block; and
[8b]	two elastic hooks being arranged on a side of the inserting portion facing inside of the core housing, wherein:
[8c]	the two elastic hooks are brought together under action of external thrust and the stopping block, and
[8d]	after passing through the stopping block, the two elastic hooks are elastically restored to be stuck on an inner surface of the stopping block to realize the fixation of the core housing and the first plug end.
[9pre]	The loudspeaker apparatus of claim 8, wherein
[9a]	the inserting portion is partially inserted into the first socket, and
[9b]	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.
[10pre]	The loudspeaker apparatus of claim 9, wherein
[10a]	the protective sleeve further extends to a side of the annular table surface facing the outer end surface of the core housing, and
[10b]	when the core housing and the first plug end are fixed, the protective sleeve elastically abuts against the core housing to realize sealing.
[12pre]	The loudspeaker apparatus of claim 1, wherein
[12a]	the housing panel and the earphone core are in a transmission connection, and
[12b]	all or part of the housing panel is used to contact or abut a user's body to conduct a sound generated by the vibration of the earphone core.
[13pre]	The loudspeaker apparatus of claim 12,
[13a]	wherein when a straight line of the driving force has a positive direction pointing to outside of the loudspeaker apparatus from the housing panel and the

CHART OF CLAIMS	
	normal line has a positive direction pointing to the outside of the loudspeaker apparatus, an angle between the two lines in their positive direction is an acute angle.
[14pre]	The loudspeaker apparatus of claim 12, wherein
[14a]	the earphone core includes a coil and a magnetic circuit system, and
[14b]	an axis of the coil or the magnetic circuit system is not parallel to the normal line, the axis being perpendicular to a radial plane of the coil or the magnetic circuit system.
[15pre]	The loudspeaker apparatus of claim 12, wherein
[15a]	the driving force has a component in a first quadrant or a third quadrant of an XOY plane coordinate system, wherein an origin O of the XOY plane coordinate system is on a contact surface between the loudspeaker apparatus and a human body, an X-axis of the XOY plane coordinate system is parallel to a coronal axis of the human body, a Y-axis of the XOY plane coordinate system is parallel to a sagittal axis of the human body, a positive direction of the X-axis faces outside of the human body, and a positive direction of the Y-axis faces front of the human body.
[16pre]	The loudspeaker apparatus of claim 1,
[16a]	wherein the earphone core further includes a magnetic circuit component generating a first magnetic field
[16b]	the magnetic circuit component including: a first magnetic unit configured to generate a second magnetic field;
[16c]	a first magnetically conductive unit; and
[16d]	at least one second magnetic unit, the at least one second magnetic unit surrounding the first magnetic unit and forming a magnetic gap with the first magnetic unit, a magnetic field strength of the first magnetic field in the magnetic gap being greater than a magnetic field strength of the second magnetic field in the magnetic gap.
[17pre]	The loudspeaker apparatus of claim 16,
[17a]	wherein the magnetic circuit component further includes: a second magnetically conductive unit; and
[17b]	at least one third magnetic unit being connected to the second magnetically conductive unit and the at least one second magnetic unit.
[18pre]	The loudspeaker apparatus of claim 17,
[18a]	wherein the magnetic circuit component further includes: at least one fourth magnetic unit being located below the magnetic gap and connected to the first magnetic unit and the second magnetically conductive unit.
[19pre]	The loudspeaker apparatus of claim 17, wherein

CHART OF CLAIMS	
[19a]	the first magnetically conductive unit is connected to the upper surface of the first magnetic unit,
[19b]	the second magnetically conductive unit includes a bottom plate and a sidewall; and
[19c]	the first magnetic unit is connected to the bottom plate of the second magnetically conductive unit.
[20pre]	The loudspeaker apparatus of claim 17, further comprising:
[20a]	at least one electrically conductive unit being connected to at least one unit of the first magnetic unit, the first magnetically conductive unit, or the second magnetically conductive unit.

I. INTRODUCTION

Per 37 C.F.R. §42.104(a), Petitioner certifies that U.S. Patent No. 11,197,084 (the “’084 Patent”) is available for *inter partes* review, and Petitioner is not barred or estopped from requesting an *inter partes* review challenging the claims on the below grounds.

II. STATEMENT OF PRECISE RELIEF REQUESTED

Per 35 U.S.C. § 311, Petitioner requests cancelation of the ’084 Patent’s claims 1-10 and 12-20 on the following grounds:

Ground	Claims	Stat. Basis	Prior Art
1	1	35 U.S.C. § 103	Li and Fujita
2	12-15	35 U.S.C. § 103	Li, Fujita, and Fukuda
3	2-6	35 U.S.C. § 103	Li, Fujita, and Asaka
4	7-10	35 U.S.C. § 103	Li, Fujita, and Numata
5	16-20	35 U.S.C. § 103	Li, Fujita, Wang, Xu, and Nielsen

III. THE ’084 PATENT AND PROSECUTION HISTORY

A. The ’084 Patent

The ’084 Patent discloses a loudspeaker apparatus; specifically, modularly designed bone conduction headphones having an ear hook 10 surrounded by a protective sleeve 16, a core housing 20 accommodating an earphone core 50, and a circuit housing 30 accommodating a control circuit 60 or battery 70. See EX1001,



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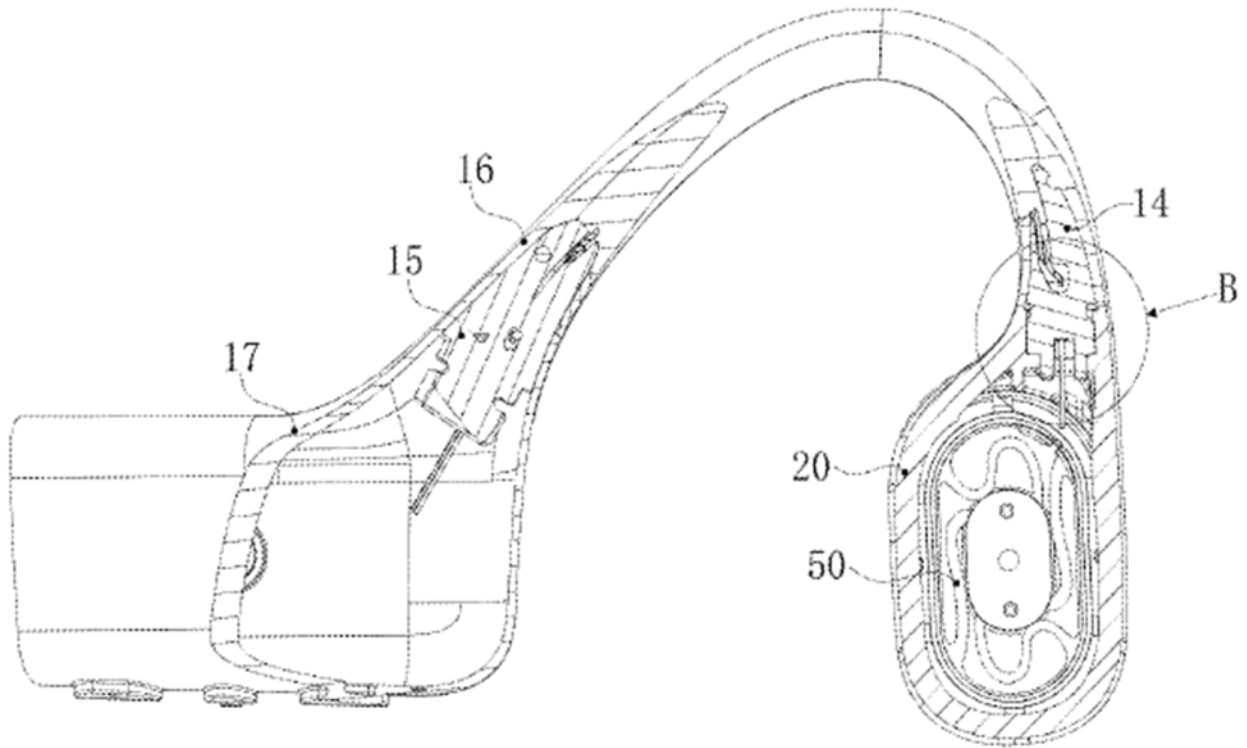


Fig. 5

In some embodiments of the speaker, a driving force generated by the driving component 1001 and applied to a panel 1003 and housing 1004 via a transmission component 1002 along a straight line B, and a normal line A of the panel 1003, may form an angle θ . EX1001, 17:14-46, Fig. 10. In other words, the straight line B is not parallel to the normal line A. *Id.*, 17:45-46; EX1003, ¶40.

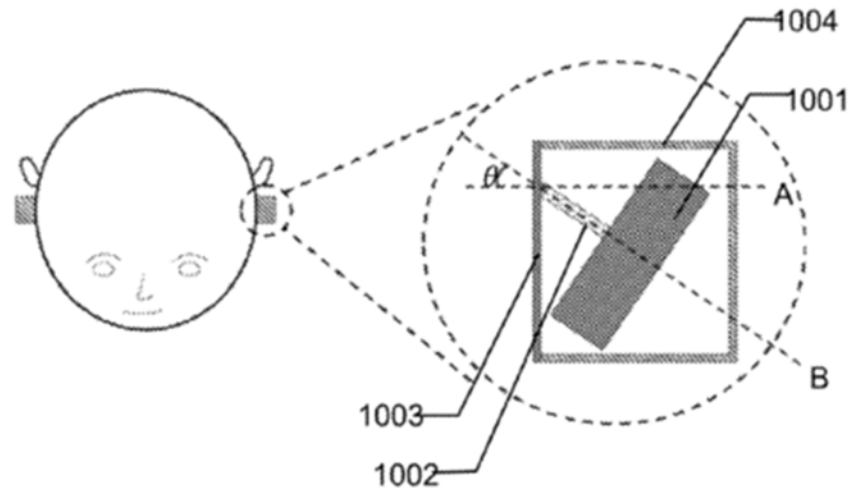


FIG. 10

A magnetic circuit component 2100 generates sound. EX1001, Figs. 15-21, 23:12-34:39, 38:38-39:8. As shown below, “the magnetic circuit component 2100 may include a first magnetic unit 2102, a first magnetically conductive unit 2104, a second magnetically conductive unit 2106, and a second magnetic unit 2108.” *Id.*, 24:61-65. A voice coil 2128 may be located in the gap between magnets. *Id.*, 25:67-26:1; EX1003, ¶41.

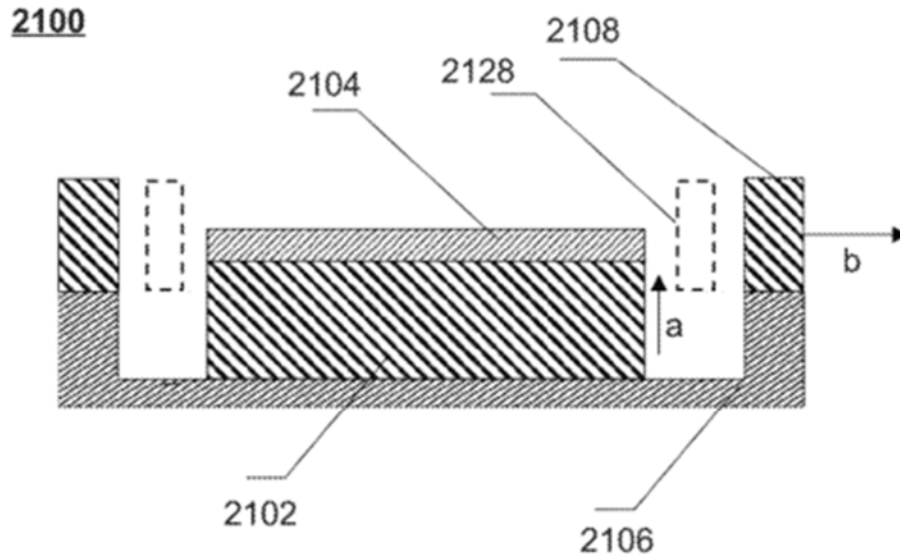


FIG. 16

B. Prosecution History and Priority Date

The '084 Patent was filed on December 30, 2020 and claims priority to Chinese Application No. 201910009927.4, filed January 5, 2019. EX1001, (22), (30). 20 claims issued on December 7, 2021. EX1002, 1 (Issue Notification); EX1003, ¶¶43-45.

C. Level of Ordinary Skill in the Art

A person of ordinary skill in the art (“POSITA”) at the '084 Patent’s earliest priority date (January 5, 2019), 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. EX1003, ¶¶34-36.

IV. CLAIM CONSTRUCTION UNDER 37 C.F.R. § 42.104(B)(3)

Petitioner does not contend that its proposed constructions are complete constructions of these limitations or the claims for any other purpose, including for the related litigation. Because the prior art discloses the preferred embodiment within the indisputable scope of the challenged claims, the Board need not construe the outer bounds of the claims in these proceedings. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (providing that only those terms that are in controversy need be construed, and only if necessary to resolve the controversy) (citation omitted).

Any claim terms not listed below should be construed according to their plain and ordinary meaning to a POSITA at the time of the '084 Patent. 37 C.F.R. § 42.100(b).

A. “the second wiring channel includes a second wiring groove and a second wiring hole connecting the second wiring groove and the outer end surface of the first plug end” (claim 5)

This term should be construed as “the second wiring channel includes a second wiring groove and a second wiring hole connecting the second wiring groove and the outer end surface of the second plug end.” A POSITA would have understood that there is a typo where “first” was written instead of “second.” This

is clear from the claim language, where the first two substantive claim elements address the “first” wiring channel, wiring groove, wiring hole, and plug end, and the third and fourth substantive claim elements address the “second” version of the same structures, including the “second plug end” in the final claim element.

Without this construction, there would be no disclosure of the first plug end connecting to the disclosed “second” elements and the connection would have to traverse the space between the first and second plugs. EX1003, ¶¶52-54.

V. OVERVIEW OF THE PRIOR ART

A. CN107454492A (“Li”) (EX1004)¹

Li was filed on August 18, 2017 and published on December 8, 2017.

EX1004, (22), (45). Li is prior art under post-AIA §102(a)(1). Li was not cited as prior art and thus was not considered by the patent examiner during prosecution.

EX1001, (56). Li discloses a bone conduction earphone with an ear hook assembly 11, a first housing 111 containing a battery pack 13 or control circuit assembly 14, and a second housing 112 forming the bone conduction speaker. EX1004, Abstract, [0023], [0040], Figs. 1-2. The first housing 111 and second housing 112 are connected by a first elastic metal wire 1131 covered by a first elastic coating

¹ EX1004 is a certified English translation of this reference, cited throughout. The original reference is available at EX1025.

layer 1132. *Id.*, [0004]-[0005], [0023], Figs. 1-2. A rear hook assembly 12 fits around the back of a user's head with plug-in portions 123 that connect to the first housings of both ear hook assemblies. *Id.*, [0058], Fig. 5; EX1003, ¶¶56-57.²

² All emphasis, color, and annotations are added, unless otherwise indicated.

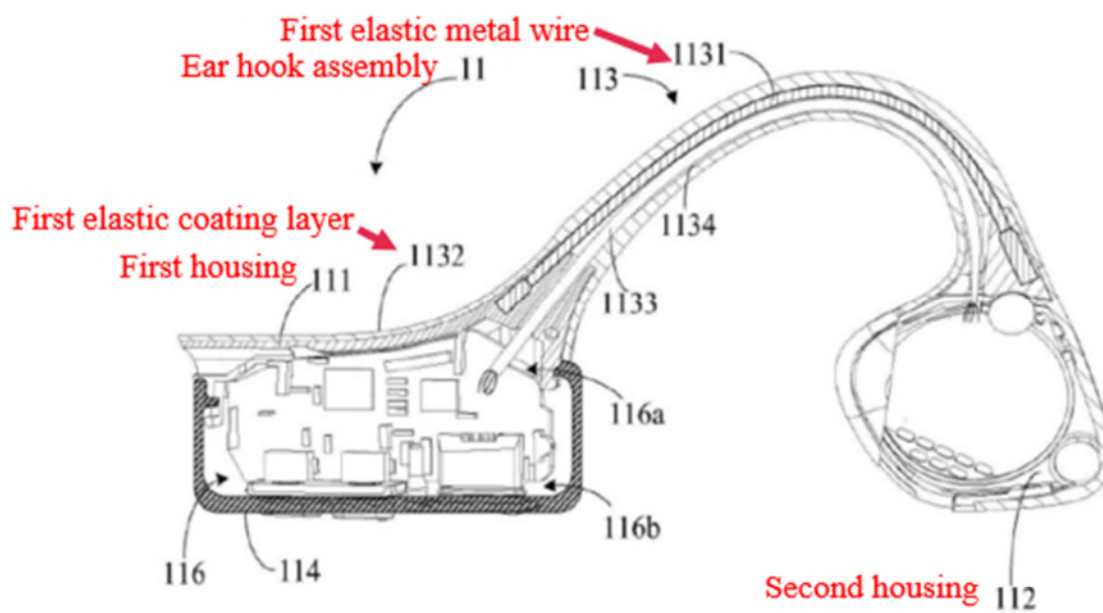


Figure 1

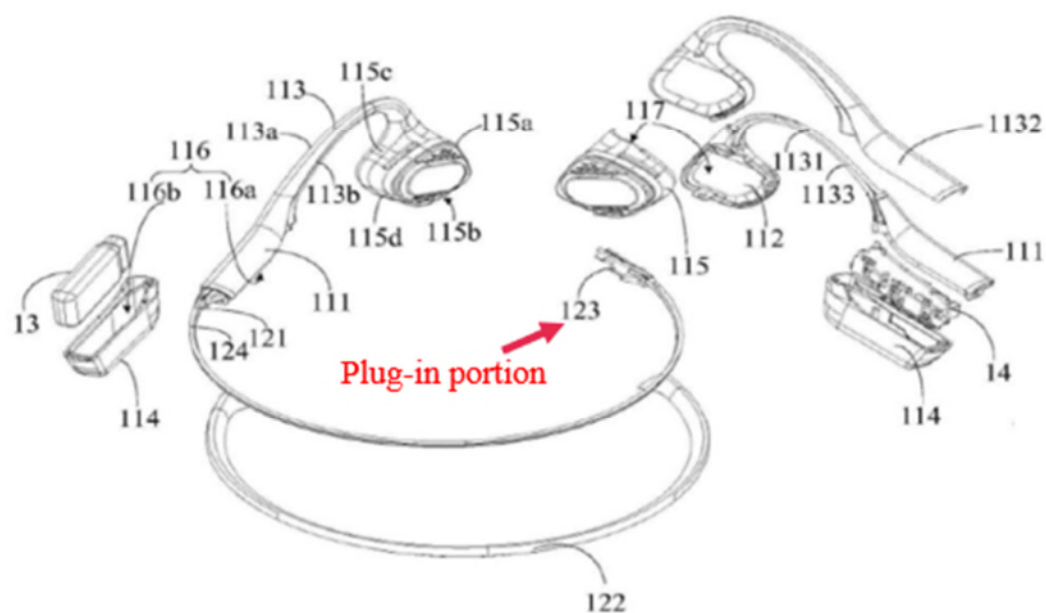


Figure 2

B. CN106937222A (“Liao”) (EX1005)³

Liao was filed on August 13, 2015 and published on July 7, 2017. EX1005, (22), (45). Liao is prior art under post-AIA §102(a)(1). Liao was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56); EX1003, ¶58.

Liao discloses a bone conduction speaker with a housing 210, panel 220, and energy conversion device 230, and connection members 240. EX1005, [0055], Fig. 2-B. The energy conversion device 230 vibrates panel 220 against the human skin, and the vibration transmits to the housing 210. *Id.*, [0056]. In some embodiments, the panel 220 can be attached to the housing 210 “by clamping or welding” without connection members 240. *Id.*, [0057]-[0058]; EX1003, ¶59.

³ EX1005 is a certified English translation of this reference, cited throughout. The original reference is available at EX1026.

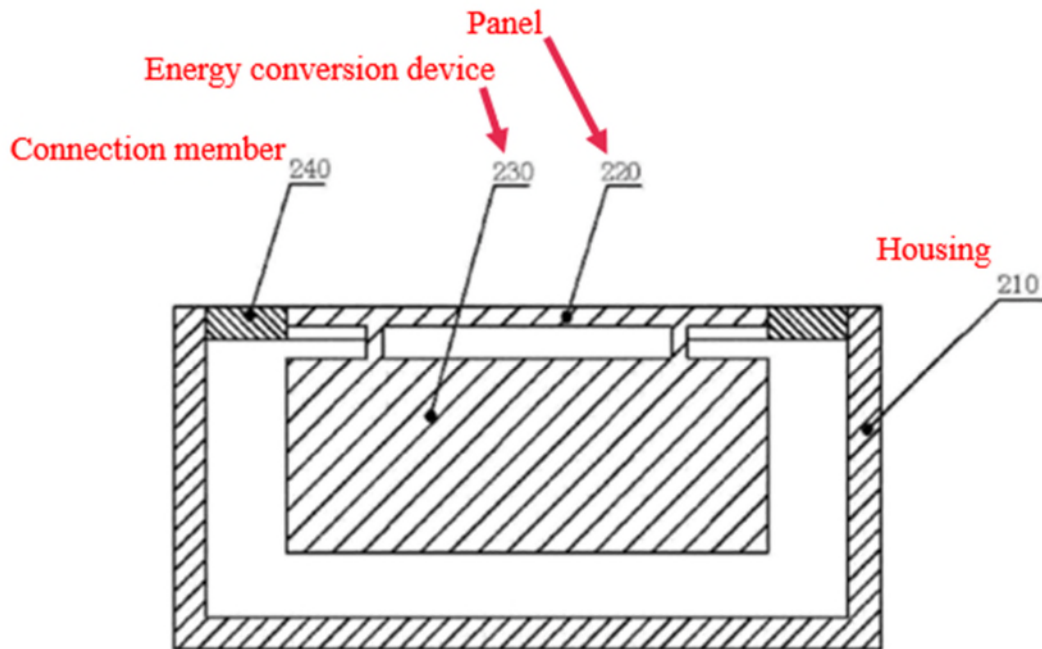
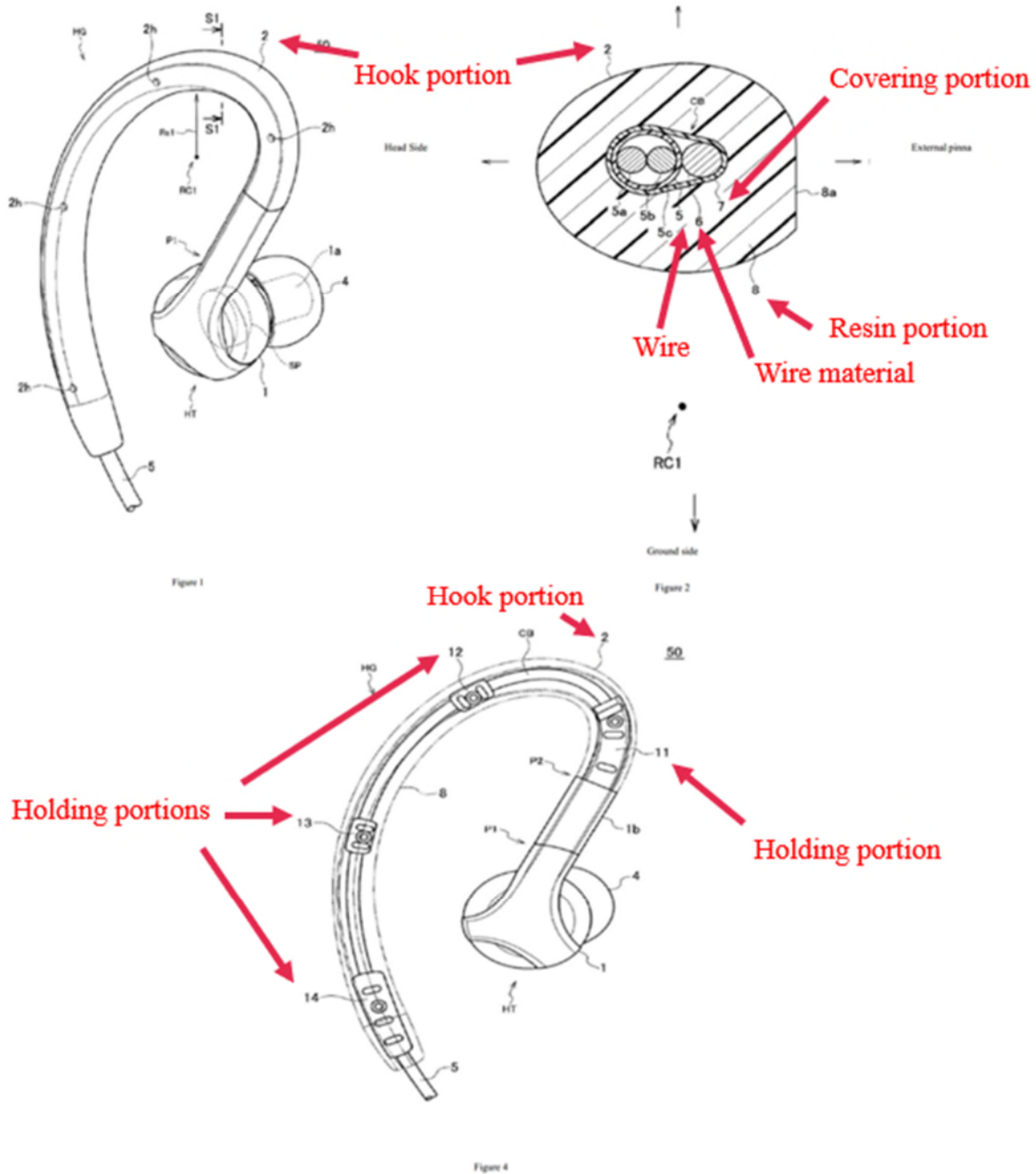


Figure 2-B

C. CN202931524U (“Asaka”) (EX1006)⁴

Asaka was filed on May 16, 2012 and published on May 8, 2013. EX1006, (22), (45). Asaka is prior art under post-AIA §102(a)(1). Asaka was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56). Asaka discloses an ear hook and earphone. EX1006, (54). Figure 2 depicts a cross-section view of the ear hook, including the shape of the integrated wire CB. *Id.*, [0030], [0067]; EX1003, ¶¶60-61.

⁴ EX1006 is a certified English translation of this reference, cited throughout. The original reference is available at EX1027.



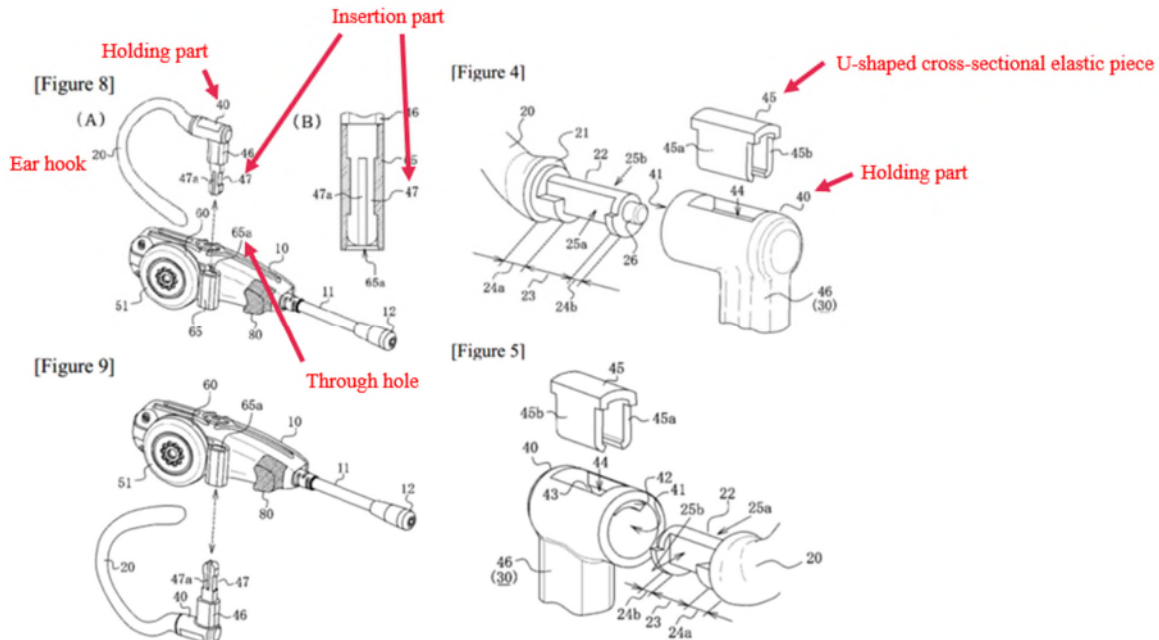
The hook portion 2 includes wire 5, wire material 6, covering portion 7 that integrates wire 5 and wire material 6, and resin portion 8 wrapping around covering portion 7. EX1006, [0058], Figs. 1-2. Four holding portions are spaced inside the hook portion 2. *Id.*, [0086]; EX1003, ¶61.

D. JP2008294872A (“Numata”) (EX1007)⁵

Numata was filed on May 26, 2007, and published on December 4, 2008. EX1007, (22), (43). Numata is prior art under post-AIA §102(a)(1). Numata was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56); EX1003, ¶62.

Numata discloses a wireless headset with an earhook. EX1007, Abstract, Figs. 1-3. The earhook part 20 connects to holding part 40 via a U-shaped cross-sectional elastic piece 45. *Id.* at [0022]-[0023], [0025], Figs. 4-5. The earhook part 20 connects to the rest of the wireless headset via insertion part 47 into through-hole 65a. *Id.*, [0033]-[0034], Figs. 8-9; EX1003, ¶63.

⁵ EX1007 is a certified English translation of this reference, cited throughout. The original reference is available at EX1028.

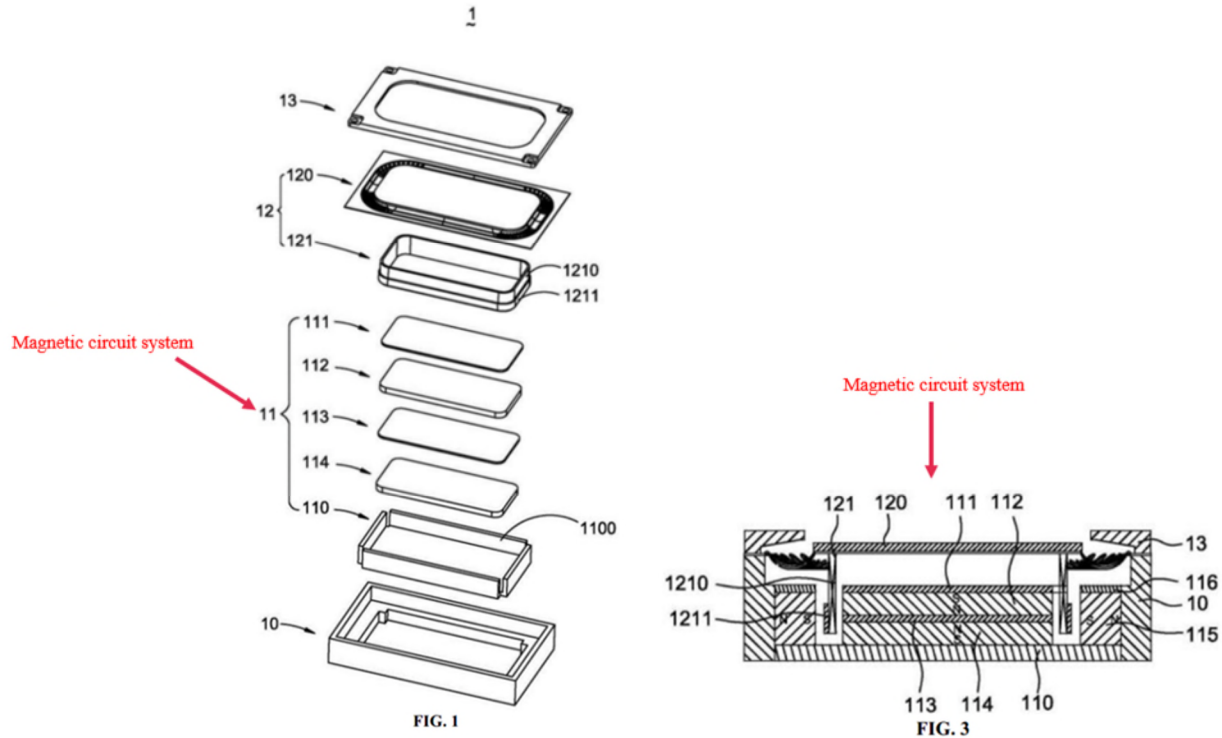


E. CN205356672U (“Wang”) (EX1008)⁶

Wang was filed on December 24, 2015, and published on June 29, 2016.

EX1008, (22), (45). Wang is prior art under post-AIA §102(a)(1). Wang was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56). Wang discloses a loudspeaker having a magnetic circuit system 11 generating a magnetic field. EX1008, (54), [0018], Figs. 1, 3; EX1003, ¶¶64-65.

⁶ EX1008 is a certified English translation of this reference, cited throughout. The original reference is available at EX1029.



F. CN205017577U (“Xu”) (EX1009)⁷

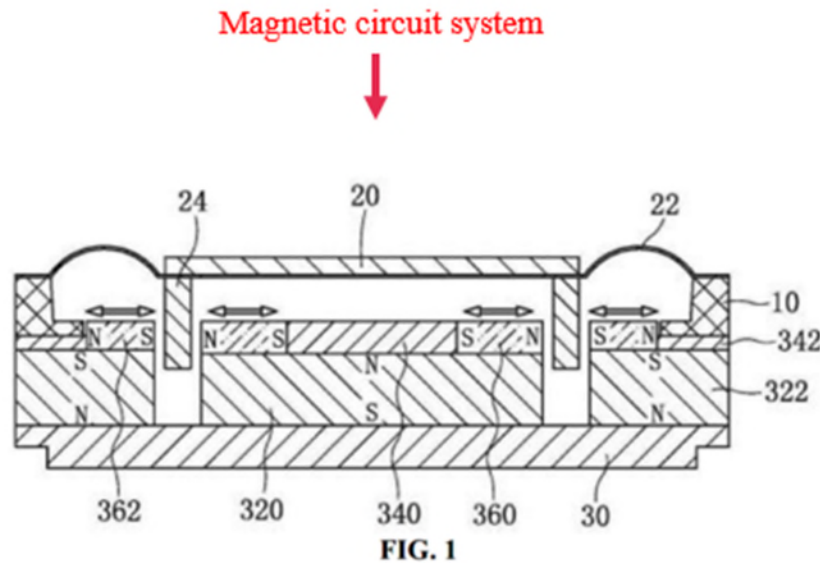
Xu was filed on October 19, 2015, and published on February 3, 2016.

EX1009, (22), (45). Xu is prior art under post-AIA §102(a)(1). Xu was not cited as prior art and thus was not considered by the patent examiner during prosecution.

EX1001, (56). Xu discloses a micro loudspeaker having a magnetic circuit system.

EX1009, (54), [0026], Fig. 1; EX1003, ¶¶66-67.

⁷ EX1009 is a certified English translation of this reference, cited throughout. The original reference is available at EX1030.



G. WO 2009/086838 (“Nielsen”) (EX1010)

Nielsen was filed on January 6, 2009 and published on July 16, 2009.

EX1010, (22), (43). Nielsen is prior art under post-AIA §102(a)(1), (a)(2). Nielsen was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56). Nielsen discloses a loudspeaker magnet assembly. EX1010, (54); EX1003, ¶¶68-69.

H. JP2007189269A (“Nakada”) (EX1018)⁸

Nakada was filed on December 22, 2005 and published on July 26, 2007.

EX1018, (22), (43). Nakada is prior art under post-AIA §102(a)(1). Nakada was not cited as prior art and thus was not considered by the patent examiner during

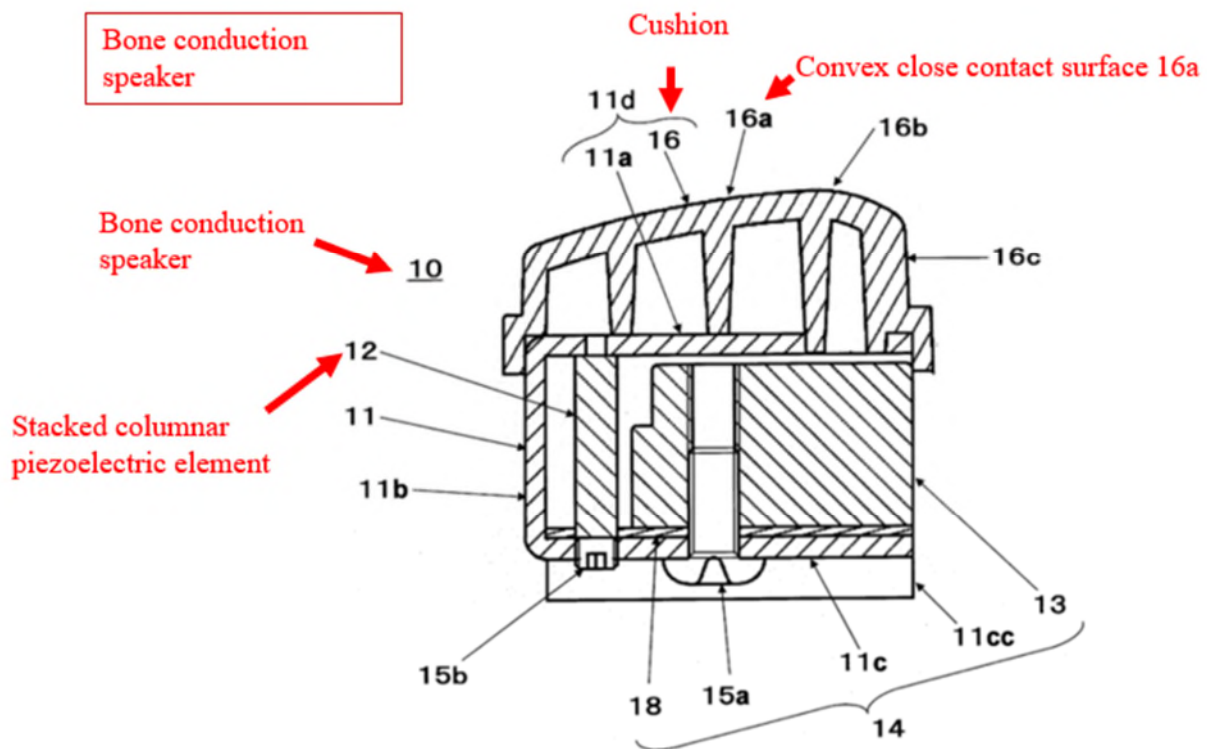
⁸ EX1018 is a certified English translation of this reference, cited throughout. The original reference is available at EX1031.



EX1022, (22), (43). Fujita is prior art under post-AIA §102(a)(1), (a)(2). Fujita was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56); EX1003, ¶72.

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Fujita discloses a bone conduction receiver 1 with a bone conduction speaker 10 for converting sound information to oscillation. EX1022, Abstract. Bone conduction speaker 10 has a multilayer columnar piezoelectric element 12 for generating oscillation and a cushion 16 for transmitting the oscillation to the human head. *Id.*; Fig. 1; EX1003, ¶73.

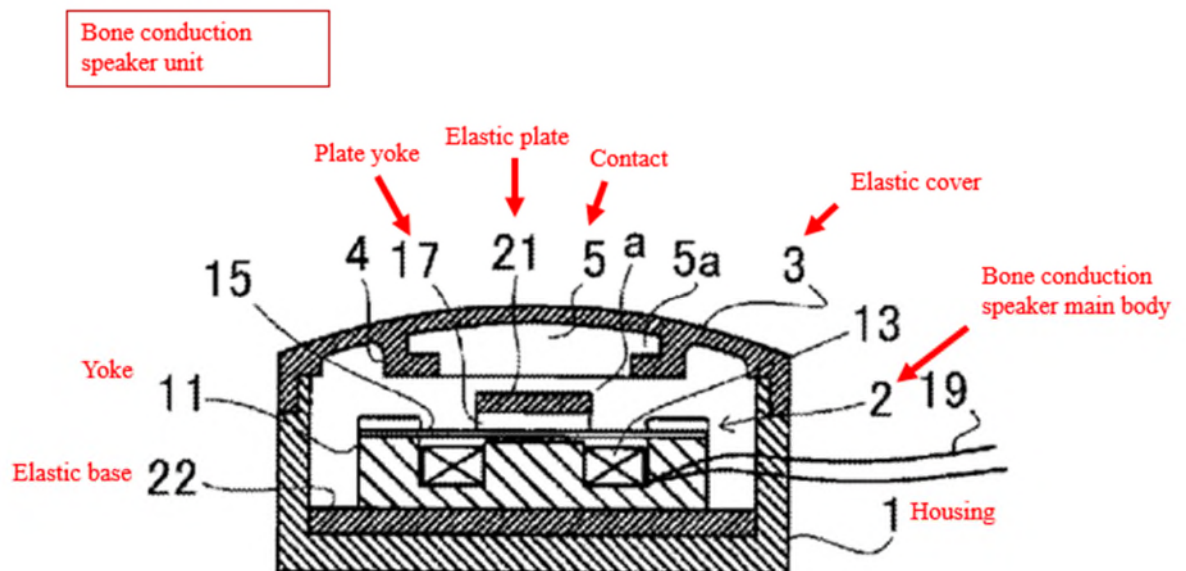


J. US9253563 (“Fukuda”) (EX1023)

Fukuda was filed on October 25, 2013 and issued on February 2, 2016. EX1023, (22), (45). Fukuda is prior art under post-AIA §102(a)(1), (a)(2). Fukuda

was not cited as prior art and thus was not considered by the patent examiner during prosecution. EX1001, (56); EX1003, ¶74.

Fukuda discloses a bone conduction speaker unit incorporating a bone conduction speaker main body 2 in a housing 1, wherein an elastic plate 21 is fixed on a top face of a plate yoke 17 of the bone conduction speaker main body 2; an elastic base 22 is disposed on a rear face of a yoke 11; and an elastic cover 3 for holding a contact 5 which, upon a pressing force having been applied thereto in use, is abutted against the plate yoke 17 through the elastic plate 21 is loaded on the housing 1. EX 1023, Abstract, Fig. 1; EX1003, ¶75.



K. Interchangeable Audio Headset Prior Art

Modular audio portions of headsets, including speakers, control circuits, and batteries, were well-known as of the '084 Patent's priority date. The speakers were

modular for various reasons, including sound quality, ease of use, aesthetics, user comfort, EX1011, [0007], component replacements and removability, upgrades, changes, shape simplification, reducing manufacturing and production costs due to the simple shape of components, EX1012, 2:4-15, EX1014, [0004], EX1015, 2:6-17, EX1016, [0056], [0079], [0085], [0096], comfort, safety, wearing stability, EX1013, 11:5-8, allowing for different uses, and configurations other than listening to music or speech. EX1015, 2:6-17. The control circuit and/or battery portions were modular for various reasons, such as circuit and power module configuration options, EX1014, [0017], and removable batteries for replacement or charging. EX1015, 5:19-6:17. Modular electrical connections were achieved through various connectors, including plugs, jacks, and pins. EX1012, 3:21-35; EX1019, Figs. 1-15, [0009]-[0015], [0035], [0045]; EX1003, ¶¶76-105.

**VI. GROUND 1: LI, FUJITA, AND THE KNOWLEDGE OF A POSITA
RENDER OBVIOUS CLAIMS 1 AND 11**

A. Motivation to Combine

At the time of the '084 Patent, a POSITA would have found it obvious to combine Li and Fujita by using bone conduction speakers of the type taught by Fujita in bone conduction earphones of the type taught by Li because, although Li describes most of the earphone structure, it lacks details on the bone conduction speaker design, including the design of the vibration mechanism, and therefore a POSITA would have looked to other references in the field for details of such

design. These contemporaneous references are within the same field: bone conduction speaker devices. EX1004, [0002]-[0005], [0024], [0040]; EX1022, [0001]-[0002]. Fujita acknowledges bone conduction speakers were known. EX1022, [0002]. A POSITA would, therefore, have been motivated to use Fujita's construction of the bone conduction speakers and would have been capable of combining the disclosures of Li and Fujita to do so. EX1003, ¶¶106-09.

A POSITA would have recognized the benefit of using Fujita's bone conduction speaker in Li because Fujita teaches a bone conduction speaker that "efficiently transmit[s] the output vibration" due to the speaker's design making "accurate contact with the face." EX1022, [0007]-[0017]. A POSITA would have understood, for example, that the design of Fujita's bone conduction speaker would enhance the efficiency of transmitting sound using the Li earphones. The benefit of providing such improvement would have motivated the POSITA to make the combination. EX1003, ¶110.

Combining Li with Fujita would simply involve applying known techniques (Fujita's bone conduction speaker) to a known device ready for improvement (Li's bone conduction earphones) to yield predictable results (operating bone conduction earphones with improved sound efficiency). A POSITA would have had a reasonable expectation of success in the combination because Li's earphones are designed to be worn over the ear with the bone conduction speaker touching the

side of the user's head to transfer vibrations and generate sound, which is the same orientation in which Fujita's bone conduction speaker is designed to be used.

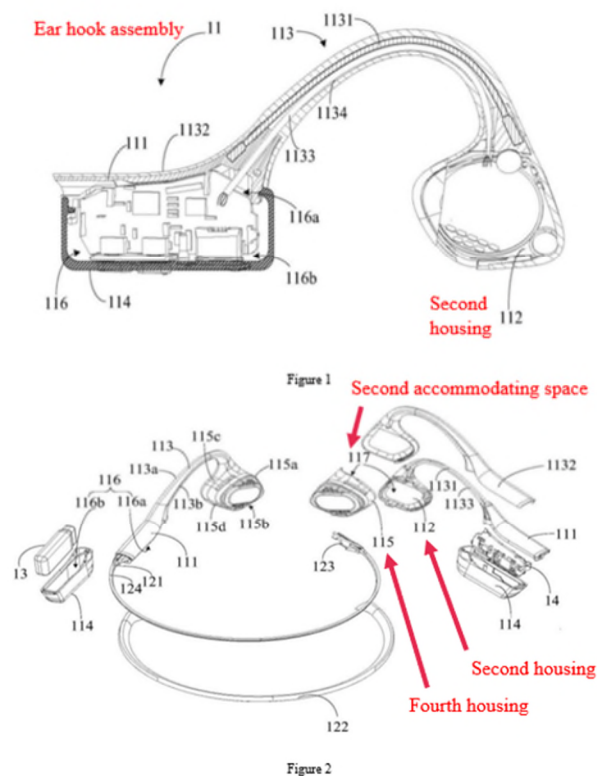
EX1004, Figs. 1-2; EX1022, Figs. 1, 6, 8. A POSITA would have had a reasonable expectation that the modification would be successful because the teachings of Li and Fujita would have been predictably combined due to the predictability of the bone conduction speaker art and the known interchangeability of elements including vibration mechanisms and housing. EX1003, ¶111.

If Patent Owner argues the portions of Li and Fujita cited below relate to different, incompatible embodiments (which they do not), it would have been obvious to a POSITA to combine such embodiments into a single device at least because such embodiments are described in the same prior art reference, are fully compatible with each other, and could be combined with minimal effort to achieve predictable results. EX1003, ¶¶112-13. Moreover, Petitioner does not assert that Li and Fujita can be bodily incorporated, and establishing obviousness does not require demonstrating that the references were capable of bodily incorporation. *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012).

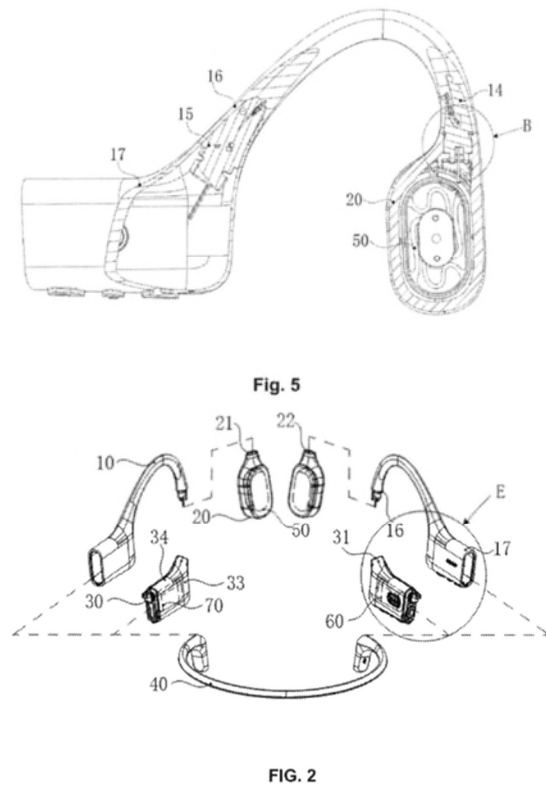
B. Claim 1

1. [1pre]

If the preamble is limiting, Li discloses or renders obvious *a loudspeaker apparatus*:¹⁰ “a bone conduction earphone,” as shown in Figures 1-2. EX1004, Abstract, Figs. 1-2; EX1003, ¶¶114-15.



Li, Figures 1, 2



'084 Patent, Figures 5, 2

¹⁰ '084 Patent claim language is italicized throughout.

2. [1a]

Li's connecting component 113 constitutes *an ear hook*. "The ear hook assembly 11 is generally used for users to hang the bone conduction earphone on their ears when wearing them....[T]he **connecting component 113** can directly contact the ear and support the bone conduction earphone...." EX1004, [0025]-[0026], [0023] Fig. 1; EX1003, ¶116.

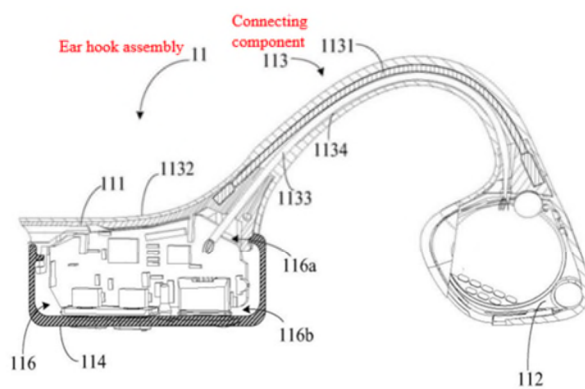


Figure 1

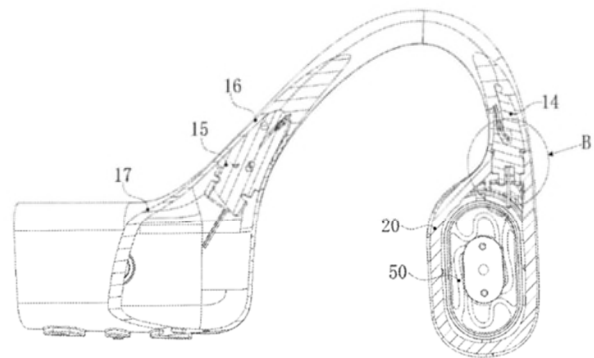


Fig. 5

Li, Figure 1

'084 Patent, Figure 5

Li renders obvious an ear hook including *a first plug end* and *a second plug end*. Li discloses plug-in portions 123 provided at both ends of the second elastic metal wire 121. EX1004, [0058]. The plug-in portions 123 are connected and fixed to the first housings 111 of the two ear hook assemblies 11. *Id.*, [0058], Figs. 2, 9. The plugs may be designed for either a tight fit or to be locked. EX1004, [0062]-[0069]; EX1003, ¶117.

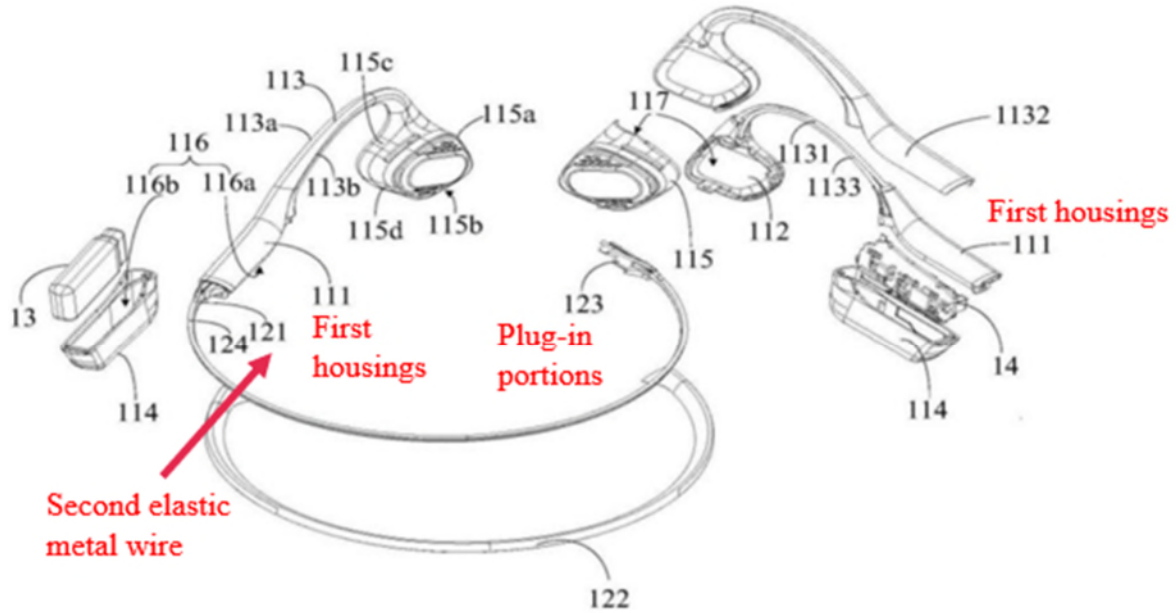


Figure 2

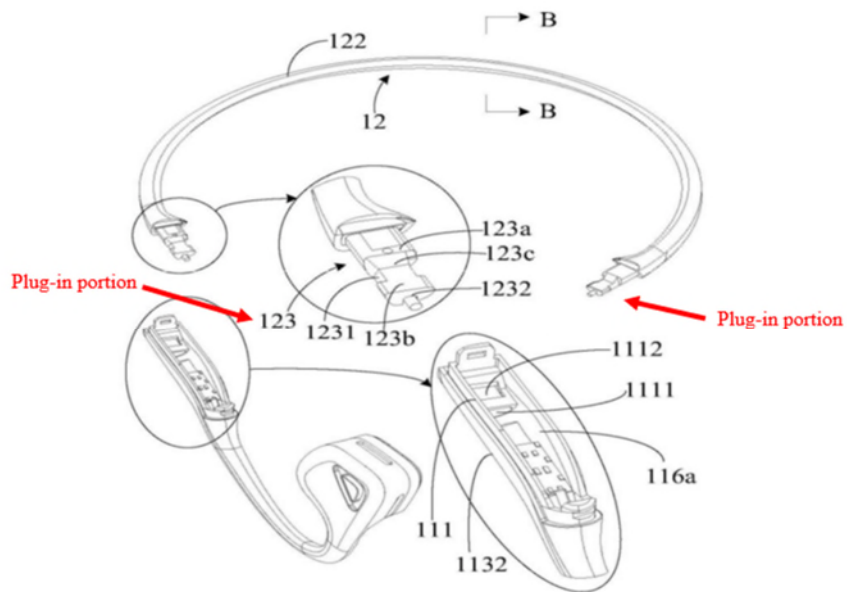


Figure 9

Li, Figures 2, 9

A POSITA would have found it obvious to include a *first plug end* in Li's ear hook using the same general design of the plug-in portions 123. As discussed

above in §V.K, modular portions, such as speaker portions and control circuit housing portions, of headsets were well-known as of the priority date of the '084 Patent. EX1011, Fig. 2, [0006]-[0007], [0030]-[0032]; EX1012, Fig. 2, 2:4-15, 3:13-35; EX1013, Fig. 1, 10:62-11:8; EX1014, Fig. 1, [0004], [0017]; EX1015, Figs. 5, 7, 2:6-17, 5:33-6:17, 6:65-7:42. 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, EX1012, 2:4-15; EX1014, [0004], EX1015, 2:6-17, EX1016, [0056], [0079], [0085], [0096]. In bone conduction, the earphone core is the vibrating mechanism of the speaker. EX1004, [0024]. Also, while Li does not disclose a method for the second wire set 124 in plug-in portions 123 to electrically “connect the components inside the two ear hook assemblies 11, such as the battery and the control circuit assembly 14,” EX1004, [0069], a POSITA would have found it obvious to configure the plug-in portions 123 with known modular electrical connections such as pins and contacts commonly found in jacks, and plugs such as the types shown below, and to include mating pins and contacts in corresponding sockets of the speaker housing and control circuit housing for electrically connecting the ear hook to those housings. EX1012, 3:21-35; EX1019, Figs. 1-15, [0009]-[0015], [0035], [0045]. A POSITA would have been motivated to use such known modular electrical connections for the additional benefit of reducing

manufacturing costs and complexity. EX1019, [0031] (“inexpensive to manufacture”); EX1003, ¶118.

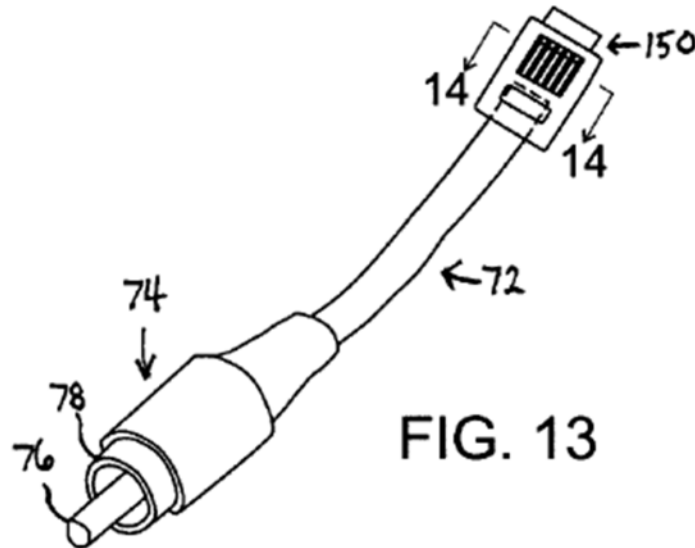


FIG. 13

EX1019, Fig. 13.

Accordingly, it would have been obvious for a POSITA to add an ear hook including a *first plug end* to Li between the ear hook and earphone core given that modular speaker portions of headsets were well-known as of the priority date of the '084 Patent. Providing the *first plug end* would have achieved the well-known benefits of a modular speaker. The '084 Patent mentions reducing manufacturing cost and adjusting for design changes as a benefit of its modular design, which modular designs were known to do. EX1001, 11:66-12:11, 16:29-40; EX1003, ¶119.

Li similarly renders obvious the *second plug end*. The prior art teaches the benefits of detachable components in a modular headphone design similar to the

'084 Patent's circuit housing for accommodating a control circuit or a battery.

EX1014, [0015], [0017], Figs. 1, 3 (detachable "power module...adapted for providing the circuit module (3) and the earphone modules with the necessary working power supply"); EX1015, 4:2-5, Fig. 3 (in-ear monitor with a removable battery); 5:19-6:17; EX1013, 22:23-23:2, 23:64-24:8, Figs. 17, 19 (headphones with a removable wireless carrier with battery unit). The prior art also teaches various electrical connectors for connecting modular pieces electrically. EX1012, 3:21-35; EX1019, Figs. 1-15; EX1003, ¶120.

Accordingly, it would have been obvious for a POSITA to add an ear hook including a *second plug end* to Li between the ear hook and circuit housing given that modular speaker portions of headsets were well-known as of the priority date of the '084 Patent. This design in Li would achieve well-known modular earphone benefits, including simplifying the structure and reducing costs, especially when it comes to replacing the housing containing the earphone's battery or control circuit. *See* EX1004, [0059]; *see also* EX1012, 2:4-15; EX1014, [0004]; EX1015, 2:6-17, EX1016, [0056], [0079], [0085], [0096]; EX1015, 2:6-17. Such a design would involve structures already used in Li and slight modifications to where they appear in the device. EX1003, ¶121.

Further, Li teaches that "[b]y connecting the plug-in portion 123 of the rear hook assembly 12 with the first housing 111 of the two ear hook assemblies 11, the

issue of large earphone size caused by screw fixation in existing bone conduction earphones are improved, simplifying the structure, reducing the weight of bone conduction earphones, facilitating later wiring, and reducing costs.” EX1004, [0059]. Li further teaches that the rear suspension assembly 12 contains wires “to connect the components inside the two ear hook assemblies 11, such as the battery and the control circuit assembly 14.” *Id.*, [0069], Fig. 12; EX1003, ¶122.

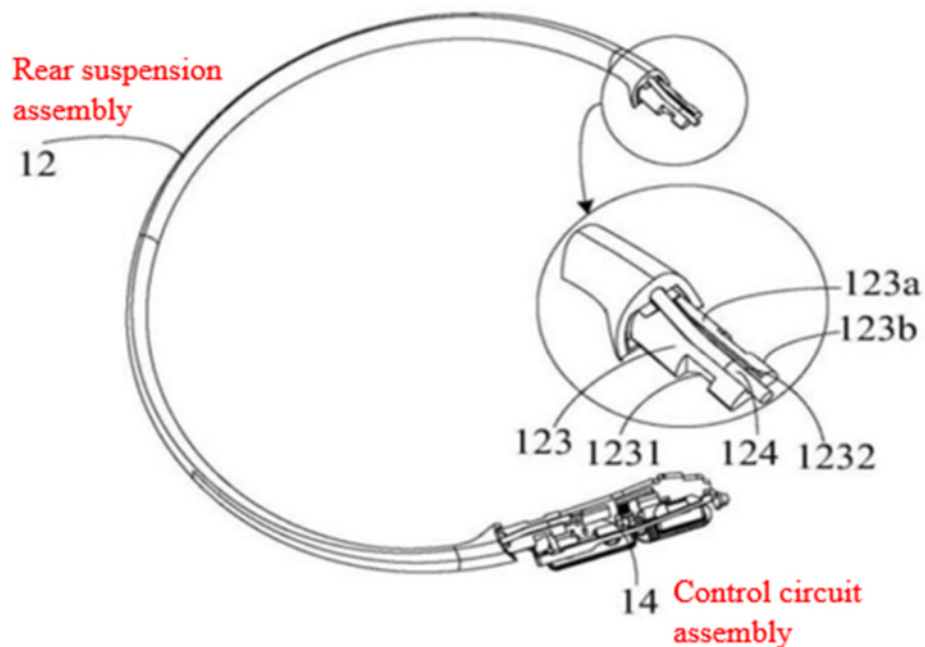


Figure 12

Li, Figure 12

It therefore would have been obvious to a POSITA to modify the ear hook assembly 11 of Li to include a *first plug end* and *second plug end* on either side of connecting component 113 to connect the first housing 111 and second housing 112. EX1004, [0023]. Li already discloses plug ends in its design and recognizes

their benefits in a modular earphone design, including reducing earphone size, simplifying the structure, facilitating later wiring, and reducing manufacturing costs and complexity. *Id.*, [0059]. A POSITA would have recognized these benefits would be further realized by adding plug ends to other components of the earphones, including on either end of connecting component 113. The design would require nothing more than adding Li's already designed plug ends to that portion of the device. The first housing 111 in Li is already designed to receive and connect such plug ends. Therefore, Li discloses or renders obvious [1a]. EX1003, ¶¶123-24.

3. [1b]

Li discloses or renders obvious that *the ear hook*—connecting component 113—is *surrounded by a protective sleeve*—a first elastic coating layer 1132—*being made of an elastic waterproof material* (silicone). EX1003, ¶125.

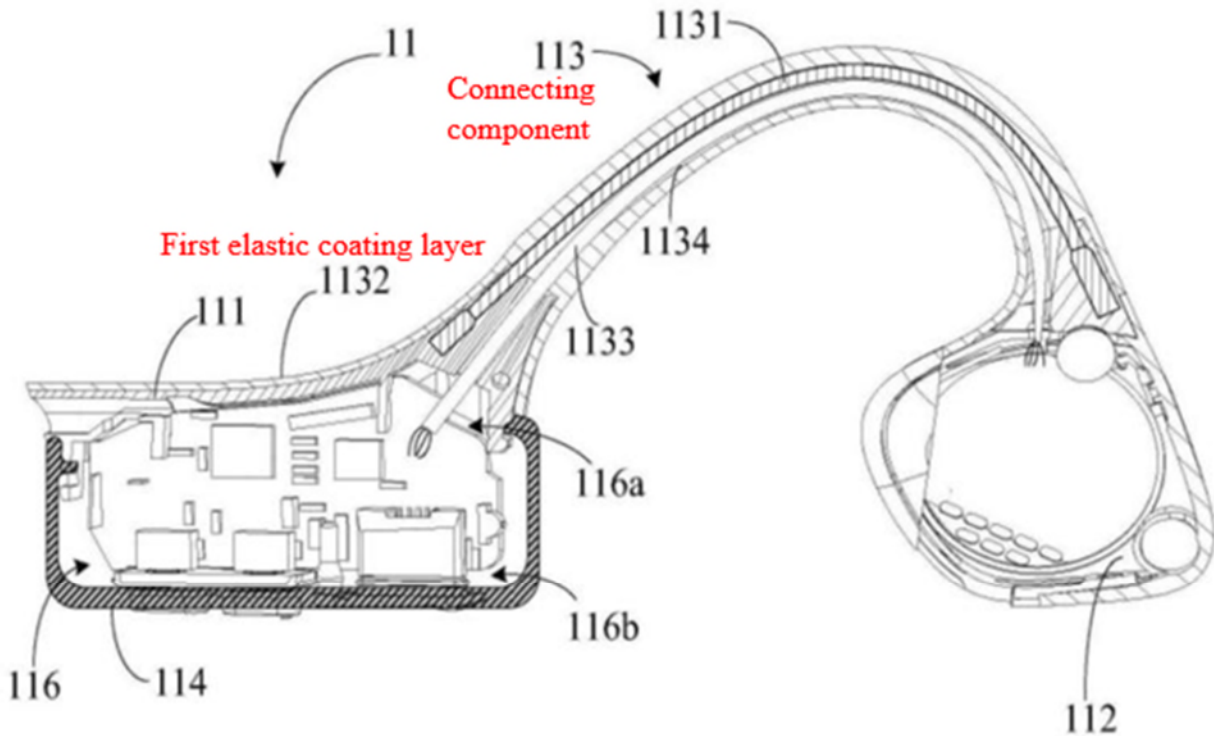


Figure 1

Li, Figure 1

Li discloses that “[t]he connecting component 113 comprises...*a first elastic coating layer 1132 wrapped around the first elastic metal wire 1131.*” EX1004, [0026], [0030], Figs. 1, 3. Li teaches the first elastic coating layer 1132 is silicone, latex, rubber, another elastic plastic layer, or a composite material layer containing silicone. *Id.*, [0028]; EX1003, ¶126.

A POSITA would have understood the material of the first elastic coating layer, *e.g.*, silicone, to be waterproof. EX1004, [0073] (“waterproof lining board 143” is covered with a “third elastic coating layer 143b” that can be made of

“silicone”). Li’s disclosure of other waterproof components such as a waterproof lining board 143 would inform a POSITA that other elements like first elastic coating layer 1132 would be waterproof. *Id.*, [0071]; EX1003, ¶127.

4. [1c]

Li discloses *a core housing for accommodating an earphone core*: “The fourth housing 115 cooperates with the second housing 112 to form a second accommodating space 117 for accommodating the bone conduction speaker.” EX1004, [0043], Figs. 1-2, 8; EX1003, ¶¶128-29.

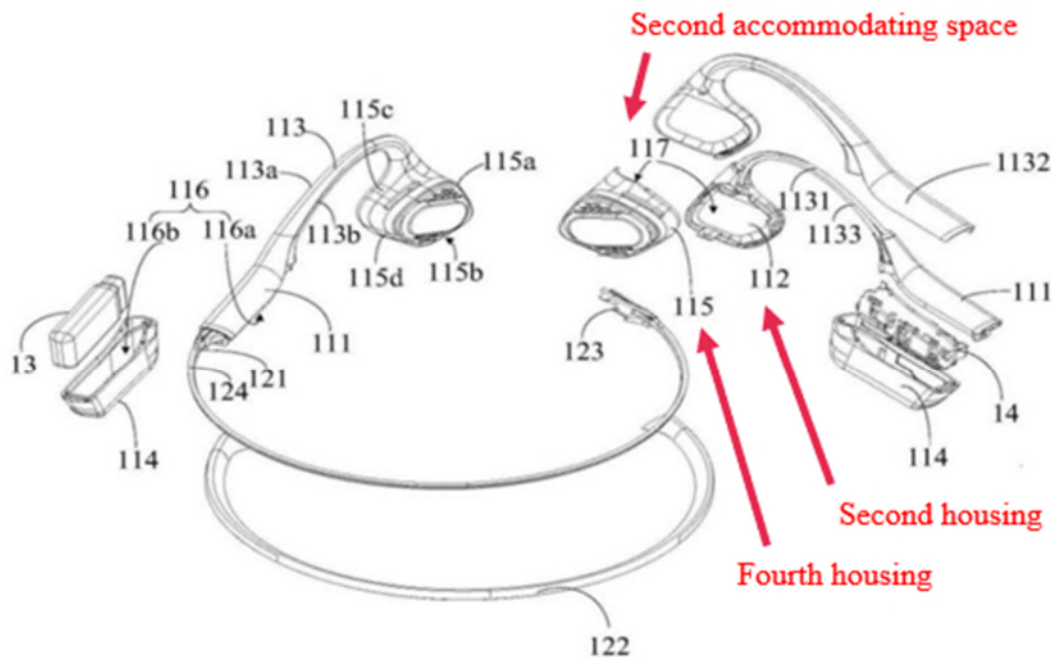


Figure 2

Li, Figure 2

Further, as discussed above in [1a], a POSITA would have found it obvious to include a *first plug end* on one end of Li’s ear hook to connect it to the earphone

core (Li's second and fourth housings 112, 115 that together form the claimed *core housing*) using Li's plug-in portions 123 design, EX1004, [0058], given that modular speaker portions of headsets were well-known as of the priority date of the '084 Patent. This first plug would provide *the core housing being fixed to the first plug end* because Li's plug design would be replicated between the core housing and earphone. It therefore would have been obvious to configure Li's *core housing* with a socket and corresponding electrical pins/contacts as discussed above to mate with the *first plug end* of the *ear hook* and connect it to the *first plug end* of the *ear hook* to achieve the benefits of a modular earphone design already recognized by Li, including simplifying the structure and reducing costs, especially when it comes to replacing the housing comprising the earphone's speaker. *See id.*, [0059]. Such design would involve structures already used in Li and slight modifications to where they appear in the device. EX1003, ¶130.

Li renders obvious the core housing being (i) *fixed to the first plug end* and (ii) *elastically abutted against the protective sleeve*, and it would be obvious to replicate that same design at the first plug location as explained above. As shown in Figure 2, “[t]he rear hook assembly 12 comprises a second elastic metal wire 121, a second elastic coating layer 122 wrapped around the second elastic metal wire 121, and plug-in portions 123 provided at both ends of the second elastic metal wire 121.” EX1004, Fig. 2, [0058]; EX1003, ¶¶131-32.

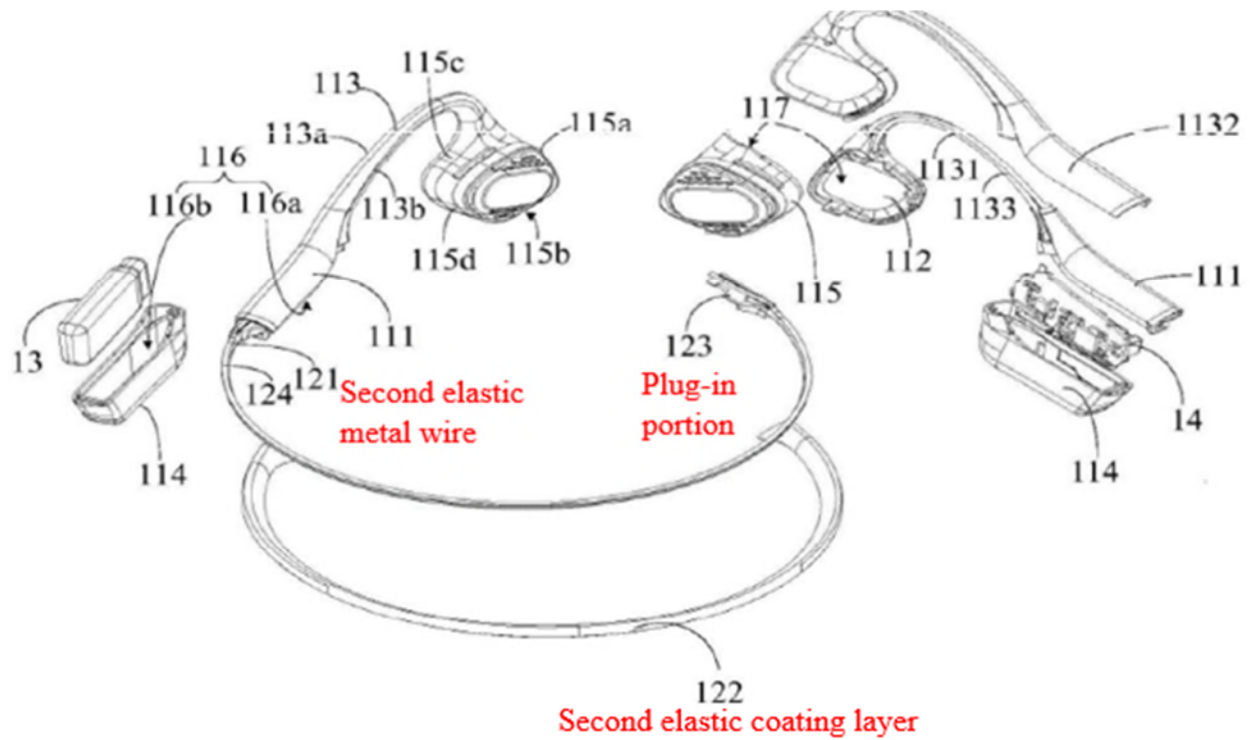


Figure 2

Li, Figure 2

The second elastic coating layer 122 may be silicone, rubber, latex, or a composite including silicone. EX1004, [0058]. As shown in Figure 2, the second elastic coating layer 122 abuts the third housing 114 at the plug-in portion 123. Thus, Li teaches a housing elastically abutted against the protective sleeve. Because it would have been obvious to replicate that same design at the first plug location as explained above in [1a], that design would yield the core housing (Li's second and fourth housing 112, 115) being fixed to the first plug end *and elastically abutted against the protective sleeve* over Li's connecting component 113 (*ear hook*). EX1003, ¶132.

Additionally, Li also teaches that its *core housing* is covered by the same first elastic coating layer 1132 of connecting component 113: “the first elastic coating layer 1132 further covers at least portion of the outer surfaces of the first housing 111 and the second housing 112, such as the entire outer surface.” EX1004, [0036]. 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. *Id.* It therefore would have been obvious to a POSITA to have elastic coating over all of the entire bone conduction earphone to achieve the same benefit. EX1003, ¶¶133-34.

5. [1d]

The combination of Li and Fujita renders this limitation obvious. Li’s third housing 114 and first housing 111 constitute the *circuit housing for accommodating a control circuit or a battery*. “[T]he third housing 114 of the ear-hook assembly 11 cooperates with the first housing 111 to form a first accommodating space 116 for accommodating the battery assembly 13 or the control circuit assembly 14.” EX1004, [0046], [0024], Figs. 1-2; EX1003, ¶135.

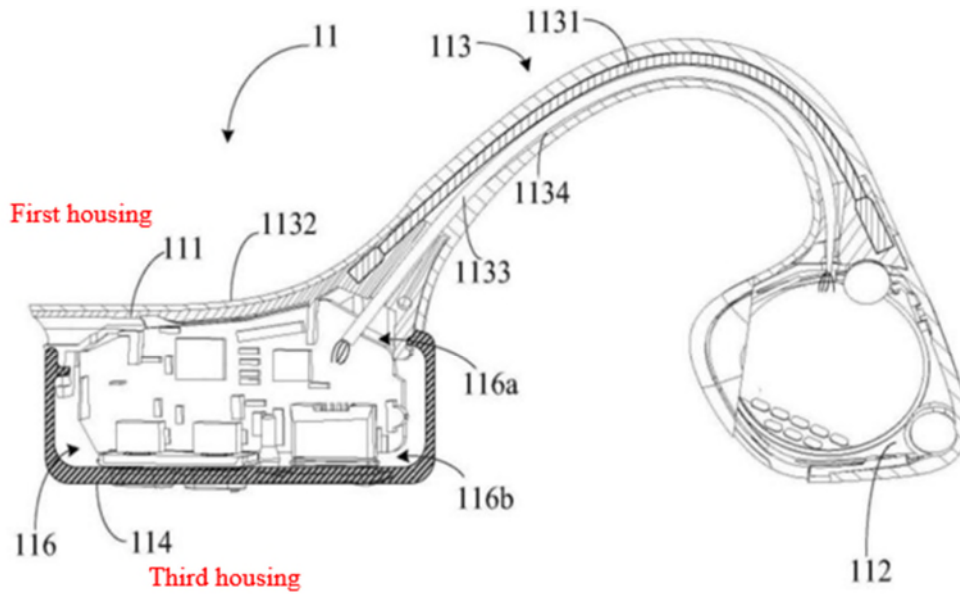


Figure 1

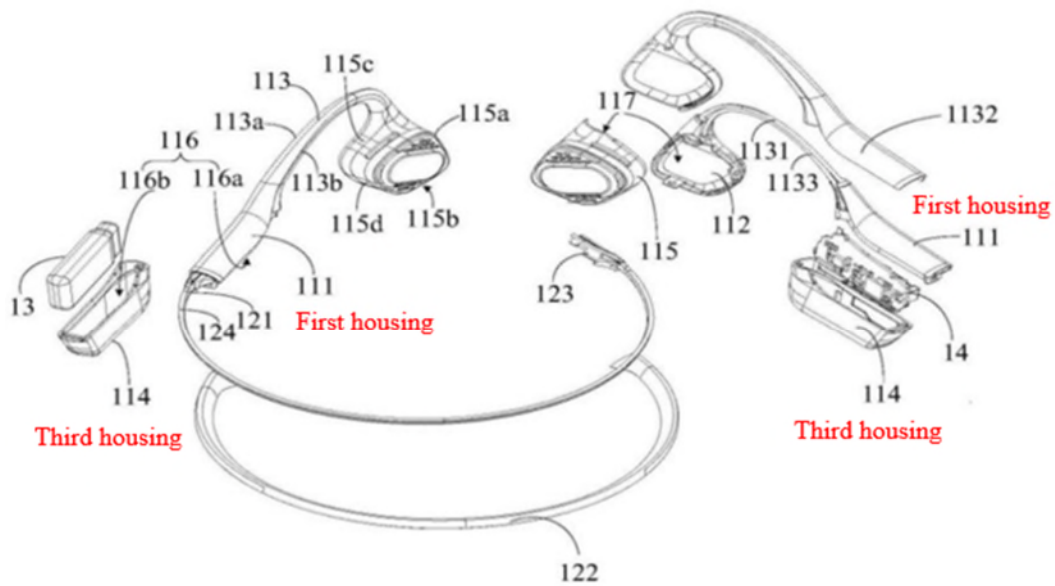


Figure 2

Li, Figures 1-2

Li also discloses or renders obvious *the control circuit or the battery driving the earphone core to vibrate*:

[B]one conduction speakers are used to output sound to users via vibration in a bone conduction manner. The battery is used to power the various components of the bone conduction earphone. The control circuit is used to control the bone conduction earphone, such as for adjusting volume, turning on and off, playing audio, and Bluetooth communication.

EX1004, [0024], [0046]; EX1003, ¶136.

Li renders obvious *the circuit housing* (third housing 114 and first housing 111) *being fixed to the second plug end* (plug-in portions 123). See [1a]. As shown in Figure 2, “[t]he plug-in portions 123 are respectively connected and fixed to the first housings 111 of the two ear hook assemblies 11.” EX1004, [0058]; EX1003, ¶137.

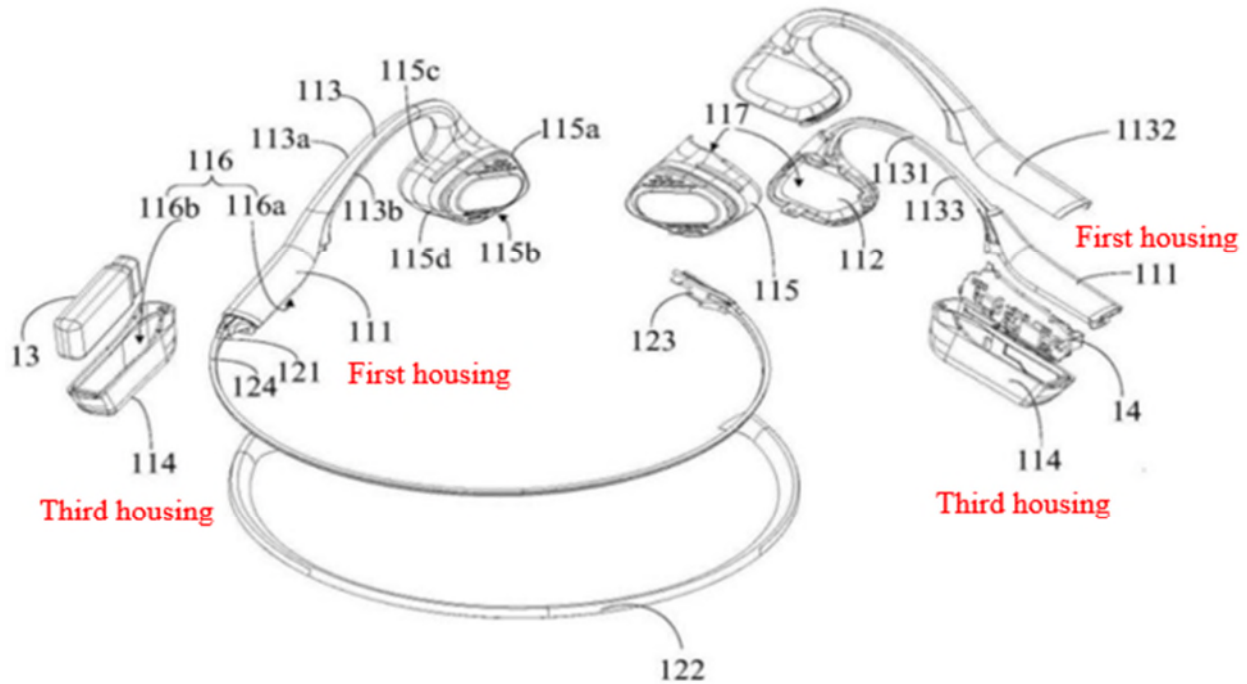


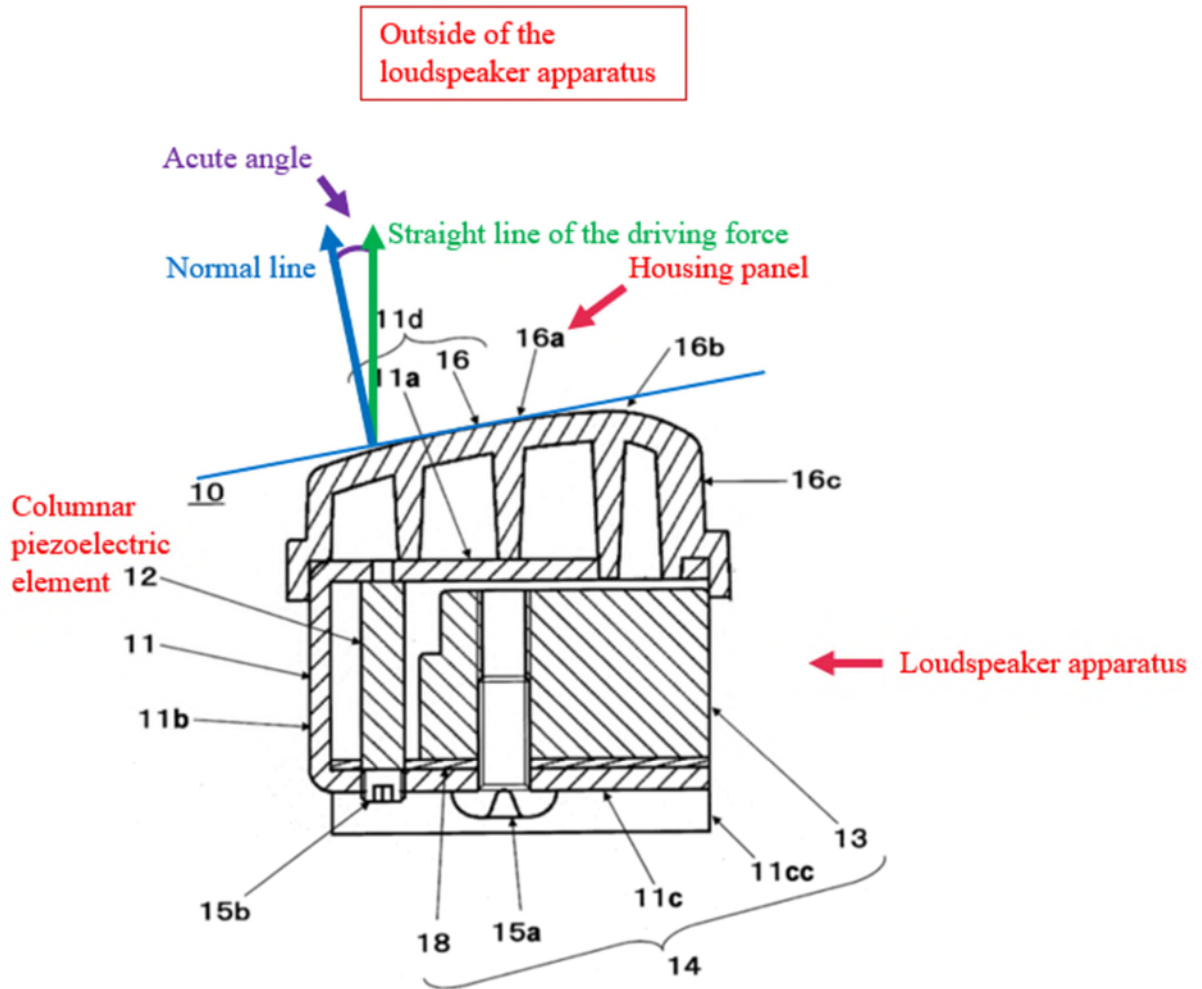
Figure 2

Li, Figure 2

A POSITA would have found it obvious to locate sockets that mate with plug-in portions 123 on the corresponding end of connecting component 113 at the other end of first housing 111 in a location at or near the green arrows shown in connecting component 113 below for the same reasons it would have been obvious to add sockets to the bone conduction speaker housing corresponding to the plug ends added to connecting component 113 proximate the bone conduction speaker housing. See [1a]; EX1003, ¶¶138-39.

and a [cushion] (16), which protrudes from the case (2) for transmitting the oscillation generated by the multilayer columnar piezoelectric element (12) by abutting to the human head.” EX1022, Abstract, [0027], [0030], [0037], Fig. 2. Convex close contact surface 16a is located on cushion 16, which is made of a material with “high rigidity.” *Id.*, [0028], [0030]; EX1003, ¶140.

As seen in Figure 2, the driving force is not parallel to a normal line of the housing panel. EX1003, ¶141.



Fujita, Figure 2

A POSITA would understand the annotated “normal line” above in Figure 2 to be one example of a normal line because the housing panel used to contact the user’s body in Fujita is non-planar (has a curvature). A POSITA would understand the normal line may be determined by selecting a certain point in an area when the panel is in contact with human skin, determining a tangent plane of the panel at the selected point, and determining a straight line that passes through the point and is

perpendicular to the tangent plane, and designating the straight line as the normal line of the panel. *See, e.g.*, EX1001, 19:32-20:14. A POSTIA would therefore understand that when the panel used to contact the user's body is non-planar like in Fujita, different points correspond to different tangent planes of the panel, and the determined normal line may also be different. Therefore, the above annotated example is just one example of a normal line in Fujita. EX1003, ¶142.

Therefore, Li and Fujita disclose or render obvious claim 1. EX1003, ¶143.

VII. GROUND 2: LI, FUJITA, FUKUDA, AND THE KNOWLEDGE OF A POSITA RENDER OBVIOUS CLAIMS 12-15

A. Motivation to Combine

1. Li-Fujita

See §VI.A; EX1003, ¶144.

2. Li-Fujita and Fukuda

At the time of the '084 Patent, it would have been obvious to a POSITA to combine Li-Fujita with Fukuda, specifically Fukuda's magnetic circuit system vibration mechanism in place of Fujita's piezoelectric mechanism in its bone conduction speaker, and a POSITA would have been motivated to do so. EX1003, ¶145.

Magnetic circuit systems were commonly found in speakers at the time of Li and Fujita, including bone conduction speakers at the time of Li, in order to provide efficient, high-quality sound. EX1005, [0052], [0053] ("high-density

permanent magnets” in bone conduction speaker achieve “better sound quality”), [0143], [0145], [0148]-[0152], [0171], Figures 11, 18-A, 18-B, 22-A; EX1008, [0005], [0013] (“magnetic steels in the middle of the voice coil” in a loudspeaker “significantly improv[es] the electromechanical conversion efficiency”); EX1009, [0002]-[0003]; EX1010, 4:1-12; EX1018, Abstract, Fig. 2(b), [0016]-[0029].

Fukuda offers an improved bone conduction speaker with a magnetic circuit system that 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,” allowing it to be incorporated in devices. EX1023, 3:6-28; EX1003, ¶146.

A POSITA at the time would understand that the sound quality of a magnetic speaker driver like Fukuda’s is generally higher than that of a piezoelectric driver, and that it is easier to fine tune the frequency response of a magnetic driver like Fukuda’s to achieve desired performance. Therefore, 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, in order to provide the benefits of a magnetic circuit system, such as efficient, high-quality sound, and simple construction. A POSITA

would look to Fukuda for inspiration and improvement of the Li-Fujita earphone speakers. EX1003, ¶147.

Combining Li-Fujita with Fukuda would simply involve applying known techniques (*i.e.*, magnetic circuit speaker design and construction) to a known device ready for improvement (Li-Fujita's bone conduction speaker) to yield predictable results (bone conduction speaker with a magnetic circuit system). A POSITA would have had a reasonable expectation of success in the combination because the Li-Fujita earphones already disclose bone conduction speakers, and Fukuda discloses the use of a magnetic circuit system in such speakers. A POSITA thus would have had a reasonable expectation that modifying Li-Fujita with Fukuda would be successful due to the predictability of the art of bone conduction speakers with magnetic circuit systems and the known interchangeability of the various elements, including the components of manufacture. EX1003, ¶148.

If Patent Owner argues the portions of Fukuda cited below relate to different, incompatible embodiments (which they do not), it would have been obvious to a POSITA to combine such embodiments into a single device at least because such embodiments are described in the same prior art reference, are fully compatible with each other, and could be combined with minimal effort to achieve predictable results. EX1003, ¶149.

Therefore, a POSITA would have considered it obvious to modify the Li-Fujita earphones with Fukuda's magnetic circuit system for use in the Fujita bone conduction speaker for the benefits described above. EX1003, ¶150.

B. Claim 12

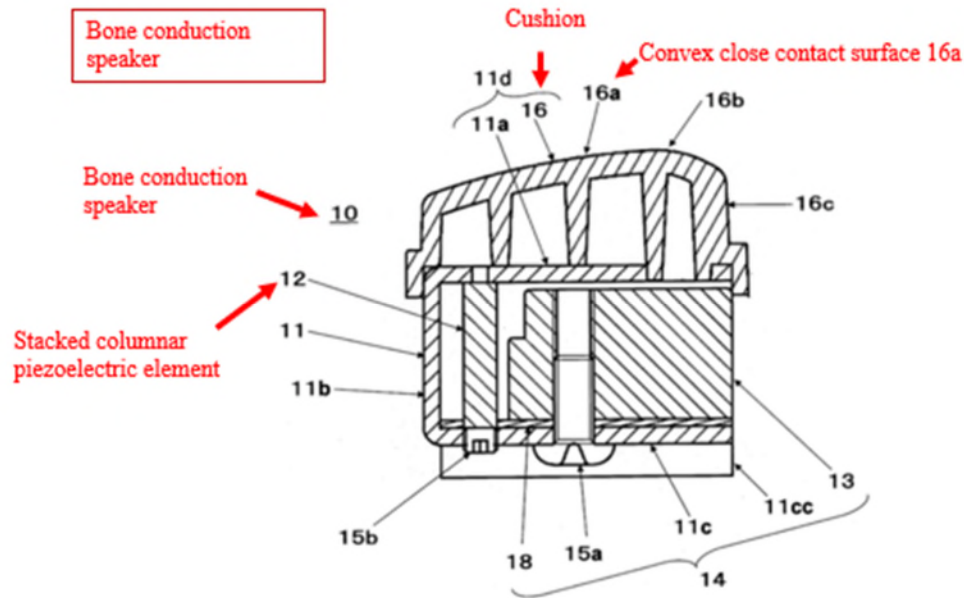
1. [12pre]

See claim 1; EX1003, ¶151.

2. [12a]

Fujita and Fukuda disclose or renders obvious [12a]. EX1003, ¶¶152-53.

For example, in Fujita: *the housing panel* (cushion 16, convex close contact surface 16a) *and the earphone core* (the vibrating mechanism of the Fujita speaker, including stacked columnar piezoelectric element 12) *are in a transmission connection*: “The vibration output part 11a and the cushion 16 form a vibration transmitting part 11d, and the vibration transmitting part 11d transmits the vibration generated by the stacked columnar piezoelectric element 12.” EX1022, [0027]; EX1003, ¶152.



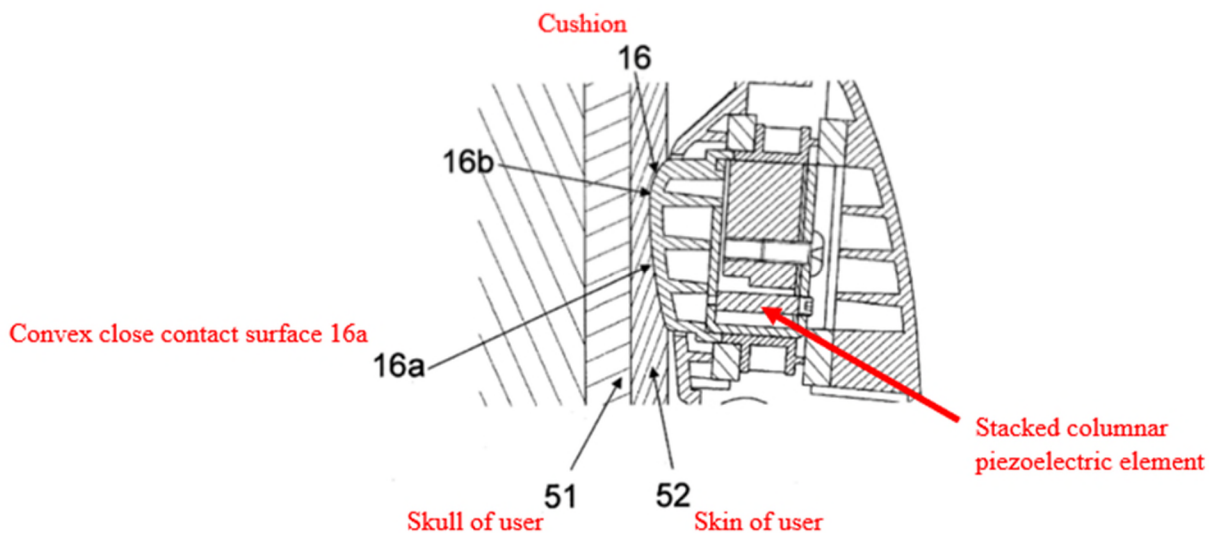
Fujita, Figure 2

EX10022, Fig. 2.

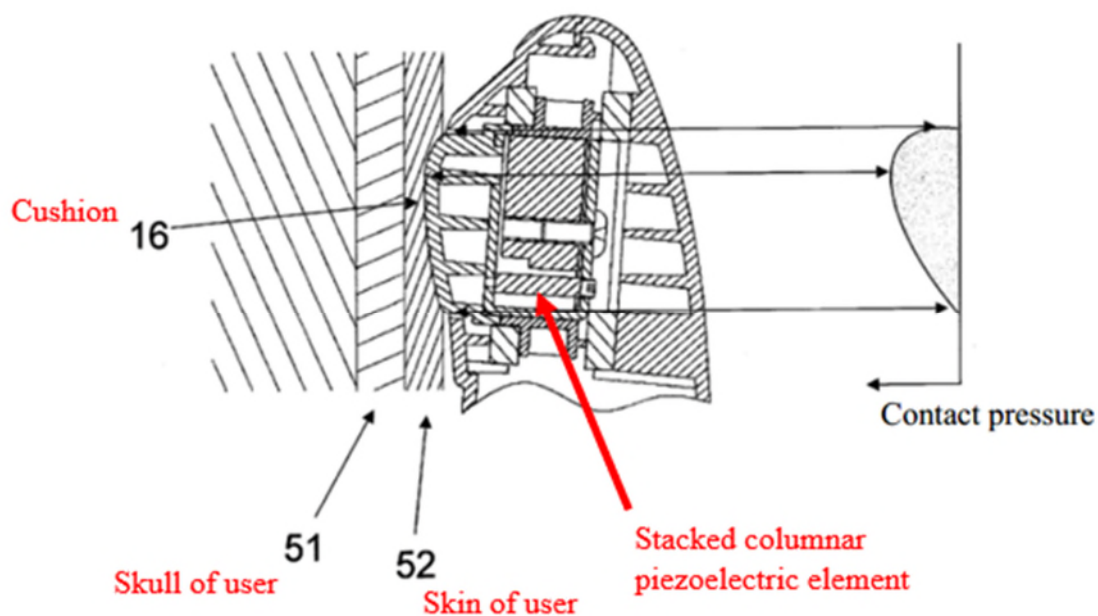
3. [12b]

Fujita and Fukuda disclose or render obvious [12b]. EX1003, ¶¶154-56.

For example, in Fujita: *all or part of the housing panel (cushion 16, convex close contact surface 16a) is used to contact or abut a user's body (head in Figures 4-6) to conduct a sound generated by the vibration of the earphone core (the vibrating mechanism of the Fujita speaker, including stacked columnar piezoelectric element 12).* EX1022, Figures 4-6, [0030]-[0035], [0037]; EX1003, ¶154.



Fujita, Figure 4



Fujita, Figure 6

EX1003, ¶154.

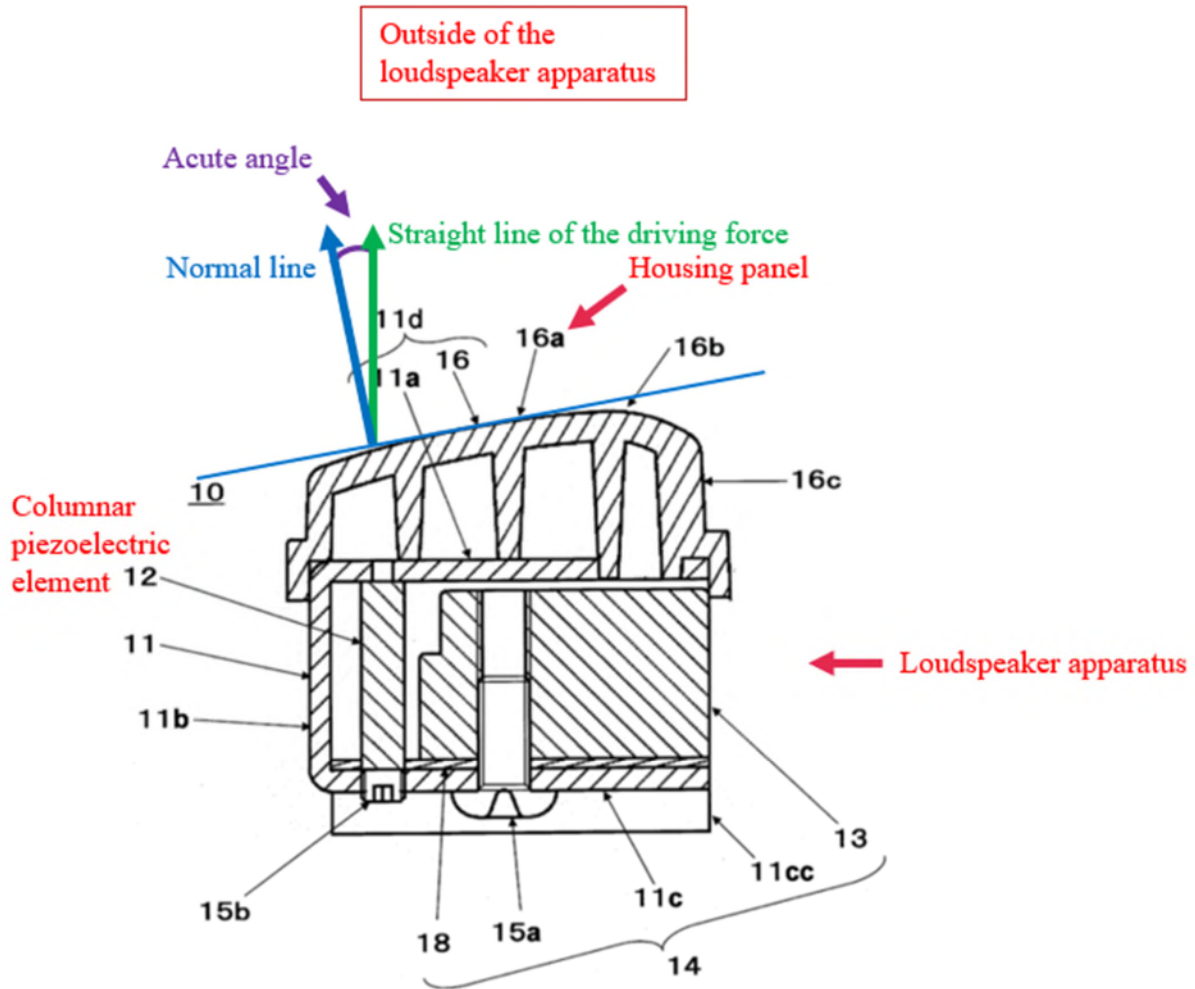
C. Claim 13

1. [13pre]

See claim 12; EX1003, ¶157.

2. [13a]

Fujita discloses or renders obvious limitation [13a], as seen in Figure 2's depiction of the *housing panel* (cushion 16, convex close contact surface 16a), *a straight line of the driving force has a positive direction pointing to outside of the loudspeaker apparatus from the housing panel* (green line pointing outside of the bone conduction speaker, where the arrow indicates the positive direction), *the normal line has a positive direction pointing to the outside of the loudspeaker apparatus*, (blue line pointing outside of the bone conduction speaker, where the arrow indicates the positive direction), and *an angle between the two lines in their positive direction is an acute angle* (in purple). EX1022, Figure 2; EX1003, ¶158.



Fujita, Figure 2

A POSITA would understand the annotated “normal line” above in Figure 2 to be one example of a normal line for the reasons discussed above. *See* [1d]; EX1003, ¶159.

D. Claim 14

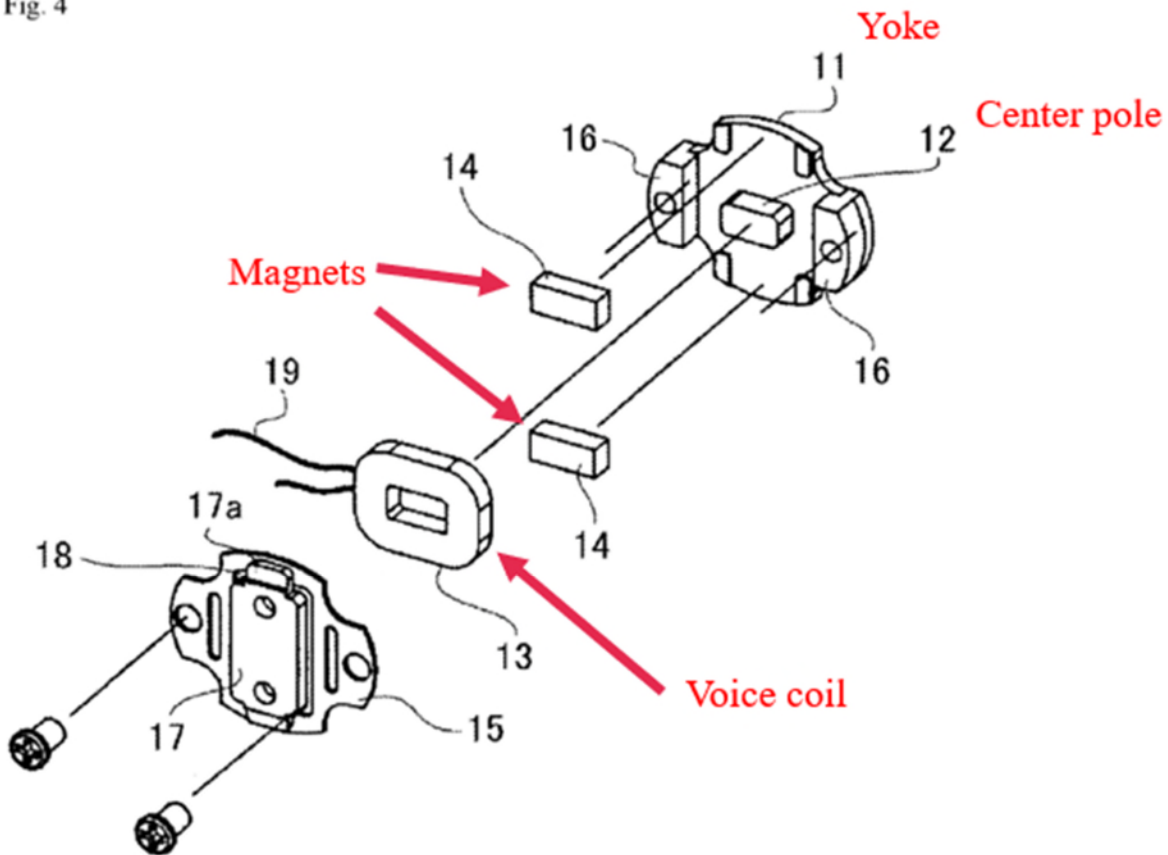
1. [14pre]

See claim 12; EX1003, ¶160.

2. [14a]

[14a] is rendered obvious by Li-Fujita-Fukuda. Fujita discloses an *earphone core* ([1d], the vibrating mechanism of Fujita's bone conduction speaker). A POSITA would find it obvious to add Fukuda's *coil* (voice coil 13) and *magnetic circuit system* (center pole 12, yoke 11, rod-shaped magnets 14) from Fukuda's *earphone core* to Fujita's *earphone core* in place of Fujita's piezoelectric mechanism, for the reasons discussed above. §VII.A. As described in Fukuda, "[t]he bone conduction speaker main body 2 is configured...with a voice coil 13 being disposed so as to surround a center pole 12 provided in the central portion of a yoke 11, a pair of bar-like magnets 14, 14 being fixed to both sides of the voice coil 13, and a diaphragm 15 being disposed so as to cover the voice coil 13 and the magnets 14, 14." EX1023, 3:57-67, Figure 4; EX1003, ¶161.

Fig. 4



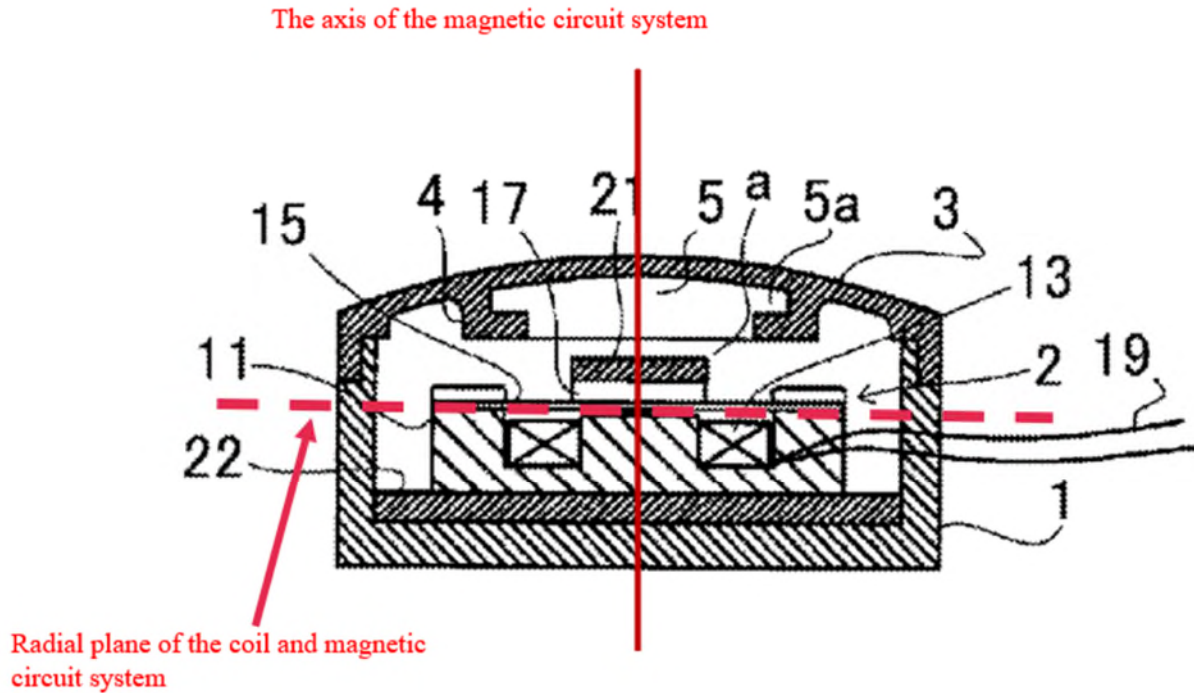
Fukuda, Figure 4

It would be obvious to a POSITA that in the Li-Fujita-Fukuda combination, *the housing panel and the earphone core would remain in a transmission connection* because that is how both Fujita and Fukuda are constructed. See claim 12. The type of vibration mechanism would merely be changed from piezoelectric to magnetic. EX1003, ¶162.

3. [14b]

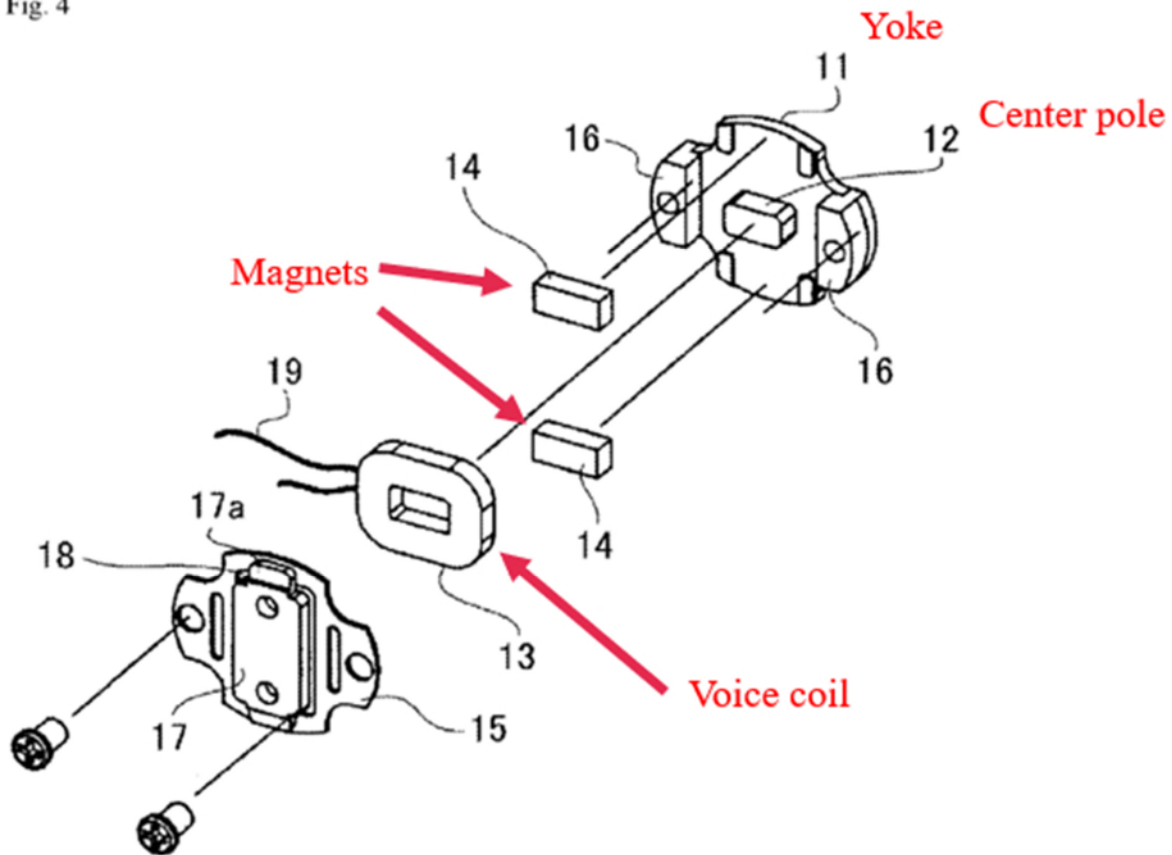
Li-Fujita-Fukuda renders obvious [14b]. In Fukuda's Figure 1, *an axis* (red below) *of the coil* (voice coil 13) *or the magnetic circuit system* (center pole 12,

yoke 11, rod-shaped magnets 14) is *perpendicular to a radial plane of the coil or the magnetic circuit system* (also in red). EX1023, Figs. 1, 4; EX1003, ¶163.



Fukuda, Figure 1

Fig. 4

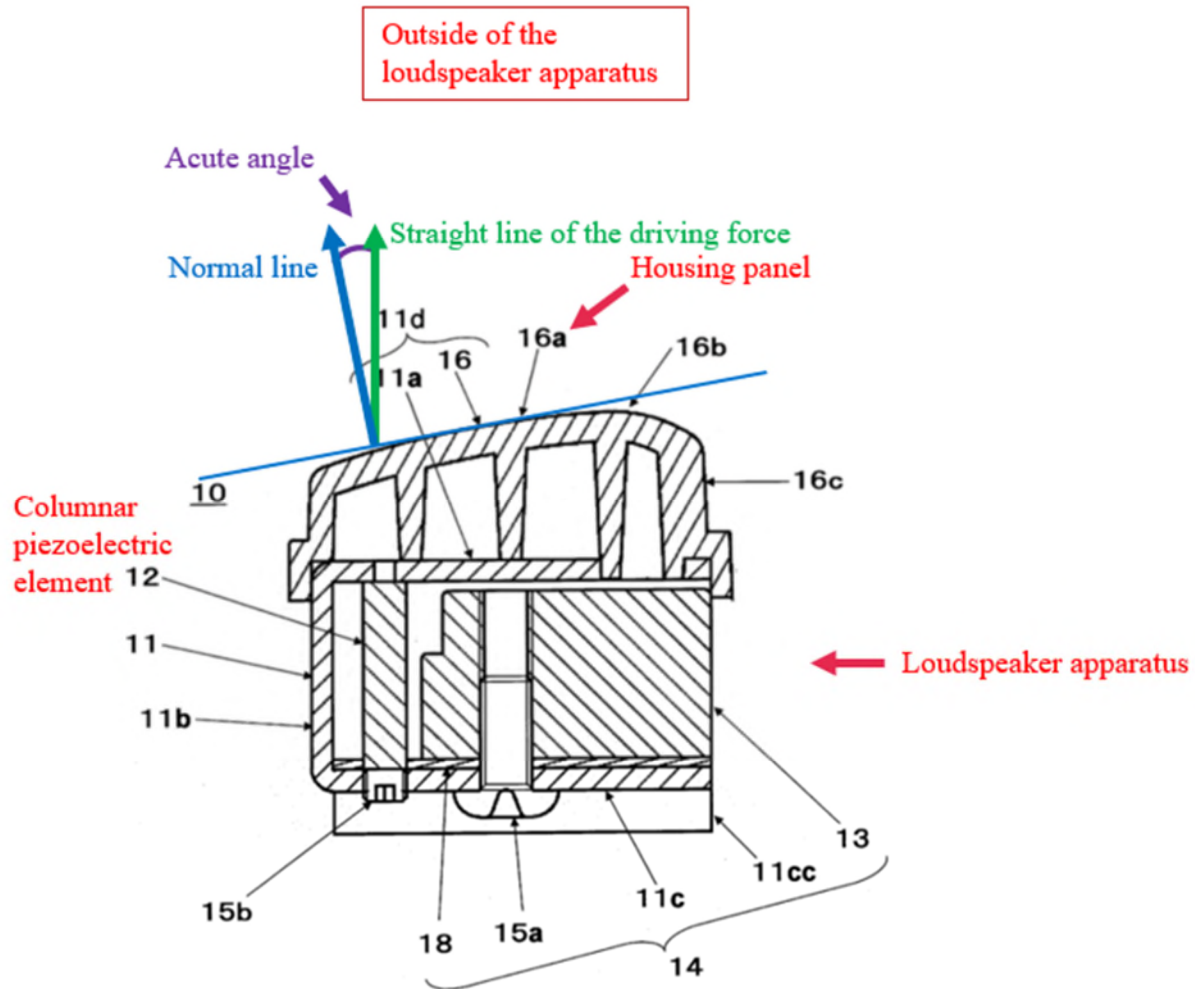


Fukuda, Figure 4

A POSITA would find it obvious that in adding Fukuda's magnetic circuit system *earphone core* in place of Fujita's piezoelectric mechanism *earphone core* in the Li-Fujita-Fukuda combination (§VII.A), *an axis of Fukuda's coil or the magnetic circuit system* would not be *parallel to the normal line* in Fujita, *the axis being perpendicular to a radial plane of the coil or the magnetic circuit system*, because the normal line of Fujita is angled and would therefore not be parallel to

the *radial plane of the coil or the magnetic circuit system*. EX1022, Figure 2;

EX1003, ¶164.



Fujita, Figure 2

A POSITA would understand the annotated “normal line” above in Fujita Figure 2 to be one example of a normal line for the same reasons discussed above for Fujita, *see* [1d], because the housing panel contacting the user’s body in Fujita is non-planar (has a curvature). EX1003, ¶165.

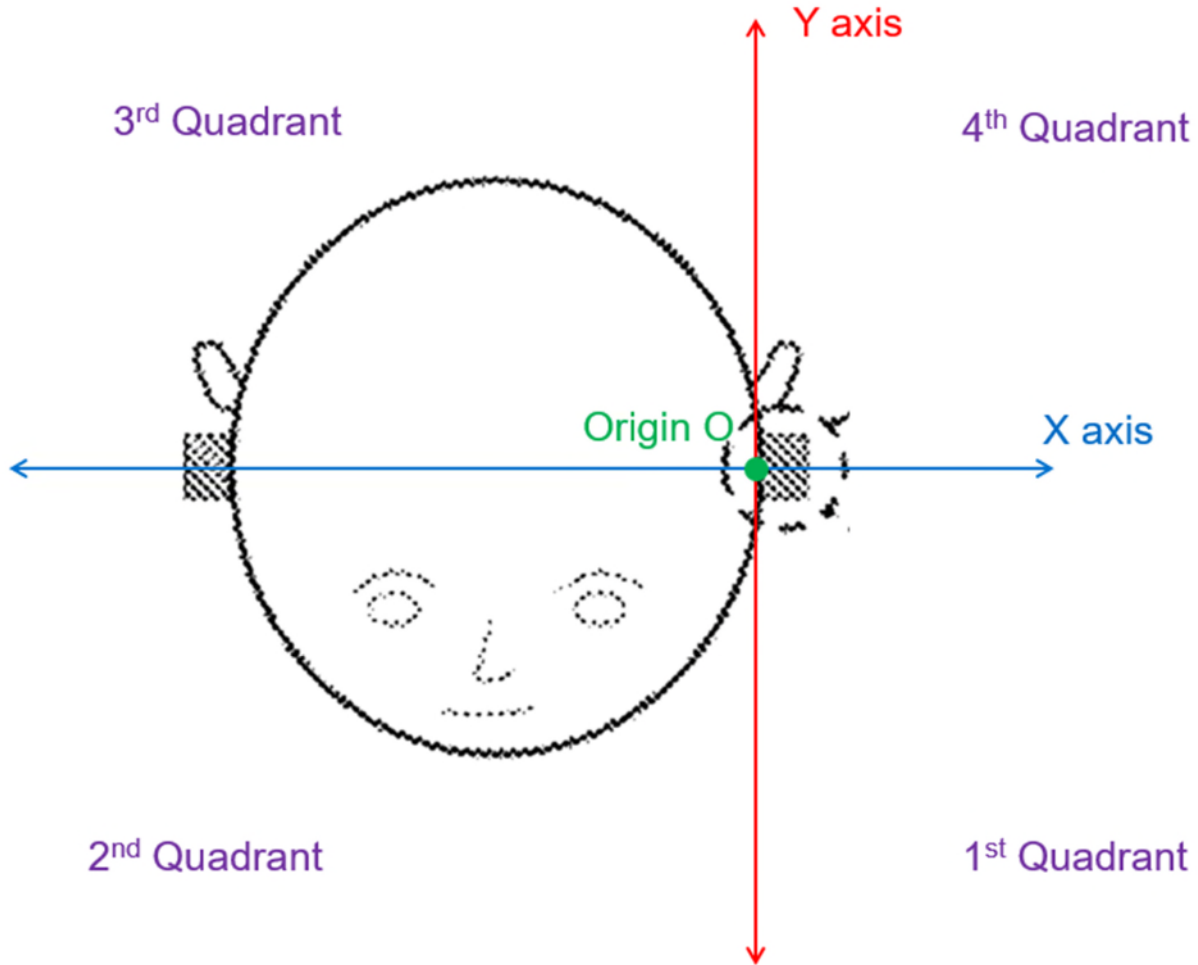
E. Claim 15

1. [15pre]

See claim 12; EX1003, ¶166.

2. [15a]

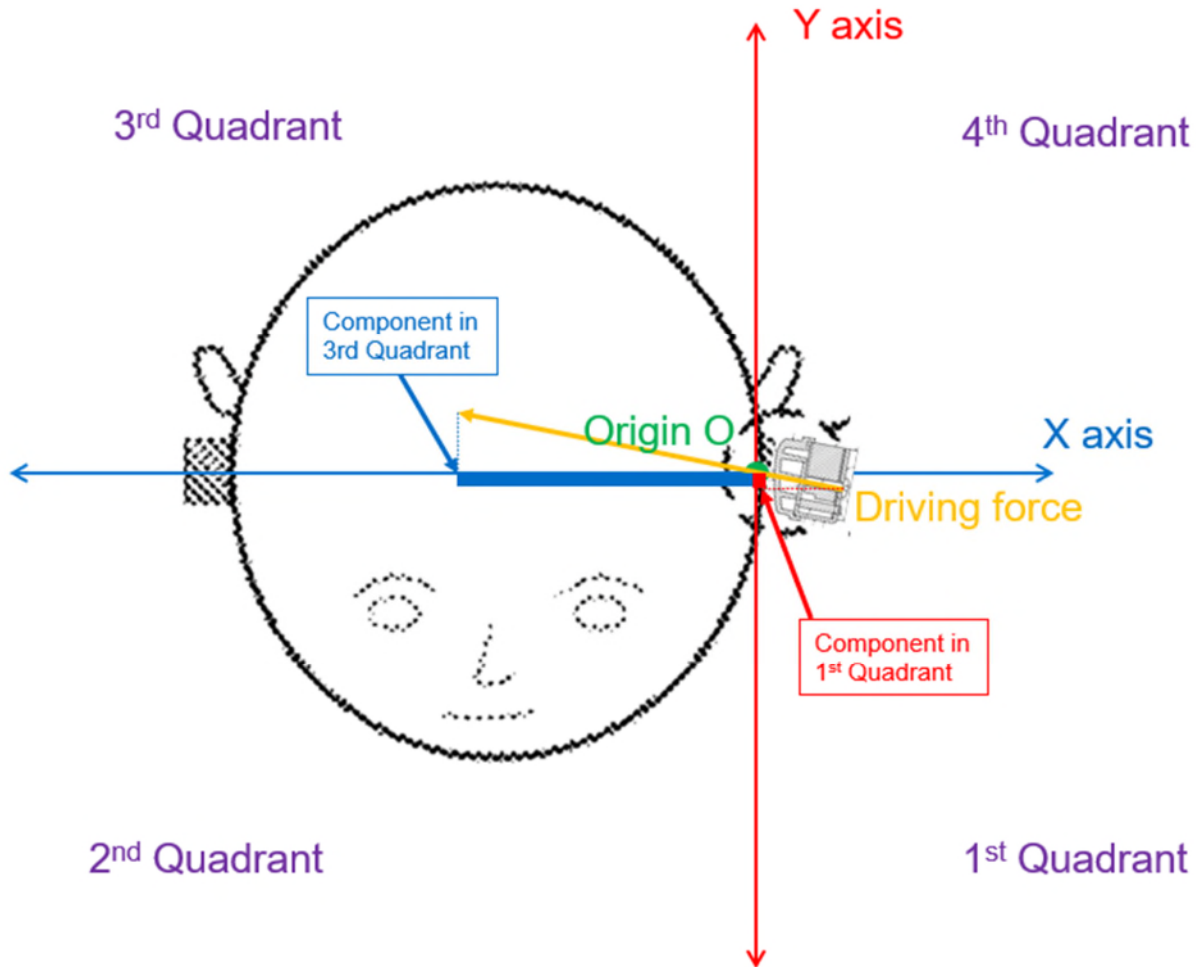
Fujita discloses or renders obvious this claim. The second portion of this claim (*wherein an origin O of the XOY plane coordinate system is on a contact surface between the loudspeaker apparatus and a human body, an X-axis of the XOY plane coordinate system is parallel to a coronal axis of the human body (the axis running from side to side, dividing a human body into front and back portions, EX1024, Page 6), a Y-axis of the XOY plane coordinate system is parallel to a sagittal axis of the human body (the axis running from front to back, dividing a human body into a left and right side, EX1024, Page 6), a positive direction of the X-axis faces outside of the human body, and a positive direction of the Y-axis faces front of the human body*) is depicted in the annotated figure below, as the quadrant system described in the '084 Patent. EX1001, 18:41-19:5. A POSITA would be familiar with the *coronal axis of the human body* and the *sagittal axis of the human body* through his or her work in acoustic technology. See, e.g., EX1024, Page 6; EX1003, ¶167.



EX1003, ¶167.

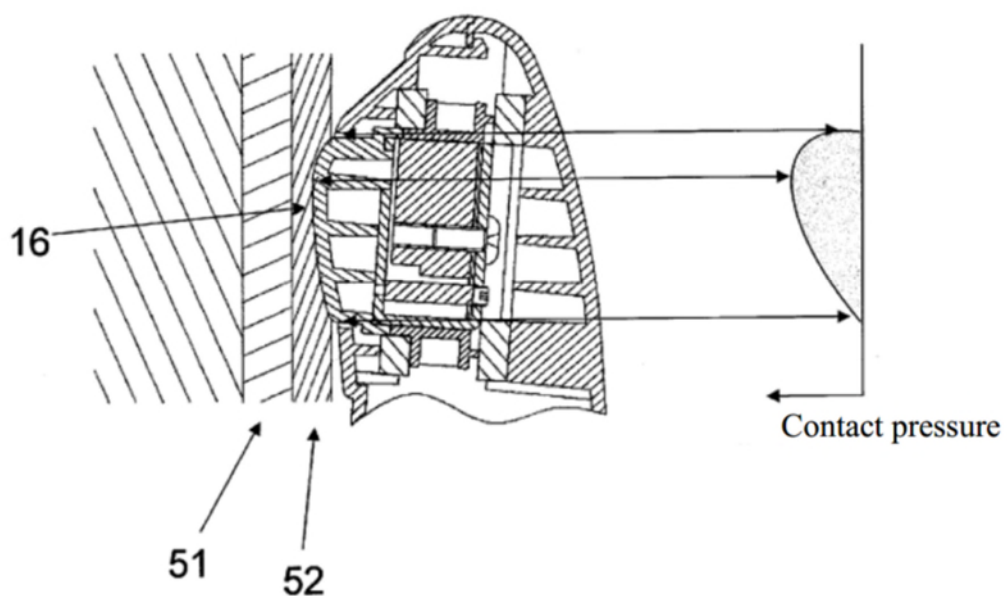
A POSITA would understand that when using Fujita's bone conduction speaker, the orientation of the device, as depicted below, would necessarily result in the first portion of this claim, *the driving force has a component in a first quadrant or a third quadrant of an XOY plane coordinate system*, because a vector of the driving force would necessarily point in the direction of the third quadrant due to the angle of the housing in contacting the user's head, resulting in an X and

Y component in a first quadrant or a third quadrant of an XOY plane coordinate system. EX1003, ¶168.

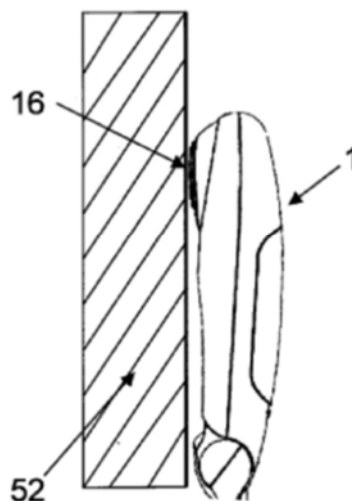


Fujita's bone conduction speaker, as taught in a mobile phone embodiment, is angled in the orientation depicted in the above annotated figure, which necessarily angles the driving force to have *a component in a first quadrant or a third quadrant of an XOY plane coordinate system* as claimed. EX1003, ¶169.

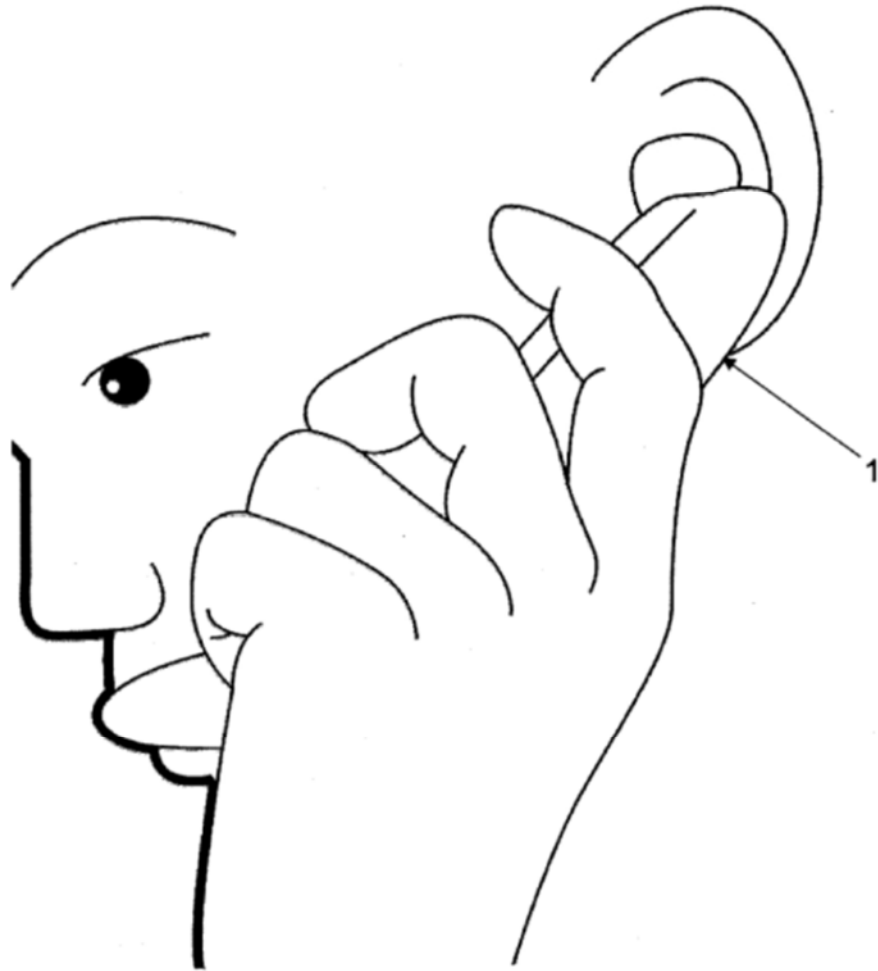
[Figure 6]



[Figure 7A]



[Figure 8]



EX1022, Figs. 6, 7A, 8.

A POSITA would have found it obvious to use Fujita's bone conduction speaker with Li's earphones for the reasons above. §VI.A. A POSITA would have further found it obvious to angle Fujita's bone conduction speaker in the same way (with the *component* in the *third quadrant* or *first quadrant*) when used in Li's earphones because Fujita teaches that is the optimal positioning of its bone conduction speaker: "the ***ideal usage posture*** of the bone conduction receiver 1 of

the embodiment is to be arranged substantially parallel to the face 52a.” EX1022, [0038], Figs. 6, 7A, 8; EX1003, ¶¶170-71.

VIII. GROUND 3: LI, FUJITA, ASAKA, AND THE KNOWLEDGE OF A POSITA RENDER OBVIOUS CLAIMS 2-6

A. Motivation to Combine

1. Li-Fujita

See §VI.A; EX1003, ¶¶172-73.

2. Li-Fujita and Asaka

A POSITA would have found it obvious to further modify Li-Fujita by using Asaka’s covering portion 7 and holding portions 11-14 (shown below) on the Li-Fujita ear hook wires, and a POSITA would have been motivated to do so. EX1003, ¶174.

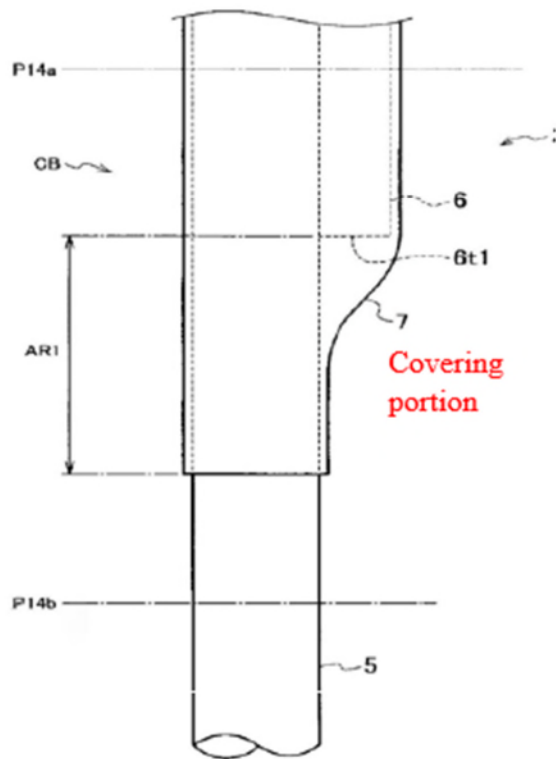


Figure 3

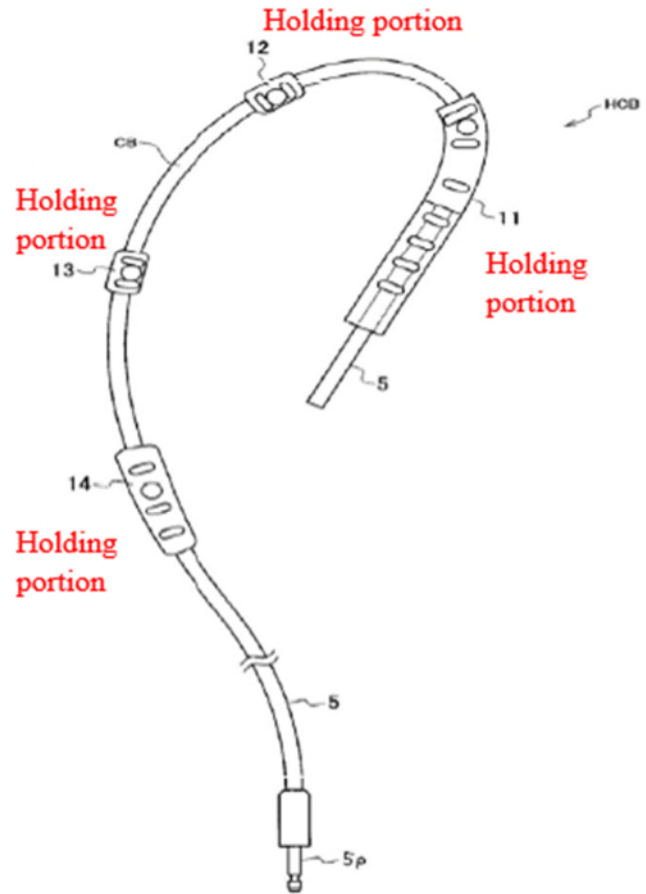


Figure 10

Asaka, Figures 3, 10

EX1006, Figs. 3, 10; EX1003, ¶174.

Because Asaka is an ear hook with earphone, a POSITA would look to it as a similar design within the same field of wearable ear hook earphones as Li-Fujita. Asaka teaches that covering portion 7 and holding portions 11-14 keep ear hook wires positioned during injection molding ensuring resin portion 8 covering them “will not easily cause faults due to sweat or water droplets and uneven thickness of

the resin, and has a beautiful appearance and simple manufacturing process.”

EX1006, Abstract, [0009]-[0028]; EX1003, ¶175.

Similar to Asaka’s holding materials, Li discloses a first elastic coating layer 1132 formed using injection molding over Li’s wires, which are analogous to Asaka’s wires. *See* claim 2; EX1004, [0026]-[0030], [0036]-[0037], [0041], Figs. 1-3. A POSITA would therefore have looked to, and recognized the benefit of, Asaka to improve the manufacturing of the Li-Fujita earphones to improve their wear-resistant nature and appearance—aims shared by Asaka. EX1004, [0030], [0032], [0036]. A POSITA would have understood that Asaka’s earphone design improved the manufacturing and quality of the first elastic coating layer 1132. This benefit would have motivated the POSITA to make the combination. EX1003, ¶176.

Combining Asaka with Li-Fujita would involve applying known techniques (ear hook earphone design and manufacturing) to a known device ready for improvement (Li-Fujita’s ear hook earphones) to yield predictable results (ear hook earphones with improved manufacturing and protective sleeve). A POSITA would have had a reasonable expectation of success in the combination because the Li-Fujita ear hook was already constructed with injection molding of the first elastic coating layer 1132, which is the same way Asaka’s ear hook is designed to

be constructed with resin portion 8—manufacturing that the Asaka design improved. EX1003, ¶177.

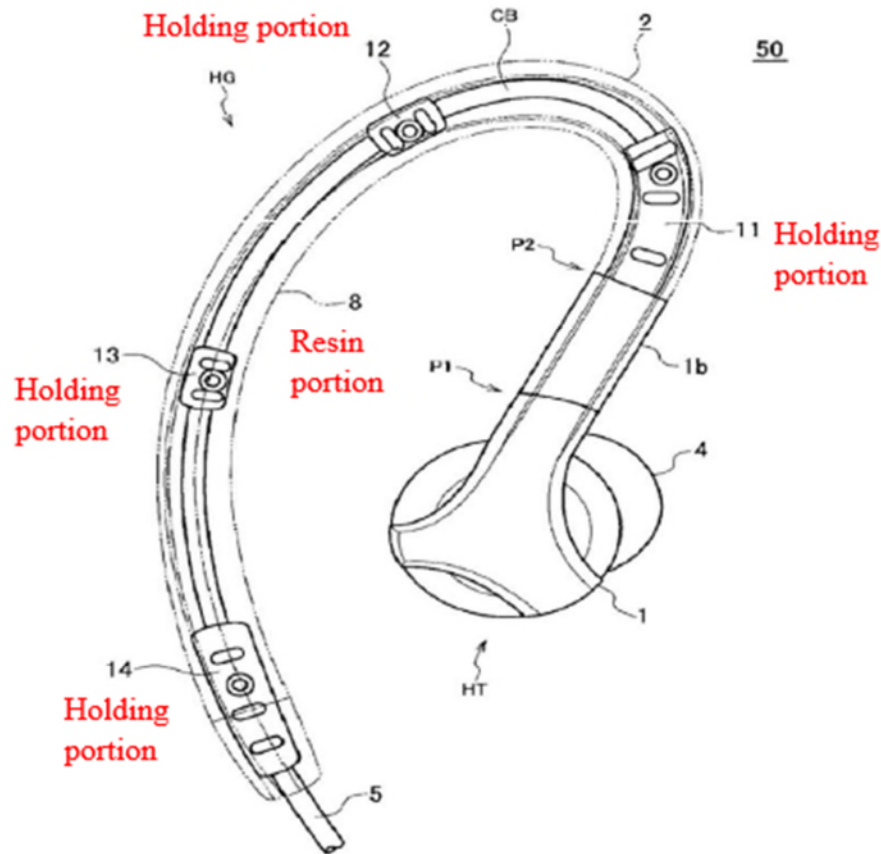


Figure 4

Asaka, Figure 4

EX1006, Fig. 4; EX1003, ¶177.

A POSITA would have had a reasonable expectation that the combination would be successful because the teachings of Li-Fujita and Asaka would have been predictably combined due to the predictability of the known ear hook earphone art,

manufacturing, and interchangeability of elements, including the components of manufacture. EX1003, ¶178.

If Patent Owner argues the portions of Asaka cited below relate to different, incompatible embodiments (they do not), a POSITA would have found it obvious to combine such embodiments into a single device at least because such embodiments are described in the same prior art reference, are fully compatible with each other, and could be combined with minimal effort to achieve predictable results. EX1003, ¶¶179-80.

B. Claim 2

1. [2pre]

See claim 1; EX1003, ¶181.

2. [2a]

Li and Asaka disclose or render obvious this limitation. EX1003, ¶¶182-83.

For example, Li discloses *wherein the ear hook further includes: an elastic metal wire, i.e.,* the first elastic wire 1131 in connecting component 113 of earhook assembly 11. EX1004, [0023], Figure 1. First elastic metal wire 1131 connects the first housing 111 and the second housing 112 at both ends and is wrapped with first elastic coating layer 1132. *Id.*; EX1003, ¶182.

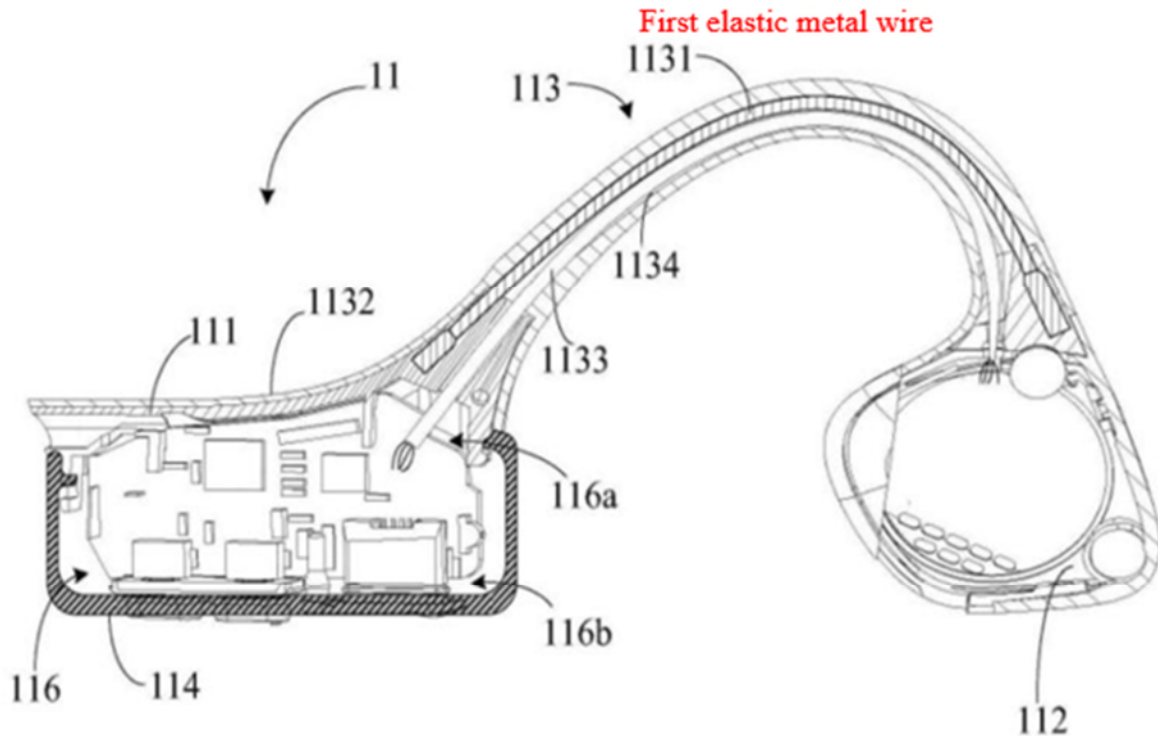


Figure 1

Li, Figure 1

3. [2b]

Li and Asaka disclose or render obvious this limitation. EX1003, ¶¶184-85.

For example, in Li: *a wire* is first wire set 1133 connecting the bone conduction speaker to the battery pack 13 or control circuit assembly 14. EX1004, [0040], Figure 1; EX1003, ¶184. As discussed above in §VI.B.2 (Ground 1, claim 1, limitation [1a]), a POSITA would have found it obvious to include electrical contacts, pins or plugs, such as those shown on either of the ends of EX1019, Fig. 13, in the plug ends of the ear hook, and to include mating contacts, pins or plugs

in the corresponding sockets of the speaker housing and control circuit housing.

Doing so allows the wires at both ends of the first wire set to be electrically connected to the desired components in the speaker housing and control circuit housing via the contacts/pins/plugs of the ear hook plug ends and mating housing sockets while maintaining the ability to disconnect the ear hook from the speaker housing and/or control circuit housing to realize the benefits of the modular design discussed in Ground 1. EX1003, ¶¶118, 184.

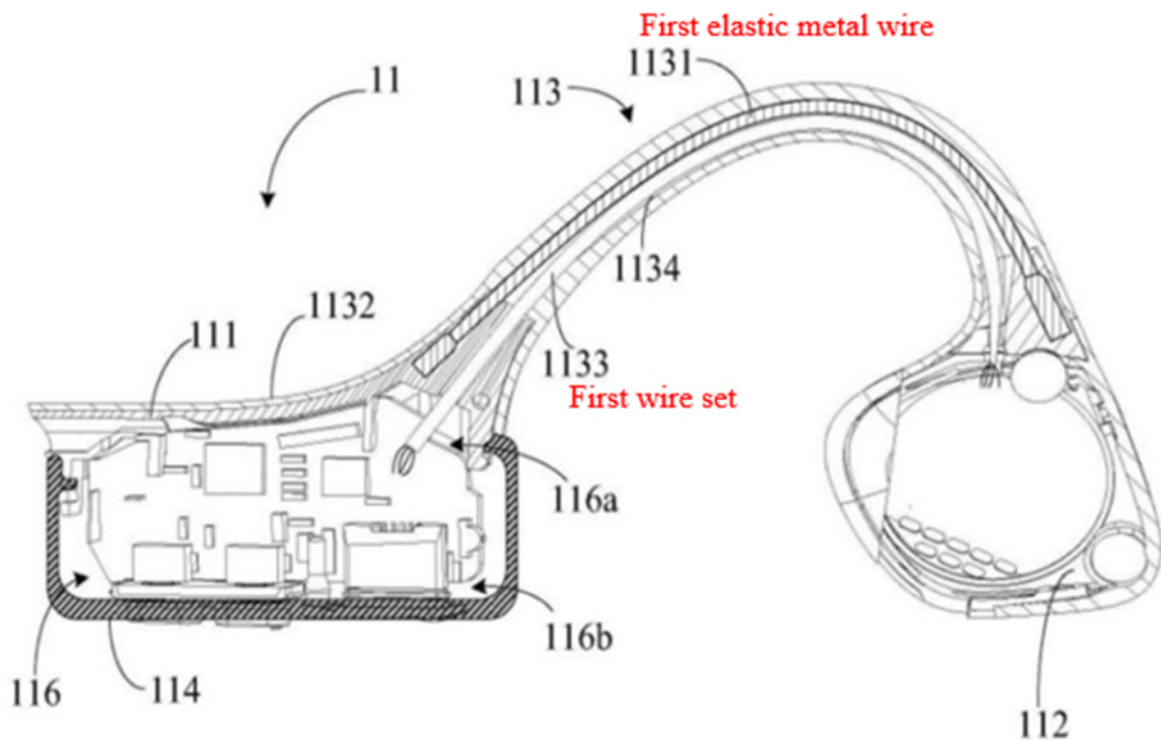


Figure 1

Li, Figure 1

EX1004, Fig. 1; EX1003, ¶184.

4. [2c]

Asaka discloses or renders obvious a *fixed sleeve*: holding portions 11 to 14 (highlighted below) along the integrated wire CB inside the hook portion 2.

EX1006, [0086], Figures 4-5. The integrated wire CB contains the wire 5 and wire material 6, and the integrated wire CB passes through holding portions 11-14, as can be seen for example in Figure 4. *Id.*, [0059], Figure 4, [0142] (“wire 5 and wire material 6 can pass through each holding portion 11-14 and be integrated with them”), [0023], Abstract. “The material of each holding portion 11-14 can be polyethylene PE.” *Id.*, [0087]. A POSITA would have understood that holding portions 11 to 14 *fix the wire* (wire 5) *on the elastic metal wire* (wire material 6).

EX1003, ¶187; *see also* EX1003, ¶186.

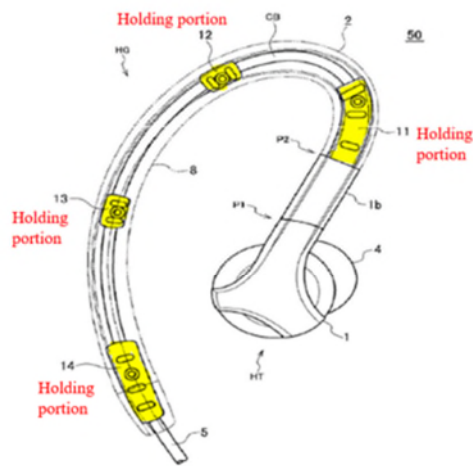


Figure 4

Asaka, Figure 4

EX1003, ¶187.

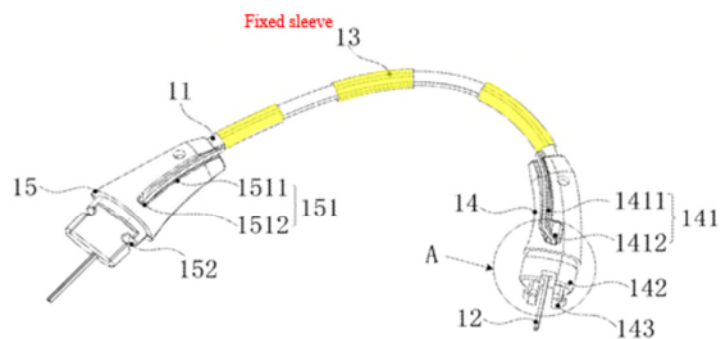


Fig. 3

'084 Patent, Figure 3

Combining Asaka's fixed sleeve with Li-Fujita renders obvious *the protective sleeve being formed, by injection molding, on periphery of the elastic metal wire, the wire, the fixed sleeve, the first plug end, and the second plug end*. The *protective sleeve* in Li, a first elastic coating layer 1132, *see* [1b], is taught to be *formed by injection molding* on periphery of the ear hook and its components, including the first elastic metal wire 1131 (*an elastic metal wire*), first wire set 1133 (*a wire*), and the entire outer surface of the first housing 111 and the second housing 112. EX1004, [0029]-[0030], [0036]-[0037], [0041], Figure 1. A POSITA would have found it obvious to form the protective sleeve on periphery of the *fixed sleeve* of Asaka with Li (holding portions 11 to 14) because they would be on the first elastic metal wire 1131 and first wire set 1133 and their purpose is to fix the wires together. EX1003, ¶188.

Further, a POSITA would have found it obvious to *form[] the protective sleeve on periphery of...the first plug end, and the second plug end* in Li (*see* claim 1) because Li already teaches the first elastic coating layer 1132 being formed on periphery of the first housing 111 and the second housing 112, as well as connecting component 113. EX1004, [0029]-[0030], [0036]-[0037], [0041]. Li's *protective sleeve* is therefore formed in the same areas where it would be obvious that the *first plug end* and *second plug end* of Li would be. A POSITA would be motivated to form the *protective sleeve* there to serve the same purposes of the first

elastic coating layer 1132 in Li of protecting the components of the ear hook,
including to “enhance[] the texture and unity of the bone conduction earphone.”

Id., [0036]; EX1003, ¶¶189-90.

C. Claim 3

1. [3pre]

See claim 2; EX1003, ¶191.

2. [3a]

Li renders obvious *the first plug end and the second plug end*. See [1a]. It would have been obvious to a POSITA that *the first plug end and the second plug end are formed, by injection molding, at both ends of the elastic metal wire respectively* because Li teaches that its plugs can be formed at the end of a wire by injection molding. EX1004, [0058]. The *elastic metal wire* is Li’s first elastic metal wire 1131. See claim 2. Li teaches that the plug-in portions 123 on the rear hook assembly 12 “can be fixed to both ends of the second elastic metal wire 121 **by injection molding**, which can make the plug-in portion 123 more firmly fixed to both ends of the second elastic metal wire 121.” EX1004, [0058], Figs. 2, 9. It therefore would have been obvious to a POSITA to construct the *first plug end* and *second plug end* in the same way on each end of the ear hook, *by injection molding, at both ends of the elastic metal wire respectively*, because that is already how the plug ends disclosed in Li are constructed. Their location is simply moved

to both ends of the ear hook (see [1a]) and its *elastic metal wire*. A POSITA would use the same production technique disclosed in Li. EX1003, ¶¶192-93.

3. [3b]

Li discloses or renders obvious *a first wiring channel and a second wiring channel* (buried wire grooves 1232 at the ear hook plugs proximate the speaker (first channel) and the circuit (second channel) when Li's plugs are replicated on connecting component 113 as explained in [1a]): ***“the top surface of the plug-in portion 123 is provided with a buried wire groove 1232*** for accommodating the exposed portion of the second wire set 124.” EX1004, [0069]; EX1003, ¶194.

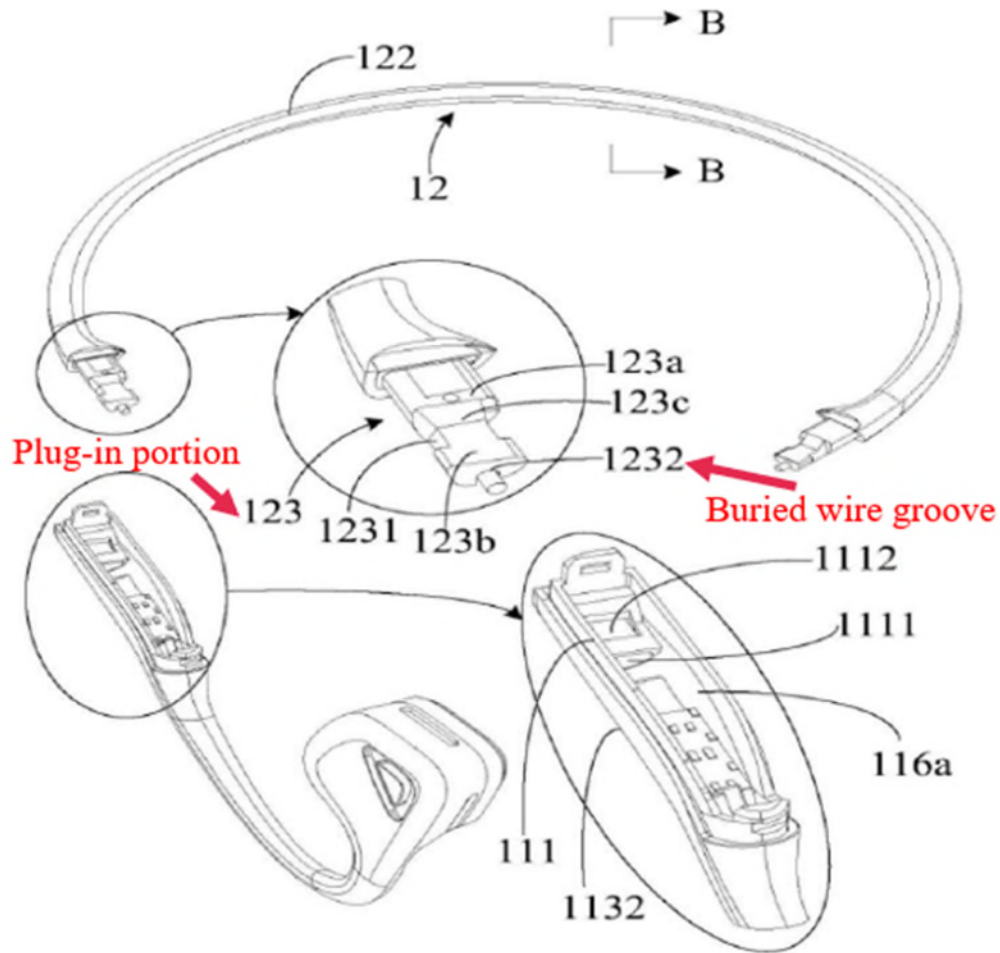


Figure 9

Li, Figure 9

EX1004, Fig. 9. “Setting the buried wire groove 1232 can effectively arrange and fix the second wire set 124 on the one hand, and reduce the footprint on the other hand.” *Id.*, [0069], Figures 9, 12-13; EX1003, ¶194.

Li teaches that buried wire groove 1232 is present in both plug-in portions 123 on either end of the rear hook assembly 12, and it would therefore be present if Li’s plugs were included on both ends of Li’s connecting component 113. EX1004,

[0069], Figures 9, 12, 13. A POSITA would have found it obvious to arrange *the first plug end and the second plug end...with a first wiring channel and a second wiring channel respectively* in the same way because that is how the plug ends disclosed in Li are constructed. Their location is simply moved to both ends of the ear hook (see [1a]). Exemplary plug locations are shown below with green arrows.

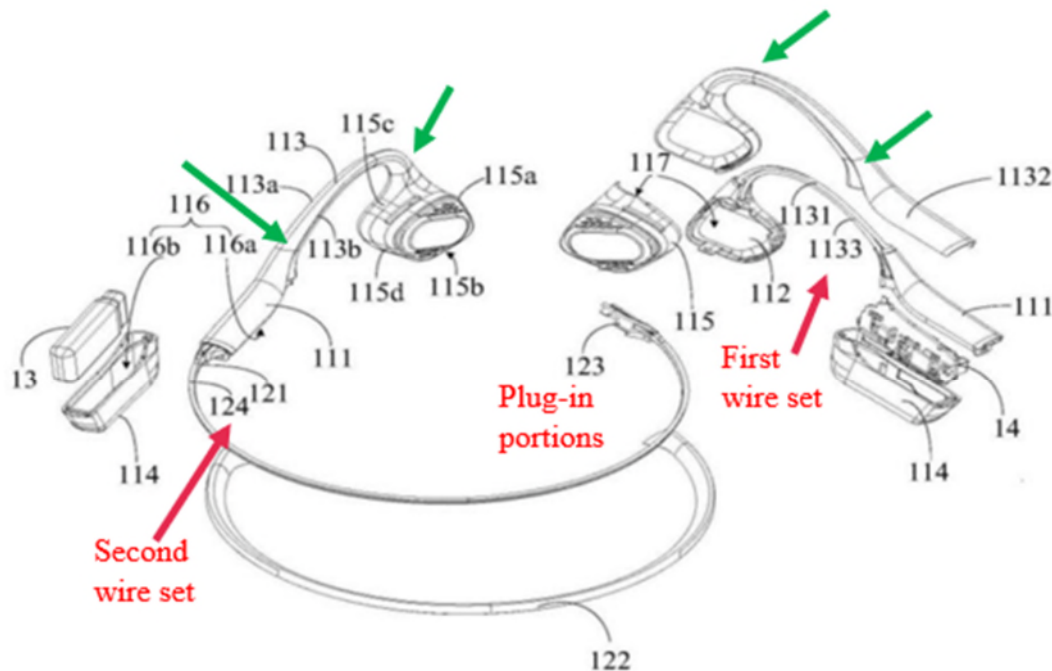


Figure 2

Li, Figure 2

EX1004, Fig. 2; EX1003, ¶¶195-96.

A POSITA would have used the same production technique disclosed in Li, including the buried wire groove 1232 for each *first plug end* and *second plug end*, therefore providing the *first wiring channel* and a *second wiring channel*. EX1003, ¶¶197-98.

4. [3c]

Li discloses or renders obvious a *wire* (second wire set 124) that *extends along* buried wire grooves 1232: “the top surface of the plug-in portion 123 is provided with a buried wire groove 1232 **for accommodating the exposed portion of the second wire set 124.**” EX1004, [0069], Figures 9, 12-13; EX1003, ¶199.

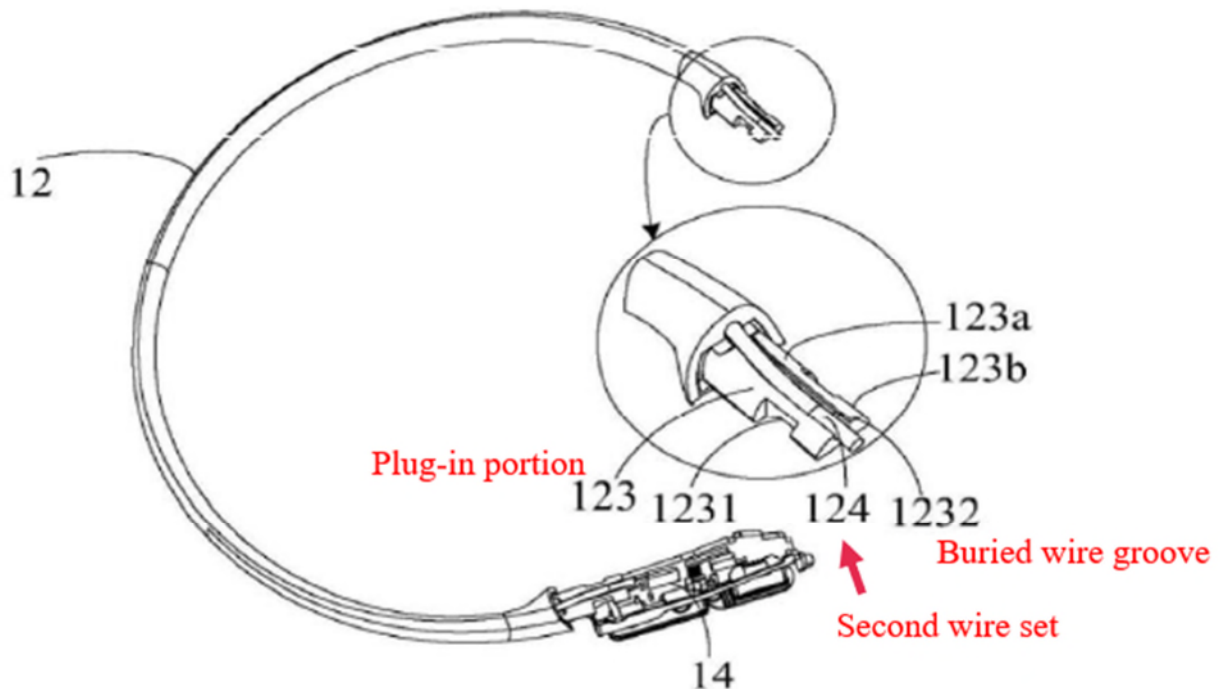


Figure 12

Li, Figure 12

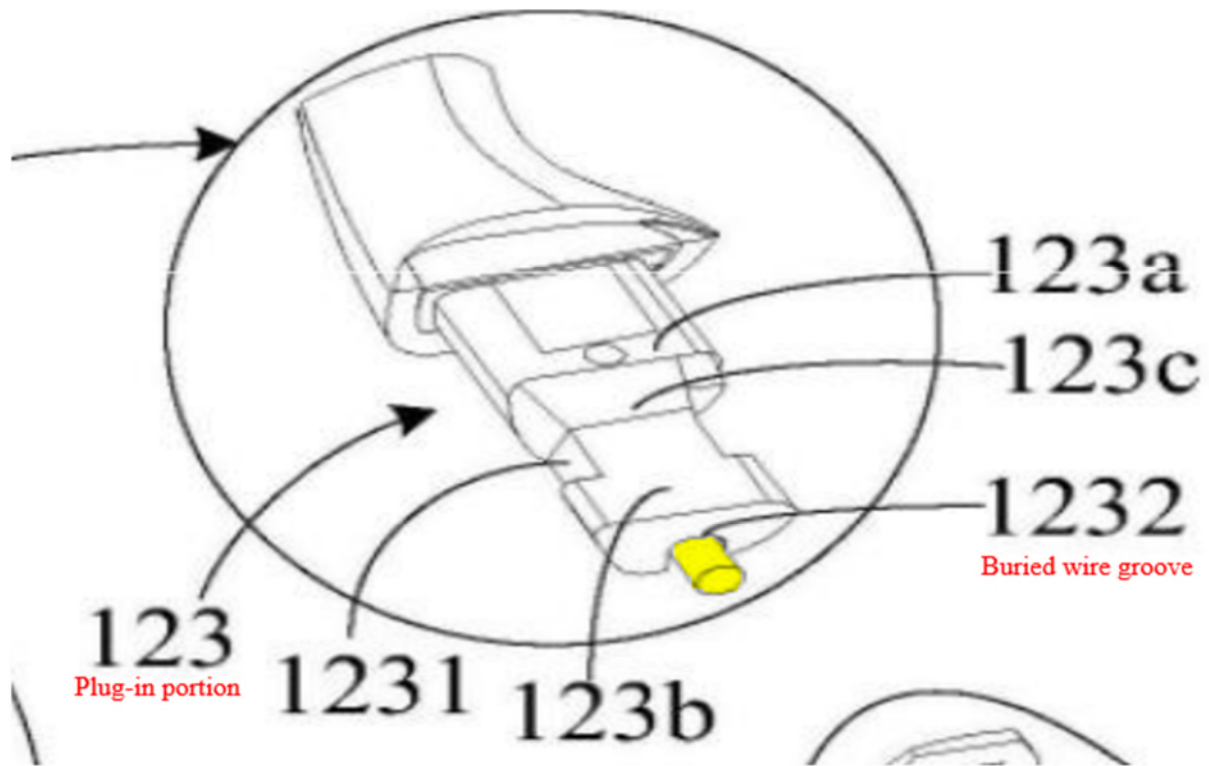
As shown in [3b], *the first wiring channel and the second wiring channel* are buried wire grooves 1232 located at the ear hook plugs proximate the speaker (first channel) and the circuit (second channel)). Accordingly, when Li’s plugs are replicated on connecting component 113 as explained in [1a], it would have been

obvious to a POSITA to have *the wire* (second wire set 124, which in the ear hook location would be Li's first wire set 1133) *extend[ing] along the first wiring channel and the second wiring channel* (replicated buried wire grooves 1232 at plug locations) because that is how the plug ends disclosed in Li are constructed. Their location is simply moved to both ends of the ear hook (*see* [1a]). A POSITA would use the same production technique disclosed in Li, only with Li's first wire set 1133 rather than second wire set 124, extending along buried wire grooves 1232. As discussed above, the first and second plug ends would be configured with pins or contacts commonly found in jacks and plugs, and the respective ends of the second wire set would pass through the first and second wiring channels for connection to the pins/contacts at the first and second plug ends (not shown in the figure above) for mating with corresponding pins or contacts in the sockets of the respective speaker and control circuit housings. EX1003, ¶¶200-01.

D. Claim 4

Li-Fujita-Asaka renders obvious claim 3. *See* above. In the same way Li-Fujita-Asaka renders obvious *the wire extends along the first wiring channel and the second wiring channel*, the combination renders obvious *wherein the wire passes through the first wiring channel and the second wiring channel*. *See* claim 3. For example, Li teaches that second wire set 124 protrudes through wire groove 1232 as shown in Fig. 9 below (highlighted) with its exposed wire. EX1004,

[0069], Figure 9. Accordingly, Li's second wire set 124 would pass through the first wiring channel and the second wiring channel. EX1003, ¶202.



EX1004, Fig. 9 (excerpt); EX1003, ¶202.

E. Claim 5

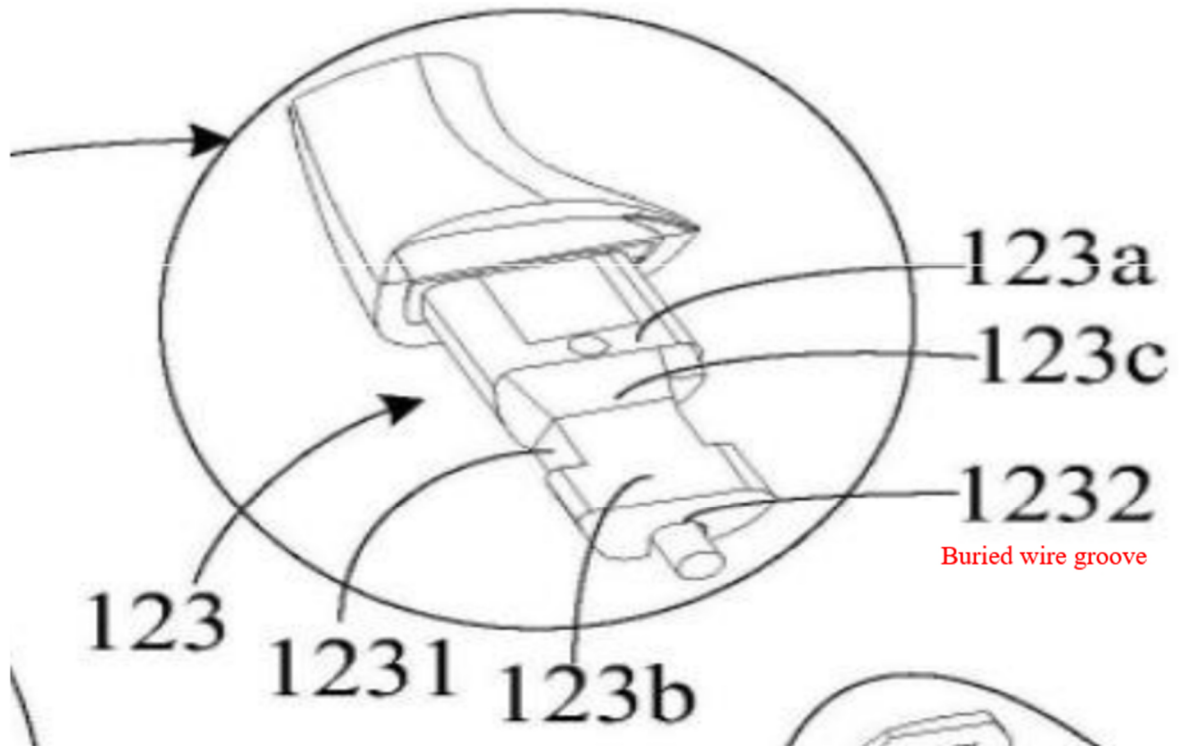
1. [5pre]

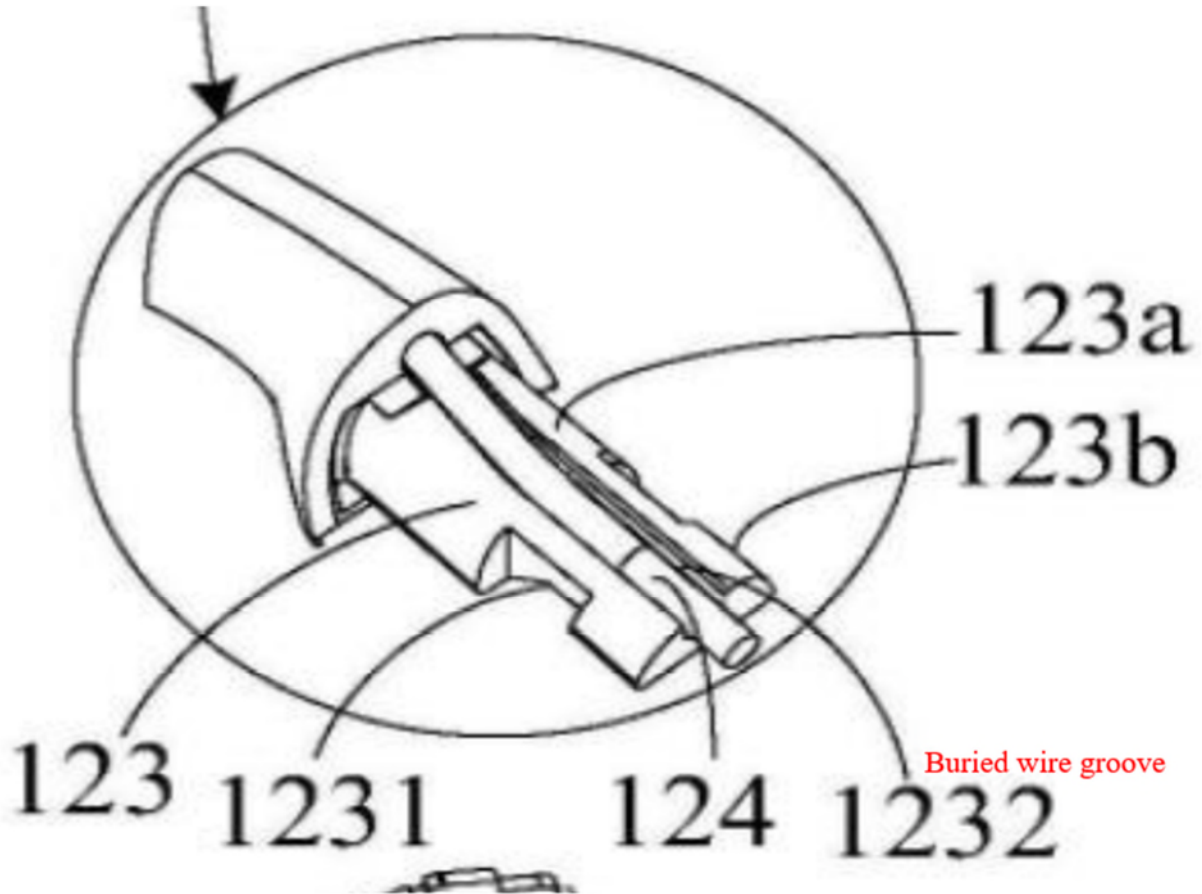
See claim 3; EX1003, ¶203.

2. [5a]

Li discloses or renders obvious a *first wiring channel*, buried wire groove 1232 (see claim 3), that further includes a *first wiring groove*. The buried wire groove 1232 has a groove shape and, thus, part of the buried wire groove 1232

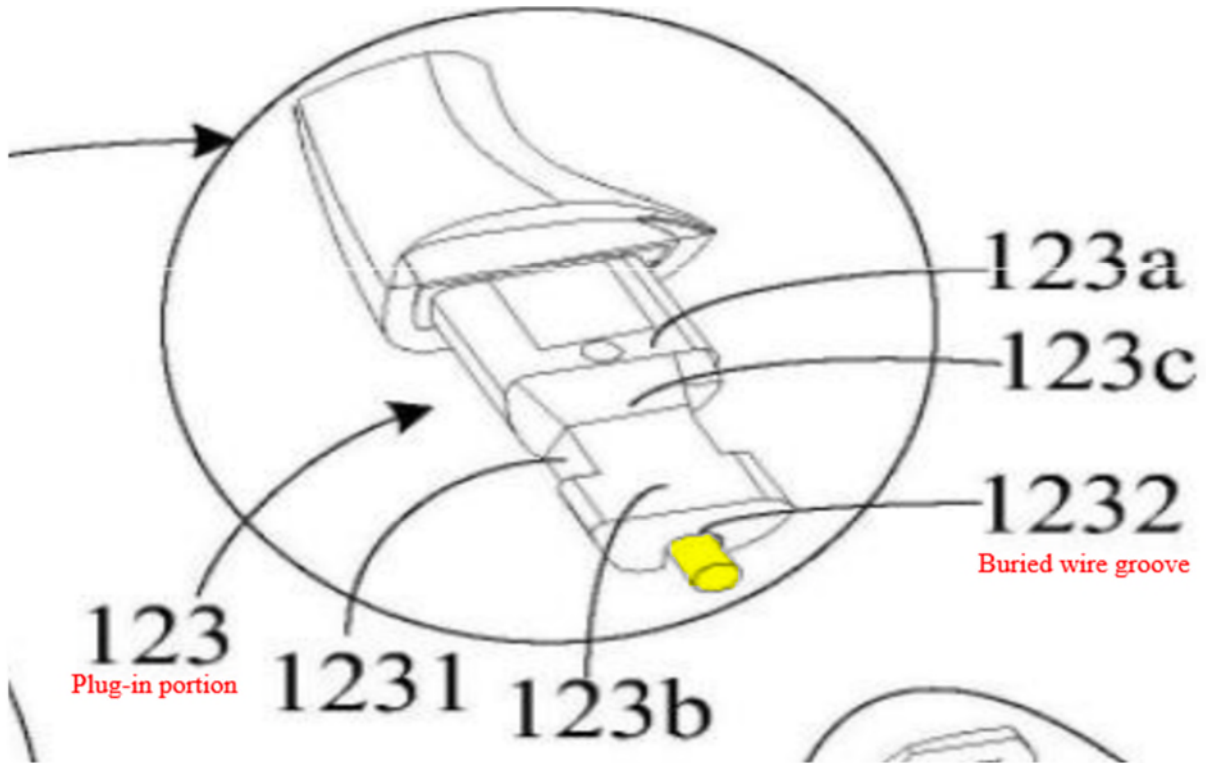
shape is a groove where the wire sits as shown below. EX1004, [0069], Figs. 9, 12-13; EX1003, ¶204.





EX1004, Figs, 9, 12 (excerpts); EX1003, ¶204.

Li teaches that buried wire groove 1232 has a *first wiring hole connecting the first wiring groove and an outer end surface of the first plug end*. Li teaches that second wire set 124 is “exposed” through the *first wiring hole*, such as shown in Figure 9, and that the *first wiring hole is connecting the first wiring groove and an outer end surface of the first plug end*, as is visible in Fig. 9 with its exposed wire, highlighted below, coming out of a hole in buried wire groove 1232 at the outer end surface of plug-in portion 123. EX1004, [0069], Figure 9; EX1003, ¶205.

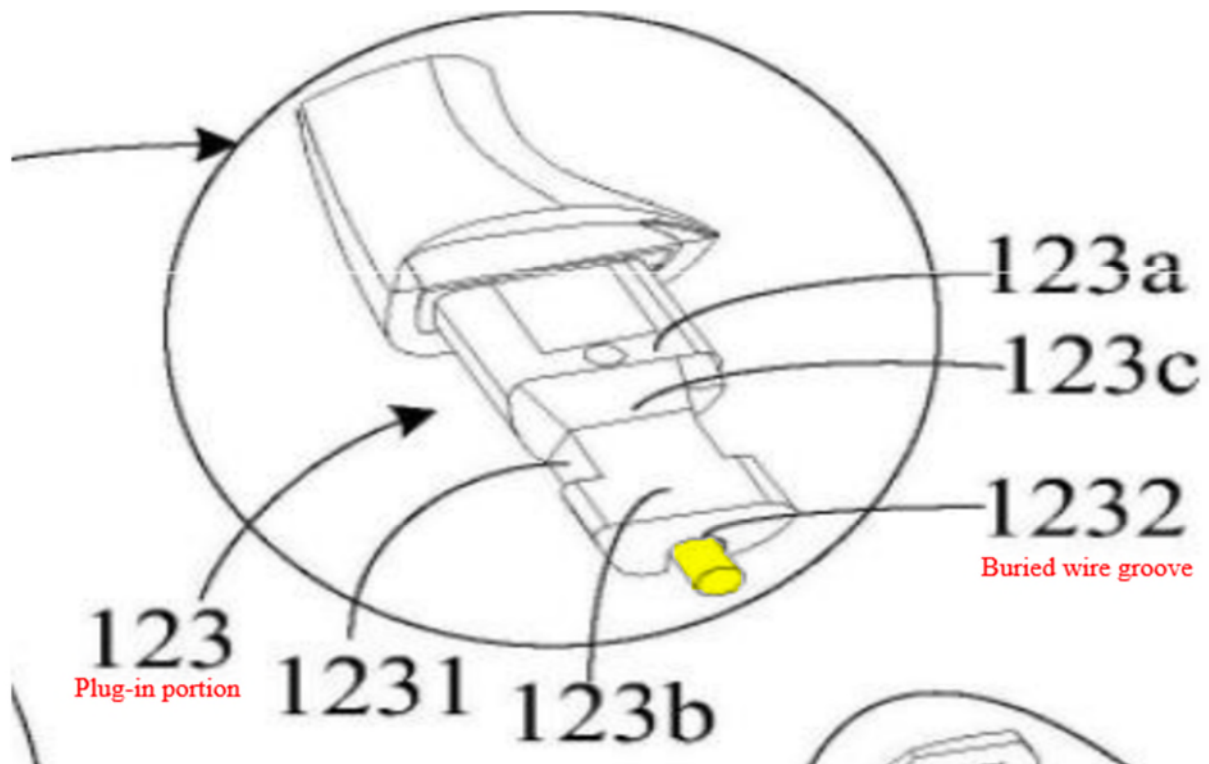


EX1004, Fig. 9 (excerpt); EX1003, ¶205.

A POSITA would have found it obvious to design the *first wiring channel* (see claim 3) in the same way as already disclosed by buried wire groove 1232 in Li. The location of the structure is simply moved to both ends of the ear hook (see [1a]). A POSITA would use the same production technique disclosed in Li, including the buried wire groove 1232 for each *first plug end* and *second plug end* and providing it with the *first wiring channel* and claimed *first wiring hole* already taught in Li. EX1003, ¶206.

3. [5b]

Li teaches a wire (second wire set 124) that *extends along the first wiring groove (buried wire groove 1232) and the first wiring hole and is exposed on the outer end surface of the first plug end*, as is depicted in Figure 9.



EX1004, [0069], Fig. 9 (excerpt); EX1003, ¶207.

A POSITA would have found it obvious to design the *first wiring channel* (see claim 3) in the same way as already disclosed by buried wire groove 1232 in Li, including the claimed *wire* (Li's first wire set 1133) as analogous to second wire set 124. The location of the structure is simply moved to both ends of the ear hook (see [1a]). A POSITA would have used the same production technique disclosed in Li, including *the wire extends along the first wiring groove and the*

first wiring hole and is exposed on the outer end surface of the first plug end as already taught in Li. EX1003, ¶208.

4. [5c]

Li-Fujita-Asaka renders this limitation obvious, for the same reasons discussed above. *See* [5a], claim 3. A POSITA would have found it obvious to implement the same structures of [5a] with the second plug end on the opposite side of the ear hook for the same reasons discussed above, including because Li teaches the same plug-in portion 123 on each side of the rear hook assembly 12. *Id.*; EX1003, ¶209.

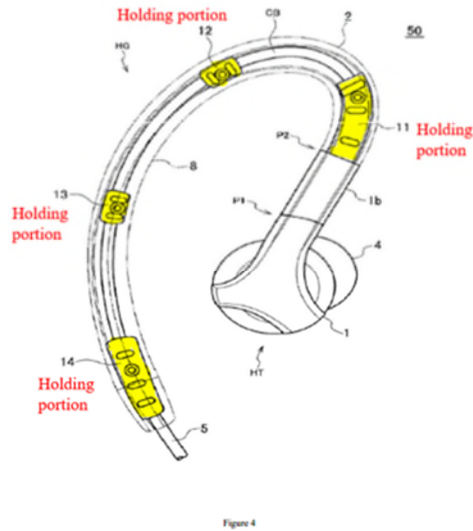
5. [5d]

Li-Fujita-Asaka renders this limitation obvious, for the same reasons discussed above. *See* [5b], claim 3. A POSITA would have found it obvious to implement the same structures of [5b] with the second plug end on the opposite side of the ear hook for the same reasons discussed above, including because Li teaches the same plug-in portion 123 on each side of the rear hook assembly 12. *Id.*; EX1003, ¶210.

F. Claim 6

Li-Fujita-Asaka renders obvious *the loudspeaker apparatus of claim 2. See* above. Asaka discloses that holding portions 11 to 14 are *spaced apart along the*

elastic metal wire (wire material 6). EX1006, [0086], [0023], [0087], Figures 4-5;
EX1003, ¶¶211-14.



Asaka, Figure 4

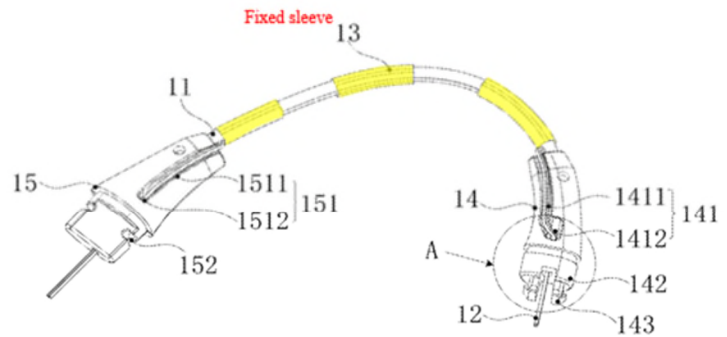


Fig. 3

'084 Patent, Figure 3

EX1003, ¶212.

IX. GROUND 4: LI, FUJITA, NUMATA, AND THE KNOWLEDGE OF A POSITA RENDER OBVIOUS CLAIMS 7-10

A. Motivation to Combine

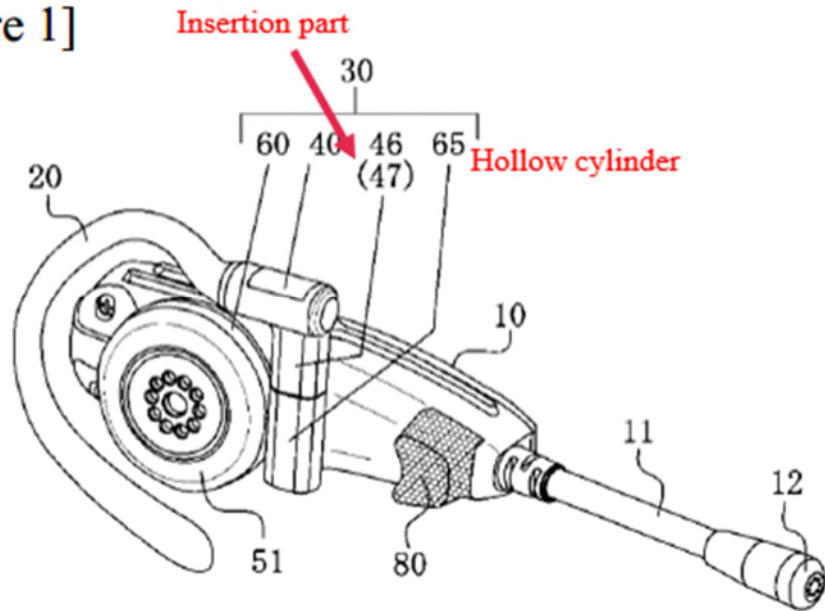
1. Li-Fujita

See §VI.A; EX1003, ¶¶215-16.

2. Li-Fujita and Numata

A POSITA would have found it obvious to modify Li-Fujita with Numata, including Numata's insertion part 47 on the plug ends in Li-Fujita and Numata's hollow cylinder 65 design for the sockets in Li-Fujita. EX1003, ¶217.

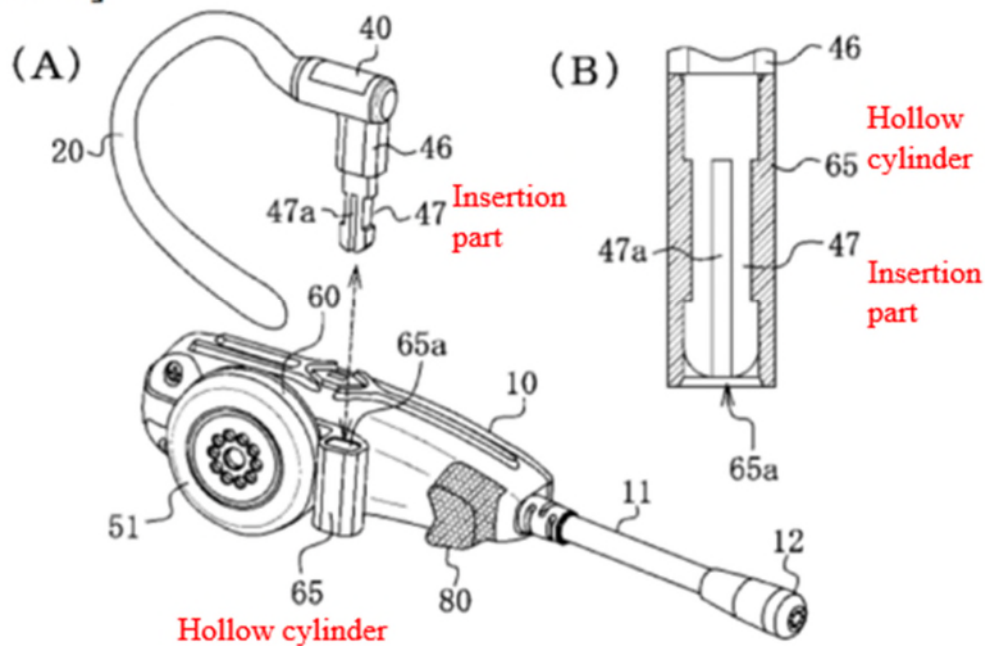
[Figure 1]



EX1007, Fig. 1. A POSITA would have been motivated to do so because Li and Numata are within the same field (wearable speaker headsets) requiring tightly fitting components. EX1004, [0062]-[0064], [0036]; EX1007, [0011], [0020]; EX1003, ¶¶217-18.

Numata discloses a wireless headset connecting an earhook via a plug on the earhook (insertion part 47) and socket (hollow cylinder 65). EX1007, Figure 8. A POSITA would have looked to Numata as being in the same field as Li and sharing a similar design: tightly connecting headset components with earhooks. Numata teaches that insertion part 47 can be connected “no matter in which direction” it is inserted in hollow cylinder 65. EX1007, [0034]. A POSITA would have recognized the connection between the insertion part 47 and hollow cylinder 65 as a secure fit operating snugly on a user’s head. EX1003, ¶219.

[Figure 8]



EX1007, Fig. 8; EX1003, ¶219.

Similarly, Li's plug ends need a secure "tight fit" between components and "wear resistance" for head friction from active use. EX1004, [0062]-[0064], [0036]. A POSITA would have looked to Numata to improve the plugs and sockets of the Li-Fujita earphones, including to improve wear-resistance and add Numata's convenient bi-directional plugging. A POSITA would have recognized the benefit of Numata's insertion part 47 and hollow cylinder 65 in the Li-Fujita earphones, including as the plug and socket connecting the ear hook to the core housing and locating the Numata socket on the core housing. This benefit would have motivated the combination. EX1003, ¶220.

Combining Numata with Li-Fujita would apply known techniques (ear hook/speaker headset construction) to a known device ready for improvement (Li-Fujita's earphones) to yield predictable results (ear hook speakers with improved plugs and sockets). A POSITA would have had a reasonable expectation of success in the combination because Li-Fujita has plugs and sockets, including a socket in the circuit housing, which is similar to Numata's improved ear hook-headset connection. A POSITA would have had a reasonable expectation of modification success because the references' teachings were predictably combinable due to the predictability of ear hook speaker art and manufacturing, and known component interchangeability. EX1003, ¶221.

If Patent Owner argues the portions of Numata cited below relate to different, incompatible embodiments (they do not), a POSITA would have found it obvious to combine such embodiments into a single device because such embodiments are described in the same prior art reference, are fully compatible with each other, and could be combined with minimal effort to achieve predictable results. EX1003, ¶¶222-23.

B. Claim 7

1. [7pre]

See claim 1; EX1003, ¶224.

2. [7a]

Li's second housing 112 and the fourth housing 115 constitute *a core housing*. See [1c]. A POSITA would have been motivated to construct additional plug locations (see claim 1) and exemplary plug locations are shown below with green arrows.

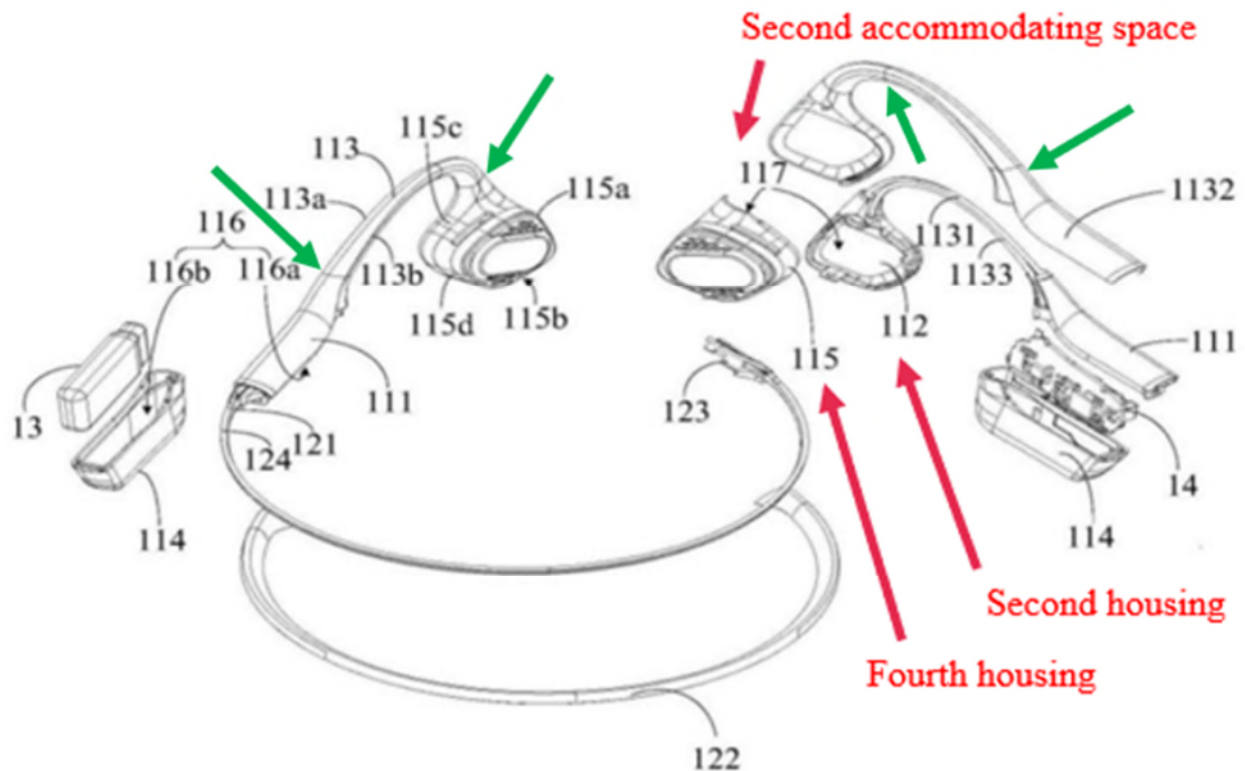


Figure 2

EX1004, Fig. 2; EX1003, ¶225.

If additional plugs are used, the connecting component 113 in ear hook assembly 11 would include plug ends 123. As such, the *core housing* would include a housing arranged with a *socket* (a plug-in hole 1111) *connecting with an*

outer end surface of the core housing (see green arrow locations above). As explained in Li, “the end of the first housing 111 is provided with a plug-in hole 1111 for allowing the insertion of the plug-in portion 123.” EX1004, [0060]-[0068], Figs. 9-11; EX1003, ¶226.

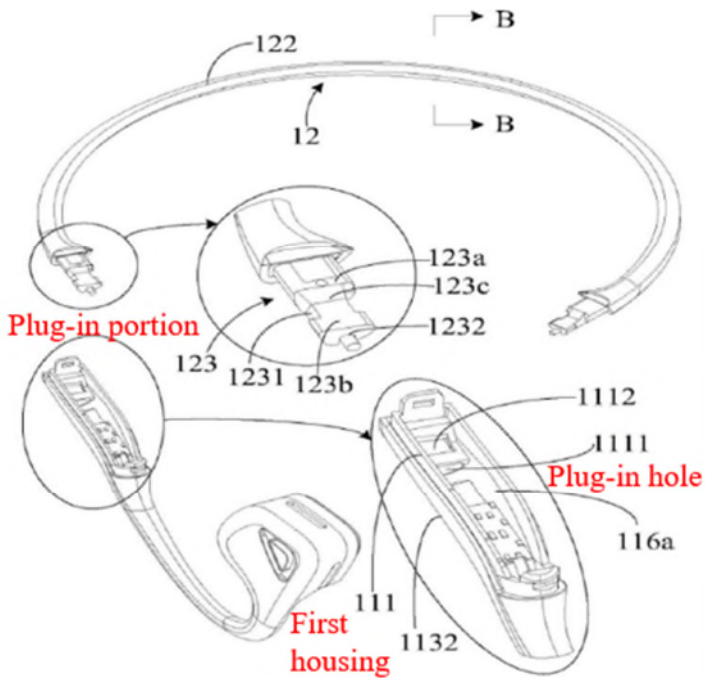


Figure 9

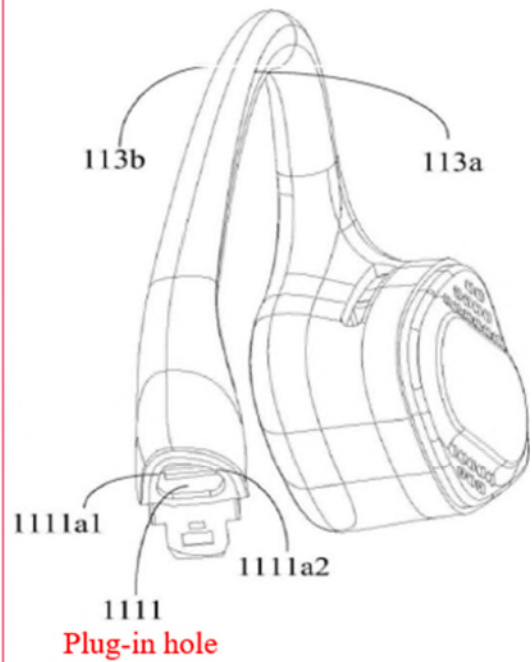


Figure 11

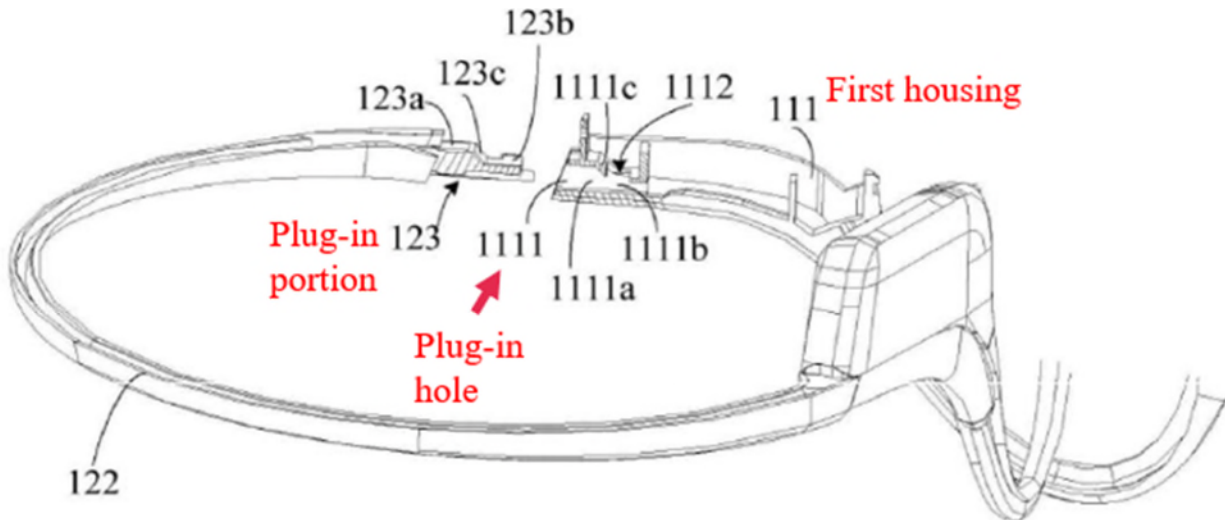


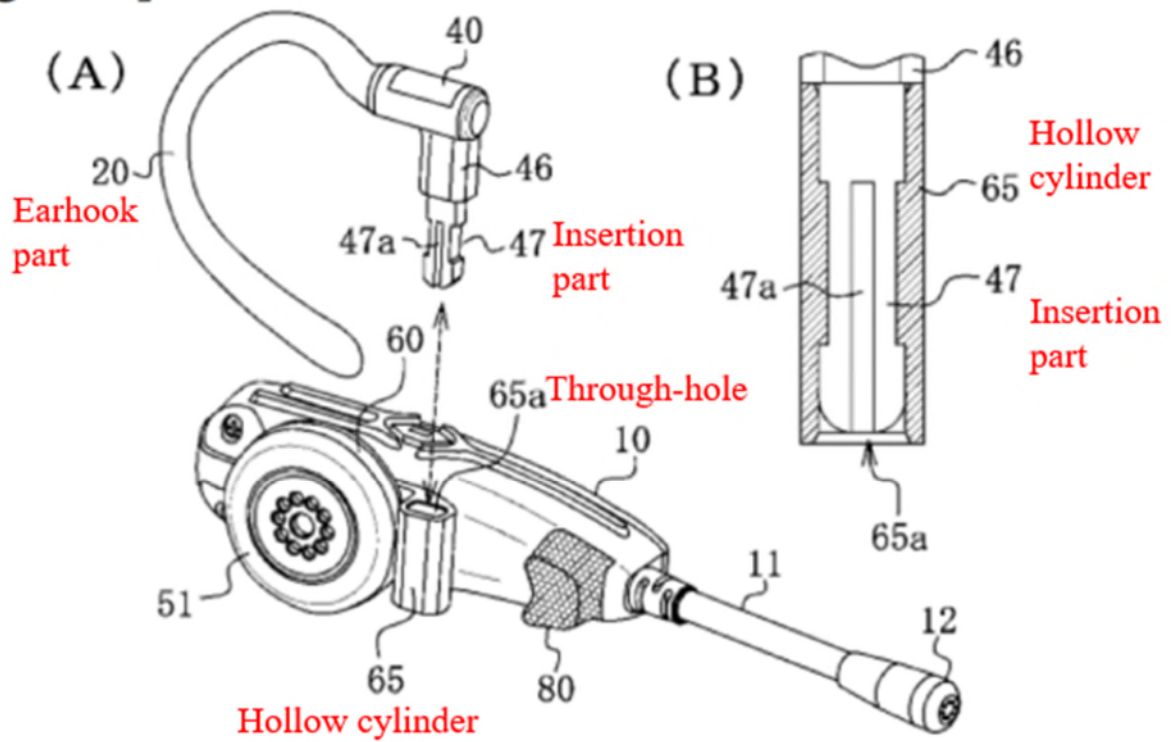
Figure 10

EX1004, Figs. 9-11; EX1003, ¶226.

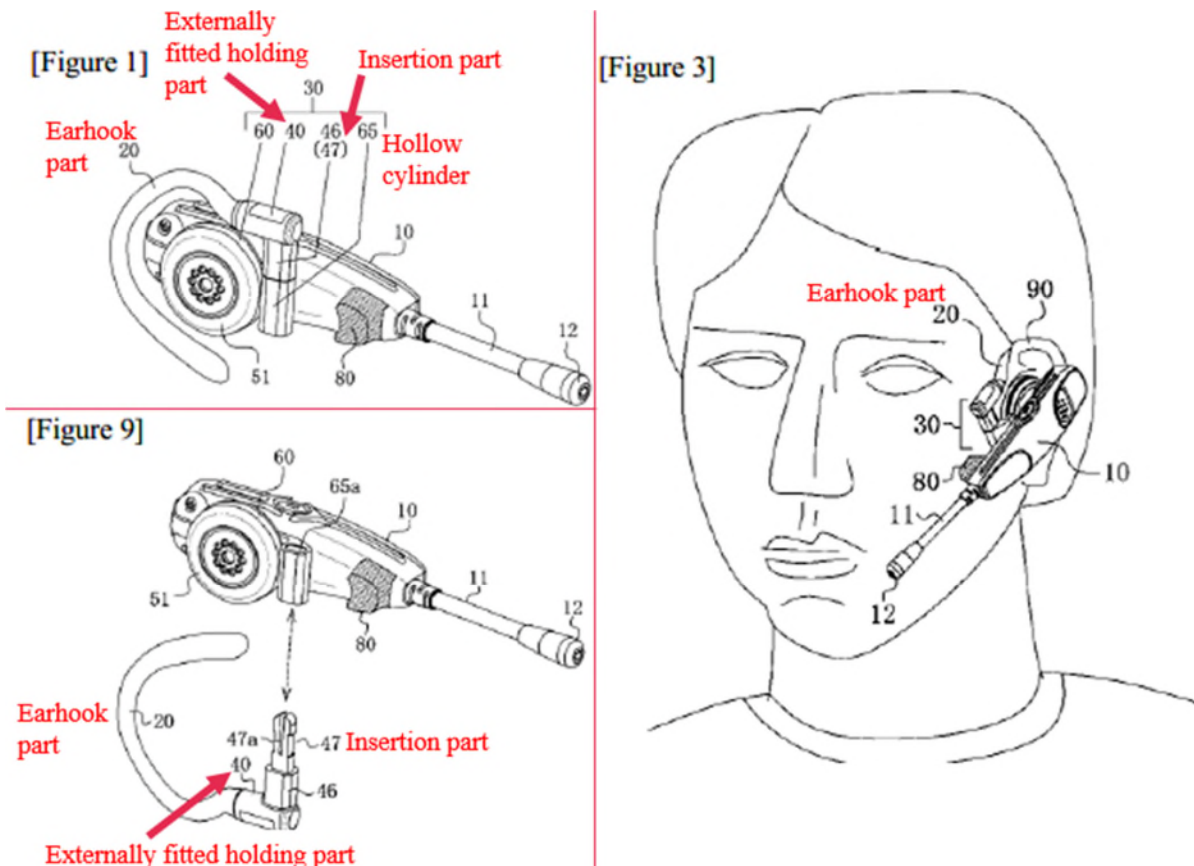
It would have been obvious to arrange Li's *core housing* with a plug-in hole and connect it to the *first plug end* of the *ear hook* to achieve the benefits of a modular earphone design already recognized by Li, including simplifying the structure and reducing costs, especially for replacing the earphone's speaker. See EX1004, [0059], [1c]. Such design would involve slight location modifications to structures in Li. EX1003, ¶227.

If Li does not disclose or render obvious *arranged with a first socket connecting with an outer end surface*, Numata discloses or renders obvious that limitation. Numata discloses an earhook part 20 that is connected to a wireless headset by insertion part 47 in through-hole 65a of the hollow cylinder 65 (*first socket*). EX1007, [0032]-[0035], Figs. 1-3, 8-9; EX1003, ¶228.

[Figure 8]



EX1007, Fig. 8. The hollow cylinder 65 is connecting with an outer end surface of the headset not including the earhook. *Id.*, [0033]; EX1003, ¶229.



EX1007, Figs. 1, 3, 9; EX1003, ¶229.

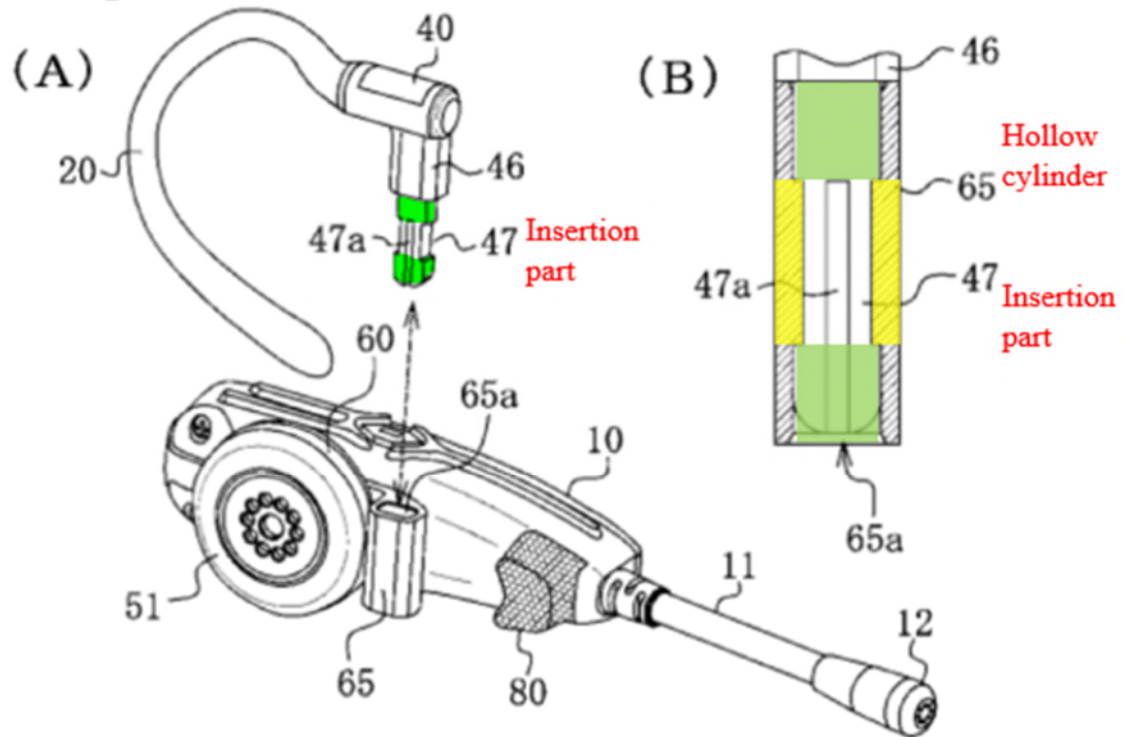
A POSITA would have been motivated to combine Numata's *first socket* to the outer end surface of the core housing in Li for the reasons discussed above, including in a smaller size to allow for use with Li. §IX.A; EX1003, ¶230.

3. [7b]

Li and Numata disclose or render obvious this limitation. EX1003, ¶¶231-32

For example, Numata discloses or renders obvious *a stopping block arranged on an inner sidewall of the first socket* (the shape of hollow cylinder 65), highlighted below.

[Figure 8]



EX1007, [0032]-[0035], Fig. 8. The green highlighted portion of insertion part 47 abuts the yellow highlighted portion of hollow cylinder thereby creating *a stopping block arranged on an inner sidewall of the first socket*. EX1003, ¶232.

4. [7c]

Li-Fujita-Numata renders obvious this limitation. See [1c], (*the core housing being fixed to the first plug end*), [7a]. A POSITA would find it obvious to add the *first socket* to the *core housing* for the reasons discussed above, including having plugs on Li's connecting component 113 to allow for the *first socket* to connect to the *first plug end* of the *ear hook* to achieve the benefits of a modular earphone design already recognized by Li. See [1c], [7a], [7b]. A POSITA would be

motivated to combine the Numata socket for use in Li-Fujita. §IX.A.2. Numata discloses or renders obvious the *first socket* (hollow cylinder 65) connected to a plug end of an ear hook (insertion part 47). EX1007, [0032]-[0035], Figure 8. A POSITA therefore would have found it obvious to *connect the first socket to the first plug end*. §IX.A.2. Furthermore, a POSITA would understand how to modify Numata's insertion part to allow for known modular electrical connections such as pins and contacts commonly found in jacks (see claims 1-3) in a place where they would not interfere with the two moving parts of insertion part 47, such as locating the connection in the fixed square portion above and out of the way of the two moving parts (highlighted in green in Figure 8 above in [7b]). EX1003, ¶233.

C. Claim 8

1. [8pre]

See claim 7; EX1003, ¶234.

2. [8a]

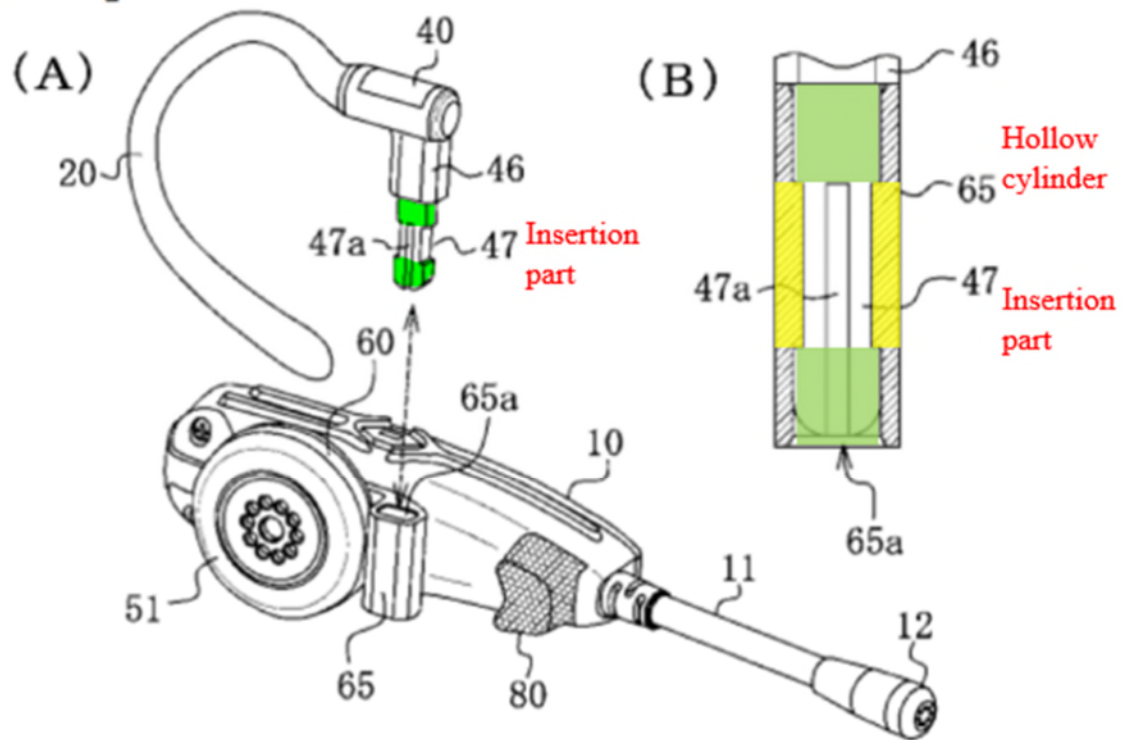
Li and Numata disclose or render obvious this limitation. EX1003, ¶¶235-37.

For example, Numata discloses or renders obvious a plug end on an ear hook (insertion part 47) with *an inserting portion being at least partially inserted into the first socket* (hollow cylinder 65, see claim 7) *and abutting against an outer side*

surface of the stopping block (located in hollow cylinder 65, see claim 7), as seen

in Figure 8(b). EX1007, [0032]-[0035], Figure 8:

[Figure 8]

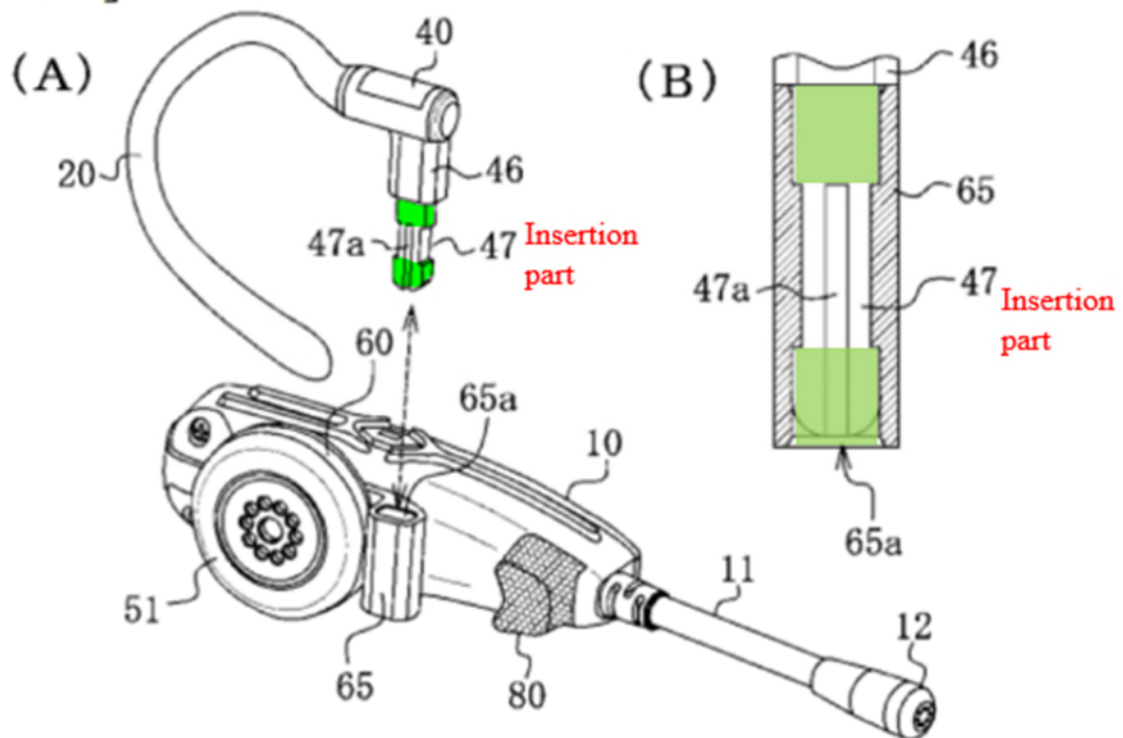


The green highlighted portion of insertion part 47 abuts the yellow highlighted portion of hollow cylinder 65 thereby creating *an inserting portion being at least partially inserted into the first socket and abutting against an outer side surface of the stopping block*. A POSITA would have found it obvious to use the structure of Numata's insertion part 47 structures for Li's *first plug end* (plug-in portion 123) for the reasons discussed above. §IX.A.2; EX1003, ¶237.

3. [8b]

Numata discloses or renders this limitation obvious. Numata teaches a plug end on an ear hook (insertion part 47) that has *two elastic hooks being arranged on a side of the inserting portion*. EX1007, [0032]-[0035], Figure 8.

[Figure 8]



Id., Fig. 8; EX1003, ¶238.

A POSITA would have been motivated to use such a plug design for the *first plug end*, the two elastic hooks *being arranged on a side of the inserting portion facing inside of the core housing*, for the reasons discussed above. §IX.A.2; EX1003, ¶239.

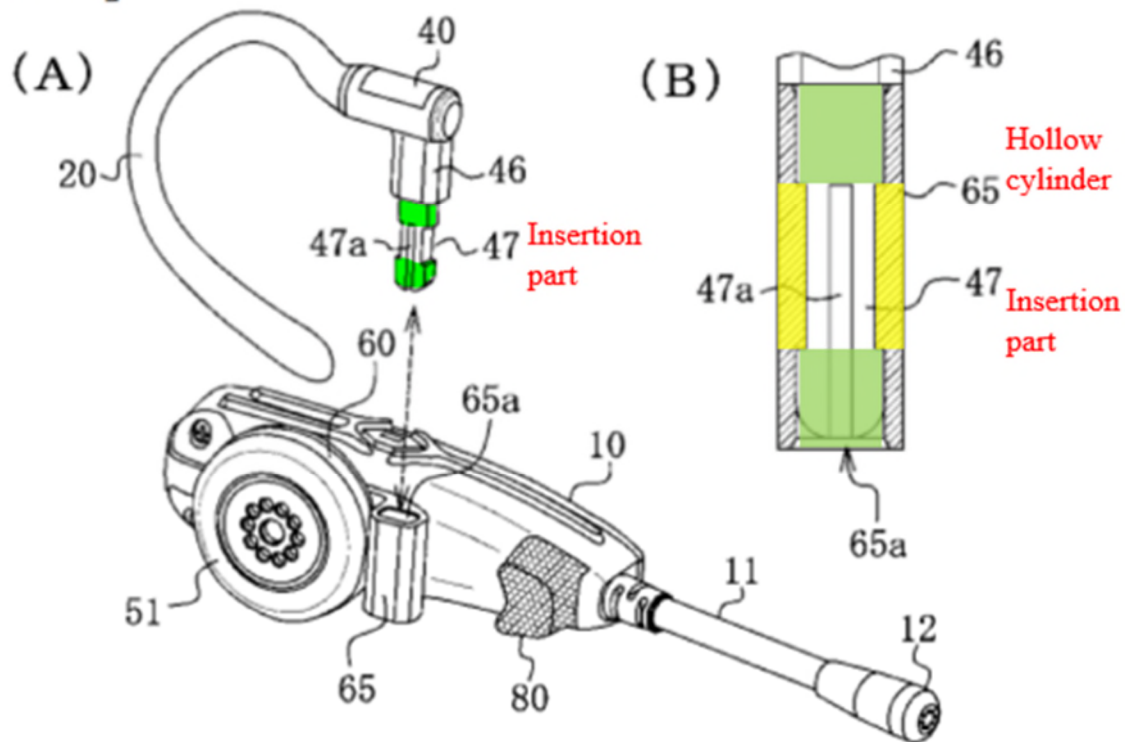
4. [8c]

Numata discloses or renders obvious *the two elastic hooks (see [8b]) are brought together under action of external thrust and the stopping block:*

[A]t the same time the insertion part 47 forms a slit 47A from the front end to the axis, the parts divided into two sides by the slit 47A become the locking tongue connecting rod of the leaf spring. In addition, the through-hole 65A of the hollow cylinder 65, as shown in Figure 8 (B), can be engaged with the locking tongue connecting rod no matter in which direction is the insertion part 47 inserted.

EX1007, [0034]. Figure 8 shows this.

[Figure 8]



EX1003, ¶240.

5. [8d]

Li-Fujita-Numata renders obvious this limitation. Numata discloses or renders obvious *after passing through the stopping block* (stopping block in hollow cylinder 65), *the two elastic hooks* (insertion part 47) *are elastically restored to be stuck on an inner surface of the stopping block to realize fixation*. See [8a]-[8c]. A POSITA would have been motivated to use this plug design in Li-Fujita *to realize the fixation of the core housing and the first plug end* for the reasons identified above. §IX.A.2; EX1003, ¶241.

D. Claim 9

1. [9pre]

See claim 8; EX1003, ¶242.

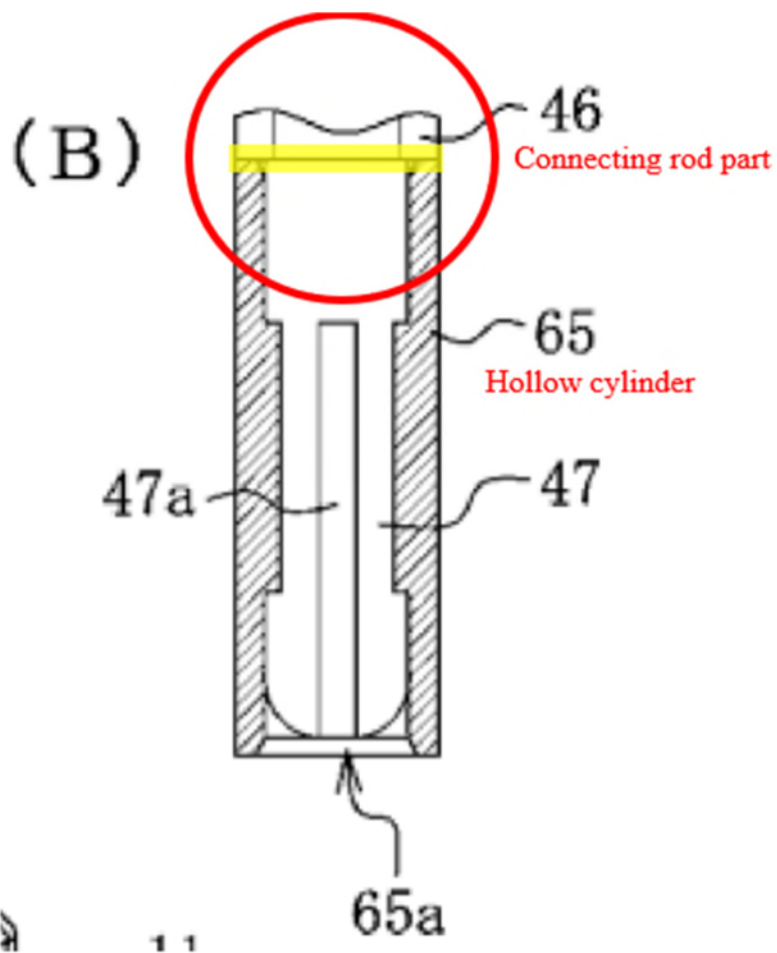
2. [9a]

See [8a]; EX1003, ¶243.

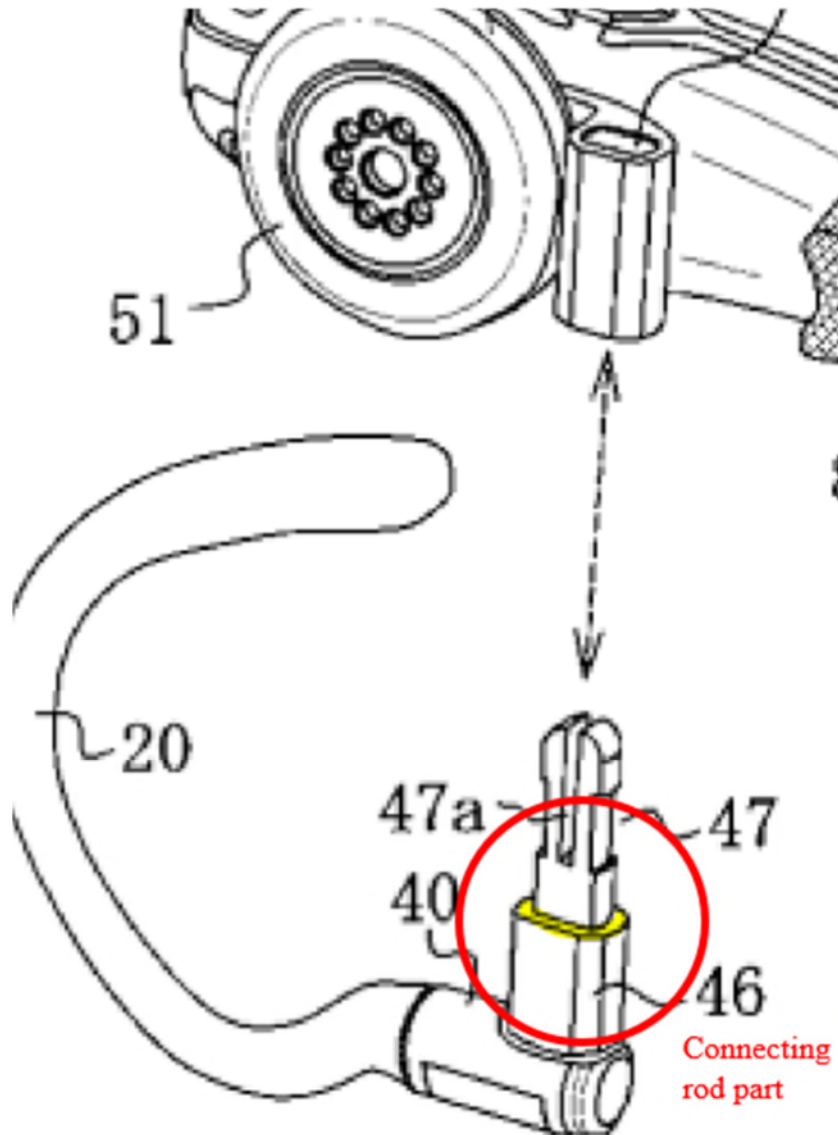
3. [9b]

Li and Numata disclose or render obvious this limitation. EX1003, ¶¶244-47.

For example, Numata discloses or renders obvious *an exposed part of the inserting portion* (connecting rod part 46) *is arranged in a stepped manner to form an annular table surface spaced apart from the outer end surface* (annotated in yellow and circled in red in Figures 8(B) and 9) *of the core housing* (Li's core housing, [7a], §IX.A.2); EX1003, ¶247.



EX1007, Fig. 8(B).



Id., Fig. 9 (excerpt). As shown above in yellow highlight, the shape of the connecting rod part 46 is arranged in a stepped manner to form an annular table surface. EX1003, ¶247.

E. Claim 10

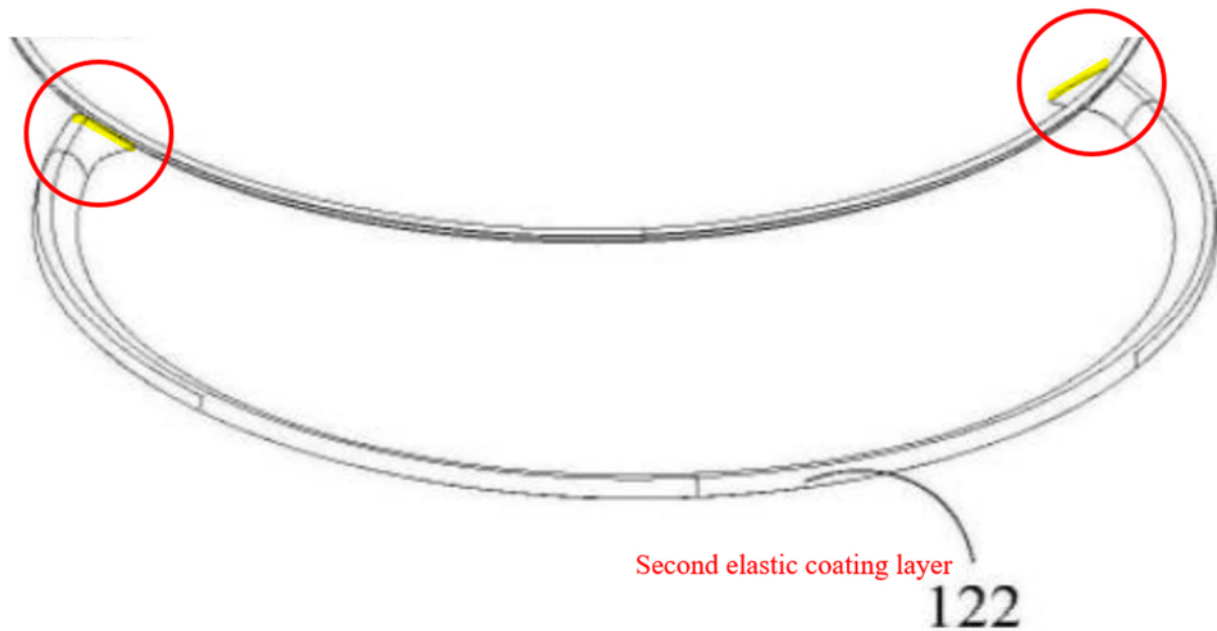
1. [10pre]

See claim 9; EX1003, ¶248.

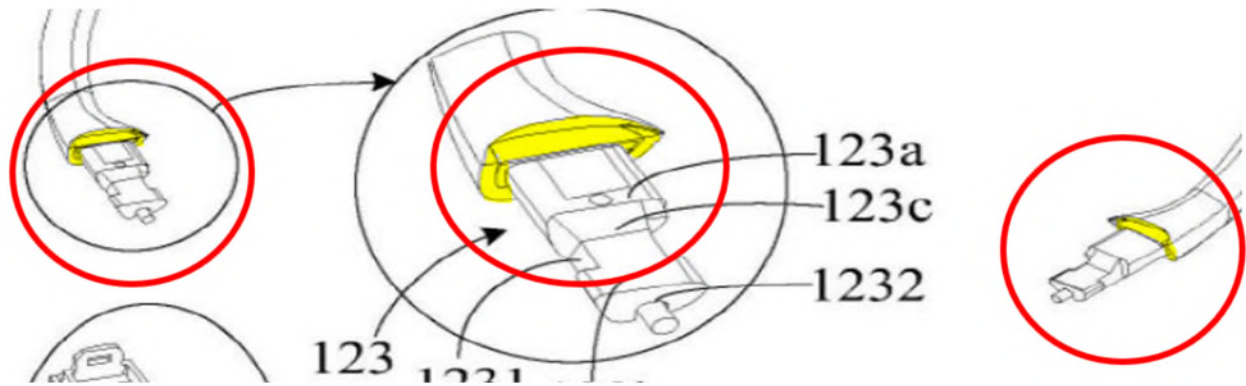
2. [10a]

Li and Numata disclose or render obvious this limitation. EX1003, ¶249.

For example, a POSITA would have found it obvious to have Li's *protective sleeve* extend to the side of Numata's *annular table surface* because Li already has an analogous *protective sleeve* (second elastic coating layer 122) form an annular table surface shape proximate the plug-in portion 123 as shown below in Figures 2 and 9.



EX1004, Figure 2 (excerpt).



Id., Figure 9 (excerpt); EX1003, ¶249.

The second elastic coating layer 122 is a *protective sleeve* because it is “a silicone layer...[or] a rubber layer or a latex layer, or a composite material layer including silicone.” EX1004, [0058]. Because the second elastic coating layer 122 (*protective sleeve*) forms an annular table surface shape, it would have been obvious for the *protective sleeve* to *further extend to a side of the Numata annular table surface facing the outer end surface of Li’s core housing*. EX1003, ¶250.

3. [10b]

Li renders obvious a *first plug end* elastically abutted against the protective sleeve. [1c]. “The rear hook assembly 12 comprises a second elastic metal wire 121, a second elastic coating layer 122 wrapped around the second elastic metal wire 121, and plug-in portions 123 provided at both ends of the second elastic metal wire 121.” EX1004, Fig. 2, [0058]; EX1003, ¶251.

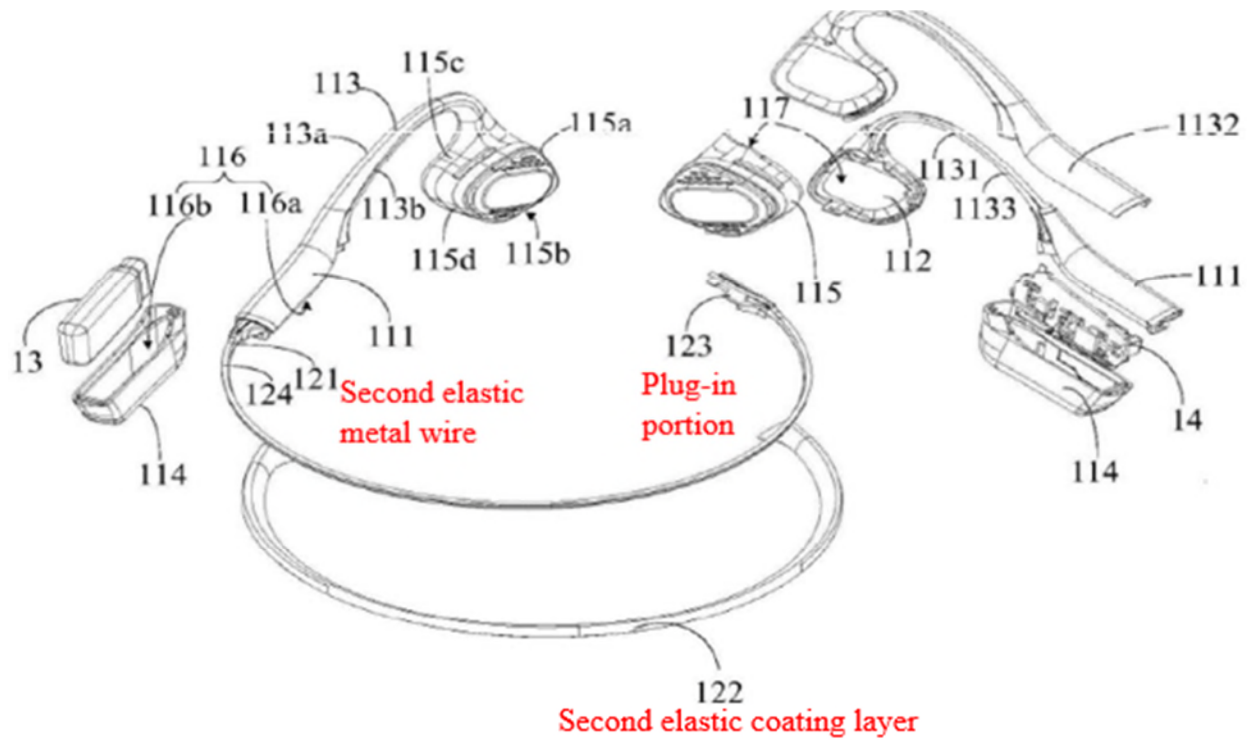


Figure 2

Li, Figure 2

The second elastic coating layer 122 may be silicone, rubber, latex, or a composite including silicone. EX1004, [0058]. 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*. EX1003, ¶252.

It therefore would have been obvious to a POSITA *when the core housing and the first plug end are fixed, the protective sleeve elastically abuts against the*

core housing to realize sealing, including for the same reasons discussed above in [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*). Li is designed to “ensure a tight fit” between the plug and the socket. EX1004, [0062]-[0063]. Li’s device also teaches waterproofing, including by using its *protective sleeve* to “protect the housing and internal components, making the bone conduction earphone more wear-resistant.” *Id.*, [0036], [0037], [0056], [0071]. A POSITA would have understood that when the *core housing* and the *first plug end* are fixed, the protective sleeve elastically abuts the core housing to realize sealing and contribute to the waterproofing of the device. *Id.*; EX1003, ¶253.

X. GROUND 5: LI, FUJITA, WANG, XU, NIELSEN, AND THE KNOWLEDGE OF A POSITA RENDER OBVIOUS CLAIMS 16-20

A. Motivation to Combine

1. Li-Fujita

See §VI.A; EX1003, ¶¶254-55.

2. Li-Fujita and Wang, Xu, and Nielsen

Moreover, it would have been obvious to a POSITA to further modify the Li-Fujita combination with magnetic circuit components and orientations disclosed in Wang, Xu, and Nielsen—and for a POSITA to use the Wang, Xu, and Nielsen components and orientations between those three references (*see infra* [17b], [20a])—and a POSITA would have been motivated to do so. EX1003, ¶256.

As discussed above regarding the motivation to combine Li-Fujita with Fukuda (§VII.A.2), magnetic circuit systems were commonly found in speakers at the time of Li and Fujita, including bone conduction speakers at the time of Li, in order to provide efficient, high-quality sound to the user. EX1005, [0052], [0053] (using “high-density permanent magnets” in bone conduction speaker achieves “better sound quality”), [0143], [0145], [0148]-[0152], [0171], Figures 11, 18-A, 18-B, 22-A; EX1023, 3:6-28 (improved bone conduction speaker design with a magnetic circuit system that 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”); EX1018, Abstract, Fig. 2(b), [0016]-[0029] (compact speaker design with strong electromagnetic attractive force). Wang, Xu, and Nielsen offer improved magnetic circuit systems for use in loudspeakers. EX1008, Abstract; EX1009, Abstract, [0005]; EX1010, 4:1-12. Wang improves magnetic circuit efficiency. EX1008, [0005]. Xu improves the magnetic circuit system structure, addressing low loudspeaker magnetic flux density and smaller magnetic field force against the voice coil. EX1009, [0002]-[0003]. Nielsen improves speaker magnet system performance via a compact design that creates a homogenous magnetic flux in the voice coil gap. EX1010, 4:1-12; EX1003, ¶257.

A POSITA at the time would understand that the sound quality of a magnetic speaker driver like Wang, Xu, and Nielsen is generally higher than that

of a piezoelectric driver, and further more that it is easier to fine tune the frequency response of a magnetic driver to achieve the desired performance. Therefore, a POSITA would have looked to Wang, Xu, and Nielsen to improve the speaker in the Li-Fujita earphones with a magnetic circuit system vibration mechanism in place of the piezoelectric mechanism in order to provide the benefits of a magnetic circuit system, such as efficient, high-quality sound, as well as a simple construction. A POSITA would look to Wang, Xu, and Nielsen for inspiration and improvement of the Li-Fujita earphone speakers. A POSITA would have recognized the benefit of Wang, Xu, and Nielsen's improvements, motivating the combinations. EX1003, ¶258.

A POSITA would have looked to Wang, Xu, and Nielsen to improve the speaker in the Li-Fujita earphones with a magnetic circuit system with a strong, efficient magnetic field. Wang, Xu, and Nielsen are all in the same field of speaker technology involving magnetic circuit systems. A POSITA would therefore look to the references for inspiration and improvement of the Li-Fujita earphone speakers. A POSITA would find the magnetic speaker system components and orientations in Wang, Xu, and Nielsen to be interoperable, and recognized the benefit of their improvements, motivating the combinations. EX1003, ¶259.

Combining Li, Fujita, Wang, Xu, and Nielsen would simply involve applying known techniques (magnetic circuit speaker design and construction) to a

known device ready for improvement (Li-Fujita's bone conduction speaker) to yield predictable results (bone conduction speakers with an improved magnetic circuit system). A POSITA would have had a reasonable expectation of success in the combinations because the Li-Fujita earphones disclose bone conduction speakers, it was known in the art to use magnetic circuit systems in such speakers, and Wang, Xu, and Nielsen disclose improved magnetic circuit systems in speakers. A POSITA would have found that the teachings of Li-Fujita with Wang, Xu, and Nielsen would have been predictably combined due to the predictability of the magnetic circuit system speaker art and known component interchangeability. EX1003, ¶260.

If Patent Owner argues the portions of Wang, Xu, and Nielsen cited below relate to different, incompatible embodiments (which they do not), it would have been obvious to a POSITA to combine such embodiments into a single device at least because such embodiments are described in the same prior art reference, are fully compatible with each other, and could be combined with minimal effort to achieve predictable results. EX1003, ¶¶261-62.

B. Claim 16

1. [16pre]

See claim 1; EX1003, ¶263.

2. [16a]

Wang and Xu disclose or render obvious this limitation. EX1003, ¶¶264-65.

For example, Wang’s “magnetic circuit system 11” constitutes *a magnetic circuit component generating a first magnetic field*. EX1008, [0018], Figures 1, 3.

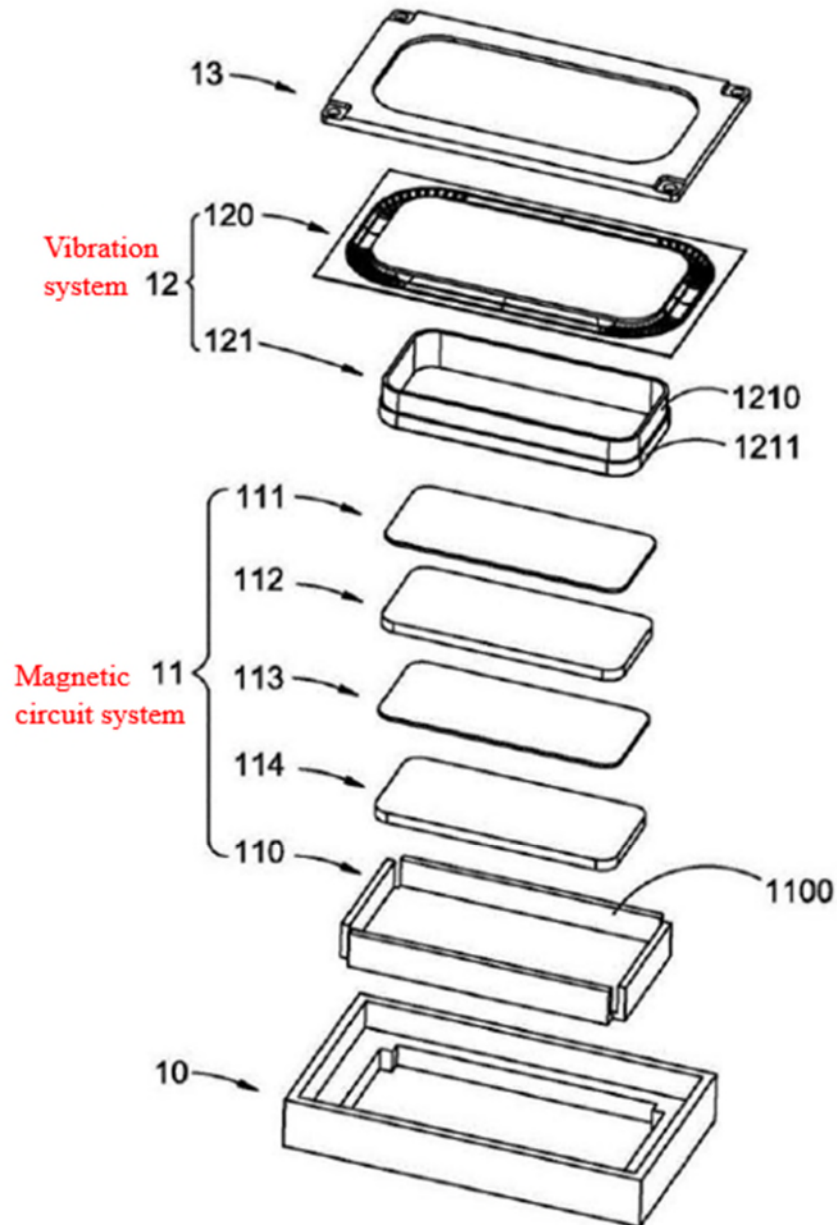
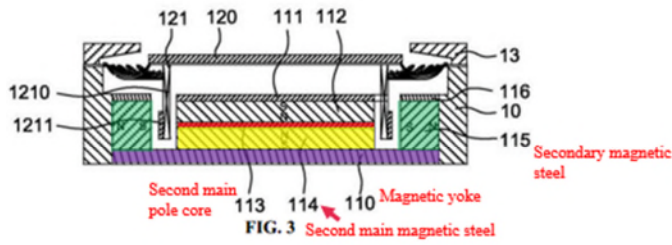
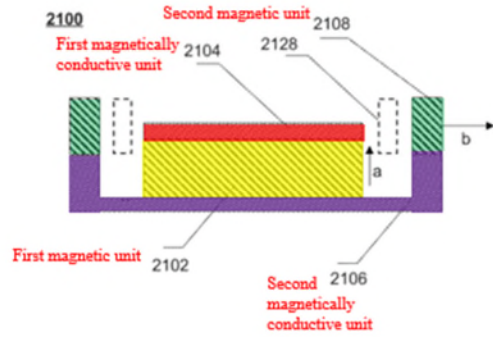


FIG. 1

Wang, Figure 1



Wang, Figure 3



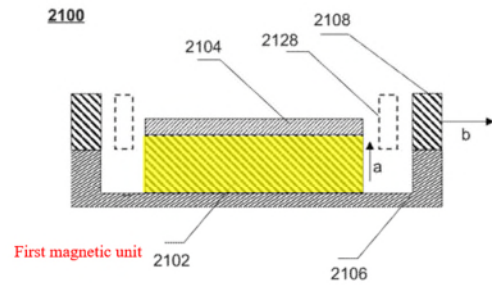
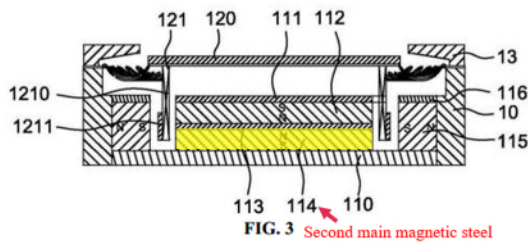
'084 Patent, Figure 16

A POSITA would have understood that the collective magnetic fields generated by Wang's magnetic circuit system components yield *a first magnetic field*. EX1008, [0018], Figures 1, 3; EX1001, 25:64-26:45, Fig. 16; EX1003, ¶264.

3. [16b]

Wang and Xu disclose or render obvious this limitation. EX1003, ¶¶266-68.

For example, in Wang: *the magnetic circuit component including: a first magnetic unit configured to generate a second magnetic field* (second main magnetic steel 114-yellow below). EX1008, [0020]; EX1003, ¶¶266-67.



Wang, Figure 3

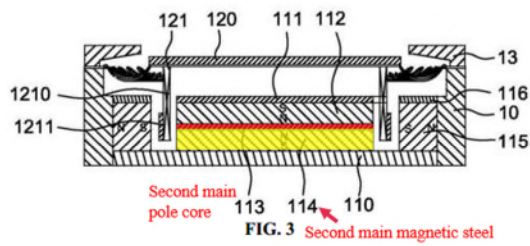
'084 Patent, Figure 16

A POSITA would have understood that second main magnetic steel 114 is *configured to generate a second magnetic field*, which would be different than the *first magnetic field* generated by the entire unit. EX1008, [0020]; EX1003, ¶267.

4. [16c]

Wang and Xu disclose or render obvious this limitation. EX1003, ¶¶269-70.

For example, Wang's second main pole core 113 (red below) constitutes a *first magnetically conductive unit*. EX1008, [0020].



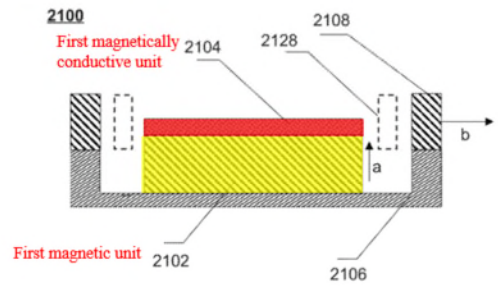
Wang, Figure 3

EX1003, ¶269.

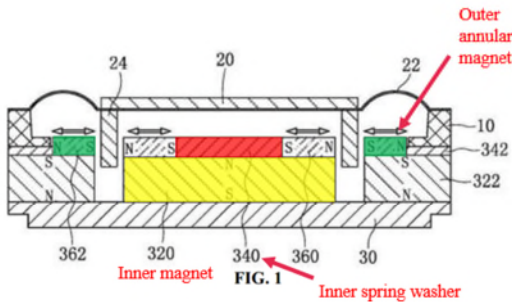
5. [16d]

Xu and Wang disclose or render obvious this limitation. EX1003, ¶¶271-76.

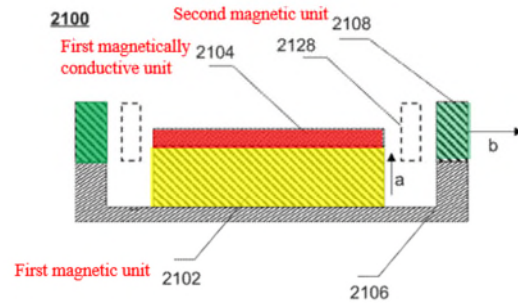
For example, Xu's outer annular magnet 362 (green below) constitutes *at least one second magnetic unit*. EX1009, [0027].



'084 Patent, Figure 16



Xu, Figure 1



'084 Patent, Figure 16

The outer annular magnet 362 surrounds inner magnet 320 (*the first magnetic unit*) and forms a magnetic gap with it. EX1003, ¶¶274-75.

Xu discloses that the orientation of the poles of outer annular magnet 362 and inner magnet 320 result in “the magnetic field of the first magnet and the magnetic field of the second magnet will be superimposed and be directed to the position of the magnetic gap [which] **increases the magnetic flux density at the magnetic gap**, significantly increasing the number of magnetic lines of force passing through the voice coil 24.” EX1009 at [0028]. Thus, a POSITA would have understood that Xu discloses *a magnetic field strength of the first magnetic field in the magnetic gap* (the magnetic circuit system as a whole) *being greater*

than a magnetic field strength of the second magnetic field in the magnetic gap.

EX1003, ¶276.

C. Claim 17

1. [17pre]

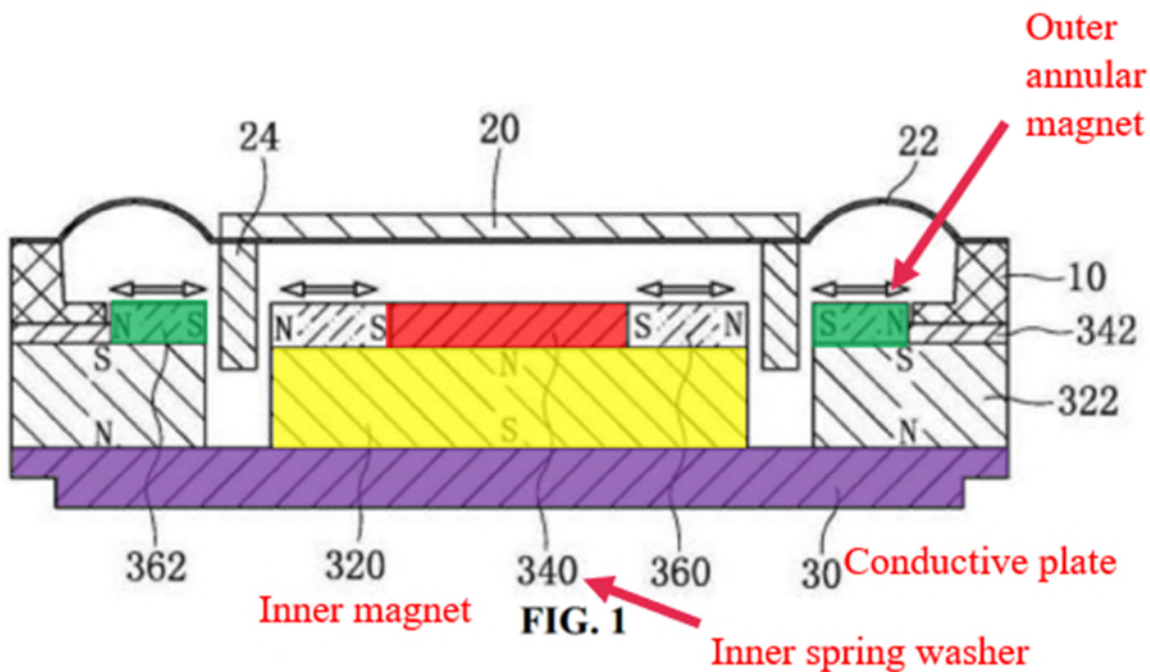
See claim 16; EX1003, ¶277.

2. [17a]

Wang and Xu disclose or render obvious this limitation. EX1003, ¶¶278-79.

For example, in Xu, *the magnetic circuit component further includes: a second magnetically conductive unit (magnetic conductive plate 30-purple below).*

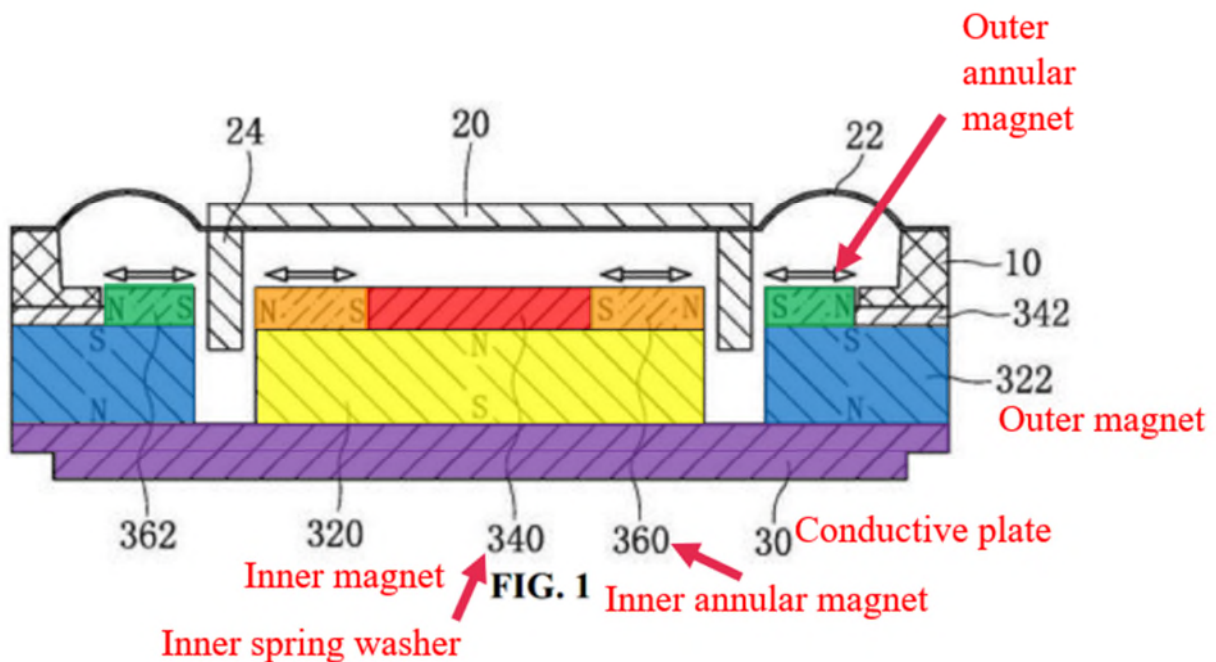
EX1009, [0026], Fig. 1.



EX1003, ¶279.

3. [17b]

Xu discloses or renders obvious *at least one third magnetic unit (outer magnet 322-blue below) being connected to the second magnetically conductive unit (magnetic conductive plate 30-purple below) and the at least one second magnetic unit (outer annular magnet 362-green below).* EX1009, [0026], Fig. 1.



EX1003, ¶280.

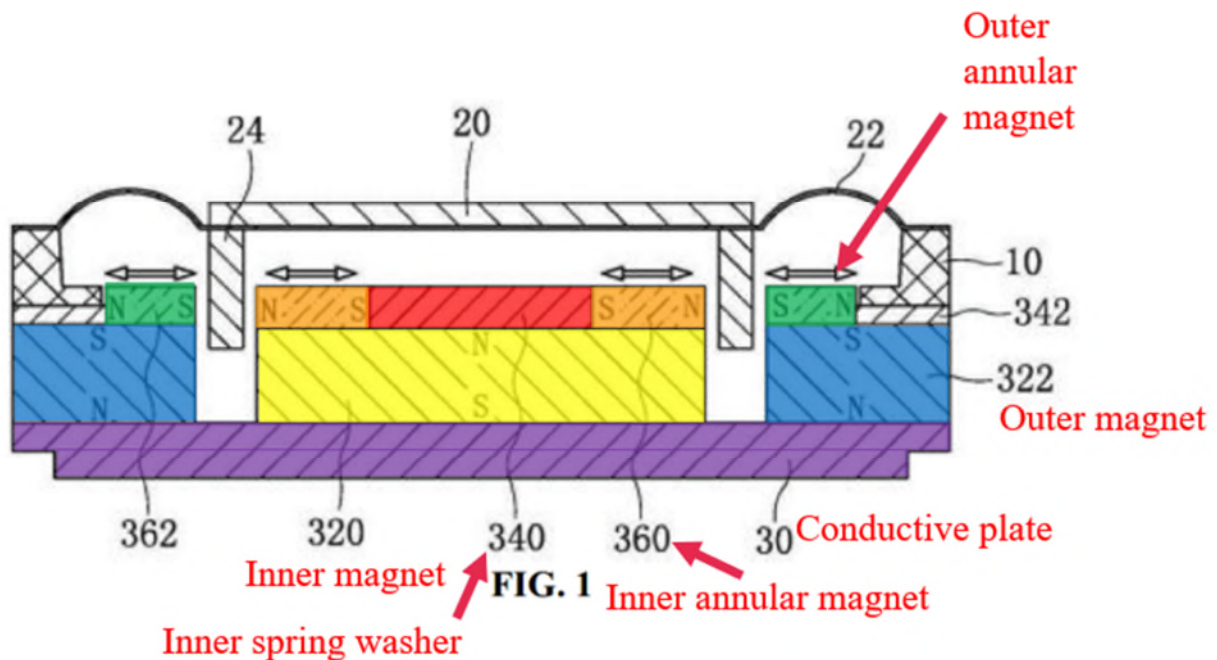
D. Claim 18

1. [18pre]

See claim 17; EX1003, ¶281.

2. [18a]

Xu discloses or renders obvious *one fourth magnetic unit* (inner annular magnet 360-orange below) that is *connected to the first magnetic unit* (inner magnet 320-yellow below). EX1009, [0027], Fig. 1; EX1003, ¶282.



EX1003, ¶282.

A POSITA would have found it obvious to reorient inner annular magnet 360 to be *below the magnetic gap* and *connected to...the second magnetically conductive unit* (magnetic conductive plate 30-in purple) because the modification requires only a simple reorientation of components that a POSITA would have considered as a way to generate a strong magnetic field in the magnetic circuit component. Xu already teaches orienting inner annular magnet 360 close to the

For example, in another prior art reference (Nakada), *one fourth magnetic unit being located below the magnetic gap* (annular magnet 1B-orange below) *is connected to the first magnetic unit* (cylindrical magnet 1A-yellow below) *and the second magnetically conductive unit* (cylindrical magnetic body 3-purple).

A cross-sectional diagram of a speaker assembly. The diagram shows a cylindrical magnetic body (3) at the base, which is part of a larger cylindrical magnet (1A). The magnet has a central cylindrical magnet (1B) and an annular magnet (1C) surrounding it. The annular magnet is divided into alternating North (N) and South (S) poles. Above the magnet is a voice coil (4) mounted on a spider (5). The spider is connected to a central cap (6) and a central pole piece (7a). The central pole piece is surrounded by a central pole piece (7b). The voice coil is connected to a terminal (X1). The entire assembly is housed in a speaker (SP) enclosure. Labels include: Voice coil (4), SP (Speaker), 2b, X1, 5, 8, 6, 2a, X1, 7a, 7b, 1C, S, N, 1B, 1A, 3, and Annular magnet (1C).

Nakada teaches the benefit of such orientation:

113

increases, the magnetic energy also increases....Thus, the electromagnetic force acting on the voice coil 4 increases. As a result, the output power improves, and miniaturization can be achieved under the same output conditions compared to the conventional method.

EX1018, [0026]. A POSITA would have understood that compact speaker designs like Nakada maintain strong electromagnetic attractive force due to the orientation of components like first annular magnet 1B. *Id.*, Abstract, Fig. 2(b), [0016]-[0029]. It therefore would have been obvious for a POSITA to orient Xu's inner annular magnet 360 in the same way as Nakada's first annular magnet 1B to achieve the same benefits of increasing magnetic energy and the number of magnetic fluxes to Xu's voice coil while improving the compact size and output efficiency of the device. EX1003, ¶¶285-86.

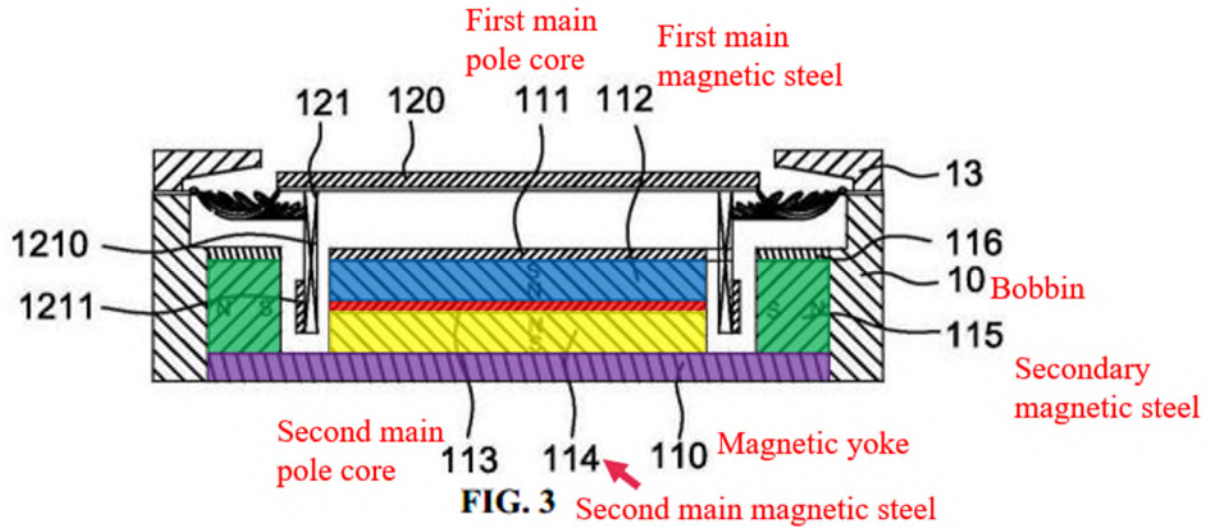
E. Claim 19

1. [19pre]

See claim 17; EX1003, ¶287.

2. [19a]

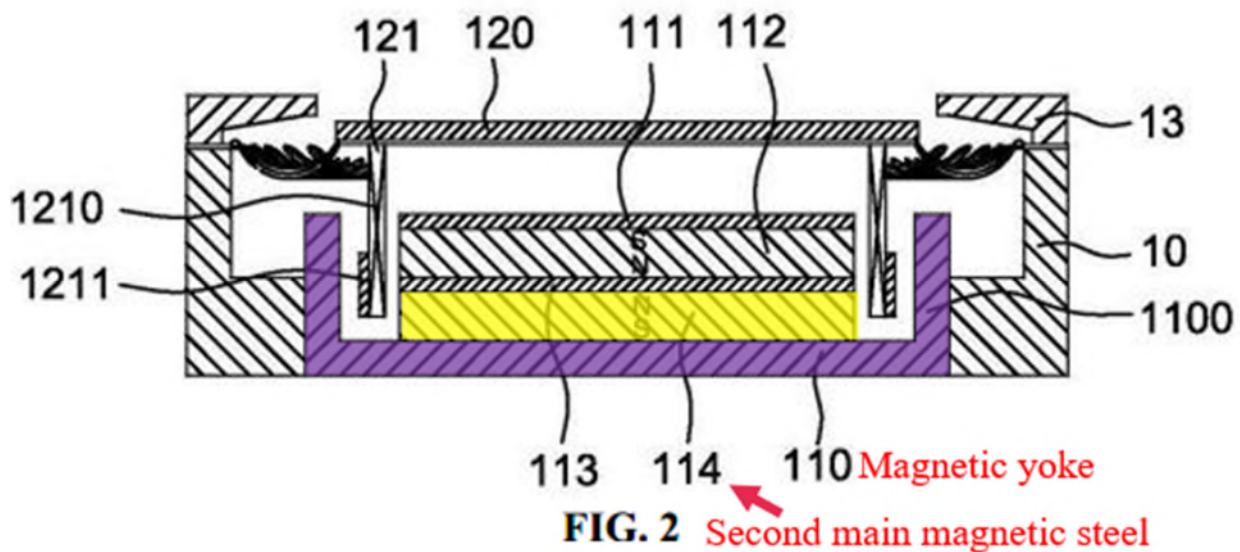
Wang discloses or renders obvious that *the first magnetically conductive unit* (second main pole core 11-red below) *is connected to the upper surface of the first magnetic unit* (second main magnet steel 114-yellow below).

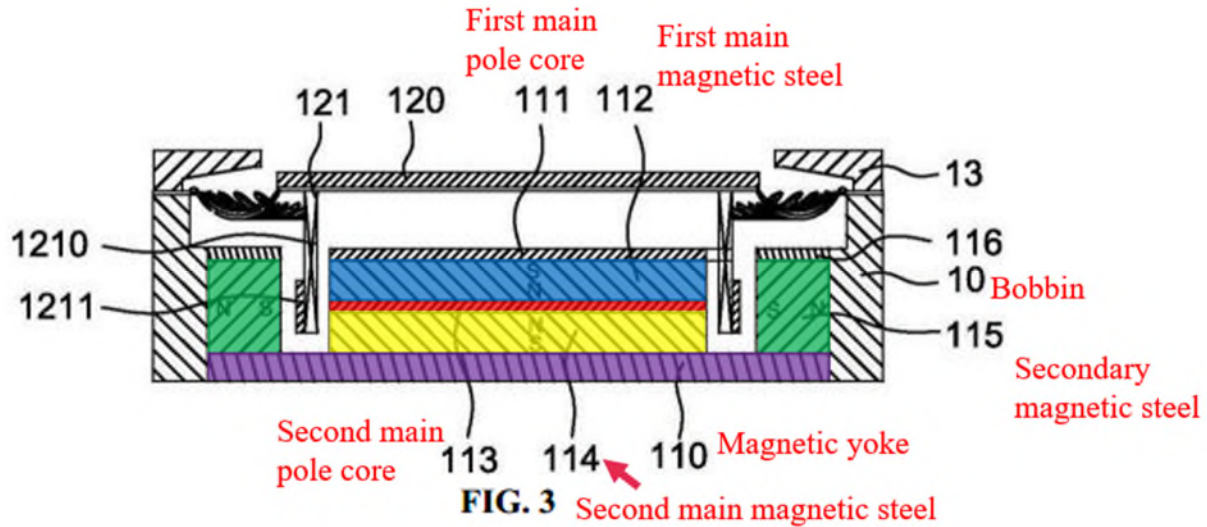


EX1008, Fig. 3; *see also* [16b], [16c]; EX1003, ¶288.

3. [19b]

Wang discloses or renders obvious *the second magnetically conductive unit* (magnetic yoke 110-purple below) *includes a bottom plate and a sidewall*: “The magnetic yoke 110 further comprises a flange 1100 arranged parallel to and spaced from the voice coil 121.” EX1008, [0022]; EX1003, ¶289.



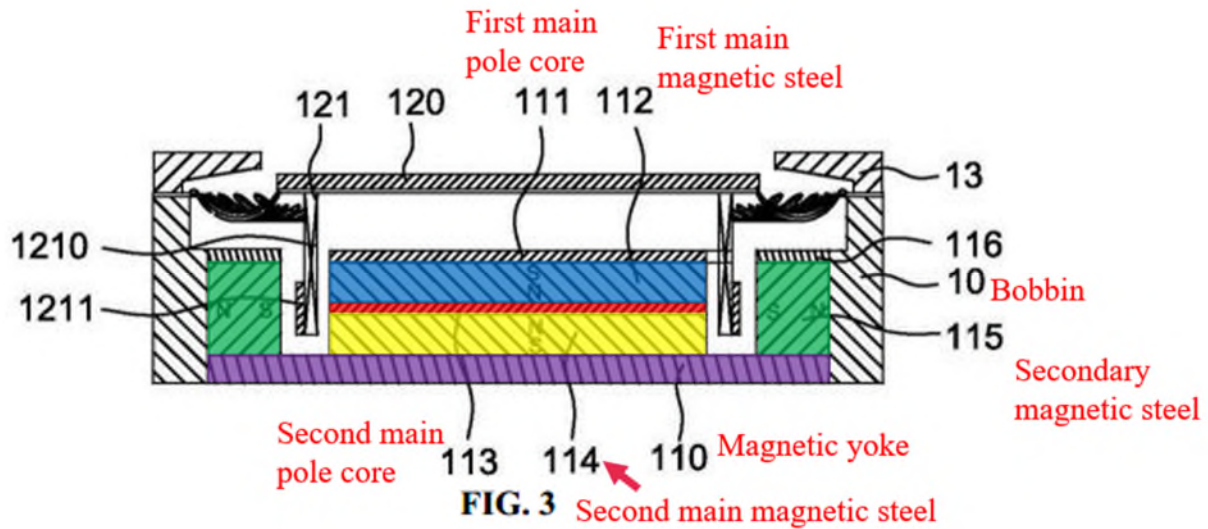
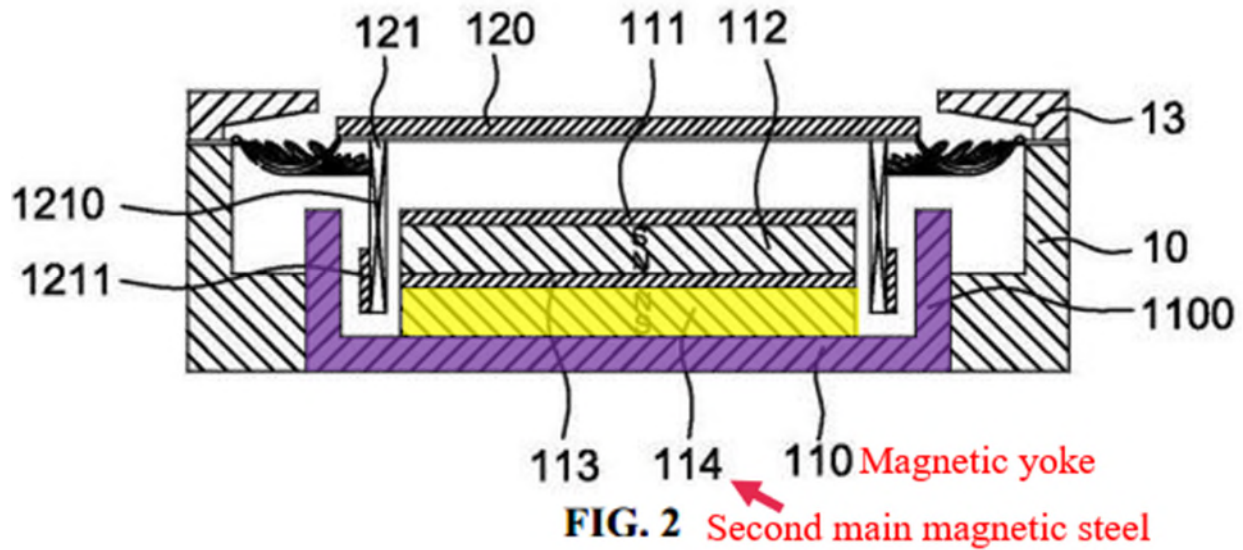


EX1008, Figs. 2-3; EX1003, ¶289.

A POSITA would have found it obvious to use the structure of the magnetic yoke 110 in Figure 2 along with the Figure 3 components, including secondary magnetic steel 115, because the figures have nearly identical structure and Wang does not limit itself to separate embodiments of the invention in Figures 1-2. See EX1008, [0017], [0024]; EX1003, ¶290.

4. [19c]

Wang discloses or renders obvious that *the first magnetic unit* (second main magnet steel 114-yellow below) *is connected to the bottom plate of the second magnetically conductive unit* (magnetic yoke 110-purple). EX1003, ¶291.



EX1008, Figs. 2-3; EX1003, ¶291.

F. Claim 20

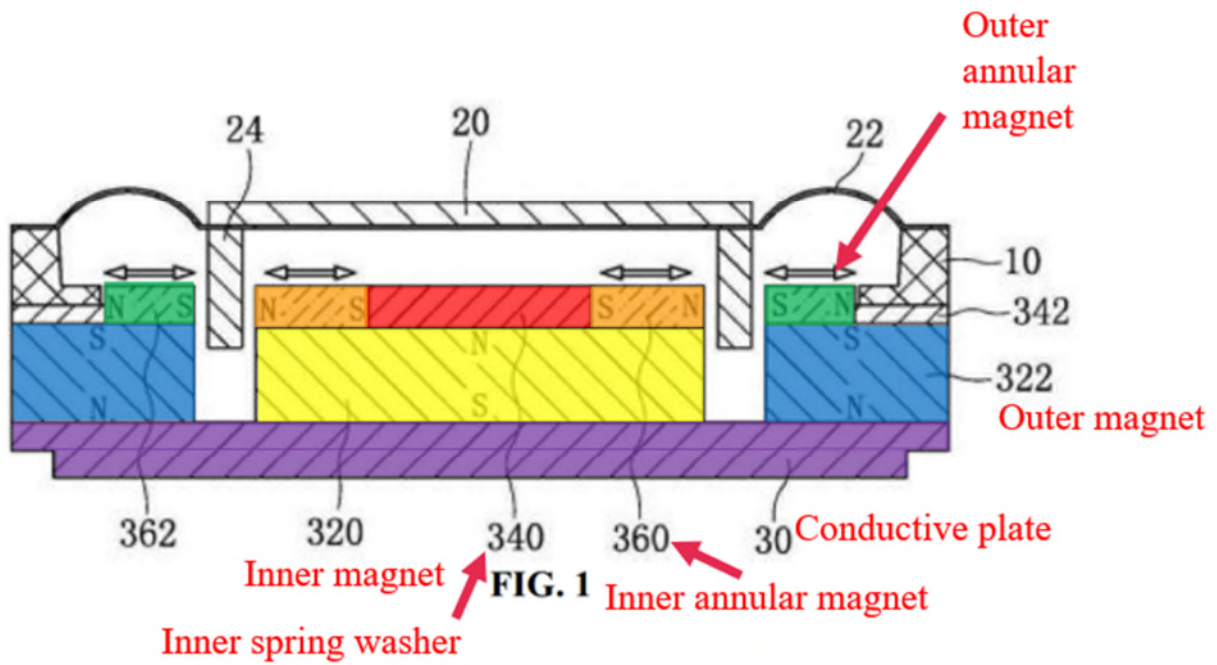
1. [20pre]

See claim 17; EX1003, ¶292.

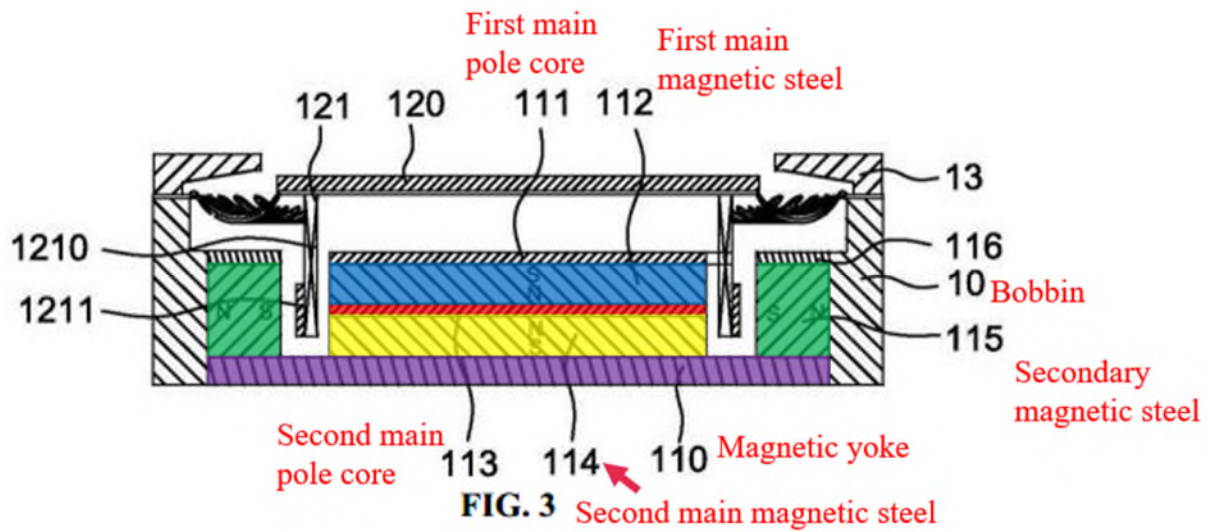
2. [20a]

Nielsen discloses or renders obvious a layer of a conductive material (*one electrically conductive unit*) being connected to a magnetic unit: “the magnet assembly...outer surface 10 of the T-yoke and/or the upper, inner surface 36 of the top plate is/are provided with **a layer of a conductive material.**” EX1010, 16:1-4. Nielson’s conductive material layer’s purpose is the same as the claimed *one electrically conductive unit* in the ’084 Patent: reducing the inductive reactance of the voice coil. EX1010, 17:6-15, EX1001, 27:59-28:21; EX1003, ¶¶293-95.

A POSITA would have found it obvious to add Nielsen’s layer of a conductive material (*at least one electrically conductive unit*) to a surface of *at least one unit of the first magnetic unit* (yellow below), *the first magnetically conductive unit* (red below), *or the second magnetically conductive unit* (purple below) in Wang or Xu, all of which have exposed sides for making the modification, to achieve the benefit taught by Nielsen of reducing the inductive reactance of the voice coil. See §X.A.2. Electrically conductive units were common elements in magnet assemblies for speakers at the time, such as in Nielsen. Wang and Xu’s exposed sides are shown below. EX1003, ¶296.



EX1009, Fig. 1.



EX1008, Fig. 3; EX1003, ¶296.

XI. DISCRETIONARY DENIAL

Pursuant to Acting Director Coke M. Stewart’s March 26, 2025, Memorandum regarding Interim Processes for PTAB Workload Management (the “Memorandum”) and the FAQs for Interim Processes for PTAB Workload Management, No. 24, dated April 25, 2025 (the “FAQs”), Petitioner understands that discretionary denial issues if any will be raised in a separate brief to be filed by Patent Owner. If Patent Owner files such a brief, Petitioner intends to respond in an opposition brief consistent with the Memorandum and the FAQs. Accordingly, consistent with the Memorandum and FAQs, Petitioner will not address discretionary denial issues in this Petition.

XII. MANDATORY NOTICES UNDER 37 C.F.R. §§ 42.8(B)(1)-(4)

A. Real Party-In-Interest

Suzhou Mojawa Intelligent Electronic Co., Ltd. is the real party-in-interest.

B. Related Matters

The ’084 Patent is subject to the following actions:

Shenzhen Shokz Co., Ltd. v. Shenzhen Wenming Technology Co., Ltd. et al,

Case No. 1-24-cv-06717.

C. Lead and Backup Counsel

Lead Counsel	Backup Counsel
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D. Service Information

Service information for lead and backup counsel is provided in the designation of lead and backup counsel above. Petitioner consents to electronic service to lead and back-up counsel and to DLA-Mojawa-IPRs@us.dlapiper.com.

XIII. CONCLUSION

All Challenged Claims of the '084 Patent should be found unpatentable for the reasons discussed in this Petition.

Respectfully submitted,

/s/ James M. Heintz

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), Petitioner certifies that this petition includes 13,960 words, as measured by Microsoft Word, exclusive of the table of contents, mandatory notices under § 42.8, certificates of service, word count, claim listing, and exhibits.

Date: May 8, 2025

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CERTIFICATE OF SERVICE

The undersigned certifies pursuant to 37 C.F.R. §§ 42.6(e) and 42.105 that on May 8, 2025, a true and correct copy of the Petition for *Inter Partes* Review of U.S. Patent No. 11,197,084 was served by emailing a copy of same (by agreement) to the attorneys for the Patent Owner at the following email address:

perkins_service_shokz_mojawa@perkinscoie.com

Respectfully submitted,

/s/ James M. Heintz

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