

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.

IPR2025-00843
Patent 11,310,582 B2

Before ST. JOHN COURTENAY III, GEORGIANNA W. BRADEN, and
STEVEN M. AMUNDSON, *Administrative Patent Judges*.

COURTENAY, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Suzhou Mojawa Intelligent Electronic Co., Ltd. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–12, 14, and 16–20 in the U.S. Patent No. 11,310,582 B2 (“the ’582 patent”) (Exhibit 1001) under 35 U.S.C. §§ 311–319. Paper 1 (“Pet.”). Claims 13 and 15 of the ’582 patent are not challenged by Petitioner. *Id.* Shenzhen Shokz Co., Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 11 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2024); 37 C.F.R. § 42.4(a) (2025). Under 35 U.S.C. § 314(a), we may not authorize an *inter partes* review unless the information in the petition and the preliminary response “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” The “reasonable likelihood” standard is “a higher standard than mere notice pleading” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

Upon consideration of the Petition, the Preliminary Response, and the evidence of record, for the reasons given below we determine the information presented in the Petition demonstrates there is a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one challenged claim of the ’582 patent.

Accordingly, we institute an *inter partes* review of all challenged claims 1–12, 14, and 16–20 of the ’582 patent on all four grounds, based upon claim 1 considered under the first ground of unpatentability, as set forth in the Petition over Li and Liao. Pet. 18–40.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner identifies itself as the sole real party in interest. Paper 9 (Petitioner's Updated Mandatory Notices), 1. Patent Owner identifies itself as the sole real party in interest: "In accordance with 37 C.F.R. § 42.8(b)(1), Shenzhen Shokz Co., Ltd. is the real party in interest in the above IPR petition." Paper 3 (Patent Owner's Mandatory Notices), 1. The parties do not raise any issue about real parties in interest.

B. *Related Matters*

Petitioner and Patent Owner identify the following civil action as a related matter: *Shenzhen Shokz Co., Ltd. v. Shenzhen Wenming Technology Co., Ltd. et al.*, No. 1:24-cv-06717 (N.D. Ill). Paper 9 (Petitioner's Updated Mandatory Notices), 1. Paper 3, (Patent Owner's Mandatory Notices), 1.

C. *The '582 patent*

The '582 patent is entitled "Loudspeaker Apparatus," and relates, "in particular, to a loudspeaker apparatus with a waterproof function." Ex. 1001, code (54), 1:15–16. The '582 patent observes the desirability of earphones that may be used for swimming, or on rainy days, such that "earphones with waterproof function and better sound quality are more popular with consumers." *Id.* at 1:27–30. Accordingly, the '582 patent describes a loudspeaker apparatus that includes "an ear hook, a core housing, and a circuit housing," where two plug ends of the ear hook are fixed, respectively, to a core housing that may accommodate an earphone core and to a circuit housing that may accommodate a control circuit or battery that "drive[s] the earphone core to vibrate to generate a sound." *Id.* at 1:37–43, 1:54–58. The ear hook may be surrounded by a "protective sleeve that may be made of an elastic waterproof material." *Id.* at 1:40–42. The '582 patent

discloses that the loudspeaker “may include, but is not limited to, an earphone, an MP3 player, and a hearing aid.” *Id.* at 8:35–37.

Figure 2 of the '582 patent, reproduced below, illustrates “an exploded structural diagram of an MP3 player.” Ex. 1001, 4:1–2.

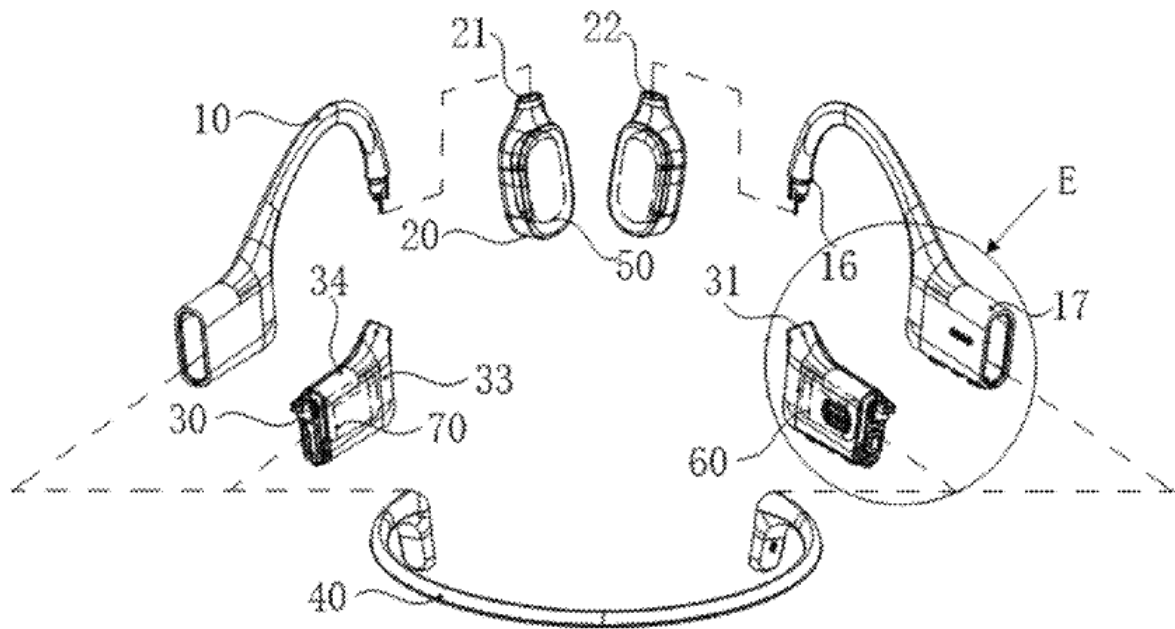


FIG. 2

An exemplary embodiment of an MP3 player is depicted above in Figure 2 of the '582 patent.

The '582 patent describes that the MP3 player of Figure 2, which may be “a bone conductive MP3 player,” includes ear hooks 10, core housings 20, each of which accommodates an earphone core 50, and circuit housings 30, each of which accommodates either control circuit 60 or battery 70. *Id.* at 8:46–62. The MP3 player further includes rear hook 40, which has two ends that connect to the two circuit housings 30. *Id.* at 8:56–

58. “In some embodiments, the ear hook 10 may further include a protective sleeve 16 and a housing sheath 17 integrally formed with the protective sleeve 16.” *Id.* at 8:67–3.

Figure 10 of the '582 patent, reproduced below, illustrates a sectional view of a bone conduction speaker. Ex. 1001, 4:16–17.

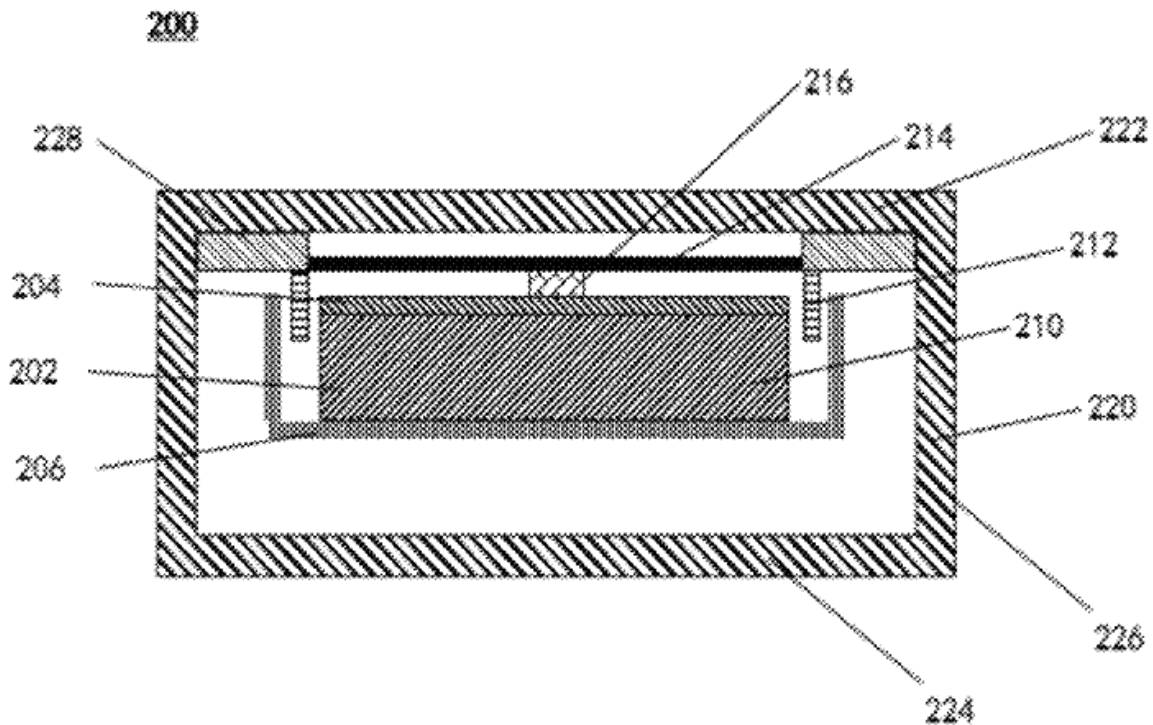


Fig. 10

An exemplary embodiment of a bone conduction speaker is depicted above in Figure 10 of the '582 patent.

The '582 patent describes that in “bone conduction speaker 200,” shown in Figure 10 above, housing 220 and the components within correspond, respectively, to core housing 20 and to earphone core 50, shown in Figure 2. *Id.* at 17:9–14. Housing 220 may include housing panel 222,

housing back panel 224, and housing side panel 226. *Id.* at 17:18–20. Housing 220 may further include magnetic circuit component 210, coil 212, vibration transmission plate 214, and housing bracket 228. *Id.* at 17:25–30. “[V]ibration transmission plate 214 may be connected to the housing 220 by the housing bracket 228, and the coil 212 may be fixed on the housing bracket 228 and may drive the housing 220 to vibrate by the housing bracket 228.” *Id.* at 17:30–34. The ’582 patent notes that “the rigidity of the housing of the bone conduction speaker may affect the vibration amplitudes and phases of different parts of the housing (for example, the housing panel, the housing back panel, and/or the housing side panel), thereby affecting the sound leakage of the bone conduction speaker.” *Id.* at 20:57–62.

D. Illustrative Claim

Petitioner challenges claims 1–12, 14, and 16–20 of the ’582 patent. Pet. 1, 6. Claim 1 is the sole independent claim. Claim 1 is illustrative of the challenged claims, and recites the following (Petitioner’s bracketing and identifiers added but do not impact our analysis):

[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, wherein

[1d] the core housing including a housing panel facing human body and a housing back panel opposite to the housing panel, and

[1e] the vibration of the earphone core drives the housing panel and the housing back panel to vibrate, the vibration of the housing panel having a first phase, the vibration of the housing back panel having a second phase, wherein when the vibration frequencies of the housing panel and the housing back panel is within a range of 2000 Hz to 3000 Hz, an absolute value of a difference between the first phase and the second phase is less than 60 degrees; and

[1f] 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 to generate a sound.

Ex. 1001, 36:18–42.

E. Prior Art of Record

Petitioner submits the following asserted references as evidence:

Name¹	Reference	Issue or Publication Date	Exhibit
Li	CN107454492A – Certified English translation	Dec. 8, 2017	Ex. 1004
Liao	CN106937222A – Certified English translation	July 7, 1017	Ex. 1005
Asaka	CN 202931524 U – Certified English translation	May 8, 2013	Ex. 1006
Numata	JP P2008-294872 A – Certified English translation	Dec. 4, 2008	Ex. 1007
Wang	CN 205356672 U – Certified English translation	June 29, 2016	Ex. 1008
Xu	CN 205017577 U – Certified English translation	Feb. 3, 2016	Ex. 1009

¹ First named author or inventor only.

Name ¹	Reference	Issue or Publication Date	Exhibit
Nielsen	WO 2009/086838 A1	July 16, 2009	Ex. 1010

a. Summary of Li (Ex. 1004)

Li is a Chinese patent application publication titled “A Bone Conduction Earphone,” filed on August 18, 2017, and published on December 8, 2017. Ex. 1004, codes (19), (22), (43), (54). Li states that the invention “relates to the field of earphones, particularly to a bone conduction headphone.” *Id.* ¶ 1.

Li explains that bone conduction transmits sound by converting sound into “mechanical vibrations of different frequencies, and sound waves are transmitted by the human skull, bone labyrinth, inner ear lymphatic fluid, organum spirale, auditory nerves, and auditory center.” Ex. 1004 ¶ 2. Li also explains that bone conduction earphones “use bone conduction technology to receive speech and closely adhere to the bone, and sound waves are directly transmitted by the bone to the auditory nerve” such that “both ears can be exposed without damaging the eardrum.” *Id.*

According to Li, however, “existing bone conduction earphones have poor bending performance and are prone to damage during bending.” Ex. 1004 ¶ 2. Li endeavors to address that deficiency by providing “a bone conduction earphone that can improve the poor bending performance of existing bone conduction earphones.” *Id.* ¶ 3.

Specifically, Li discloses “a bone conduction earphone” comprising “an ear hook assembly” that includes “a first housing, a second housing, and a connecting component connecting the first housing and the second

housing.” Ex. 1004 ¶ 4, code (57); *see id.* ¶ 23, Figs. 1–2. The connecting component “comprises a first elastic metal wire connecting the first housing and the second housing at both ends respectively, and a first elastic coating layer wrapped around the first elastic metal wire.” *Id.* ¶ 4, code (57).

Li explains that by connecting “the first housing and the second housing” with a first elastic metal wire and covering the first elastic metal wire with a first elastic coating layer, “the bending performance of the ear hook can be effectively enhanced” due to the “elastic effect” of the first elastic metal wire and the first elastic coating layer. Ex. 1004 ¶ 5; *see id.* ¶ 26. Hence, the ear hook assembly “can effectively recover to its original state when bent, with no deformation.” *Id.* ¶ 5; *see id.* ¶ 26. Thus, “the issue of easy damage caused by the use of plastic as the material of the ear hook assembly in conventional bone conduction earphones can be improved.” *Id.* ¶ 5; *see id.* ¶ 26.

Li’s Figure 1 (reproduced below) depicts an ear hook assembly in a bone conduction earphone:

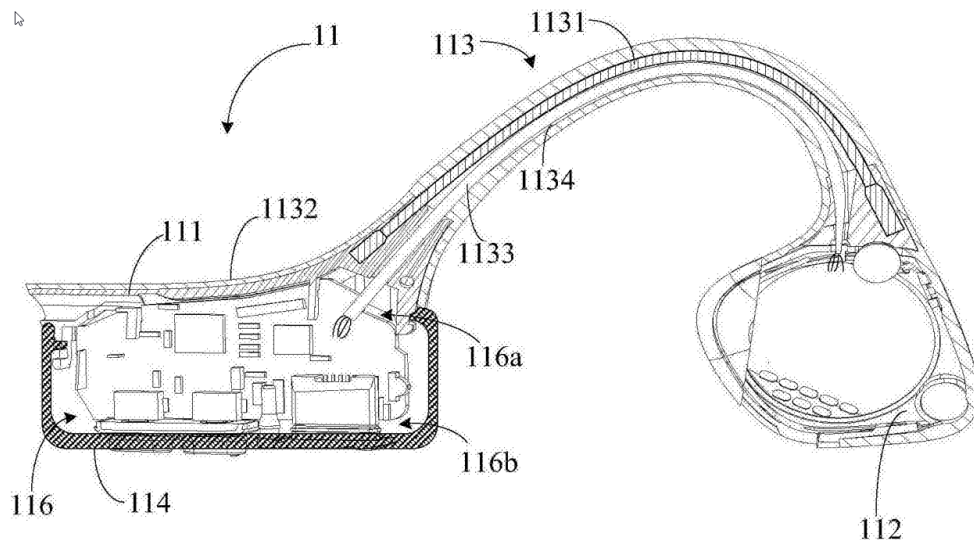


Figure 1 illustrates ear hook assembly 11 including “a first housing 111, a second housing 112, and a connecting component 113 connecting the first

housing 111 and the second housing 112.” Ex. 1004 ¶ 23, Fig. 1. Ear hook assembly 11 “is generally used for users to hang the bone conduction earphone on their ears when wearing them, which can make the bone conduction earphone more firmly worn on the user’s ear.” *Id.* ¶ 25.

As Figure 1 shows, “the connecting component 113 comprises a first elastic metal wire 1131 connecting the first housing 111 and the second housing 112 at both ends, and a first elastic coating layer 1132 wrapped around the first elastic metal wire 1131.” Ex. 1004 ¶¶ 23, 26, Fig. 1. Due to “the elastic effect of the first elastic coating layer 1132,” “the first elastic coating layer 1132 can be more effectively wrapped around the first elastic metal wire 1131, even after multiple bends, ensuring the effectiveness of the bone conduction earphone structure.” *Id.* ¶ 28.

Optionally, “the first housing 111 and the second housing 112 are plastic housings, fixed at both ends of the first elastic metal wire 1131 by injection molding, and the first elastic coating layer 1132 is integrally formed to cover the first elastic metal wire 1131.” Ex. 1004 ¶ 29; *see id.* ¶ 35. “This makes the connection between the first housing 111, the second housing 112, and the first elastic metal wire 1131 more stable, and enhances the sense of unity and texture of the bone conduction earphone, making the structure of the bone conduction earphone more compact and lightweight.” *Id.* ¶ 29.

Optionally, “the first elastic coating layer 1132 covers the first elastic metal wire 1131, at least a portion of the outer surface of the first housing 111, and at least a portion of the outer surface of the second housing 112 by injection molding.” Ex. 1004 ¶ 36; *see id.* ¶ 41. “This enhances the texture and unity of the bone conduction earphone, and the

presence of the first elastic coating layer 1132 can further protect the housing and internal components, making the bone conduction earphone more wear-resistant.” *Id.* ¶ 36.

Li’s Figure 2 (reproduced below) depicts the “overall structure disassembly” of a bone conduction earphone:

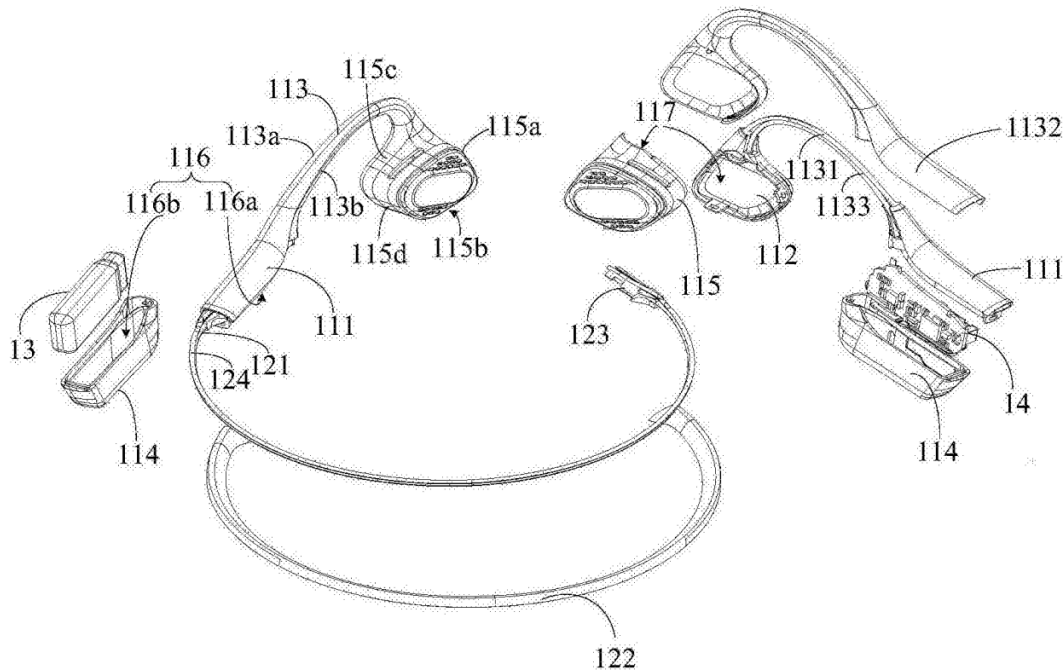


Figure 2, above, illustrates a bone conduction earphone including the following components:

- “two ear hook assemblies 11” (not labeled in Figure 2);
- “rear hook assembly 12” (not labeled in Figure 2);
- connecting component 113 of the left ear hook assembly 11 and connecting component 113 of the right ear hook assembly 11;
- first housing 111 arranged at the rearward end of each connecting component 113;
- second housing 112 arranged at the forward end of each connecting component 113;

- third housing 114 cooperating with first housing 111 “to form a first accommodating space 116 for accommodating” either battery pack 13 (on the left) or control circuit assembly 14 (on the right);
- fourth housing 115 cooperating with second housing 112 “to form a second accommodating space 117 for accommodating” a bone conduction speaker (on the left and on the right);
- first elastic metal wire 1131 “connecting the first housing 111 and the second housing 112 at both ends”;
- first elastic coating layer 1132 surrounding first elastic metal wire 1131;
- first wire set 1133 “extending from the first housing 111 to the second housing 112 through the lead channel 1134” such that “one end of the first wire set 1133 can be connected first (e.g., in a board mounted manner) to the components inside the second housing 112, such as a bone conduction speaker,” and “the other end of the first wire set 1133 can be passed through the lead channel 1134 to connect to the components inside the first housing 111,” such as battery pack 13 or control circuit assembly 14;
- second elastic metal wire 121 in rear hook assembly 12;
- second elastic coating layer 122 surrounding second elastic metal wire 121 in rear hook assembly 12;
- plug-in portions 123 provided at both ends of second elastic metal wire 121 and “connected and fixed to the first housings 111 of the two ear hook assemblies 11”;
- and
- second wire set 124 “wrapped by” second elastic coating layer 122 and “used to connect the components inside the two ear hook assemblies 11,” such as battery pack 13 and control circuit assembly 14.

Ex. 1004 ¶¶ 23, 39–40, 43, 46, 58, 69–70, Fig. 2.

Rear hook assembly 12 includes second elastic metal wire 121, second elastic coating layer 122, and plug-in portions 123 “provided at both ends of the second elastic metal wire 121.” Ex. 1004 ¶ 58, Fig. 2. By “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.” *Id.* ¶ 59.

Li’s Figure 9 (reproduced below) depicts plug-in portion 123 in more detail:

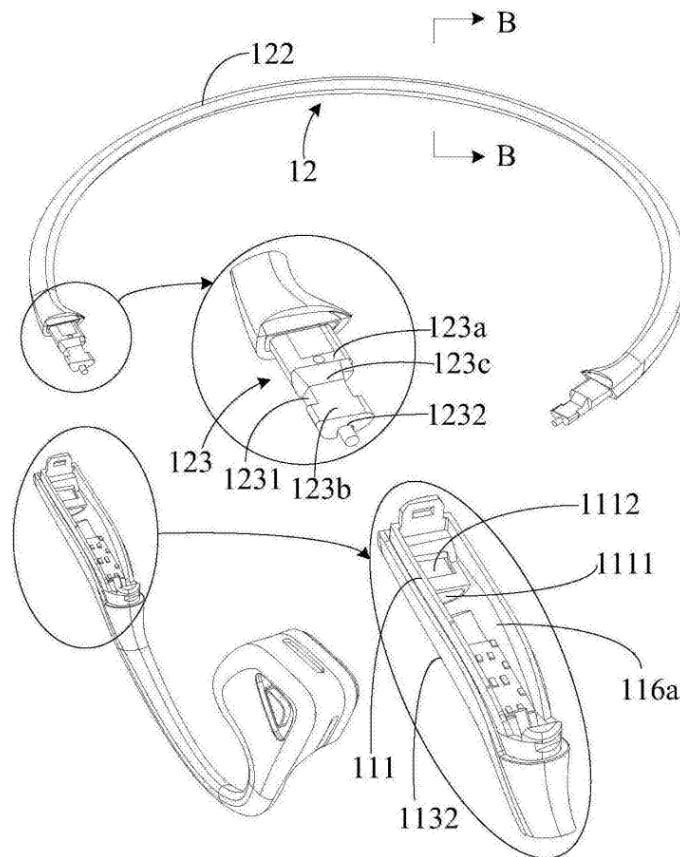


Figure 9, above, illustrates plug-in portion 123 including “a first plug-in section 123a connected to the second elastic metal wire 121, and a second

plug-in section 123b connected to the first plug-in section 123a and located away from the second elastic metal wire 121.” Ex. 1004 ¶ 62, Fig. 9.

Figure 9 also illustrates first housing 111 “provided with a plug-in hole 1111 for allowing the insertion of the plug-in portion 123, and an opening 1112 connecting the plug-in hole 1111 and the outside in the vertical direction of the insertion direction of the plug-in portion 123.” *Id.* ¶ 60, Fig. 9.

b. Summary of Liao (Ex. 1005)

Liao is titled “Bone Conduction Speaker.” Ex. 1005, code (54). Liao relates to “improv[ing] the sound quality of bone conduction speakers.” *Id.* ¶ 3. Liao discloses that various “choices, combinations, corrections, or changes” in the design “can affect the sound quality of bone conduction speakers.” *Id.* ¶ 53. In particular, sound quality includes timbre, which is “the subjective perception of sound characteristics by the human ear,” and “depends on the spectral structure of the sound,” where “[t]he spectral structure of sound is described by the fundamental frequency, number of harmonics, distribution of harmonics, amplitude, and phase relationships.” *Id.* ¶ 54.

Figure 2-B of Liao, reproduced below, illustrates a structural diagram of the vibration generating portion of a bone conduction speaker. Ex. 1005 ¶ 6.

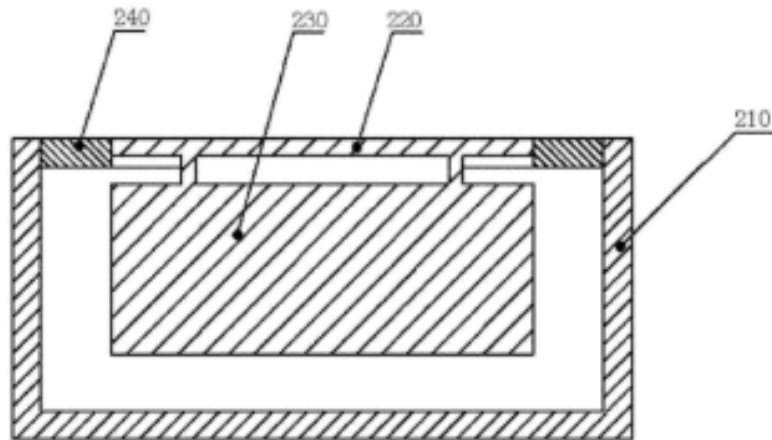


Figure 2-B

An exemplary embodiment of vibration generating portion of a bone conduction speaker is depicted above in Figure 2-B of Liao.

In the embodiment shown in Figure 2-B above, “vibration of the panel 220 is transmitted to the auditory nerve via tissues and bones, allowing people to hear sound.” *Id.* ¶ 56. Specifically,

[t]he panel 220 is connected to the energy conversion device 230 and vibrates under the drive of the energy conversion device 230. The connection member 240 connects the panel 220 and the housing 210, used to position the energy conversion device 230 within the housing. When the energy conversion device 230 transmits vibration to the panel 220, the vibration will also be transmitted to the housing via the connection member 240, causing the housing 210 to vibrate and correspondingly changing the vibration mode of the panel 220, thereby affecting the vibration transmitted from the panel 220 to the human skin.

Id. Liao discloses that the choice of materials for connection member 240, or whether to use connection member 240 at all, “affect[s] the overall vibration efficiency of the vibration system and produc[es] different sound quality.” *Id.* ¶ 57. Namely, “if connection members are not used, the panel

can be directly attached to the housing, or connected to the housing by clamping or welding.” *Id.* ¶ 58. If, on the other hand, “connection members are used, connection members with moderate elastic force have a shock-absorbing effect during the transmission of vibrations, which can reduce the vibration energy transmitted to the housing and effectively suppress the bone conduction speaker from leaking sound to the outside caused by housing vibration.” *Id.* The positioning of the connection members “inside/on the housing will also have varying degrees of impact on the transmission efficiency of vibration.” *Id.*

Furthermore, Liao discloses that the choice of “a panel with a specific vibration mode within a specific frequency range can change the sound quality of the bone conduction speaker.” Ex. 1005 ¶ 78. Liao specifies a frequency range of 20 to 20,000 Hz for the panel, and notes that “preferably, the frequency range can be between 500 Hz-2,000 Hz, and even further preferably, the frequency range can be between 800 Hz-1,500 Hz.” *Id.*

F. The Asserted Grounds of Unpatentability

Petitioner challenges claims 1–12, 14, and 16–20 of the ’582 patent based upon four proposed grounds of unpatentability:²

Grounds ³	Claim(s) Challenged	35 U.S.C. §	Reference(s)
1	1, 14	103	Li, Liao

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103, effective on March 16, 2013. The ’582 patent claims the benefit of filing dates after the effective date of the applicable AIA amendments. *See* Ex. 1001 (code 30). Therefore, we refer to the AIA versions of 35 U.S.C. §§ 102, 103.

³ The four proposed grounds of unpatentability are listed at page 1 of the Petition without including the “Knowledge of POSITA.” Petitioner,

Grounds ³	Claim(s) Challenged	35 U.S.C. §	Reference(s)
2	2–6	103	Li, Liao, Asaka
3	7–12	103	Li, Liao, Numata
4	16–20	103	Li, Liao, Wang, Xu, Nielsen

Pet. 1. Patent Owner disputes that Petitioner has shown sufficiently that any of its four proposed grounds of unpatentability render the challenged claims obvious. *See generally* Prelim. Resp.

G. Testimonial Evidence

To support its challenges, Petitioner relies upon the declaration of Chris Kyriakakis, Ph.D. (Exhibit 1003). Dr. Kyriakakis states, “I have been engaged by Petitioner” to “provide my expert opinions in support of the above-identified petition for *inter partes* review of” the ’582 patent.

Ex. 1003 ¶ 1. Dr. Kyriakakis explains that he received a “Bachelor of Science degree in Engineering and Applied Science from the California Institute of Technology (Caltech) in 1985” and a “Master of Science degree in Electrical Engineering in 1987” as well as a “Ph.D. in Electrical Engineering in 1993, both from the University of Southern California.” *Id.* ¶ 5.

At this stage of the proceeding, Patent Owner does not submit testimonial evidence.

H. The Petition’s “Interchangeable Audio Headset Prior Art”

In addition to the asserted prior art under section II(E) *supra*, the Petitioner provides extrinsic evidence to purportedly demonstrate that

however, includes the “Knowledge of POSITA” under the respective discussions of the individual grounds later in the Petition.

“[m]odular audio portions of headsets, including speakers, control circuits, and batteries, were well-known as of the ’582 Patent’s priority date.”

Pet. 17. Specifically, the Petitioner cites the following seven references under the heading “Interchangeable Audio Headset Prior Art” to demonstrate the purported knowledge of the person having ordinary skill in the art:

Name	Reference	Exhibit
Hupkes	US 2008/0279409 A1, published Nov. 13, 2008 (based on an application filed May 11, 2007)	1011
Dyer	US 7,672,469 B2, issued March 2, 2010 (based on an application filed Nov. 17, 2005)	1012
Mei	US 8,515,103 B2, issued August 20, 2013 (based on an application filed Nov. 22, 2010)	1013
Chen	US 2016/0080853 A1, published March 17, 2016 (based on an application filed Sept. 17, 2014)	1014
Lott	US 9,866,966 B2, issued January 9, 2018 (based on an application filed Nov. 24, 2016)	1015
Bellas	US 2018/0316999 A1, published Nov. 1, 2018 (based on an application filed April 26, 2017)	1016
Eggebraaten	US 2014/0126742 A1, published May 8, 2014 (based on an application filed Nov. 5, 2013)	1019

Pet. 17–18.⁴

Regarding the Petition’s list of “Interchangeable Audio Headset Prior Art” (*id.*), Patent Owner asserts that “[t]he Petition never discusses any of these references individually beyond conclusory citations to them for general assertions about headphones relying on modular components.” Prelim.

Resp. 14. Patent Owner additionally argues that “[a] closer analysis shows

⁴ See *supra* n.4. (“Knowledge of POSITA.”).

that these references have little in common with the Petition’s primary references (Li ’492 and Liao) beyond being within the general field of headsets (if even that).” Prelim. Resp. 14–15. Patent Owner summarizes in brief form the aforementioned seven references on pages 15–19 of the Preliminary Response.

In particular, we note Patent Owner argues: “The Petition appears to cite Eggebraaten for the general proposition that networked audio devices may use plugs or jacks.” Prelim. Resp. 19. Patent Owner notes that “the Petition (at 25) pastes Fig. 13, which is a generic illustration of an RCA cable adapter 72 used to connect components within such a multi-room audio distribution system.” *Id.* (citing Ex. 1019 ¶¶ 28, 30, 46, 50). Patent Owner concludes: “However, there is no mention in EX1019 of using such a jack to connect components within a headphone set of any kind. The Petition cites nothing in any of these references that discusses bone conduction headsets, much less waterproof or even water-resistant headsets.” *Id.*

Later in the Preliminary Response (at page 33), Patent Owner argues that the “Petition’s reliance on numerous ‘interchangeable headset prior art’ references fails to identify with particularity the grounds on which its challenge is based.” Prelim. Resp. 33. Patent Owner notes that the “Petition does not identify any of these references as part of its Ground 1 combination, yet it appears to rely entirely on this set of references for its assertions that a POSITA would have modified Li ’492 to add two plug ends in the specific configuration required by the ’582 Patent.” *Id.*

Furthermore, regarding the seven “Interchangeable Audio Headset Prior Art” references, Patent Owner asserts:

- (1) the Petition’s statutorily required “Statement of Precise Relief Requested” lists only the references discussed above in Section II.E, e.g., Li and Liao for claim 1;
- (2) the Petition’s introductory heading for each ground adds “and the knowledge of” an ordinarily skilled artisan (citing Pet. at 18, 42, 62, and 93);⁵
- (3) adding the seven “Interchangeable Audio Headset Prior Art” references under the guise of an ordinarily skilled artisan’s knowledge means that the Petition “adds any possible combination of one or more of these seven (that is, any one of them, any combination of two through six of them, or all seven) to the base combination” of Li and Liao; and
- (4) “the Petition’s reliance on up to seven additional references to teach two critical claim elements results in a lack of particularity that results in voluminous and excessive grounds.”

Prelim. Resp. 33–34; *see supra* § II.E.

Citing *Adaptics Ltd. v. Perfect Co.*, IPR2018-01596, Paper 20 at 24 (PTAB Mar. 6, 2019) (informative), Patent Owner further asserts that “[t]his lack of specificity alone is sufficient reason for the Board to conclude that the Petition fails to show a reasonable likelihood of prevailing on any ground.” Prelim. Resp. 34.

1. Analysis Regarding the Petition’s List of “Interchangeable Audio Headset Prior Art”

For the reasons explained below, we disagree with Patent Owner that a “lack of specificity” in the Petition warrants denial of institution because we determine Petitioner has complied with the requisite rules and the Petition demonstrates a reasonable likelihood of success.

⁵ *See supra* n.4. (“Knowledge of POSITA.”).

The Board’s rules require that a petition provide “a statement of the precise relief requested for each claim challenged,” including “specify[ing] where each element of the claim is found in the prior art patents or printed publications relied upon.” 37 C.F.R. § 42.104(b)(4). The Board’s rules also require that a petition include “a detailed explanation of the significance of the evidence.” 37 C.F.R. § 42.22(a)(2).

Contrary to Patent Owner’s assertions, the Petition satisfies these rules. *See* Pet. 1, 18–114. Under the heading “Statement of Precise Relief Requested,” the Petition (at page 1) provides the table of four grounds reproduced above under section II (F).

III. LEVEL OF ORDINARY SKILL IN THE ART

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art at the critical time. In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). “[O]ne or more factors may predominate.” *Id.* These factors are not exhaustive, but merely a guide to determining the level of ordinary skill in the art. *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007).

Relying upon the declaration testimony of Dr. Kyriakakis, Petitioner contends that a “person of ordinary skill in the art (“POSITA”) at the ’582 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.” Pet. 6 (citing Ex. 1003 ¶¶ 34–36). Petitioner notes that “[a]dditional graduate education could substitute for professional experience, and significant experience in the field could substitute for formal education.” *Id.*

At this stage, Patent Owner states that “[f]or the purposes of this Preliminary Response only, Patent Owner relies on the definition proposed by Petitioner because Petitioner has not shown that any challenged claims are unpatentable given this level of skill.” Prelim. Resp. 10.

For purposes of this Decision on Institution, we adopt Petitioner's definition of the level of ordinary skill in the art, because we are satisfied that it comports with the level of skill necessary to understand and implement the teachings of the '582 patent and the asserted prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that the prior art itself can reflect an appropriate level of ordinary skill in art).

IV. CLAIM CONSTRUCTION

In interpreting the claims of the '582 patent, we “us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b).” *See* 37 C.F.R. § 42.100(b). Accordingly, our claim construction standard is the same as that of a district court. *See id.* Under this standard, claim terms are generally given their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

For the reasons discussed *infra*, we determine that no claim term, phrase, or limitation requires an explicit construction to decide whether Petitioner satisfies the “reasonable likelihood” standard for instituting trial.

A. Petitioner’s Position Regarding Claim Construction

Petitioner asserts generally that “[b]ecause 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.” Pet. 6 (citing *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)). Petitioner specifically contends “[a]ny claim terms not listed below should be construed according to their plain and ordinary meaning to a POSITA at the time of the ’582 Patent.” (citing 37 C.F.R. § 42.100(b)). But Petitioner specifically argues that dependent claim 5 (as reproduced below) purportedly requires claim construction by the Board. Pet. 7.

Claim 5 reads as follows (with bracketed numbers and letters added for reference purposes):

5. [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

[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. Ex. 1001, 36:64–37:10 (emphasis added).

Petitioner specifically asserts that an ordinarily skilled artisan “would have understood that there is a typo” in limitation 5c where “first” appears instead of “second.” Pet. 7. According to Petitioner, this typo “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.” *Id.*

Petitioner asserts that without interpreting “first” to mean “second” in limitation 5c, “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 plug[s].” Pet. 7 (citing Ex. 1003 ¶¶ 52–54).

B. Patent Owner’s Position Regarding Claim Construction

Patent Owner asserts that “all claim terms should be interpreted according to their plain and ordinary meaning.” Prelim. Resp. 10.

Regarding claim 5, Patent Owner asserts that the Board *need not reach* “that issue because claim 5 depends indirectly on independent claim 1, and Petitioner has failed to show a reasonable likelihood of invalidating claim 1.” Prelim. Resp. 10 (emphasis added).

C. Discussion of Claim Construction

We construe only those claim terms that require analysis to determine whether to institute an *inter partes* review. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc.*, 200 F.3d at 803); *see also Nidec*, 868 F.3d at 1017.

Regarding dependent claim 5, we note that claim interpretation may remedy an “obvious minor” typographical or clerical error in a claim evident to “one skilled in the art” from “the face of the patent.” *See Pavo Sols. LLC v. Kingston Tech. Co.*, 35 F.4th 1367, 1373 (Fed. Cir. 2022).

But correction is appropriate “only if (1) the correction is not subject to reasonable debate based on consideration of the claim language and the specification and (2) the prosecution history does not suggest a different interpretation of the claims.” *Novo Indus., L.P. v. Micro Molds Corp.*, 350 F.3d 1348, 1354 (Fed. Cir. 2003).

Here, the analysis whether correction is appropriate “must consider how a potential correction would impact the scope of a claim and if the inventor is entitled to the resulting claim scope based on the written description of the patent.” *CBT Flint Partners, LLC v. Return Path, Inc.*, 654 F.3d 1353, 1359 (Fed. Cir. 2011).

During the instituted trial, we leave it to the parties to address the necessity of interpreting “first” to mean “second” in limitation [5c]. Accordingly, at this stage, we determine that no claim term, phrase, or limitation requires an explicit construction to decide whether Petitioner satisfies the “reasonable likelihood” standard for instituting trial.

V. PRINCIPLES OF LAW

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to Patent Owner except in certain limited circumstances not present here. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable under 35 U.S.C. § 103 “if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.” 35 U.S.C. § 103; *see KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.⁶ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). “[W]hen a patent

⁶ Patent Owner does not present arguments or evidence of secondary considerations (i.e., objective indicia of non-obviousness) in its Preliminary Response. *See generally* Prelim. Resp. Therefore, secondary considerations do not constitute part of our analysis herein.

claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 50–51 (1966)). An obviousness inquiry is not limited to the prior art’s preferred embodiment. *See, e.g., Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1370 (Fed. Cir. 2007). We also recognize that prior art references must be “considered together with the knowledge of one of ordinary skill in the pertinent art.” *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994) (citing *In re Samour*, 571 F.2d 559, 562 (CCPA 1978)).

RATIONALE TO MODIFY LI WITH THE TEACHINGS OF LIAO

A. *Petitioner’s Rationale to Combine Arguments*

Petitioner argues that at “the time of the ’582 Patent, a POSITA would have found it obvious to combine Li and Liao by using bone conduction speakers as taught by Liao in bone conduction earphones as taught by Li because, although Li describes most of the earphone device structure, it lacks details on the bone conduction speaker design, including their vibration mechanism.” Pet. 18. Petitioner asserts that “[t]hese contemporaneous references are within the same field: bone conduction earphones.” *Id.* (citing Ex. 1004 ¶¶ 2–5, 24, 40; Ex. 1005, Figs. 4, 12, 14-A, 14-B, 15, 16-A ¶¶ 117–118).

Petitioner notes that “Liao acknowledges that bone conduction speakers were known.” *Id.* (citing Ex. 1005 ¶ 2). Petitioner asserts that a “POSITA would, therefore, have been motivated to look to known designs such as Liao’s and to use Liao’s bone conduction speaker design in a bone

conduction earphones such as those described in Li, and understood that a Li-Liao combination was practical.” *Id.* (citing Ex. 1003 ¶¶ 102–105).

Petitioner contends that a “POSITA would have recognized the benefit of using Liao’s bone conduction speaker in Li because Liao teaches a bone conduction speaker with ‘improve[d] sound quality.’” Pet. 19 (citing Ex. 1005 ¶¶ 3, 53–54, 70, 74–75). Petitioner argues that a “POSITA would have understood, for example, that the design and preferred materials of Liao’s bone conduction speaker would enhance Li’s sound quality. That improvement would have motivated a POSITA to make the combination.” *Id.* (citing Ex. 1003 ¶ 106).

Petitioner further contends that “[c]ombining Li with Liao would involve applying known techniques (Liao’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 quality).” *Id.* Petitioner argues that a “POSITA would have had a reasonable expectation of success in the combination because Li’s earphones are explicitly designed to be worn over the ear to transfer vibrations to the side of the user’s head, which matches Liao’s design.” *Id.* (citing Ex. 1005, Figs. 14-A, 14-B, 15; Ex. 1004, Fig. 2).

Petitioner asserts that a “POSITA would have had a reasonable expectation that the Li-Liao modification would be successful because the teachings of Li and Liao would have been predictably combined due to the predictability of the bone conduction speaker art and known interchangeability elements including vibration mechanisms and housing.” *Id.* (citing Ex. 1003 ¶ 107). Petitioner further asserts that a “POSITA would have been motivated to combine Li and Liao because they have a common

assignee (Shenzhen Shokz Co., Ltd.), a common inventor (Qi Xin), and the open-ear with ear-hook headset designs are similar, as shown in Li Figure 2 and Liao Figure 14-B.” Pet. 20 (citing Ex. 1004 ¶¶ 71–72, Fig. 2; Ex. 1005 ¶¶ 73, 72, Fig. 14-B; Ex. 1003 ¶ 108).

Petitioner, therefore, asserts that a “POSITA would have further been motivated to select Liao’s embodiment without the connection members 240 and the rigid connection between panel 210 and housing 220 in order to simplify the design and manufacture of the speaker and therefore reduce costs.” *Id.* (citing Ex. 1003 ¶ 109).

Petitioner summarizes: “If Patent Owner argues the portions of Li and Liao 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.” Pet. 20 (citing Ex. 1003 ¶¶ 110–111). Petitioner emphasizes that it “does not assert that Li and Liao can be bodily incorporated, and establishing obviousness does not require demonstrating that the references were capable of bodily incorporation.” *Id.* (citing *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012)).

B. Patent Owner’s Arguments Against a Rationale to Combine

Patent Owner argues that “[e]ven if the Petition’s use of multiple ‘interchangeable headset prior art’ references to supply missing claim limitations was proper (it is not), the Petition would still fail to show that a POSITA would have been motivated to combine the nebulous ‘modular’

teachings from these references with its Li '492/Liao combination to produce the claimed structure.” Prelim. Resp. 34.

Patent Owner contends that the “Petition’s motivation to combine analysis (at 18-20) focuses solely on the purported motivation to combine Li '492 and Liao.” *Id.* ant 34–35. Patent Owner asserts that “Li '492 itself does not provide any teaching or suggestion to place plug ends of an ear hook in the configuration required by the claims, and the Petition does not even argue that Liao provides such a suggestion either.” Prelim. Resp. 35.

Patent Owner asserts that “the Petition’s arguments regarding the claimed ‘plug ends’ in the configuration claimed all rely on assertions that a POSITA would have known to duplicate Li '492’s plugs into different positions on the headset based on teachings obtained from the ‘Interchangeable Headset Prior Art.’” *Id.*

Patent Owner, *inter alia*, emphasizes that “the Petition fails to explain why, much less present any evidence, that a POSITA would have been motivated to incorporate those teachings into the specific headphone structure described by Li '492.” *Id.* Noting Petitioner’s extrinsic evidence, Patent Owner asserts that the Petition does not “explain why the various teachings that it cites would lead to a plug between an ear hook and a core housing containing a speaker.” *Id.* at 36 (citing Ex. 1012, 2:4–15 (“what is needed in the art is an in-ear monitor system that provides the user with greater capabilities to either replace, or upgrade, specific system components”); Ex. 1014 ¶ 4 (“Further conventional headphone systems do not allow the consumer to upgrade its specifications or changing [sic] its internal circuit module or other component parts.”); Ex. 1015, 2:6–17 (“various embodiments configure a wireless audio system that provides ... a

diverse range of capabilities that may, or may not, be facilitated by attachments physically connected to a wireless monitor”)).

Patent Owner also notes that “[a]s for the Petition’s assertion of “reducing manufacturing and production costs due to the simple shape of components,” Bellas (EX1016) is the only reference cited with any teaching even arguably related to this assertion.” Prelim. Resp. 36. Patent Owner contends, however, “the only references to ‘reducing manufacturing and production costs due to the simple shape of components’ in the cited portions of Bellas relate to reducing the cost of the particular magnetic sphere mechanism that Bellas itself uses to separate its earphone cups from a headband.” *Id.* In support, Patent Owner cites to several examples in Bellas. *Id.* (citing Ex. 1016 ¶¶ 79, 85, 96).

Patent Owner concludes that “[n]othing in Bellas’ discussion about its own magnetic attachment mechanism, nor any of Petitioner’s other citations for this point, teaches or suggests anything about how or why adding a plug between an ear hook and a speaker housing would lower manufacturing costs.” Prelim. Resp. 37–38.

Patent Owner, thus, urges that Petitioner has engaged in impermissible hindsight: “the Petition relies on the **’582 Patent itself** for the assertion that ‘reducing manufacturing cost and adjusting for design changes as a benefit of its modular design’ would have been benefits motivating a POSITA to add a plug between Li ’492’s ear hook and core housing.” Prelim. Resp. 38 (citing Pet. 25 (citing ’582 Patent at 11:58–12:3, 16:21–32)).

Patent Owner similarly concludes that none of Petitioner’s citations explain “why a POSITA without the benefit of hindsight would have been

motivated to add a plug end to Li '492 in *either* of the two places where claim elements [1c] and [1f] require a plug end, much less *both*.” Prelim. Resp. 39 (citing Pet. 26 (citing Ex. 1004 ¶ 59; *see also* Ex. 1012, 2:4–15; Ex 1014 ¶ 4; Ex. 1015, 2:6–17, Ex. 1016 ¶¶ 56, 79, 85, 96; and Ex. 1015, 2:6–17)).

C. Our Preliminary Findings Regarding Rationale to Combine

As noted *supra* under section II(H)(1), we disagree with Patent Owner that a “lack of specificity” in the Petition warrants denial of institution, or nullifies any portions of Petitioner’s proposed Ground 1. *See* Pet. 17–18.

We also have considered Patent Owner’s assertion that Petitioner has engaged in impermissible hindsight reconstruction. *See* Prelim. Resp. 38 (citing Pet. 25 (citing ’582 Patent at 11:58–12:3, 16:21–32)).

Although we are fully aware that hindsight bias often plagues determinations of obviousness, *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 36 (1966), we also are mindful that the Supreme Court has held that a “combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.” *KSR*, 550 U.S. at 401.

In reviewing the record here, we are not persuaded that Petitioner’s proposed combination of Li and Liao is based upon improper hindsight, because Patent Owner does not point to sufficient evidence of record that shows combining the teachings of the cited references in the manner proposed by the Petitioner would have been “uniquely challenging or difficult for one of ordinary skill in the art” or would have “represented an unobvious step over the prior art.” *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007) (citing *KSR*, 550 U.S. at 418).

In addition, Patent Owner has not identified any knowledge gleaned only from the present application that was not within the level of ordinary skill at the time the claimed invention was made. *See In re McLaughlin*, 443 F.2d 1392, 1395 (CCPA 1971) (“Any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made and does not include knowledge gleaned only from applicant’s disclosure, such a reconstruction is proper.”).

Moreover, Patent Owner has not provided any objective indicia of nonobviousness (e.g., long-felt but unmet need, commercial success, or unexpected results), which our reviewing court guides “operates as a beneficial check on hindsight.” *Cheese Sys., Inc. v. Tetra Pak Cheese & Powder Sys., Inc.*, 725 F.3d 1341, 1352 (Fed. Cir. 2013); *see supra* n.6.

We are persuaded by Petitioner that “[a] POSITA would have had a reasonable expectation that the Li-Liao modification would be successful because the teachings of Li and Liao would have been predictably combined due to the predictability of the bone conduction speaker art and known interchangeability elements including vibration mechanisms and housing.”

Pet. 19 (citing Ex. 1003 ¶ 107); *see, e.g.*, Ex. 1003 ¶ 107:

Combining Li with Liao would simply involve applying known techniques (*i.e.*, a bone conduction speaker as taught by Liao) to a known device ready for improvement (Li’s bone conduction earphones) to yield predictable results (operating bone conduction earphones, with improved sound quality). A POSITA would have had a reasonable expectation of success in the combination because Li’s earphones are explicitly designed to be worn over the ear to transfer vibrations to the side of the user’s head, which is the same way Liao’s bone conduction

speakers are designed to be worn. EX1005, Figs. 14-A, 14-B, 15; EX1004, Fig. 2. A POSITA thus would have had a reasonable expectation that the modification of Li with Liao would be successful because a POSITA would have found that the teachings of Li and Liao could have been predictably combined due to the predictability of the bone conduction speaker art and the known interchangeability of the various elements, including vibration mechanisms and housing.

Ex. 1003 ¶ 107; *see also* Pet. 19 (Reasonable Expectation of Success).

Based on the current record and for the reasons stated by Petitioner as supported by Dr. Kyriakakis's testimony, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have had reason to combine Liao's teachings with Li's teachings in the way Petitioner proposes. *See* Pet. 18–20; Ex. 1003 ¶¶ 107–111. Based on the current record, Petitioner also establishes sufficiently that an ordinarily skilled artisan would have had a reasonable expectation of success in combining the teachings of the references. *See* Pet. 19; Ex. 1003 ¶ 107.

VI. ALLEGED OBVIOUSNESS OVER LI AND LIAO

Petitioner contends that claims 1 and 14 of the '582 patent are unpatentable under 35 U.S.C. § 103 as obvious over the collective teachings of Li and Liao. Pet. 18–42 (citing Exhibits 1004, 1005, respectively). Petitioner additionally relies upon the Declaration of Dr. Kyriakakis, as cited by Petitioner in support of institution. Pet. 18–42; *see* Ex. 1003 ¶¶ 103–149.

Patent Owner opposes Petitioner's contentions. Prelim. Resp. 19–53.

A. *Claim 1*

1. *Preamble [1pre]*

The preamble of claim 1 recites: “A loudspeaker apparatus, comprising:” Ex. 1001, 36:18.

Petitioner maps Preamble [1pre] “loudspeaker apparatus” to the Abstract and Figures 1–2 of Li. Pet. 21 (citing Ex. 1004, Abs. Figs. 1–2; Ex. 1003 ¶¶ 112–113).⁷

At this stage of the proceeding, Patent Owner makes no arguments specific to the preamble of claim 1. *See, e.g.*, Prelim. Resp. 12–46. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Generally, a preamble does not limit a claim. *Allen Eng’g Corp. v. Bartell Indus., Inc.*, 299 F.3d 1336, 1346 (Fed. Cir. 2002). We need not decide whether the preamble limits claim 1, because based on the current record and for the reasons stated by Petitioner and supported by Dr. Kyriakakis’s testimony, Petitioner establishes sufficiently for purposes of institution that Li teaches claim 1’s preamble. *See* Pet. 21; Ex. 1003 ¶¶ 112, 113.

Therefore, at this stage, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach the preamble [1pre].

2. Limitation [1a]

Limitation [1a] of claim 1 recites: “an ear hook including a first plug end and a second plug end,” Ex. 1001, 36:19–20.

⁷ We refer throughout this Decision to our preliminary assessment of the respective Li and/or Liao *best teachings* of the particular claim 1 limitations argued and mapped by Petitioner, and do not exclude from further consideration the remaining Li and/or Liao teachings cited by Petitioner for each respective identified claim 1 limitation. *See generally* Pet.

a. Petitioner's Argument Regarding Limitation [1a] to Li

Petitioner argues Li teaches limitation [1a] “an ear hook including a first plug end and a second plug end.” Pet 22 (citing Ex. 1004 ¶¶ 23, 25–26, Fig. 1; Ex. 1003 ¶ 114).

Petitioner contends that Li renders obvious limitation [1a] for several related reasons. *See* Pet. 21–28. First, Petitioner asserts that Li's bone conduction earphone includes ear hook assembly 11 with connecting component 113 that “can directly contact the ear and support the bone conduction earphone.” *Id.* at 22 (citing Ex. 1004 ¶¶ 23, 25–26; Ex. 1003 ¶ 114). As support, Petitioner provides the following annotated version of Li's Figure 1 on page 22 of the Petition:

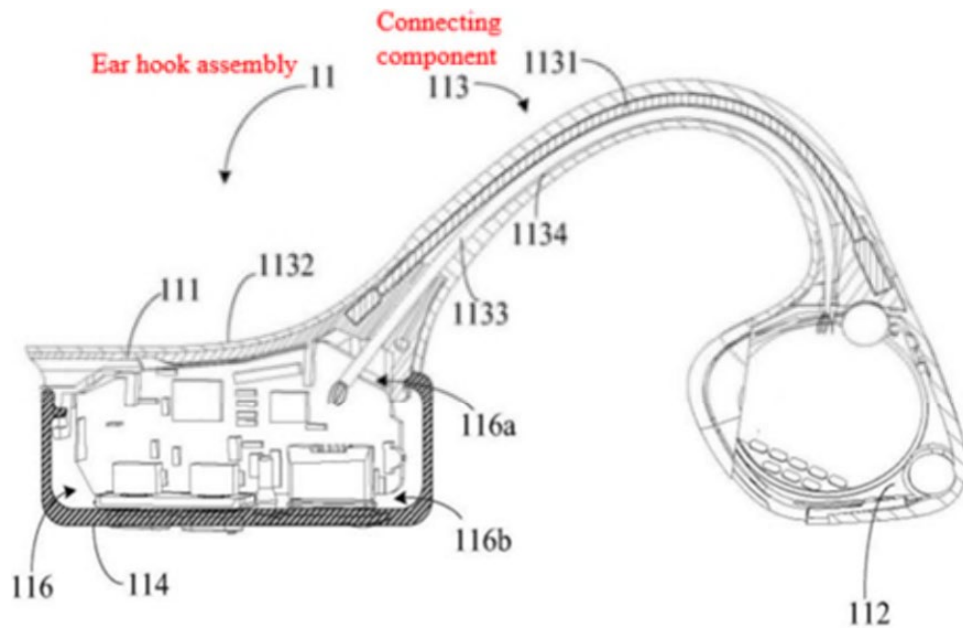


Figure 1 illustrates ear hook assembly 11 including “a first housing 111, a second housing 112, and a connecting component 113 connecting the first housing 111 and the second housing 112.” Ex. 1004 ¶ 23, Fig. 1. The above annotated version of Figure 1 includes the red annotation “Ear hook assembly” by reference numeral 11 and the red

annotation “Connecting component” by reference numeral 113. *See* Pet. 22 (citing Ex. 1003 ¶ 115).

Second, Petitioner asserts that Li’s bone conduction earphone includes second elastic metal wire 121 with plug-in portions 123 provided at both ends of second elastic metal wire 121 and connected to “the first housings 111 of the two ear hook assemblies 11.” Pet. 22 (citing Ex. 1004 ¶ 58, Figs. 2, 9). As support, Petitioner provides the following annotated version of Li’s Figure 9 (as reproduced on page 23 of the Petition):

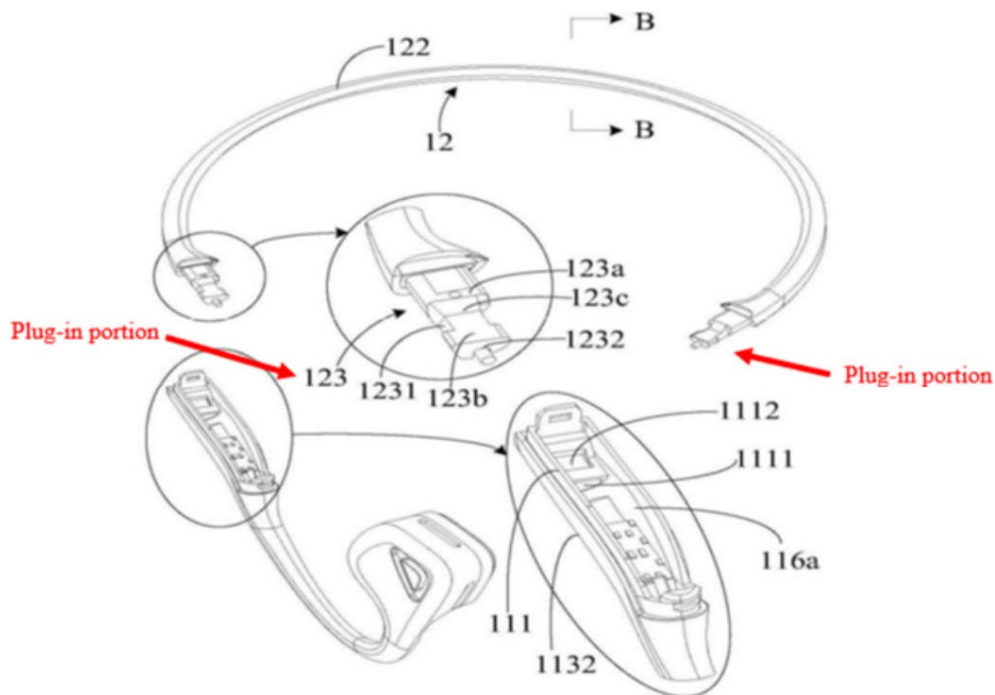


Figure 9 illustrates plug-in portion 123 including “a first plug-in section 123a connected to the second elastic metal wire 121, and a second plug-in section 123b connected to the first plug-in section 123a and located away from the second elastic metal wire 121.” Ex. 1004 ¶ 62, Fig. 9. The above annotated version of Figure 9 includes the red annotation “Plug-in portion” on the left with a red arrow identifying reference numeral 123 and the red annotation “Plug-in portion” on the right with a red arrow identifying

plug-in portion 123 at an end of second elastic metal wire 121. *See* Pet. 23; Ex. 1003 ¶ 116.

Third, Petitioner asserts that an ordinarily skilled artisan “would have found it obvious to include a first plug end in Li’s ear hook using the same general design” as plug-in portions 123 because:

- (1) modular portions of headsets were well known as of the ’582 patent’s priority date, including modular speaker portions of headsets;
- (2) speaker portions of headsets “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”;
- (3) a skilled artisan would have been motivated to use “known modular electrical connections such as pins and contacts commonly found in jacks, and plugs” 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” to beneficially reduce “manufacturing costs and complexity”; and
- (4) a skilled artisan would have been motivated 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” and because the modification “would have achieved the well-known benefits of a modular speaker.”

Pet. 24–25 (emphases omitted) (citing Ex. 1003 ¶¶ 116–117; Ex. 1004 ¶¶ 24, 69; Ex. 1011 ¶¶ 6–7, 30–32, Fig. 2; Ex. 1012, 2:4–15, 3:13–35, Fig. 2; Ex. 1013, 10:62–11:8, Fig. 1; Ex. 1014 ¶¶ 4, 17, Fig. 1; Ex. 1015, 2:6–17,

5:33–6:17, 6:65–7:42, Figs. 5, 7; Ex. 1016 ¶¶ 56, 79, 85, 96; Ex. 1019 ¶¶ 9–15, 31, 35, 45, Figs. 1–15).

Additionally, Petitioner contends that the '582 patent “mentions reducing manufacturing cost and adjusting for design changes as a benefit of its modular design, which modular designs were known to do.” Pet. 25 (citing Ex. 1001, 11:58–12:3, 16:21–32; Ex. 1003 ¶ 117).

Fourth, Petitioner asserts that an ordinarily skilled artisan would have been motivated 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” and because the modification would have achieved the “well-known modular earphone benefits.” Pet. 26 (emphasis omitted) (citing Ex. 1004 ¶ 59; Ex. 1012, 2:4–15; Ex. 1014 ¶ 4; Ex. 1015, 2:6–17; Ex. 1016 ¶¶ 56, 79, 85, 96). Petitioner asserts that those benefits include “simplifying the structure, reducing the weight of bone conduction earphones, facilitating later wiring, and reducing costs.” Pet. 27 (citing Ex. 1004 ¶ 59).

Fifth, Petitioner asserts that it would have been obvious to an ordinarily skilled artisan to modify Li’s ear hook assembly 11 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” because:

(1) “Li already discloses plug ends in its design”; Pet. 27 (citing Ex. 1004 ¶ 59);

(2) 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”; Pet. 26–27 (citing Ex. 1004 ¶ 59);

(3) Li recognizes the benefits of plug ends “in a modular earphone design, including reducing earphone size, simplifying the structure, facilitating later wiring, and reducing manufacturing costs and complexity;” Pet. 27–28 (citing Ex. 1004 ¶ 59), and;

(4) a skilled artisan would have recognized that the benefits of plug ends “would be further realized by adding plug ends to other components of the earphones, including on either end of connecting component 113.” Pet. 28 ((alteration by Petitioner) (emphases omitted) (quoting Ex. 1004 ¶ 59) (citing Ex. 1003 ¶¶ 121–122; Ex. 1004 ¶ 23)).

According to Petitioner, adding a plug end at each end of connecting component 113 “would require nothing more than adding Li’s already designed plug ends to that portion of the device.” Pet. 28; *see id.* at 51, 53, 55 (explaining that the plug location “is simply moved to both ends of the ear hook”).

b. Patent Owner’s Opposing Arguments Regarding Limitation [1a]

Patent Owner disputes that Li renders obvious limitation [1a]. *See, e.g.,* Prelim. Resp. 19–26. Patent Owner asserts that the “Petition first fails to show that any of its references teach an ear hook having first and second plug ends *at all*. The Petition (at 21) maps the ‘ear hook’ to a ‘connecting component’ 113 on an ear hook assembly 11.” Prelim. Resp. 21 (citing Ex. 1004, Fig. 1, as annotated in Petition 21).

In particular, Patent Owner contends that Li does not disclose “plug ends between the connecting component 113 and the first and second

housings 111 and 112 on either end.” *Id.* at 22. Patent Owner argues that the “Petition does not even argue that the connecting component 113 (*i.e.*, the ‘ear hook’) has plug ends. Rather, as the Petition relies (at 22–23) on ‘plug-in portions’ 123 at the end of a ***different component***, a ‘second elastic metal wire’ 121 on a ‘rear hook assembly.’” Prelim. Resp. 24 (citing Ex. 1004 ¶ 58; Figs 2, 9).

Patent Owner argues that the “second elastic metal wire 121 is a distinct component from the connecting component 113 that Petitioner identifies as the ‘ear hook.’” Prelim. Resp. 25 (citing Ex. 1004, annotated Figs 2 and 9). Patent Owner asserts that the “Petition does not suggest that the elastic metal wire 121, nor any other portion of the rear hook assembly 12, constitutes an ‘ear hook,’ and it is not.” *Id.* Patent Owner thus contends the “Petition fails to demonstrate that Li ’492 teaches an ear hook having a first plug end and a second plug end.” *Id.* at 26.

Patent Owner argues that “[d]espite the clear absence of plugs at the ends of Li ’492’s ear hook, the Petition nevertheless argues (at 23–28) that it would have been obvious to a POSITA to add them.” Prelim. Resp. 26. Patent Owner notes: “As discussed with respect to elements [1c] and [1f] below, this feature is absent from Petition’s references, and a POSITA would not have had any reason for adding the claimed plugs, and would not have found such contrived modifications obvious.” *Id.*

Regarding the seven “Interchangeable Audio Headset Prior Art” references, Patent Owner asserts that the Petition’s arguments regarding the claimed “plug ends” in the configuration claimed all rely on assertions that a POSITA would have known to duplicate Li ’492’s plugs into different positions on the headset based on teachings obtained from the

‘Interchangeable Headset Prior Art.’” Prelim. Resp. 35. Patent Owner contends “the Petition fails to explain why, much less present any evidence, that a POSITA would have been motivated to incorporate those teachings into the specific headphone structure described by Li ’492.” *Id.* Patent Owner argues: “Nor does the Petition explain why the various teachings that it cites would lead to a plug between an ear hook and a core housing containing a speaker.” *Id.*

Patent Owner asserts that Petitioner fails to explain why an ordinarily skilled artisan would have been motivated to incorporate the teachings of these references into Li’s specific headphone structure to yield plug ends of an ear hook, as required by claim 1. *Id.* at 38. Patent Owner also asserts that Petitioner fails to analyze or discuss “the similarities or differences between each” of the seven “Interchangeable Audio Headset Prior Art” references and “how or why” an ordinarily skilled artisan would have combined them. *Id.*

Regarding Petitioner’s contention that the ’582 patent “mentions reducing manufacturing cost and adjusting for design changes as a benefit of its modular design,” Patent Owner asserts that Petitioner improperly relies on hindsight obtained from the ’582 patent instead of “a teaching from the prior art.” Prelim. Resp. 38–39 (quoting Pet. 25–26).

Additionally, Patent Owner contends that Li teaches away from Petitioner’s proposed modifications to add a plug at each end of connecting component 113. *Id.* at 39, 41. Specifically, Patent Owner asserts that Li teaches using injection molding to form the housings at each end of connecting component 113 to advantageously:

- (1) make the connections “more stable”;

(2) enhance “the sense of unity and texture of the bone conduction earphone”; and

(3) make “the structure of the bone conduction earphone more compact and lightweight.”

Id. at 39 (quoting Ex. 1004 ¶ 29).

Patent Owner also asserts that Petitioner’s proposed modifications to add a plug at each end of connecting component 113 “would negate all these goals” and “result in a significantly more complex structure.” Prelim.

Resp. 39. Patent Owner explains:

(1) when Li’s teaching to “join the housings and connecting component with integrated injection molding is applied to the preferred embodiment of a binaural headset, there will be only three separately molded assemblies.” *Id.* at 39.

(2) Petitioner’s proposed modifications to add a plug at each end of connecting component 113 would split the headset into seven separately molded assemblies joined by six plugs. *Id.* at 40.

c. Our Preliminary Finding Regarding Limitation [1a]

Based on the current record and for the reasons explained below, Petitioner establishes sufficiently for purposes of institution that Li renders obvious limitation [1a.] *See* Pet. 21–28; Ex. 1003 ¶¶ 114–116, 118–119, 120–122. First, Li’s bone conduction earphone includes ear hook assembly 11 with connecting component 113 that “can directly contact the ear and support the bone conduction earphone.” Ex. 1004 ¶¶ 23, 25–26, Fig. 1; *see* Ex. 1003 ¶¶ 57, 116; Pet. 21–22. Furthermore, as Li’s Figures 2 and 9 show, “there are two ear hook assemblies 11, and the bone conduction

earphone further includes a rear hook assembly 12.” Ex. 1004 ¶ 58, Figs. 2, 9; *see* Ex. 1003 ¶¶ 57, 117; Pet. 22–23.

Second, Li’s bone conduction earphone also includes the following components:

- (1) first housing 111 arranged at the rearward end of each connecting component 113;
- (2) second housing 112 arranged at the forward end of each connecting component 113;
- (3) third housing 114 cooperating with first housing 111 “to form a first accommodating space 116 for accommodating” either battery pack 13 or control circuit assembly 14;
- (4) fourth housing 115 cooperating with second housing 112 “to form a second accommodating space 117 for accommodating” a bone conduction speaker; and
- (5) first elastic metal wire 1131 “connecting the first housing 111 and the second housing 112 at both ends.”

Ex. 1004 ¶¶ 23, 43, 46, 70, Fig. 2; *see* Ex. 1003 ¶¶ 57, 117; Pet. 21–23.

Third, rear hook assembly 12 includes plug-in portions 123 at both ends with plug-in portions 123 “connected and fixed to the first housings 111 of the two ear hook assemblies 11.” Ex. 1004 ¶ 58, Figs. 2, 9; *see* Ex. 1003 ¶¶ 57, 117; Pet. 24.

Fourth, based on the current record, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have had reason to modify Li to add:

- (1) “a first plug end to Li between the ear hook and earphone core” comprising second housing 112 cooperating with fourth housing 115; and

(2) “a second plug end to Li between the ear hook and circuit housing” comprising first housing 111 cooperating with third housing 114. *See* Ex. 1003 ¶¶ 117–119 (emphases omitted); Pet. 22–28 (emphases omitted).

The added plug ends would have the “same general design” as plug-in portions 123 and would reside at each end of connecting component 113 to connect it with first housing 111 and second housing 112. *See* Ex. 1003 ¶¶ 118, 123; Pet. 25, 29. Thus, the proposed modifications “would require nothing more than adding Li’s already designed plug ends” to connecting component 113. *See* Ex. 1003 ¶ 123; Pet. 30.

Based on the current record, Petitioner establishes sufficiently for purposes of institution that an ordinarily skilled artisan would have had reason to modify Li to add a plug at each end of connecting component 113 to obtain the well-known benefits of modular component design. *See* Ex. 1003 ¶¶ 76, 118–121, 123; Pet. 19–20, 25–28. Those benefits include, among other things, reduced manufacturing costs, e.g., “due to the simple shape of components,” “facilitating later wiring,” reduced costs when replacing components, and facilitating upgrades. *See* Ex. 1003 ¶¶ 76, 118–121, 123; Pet. 21–28.

Based on the current record, we are unpersuaded by Patent Owner that Li teaches away from Petitioner’s proposed modifications to add a plug at each end of connecting component 113. *See* Prelim. Resp. 39, 41.

A “reference does not teach away” if “it merely expresses a general preference for an alternative invention but does not ‘criticize, discredit, or otherwise discourage’ investigation into the invention claimed.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327

(Fed. Cir. 2009) (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)).

Li expresses a general preference for connecting first housing 111 and second housing 112 to the two ends of first elastic metal wire 1131 in connecting component 113 by injection molding. Ex. 1004 ¶¶ 29, 35, dependent claims 2 and 7. For example, Li explains that “[o]ptionally, the first housing 111 and the second housing 112 are fixedly connected to both ends of the first elastic metal wire 1131 by injection molding.” *Id.* ¶ 29. Li does not “criticize, discredit, or otherwise discourage” using a plug to connect a housing to connecting component 113. *See, e.g., id.* ¶¶ 29, 35.

Instead, Li discloses using plugs to mechanically connect components, i.e., to connect rear hook assembly 12 to “the first housings 111 of the two ear hook assemblies 11.” Ex. 1004 ¶ 58, Figs. 2, 9; *see* Ex. 1003 ¶¶ 57, 117, 122. Li similarly discloses using mechanical connectors comprising a clamping portion that engages with a locking portion to connect components, e.g., to “fix the first housing 111 and the third housing 114 together” and “fix the second housing 112 and the fourth housing 115 together.” Ex. 1004 ¶¶ 44–45. Li identifies these mechanical connectors as alternatives to adhesive bonding and “fasteners such as screws.” *Id.* ¶ 44; *see id.* ¶ 59 (identifying plugs as alternatives to “screw fixation”).

Hence, we determine Li discloses a variety of ways to connect components in a bone conduction earphone but does not appear to “criticize, discredit, or otherwise discourage” any of those ways. *See, e.g.,* Ex. 1004 ¶¶ 29, 35, 44–45, 58–59, Figs. 2, 9; *see* Ex. 1003 ¶¶ 57, 117, 121.

As Patent Owner contends, Li does not disclose “plug ends between the connecting component 113 and the first and second housings 111

and 112 on either end.” *See* Prelim. Resp. 22–23. Based on the current record, however, the absence of that disclosure in Li does not matter because Petitioner identifies a reason with rational underpinning to modify Li to add a plug at each end of connecting component 113, i.e., to obtain the well-known benefits of modular component design. *See* Ex. 1003 ¶¶ 76, 118–121, 123; Pet. 18–20, 23–28. Hence, at this preliminary stage, we are unpersuaded by Patent Owner’s assertion that an ordinarily skilled artisan would not have had “any reason for adding the claimed plugs” to connecting component 113. *See* Prelim. Resp. 26.

Although Li’s paragraph 59 discusses the advantages of using plug-in portions 123 with rear hook assembly 12 to connect rear hook assembly 12 to each first housing 111, Petitioner relies on an ordinarily skilled artisan’s knowledge to demonstrate that a skilled artisan would have recognized that the benefits of plug ends “would be further realized by adding plug ends to other components of the earphones, including on either end of connecting component 113.” Pet. 28; Ex. 1003 ¶ 121–122; *see* Pet. 18–28; Ex. 1003 ¶¶ 76, 118–121; Ex. 1004 ¶ 59.

An ordinarily skilled artisan’s knowledge is “part of the store of public knowledge that must be consulted when considering whether a claimed invention would have been obvious.” *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013). Hence, a patent challenger may rely on an ordinarily skilled artisan’s knowledge to establish obviousness. *See, e.g., Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337–38 (Fed. Cir. 2020) (“*Philips*”); *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015). For instance, the Supreme Court stated in *KSR* that determining “whether there was an apparent reason to

combine the known elements in the fashion claimed by the patent at issue” may involve analyzing “the background knowledge possessed by a person having ordinary skill in the art.” *KSR*, 550 U.S. at 418. Furthermore, the Federal Circuit stated in *Randall* that “well-documented knowledge” could “easily explain why an ordinarily skilled artisan would have been motivated to combine or modify the cited references to arrive at the claimed inventions.” *Randall*, 733 F.3d at 1356, 1362.

To show “the background knowledge possessed by a person having ordinary skill in the art,” Petitioner cites documentary evidence consisting of prior art. Pet. 17–18 (citing Ex. 1003 ¶¶ 72–101; Ex. 1004 ¶¶ 2, 5, 24, 40; Ex. 1011 ¶ 7, Fig. 2; Ex. 1012, 2:4–15, 3:13–35, Fig. 2; Ex. 1013, 10:62–11:8, 22:23–23:2, 23:64–24:8, Figs. 1, 17, 19; Ex. 1014 ¶¶ 4, 15, 17, Figs. 1, 3; Ex. 1015, 2:6–17, 4:2–5, 5:19–6:17, 6:65–7:42, Figs. 3, 5, 7; Ex. 1016 ¶¶ 56, 79, 85, 96; Ex. 1019 ¶¶ 9–15, 31, 35, 45, Figs. 1–15). Petitioner additionally cites to various exhibits that demonstrate, inter alia, that documentary evidence teaches the benefits of modular component design. *See, e.g.*, Ex. 1011 ¶¶ 6–7, 30–37, Fig. 2; Ex. 1012, 2:4–15; Ex. 1013, 10:62–11:8, 22:23–23:2, 23:64–24:8, Figs. 1, 17, 19; Ex. 1014 ¶¶ 4–5, 14–17, Figs. 1, 3; Ex. 1015, 2:6–17, 4:2–5, 5:19–6:17, 6:65–7:42, Figs. 3, 5, 7; Ex. 1016 ¶¶ 56, 79, 85, 96).

As an example, Hupkes teaches that “easily exchangeable” speaker modules beneficially allow a user to eliminate discomfort “not apparent to the user when the user tests the headset prior to purchase.” *See* Ex. 1011 ¶¶ 6–7, 30–37. As another example, Chen teaches that modular speaker components beneficially allow “different configurations with different functions [to] be selectively used” and “provid[e] the desired sound effects

and quality, sav[e] the costs and bring[] convenience to the user.” *See* Ex. 1014 ¶¶ 4–5, 14–17. As yet another example, Bellas teaches that (1) “removable” components “can provide headphone users with increased mobility and/or flexibility” and (2) components having “a relatively simple shape . . . can lower production costs.” Ex. 1016 ¶¶ 56, 96.

Patent Owner’s assertion that Petitioner fails to explain why an ordinarily skilled artisan would have been motivated to incorporate the teachings of the seven “Interchangeable Audio Headset Prior Art” references into Li’s “specific headphone structure” to yield plug ends of an ear hook as required by claim 1 does not address the relevant inquiry. *See* Prelim. Resp. 37. The relevant inquiry is whether a skilled artisan would have been motivated to combine Li’s teachings with the skilled artisan’s knowledge about the benefits of modular component design. *See Philips*, 948 F.3d at 1338.

Similarly, Patent Owner’s assertion that Petitioner fails to analyze or discuss “the similarities or differences between each” of the seven “Interchangeable Audio Headset Prior Art” references and “how or why” an ordinarily skilled artisan would have combined them lacks merit. *See* Prelim. Resp. 40. We do not understand Petitioner to propose combining the seven “Interchangeable Audio Headset Prior Art” references with each other or with Li. *See* Pet. 19–20, 25–30.

If, as Patent Owner asserts (Prelim. Resp. 39), Petitioner’s proposed modifications to add a plug at each end of connecting component 113 would “result in a significantly more complex structure,” that does not preclude obviousness. A patent challenger does not need to show “that a combination is ‘the *best* option, only that it be a *suitable* option.’” *Intel Corp. v.*

Qualcomm Inc., 21 F.4th 784, 800 (Fed. Cir. 2021) (emphases by the court) (quoting *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d 1186, 1197–98 (Fed. Cir. 2014)).

Furthermore, a “given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine.” *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed Cir. 2006). The “benefits, both lost and gained, should be weighed against one another.” *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000). This issue is better resolved at trial on a more developed record.

Additionally, at this preliminary stage, we are not persuaded by Patent Owner that Petitioner improperly relies on hindsight obtained from the ’582 patent instead of “a teaching from the prior art” about the benefits of modular component design. *See* Prelim. Resp. 38. Petitioner contends that the ’582 patent “mentions reducing manufacturing cost and adjusting for design changes as a benefit of its modular design, which modular designs were known to do.” Pet. 27 (citing Ex. 1001, 11:66–12:11, 16:29–40; Ex. 1003 ¶ 119). As we understand Petitioner’s contention, Petitioner points out that the ’582 patent’s disclosure comports with the prior art’s teachings about the benefits of modular component design.

Accordingly, at this stage, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1a].

3. Limitation [1b]

Limitation [1b] of claim 1 recites: “the ear hook being surrounded by a protective sleeve, the protective sleeve being made of an elastic waterproof material.” Ex. 1001, 36:20–22.

Petitioner argues Li teaches limitation [1b] (“the ear hook being surrounded by a protective sleeve, the protective sleeve being made of an elastic waterproof material”). Pet. 29–30 (citing Ex. 1004 ¶¶ 26, 28, 30, 71, 73; Figs. 1, 3; Ex. 1003 ¶¶ 124–125).

Regarding limitation [1b], Patent Owner does not provide substantive arguments against the specific paragraphs and Figures of Li relied upon by Petitioner. *See generally* Prelim. Resp. Nor does Patent Owner provide substantive argument against Dr. Kyriakakis’s testimony (Ex. 1003 ¶¶ 124–125) supporting Petitioner’s argument regarding limitation [1b]. *Id.* Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the record at this stage of the proceeding, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1b].

4. *Limitation [1c]*

Limitation [1c] of claim 1 recites: “a core housing for accommodating an earphone core, the core housing being fixed to the first plug end and elastically abutted against the protective sleeve, wherein.” Ex. 1001, 36:27–29.

a. *Petitioner’s Mapping Regarding Limitation [1c] to Li*

Petitioner argues Li teaches [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, wherein.” Pet. 30–33 (citing Ex. 1004 ¶¶ 36, 43, 58–59; Figs. 1–2; Ex. 1003 ¶¶ 126–132). Petitioner contends that Li renders obvious the core housing being “elastically abutted against the protective sleeve.” *Id.* at 30–33. Specifically, Petitioner asserts

that Li teaches a housing “elastically abutted against the protective sleeve” because:

(1) Li’s bone conduction earphone includes rear hook assembly 12 comprising “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”;

(2) the “second elastic coating layer 122 may be silicone, rubber, latex, or a composite including silicone”; and

(3) “[a]s shown in Figure 2, the second elastic coating layer 122 abuts the third housing 114 at the plug-in portion 123.”

Id. at 31–32 (citing Ex. 1003 ¶¶ 129–130; Ex. 1004 ¶ 58, Fig. 2).

Additionally, Petitioner asserts that Li discloses first elastic coating layer 1132 of connecting component 113 covering at least part of Li’s core housing, i.e., second housing 112 and fourth housing 115, because Li explains that “the first elastic coating layer 1132 further covers at least [a] portion of the outer surfaces of the first housing 111 and the second housing 112, such as the entire outer surface.” Pet. 33 (quoting Ex. 1004 ¶ 36; Ex. 1003 ¶¶ 131–132).

Furthermore, Petitioner asserts that “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.” Pet. 33 (citing Ex. 1004 ¶ 36). Therefore, according to Petitioner, it would have been obvious to an ordinarily skilled artisan “to have elastic coating over all of the entire bone conduction earphone to achieve the same benefit.” *Id.* (citing Ex. 1003 ¶¶ 131–132).

b. Patent Owner's Opposing Arguments Regarding Limitation [1c]

Turning to Patent Owner's arguments, we note Patent Owner advances arguments regarding limitation [1c] in *two separate sections* of the Preliminary Response. *See* Prelim. Resp. 26–29, 42–44.

Patent Owner disputes that Li renders obvious the core housing being “elastically abutted against the protective sleeve.” *See* Prelim. Resp. 26–29, 42–44. In particular, Patent Owner contends that Li does not “teach joining the connecting component 113 to the first housing in such a way that the core housing elastically abuts the protective sleeve.” *Id.* at 27. Patent Owner contends that Li teaches that the two housings 111 and 112 “are fixed at both ends of the connecting component by injection molding” so that “the elastic coating layer covers at least portions of all three,” i.e., connecting component 113 and the two housings 111 and 112. *Id.* at 27–28, 43 (citing Ex. 1004 ¶¶ 29, 36).

According to Patent Owner, nothing in Li's disclosure about joining connecting component 113 and the two housings 111 and 112 by injection molding “suggests any benefit to adding a connection formed by a plug with a protective sleeve abutted against a housing.” *Id.* at 44.

Furthermore, Patent Owner asserts that Li achieves the benefits of an elastic coating, such as wear resistance, by “fixing the housings to the connecting component by injection molding, not by plug junctions.” Prelim. Resp. 44. Patent Owner also asserts that Petitioner “fails to explain why replacing the fixed injection-molded connections with plug junctions would improve such wear resistance.” *Id.*

Regarding Li's Figure 2, Patent Owner contends that Petitioner erroneously asserts “without any further explanation, that ‘[a]s shown in

Figure 2, the second elastic coating layer 122 abuts the third housing 114 at the plug-in portion 123.” Prelim. Resp. 42 (alteration by Patent Owner) (quoting Pet. 32).

According to Patent Owner, Figure 2 is an “exploded” illustration depicting many components separated from each other rather than assembled, and Figure 2 “does not show whether the second elastic coating layer 122 and the third housing 114 make contact at all, much less whether they ‘elastically abut[]’ in the claimed manner.” *Id.* at 42–43. Patent Owner contends that Petitioner does not explain how an ordinarily skilled artisan would have gleaned the “elastically abutted” limitation from Figure 2. *Id.* at 43.

c. Our Preliminary Finding Regarding Limitation [1c]

Based on the current record and for the reasons explained below, Petitioner establishes sufficiently for purposes of institution that Li renders obvious the core housing being “elastically abutted against the protective sleeve.” *See* Pet. 31–33; Ex. 1003 ¶¶ 129–132.

Specifically, as Petitioner asserts, Li teaches a housing “elastically abutted against the protective sleeve.” *See* Ex. 1003 ¶ 129–130; Ex. 1004 ¶ 58, Figs. 2–3, 5, 9–10; Pet. 30–33. Li’s bone conduction earphone includes rear hook assembly 12 comprising “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.” Ex. 1004 ¶ 58, Figs. 2, 5, 9–10; *see* Ex. 1003 ¶¶ 129–130. “[T]he second elastic coating layer 122 is a silicone layer” and “can also be a rubber layer or a latex layer, or a composite material layer including silicone.” Ex. 1004 ¶ 58; *see* Ex. 1003 ¶ 130. We are persuaded

at this preliminary stage that an ordinarily skilled artisan would have understood that silicone may serve as a protective waterproof covering for electronic audio devices. *See* Ex. 1003 ¶ 125.

Li's figures show that second elastic coating layer 122 abuts a housing when "plug-in portions 123 are respectively connected and fixed to the first housings 111 of the two ear hook assemblies 11." *See* Ex. 1004 ¶ 58, Figs. 2–3, 5, 9–10. For instance, Li's Figure 10 (reproduced below) shows second elastic coating layer 122 with end portions extending over each plug-in portion 123 and abutting first housing 111 or third housing 114 (or both) when plug-in hole 1111 in first housing 111 receives plug-in portion 123:

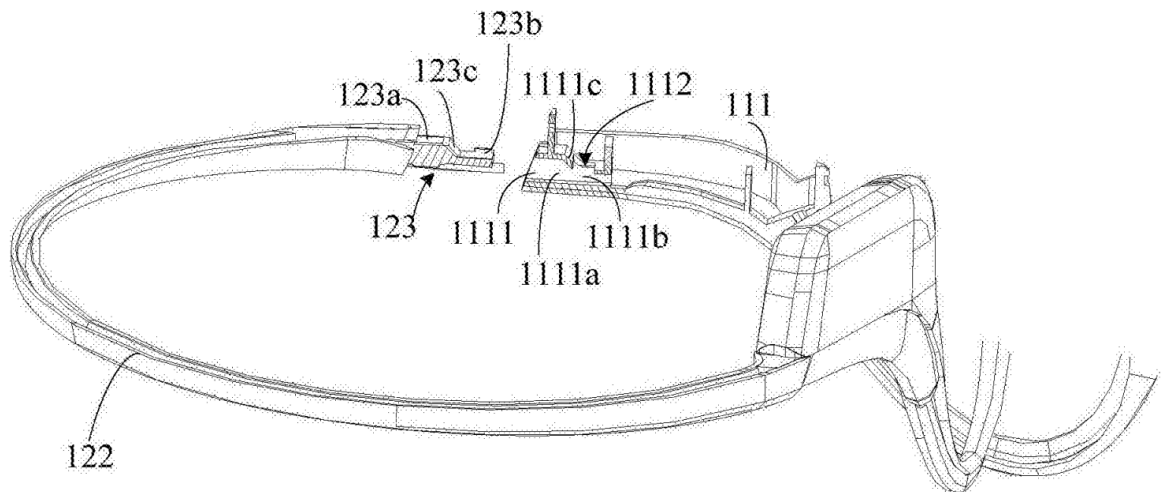


Figure 10 illustrates (1) second elastic coating layer 122 surrounding second elastic metal wire 121 (not shown in Figure 10), (2) an upper, center plug-in portion 123 ready for insertion into plug-in hole 1111 in first housing 111, and (3) a lower, right plug-in portion 123 (not labeled in Figure 10) inserted into plug-in hole 1111 in first housing 111 (not labeled in Figure 10). *See* Ex. 1004 ¶ 60, Fig. 10.

Second elastic coating layer 122 has the same shape in Figures 2, 5, 9, and 10. *See* Ex. 1004, Figs. 2, 5, 9–10. Hence, even if Figure 2 does not clearly show second elastic coating layer 122 contacting a housing as Patent

Owner argues (Prelim. Resp. 43–44), Li’s figures collectively show that feature. *See* Ex. 1004, Figs. 2, 5, 9–10.

Additionally, as Petitioner asserts, Li discloses first elastic coating layer 1132 of connecting component 113 covering at least part of Li’s core housing, i.e., second housing 112 and fourth housing 115. *See* Ex. 1003 ¶¶ 131–132; Ex. 1004 ¶ 36, Figs. 1–2; Pet. 33.

In particular, Li explains that “optionally, the first elastic coating layer 1132 further covers at least [a] portion of the outer surfaces of the first housing 111 and the second housing 112, such as the entire outer surface.” Ex. 1004 ¶ 36; *see* Ex. 1003 ¶ 131. For example, “the first elastic coating layer 1132 covers the first elastic metal wire 1131, at least a portion of the outer surface of the first housing 111, and at least a portion of the outer surface of the second housing 112 by injection molding.” Ex. 1004 ¶ 36.

As Li explains and an ordinarily skilled artisan would have understood, “the presence of the first elastic coating layer 1132 can further protect the housing and internal components, making the bone conduction earphone more wear-resistant.” *See* Ex. 1003 ¶ 131; Ex. 1004 ¶ 36. To obtain the benefit of improved wear resistance, an ordinarily skilled artisan would have been motivated to have a protective elastic coating cover the entire bone conduction earphone. Ex. 1003 ¶ 131.

Patent Owner’s assertion that Li achieves the benefits of an elastic coating, such as wear resistance, by “fixing the housings to the connecting component by injection molding, not by plug junctions” appears to mischaracterize Li. *See* Ex. 1004 ¶¶ 29, 35–36; Prelim. Resp. 44. Li does not describe wear resistance as a benefit due to using injection molding to

connect first housing 111 and second housing 112 with first elastic metal wire 1131. *See* Ex. 1004 ¶¶ 29, 35–36.

Instead, Li explains that using injection molding to connect first housing 111 and second housing 112 with first elastic metal wire 1131 “makes the connection between the first housing 111, the second housing 112, and the first elastic metal wire 1131 more stable, and enhances the sense of unity and texture of the bone conduction earphone, making the structure of the bone conduction earphone more compact and lightweight.” Ex. 1004 ¶ 29. Li separately explains that using injection molding to form first elastic coating layer 1132 such that it “covers at least [a] portion of the outer surfaces of the first housing 111 and the second housing 112, such as the entire outer surface,” beneficially “enhances the texture and unity of the bone conduction earphone” and first elastic coating layer 1132 “further protect[s] the housing and internal components, making the bone conduction earphone more wear-resistant.” *Id.* ¶ 36; *see* Ex. 1003 ¶ 131.

Patent Owner’s assertion that Petitioner “fails to explain why replacing the fixed injection-molded connections with plug junctions would improve such wear resistance” appears to mischaracterize Petitioner’s position. *See* Pet. 33; Prelim. Resp. 44. We do not understand Petitioner to argue that “replacing the fixed injection-molded connections with plug junctions would improve such wear resistance.” *See* Pet. 33; Prelim. Resp. 44. Instead, Petitioner explains that “having a coating of the protective sleeve over the entirety of the ear hook and the core housing” would beneficially improve wear resistance. *Id.* at 33 (emphases omitted).

For the reasons discussed above, we are persuaded that Li would have rendered obvious limitation [1c] to an ordinarily skilled artisan before the

effective filing date of the claimed invention. *See* Pet. 30–33; Ex. 1003 ¶¶ 127–132. Therefore, at this stage, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1c].

5. *Limitation [1d]*

Limitation [1d] of claim 1 recites: “the core housing including a housing panel facing human body and a housing back panel opposite to the housing panel.” Ex. 1001, 18:50–53.

Petitioner argues this limitation is taught by Li. Pet 33–34 (citing Ex. 1004 ¶¶ 43, 49; Figs. 2–8; Ex. 1003 ¶ 133).

At this stage of the proceeding, Patent Owner does not substantively dispute Petitioner’s arguments regarding the specific paragraphs of Li relied upon by Petitioner. *See generally* Prelim. Resp. Nor does Patent Owner substantively dispute portions of Dr. Kyriakakis’s testimony relied upon by Petitioner. *See* Ex. 1003 ¶ 133. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378.

Based on the record at this stage of the proceeding, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1d].

6. *Limitation [1e]*

Limitation [1e] of claim 1 recites: “the vibration of the earphone core drives the housing panel and the housing back panel to vibrate, the vibration of the housing panel having a first phase, the vibration of the housing back panel having a second phase, wherein when the vibration frequencies of the housing panel and the housing back panel is within a range of 2000 Hz

to 3000 Hz, *an absolute value of a difference between the first phase and the second phase is less than 60 degrees.*” Ex. 1001, 36:30–38 (emphasis added regarding the disputed portion of the [1e] language).

Petitioner argues that this limitation is taught by Liao. Pet. 34–36 (citing Ex. 1005 ¶¶ 55–58, 78; Figs. 2-B) (emphasis added). Petitioner also persuasively argues that “a POSITA would have understood that in Liao, the vibration of panel 220 and housing 210 included the claimed range of 2000-3000 Hz, which overlap the disclosed frequencies.” *Id.* at 36 (citing Ex. 1003 ¶¶ 140–141).

We agree with Petitioner that Liao at paragraph 78 teaches two frequency ranges that each overlap the claimed [1e] “range of 2000 Hz to 3000 Hz,” as follows: “Preferably, the specific frequency range referred to here can be between 20 Hz-20,000 Hz, more preferably, the frequency range can be between 400 Hz-10,000 Hz.” *Id.* (citing Ex. 1005 ¶ 78). We also credit Dr. Kyriakakis’ testimony in this regard. Pet. 36 (citing Ex. 1003 ¶ 141.⁸

⁸ The Federal Circuit held in *Ormco Corp. v. Align Technology, Inc.*, 463 F.3d 1299, 1311 (Fed. Cir. 2006), “[w]here a claimed range overlaps with a range disclosed in the prior art, there is a presumption of obviousness.” The overlap need not be substantial to trigger the presumption. *In re Geisler*, 116 F.3d 1465, 1469 (Fed. Cir. 1997) (acknowledging that claimed invention was rendered prima facie obvious by prior art reference when disclosed range (50-100 Angstroms) overlapped claimed range (100-600 Angstroms)); *In re Woodruff*, 919 F.2d 1575, 1578 (Fed. Cir. 1990) (concluding that claimed invention was rendered obvious by prior art reference whose disclosed range (“about 1-5%” carbon monoxide) abutted claimed range (“more than 5% to about 25%” carbon monoxide)).

Furthermore, referring to Liao's Figure 2-B, Petitioner persuasively argues that a "POSITA would understand that if panel 220 is vibrating, housing 210 is also vibrating in phase (the absolute value of the phase difference is nearly zero) because panel 220 and the housing 210 are ***rigidly connected*** without connection members 240, as taught by Liao." Pet. 35 (citing Ex. 1005 ¶¶ 57, 58) (emphasis added).

Patent Owner focuses the argument on just the last portion of the [1e] language: "an absolute value of a difference between the first phase and the second phase is less than 60 degrees." Patent Owner disagrees that this portion of limitation [1e] is taught by Liao.

Patent Owner notes: "For this element, the Petition relies (at 35) entirely on a conclusory assertion that 'if panel 220 is vibrating, housing 210 is also vibrating in phase (the absolute value of the phase difference is nearly zero) because panel 220 and housing 210 are rigidly connected without connection members 250, as taught by Liao.'" Prelim. Resp. 44–45. Patent Owner further argues that "the Petition cites nothing in Liao explaining why this would be the case. Petitioner's only citations from Liao following this assertion are paragraphs [0057] and [0058]." *Id.* at 45. Patent Owner reproduces paragraphs 57 and 58 in their entirety in the Preliminary Response. Prelim. Resp. 45–46.

Based upon our review of the preliminary record, however, we find the first sentence of Liao's paragraph 58 is sufficient to teach the disputed portion of limitation [1e]. Specifically, Liao discloses an embodiment in which the panel (i.e., housing panel) can be ***directly*** attached to the housing back panel: "For example, if connection members are not used, the panel can

be *directly attached to the housing*, or connected to the housing by clamping or welding.” Ex. 1005 ¶ 58 (emphasis added).

We find this *direct attachment* between the housing panel and the housing back panel in Liao is sufficient at this stage to teach or at least suggest the disputed portion of the claim [1e] language: “an absolute value of a difference between the first phase and the second phase is less than 60 degrees.” We also credit Dr. Kyriakakis’ testimony in this regard. Pet. 36 (citing Ex. 1003 ¶ 140).

Therefore, at this stage, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1e].

7. *Limitation [1f]*

Limitation [1f] of claim 1 recites: “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 to generate a sound.” Ex. 1001, 36:38–42.

Petitioner argues that Li teaches the disputed limitation. Pet. 36 (citing Ex. 1004 ¶¶ 24, 46, 58, Figs. 1–2; Ex. 1003 ¶¶ 145–147). Petitioner contends that “Li’s third housing 114 and first housing 111 constitute the circuit housing for accommodating a control circuit or a battery.” Pet. 36 (quoting Ex. 1004 ¶ 46 (“[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.”) (citing Ex. 1004 ¶¶ 24, 58, Figs. 1–2)).

Petitioner further contends that “Li also discloses or renders obvious *the control circuit or the battery driving the earphone core to vibrate to generate a sound*:

[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.

Pet. 38 (citing Ex. 1004 ¶¶ 24, 46; Ex. 1003 ¶ 146).

Petitioner argues:

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.”

Pet. 38 (citing Ex. 1004 ¶ 58; Ex. 1003 ¶ 147).

Petitioner reproduces Figure 2 of Li in the Petition at page 39, and contends:

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];

Pet. 39 (citing Ex. 1003 ¶¶ 148–149).

Petitioner concludes: “The prior art teaches the benefits of modular circuit housing design, as described in [1a], and the design in Li would achieve these well-known benefits using structures already in use in Li.”

Pet. 40 (citing [1a]; Ex. 1003 ¶ 149).

Patent Owner disagrees and contends:

As with element [1c], the Petition fails to explain why Li '492 teaches the claimed “plug end” in the required configuration. The Petition’s discussion for element [1f] (at 39) just refers back to its discussion of element [1c], even though element [1f] requires a plug end connected to a different component than [1c]. The Petition never explains why its arguments for inserting a plug end at one end of the ear hook would apply to the other, much less why a POSITA would be motivated to modify Li '492 to add ***both*** plug ends.

Prelim. Resp. 31.

However, we have fully addressed limitation [1c] above and found Patent Owner’s arguments that the “Petition’s reliance on up to seven additional references to teach two critical claim elements results in a lack of particularity that results in voluminous and excessive grounds” to be unpersuasive. *See* Prelim. Resp. 34 (citing *Adaptics Ltd. v. Perfect Co.*, IPR2018-01596, Paper 20 at 24 (PTAB Mar. 6, 2019)).

As noted *supra* under section II(H)(1), we have found unpersuasive Patent Owner’s *lack of specificity* argument regarding the “Interchangeable Audio Headset Prior Art” relied on by Petitioner to teach the knowledge of a person of ordinary skill in the art. *See* Pet. 17–18. Therefore, for the reasons explained above, we disagree with Patent Owner that a “lack of specificity” in the Petition warrants denial of institution, or nullifies Petitioner’s proposed Ground 1 for limitation [1f].

As noted above, the Board’s rules require that a petition provide “a statement of the precise relief requested for each claim challenged,” including “specify[ing] where each element of the claim is found in the prior art patents or printed publications relied upon.” 37 C.F.R. § 42.104(b)(4). The Board’s rules also require that a petition include “a detailed explanation of the significance of the evidence.” 37 C.F.R. § 42.22(a)(2).

As noted above, and contrary to Patent Owner's assertions, the Petition satisfies these rules. *See* Pet. 1, 18–114.

Regarding limitation [1f], at this stage, we preliminarily find Petitioner has shown that Li (Ex. 1004) and Liao (Ex. 1005) collectively teach limitation [1f].

8. *Conclusion for Claim 1*

Having considered the arguments and evidence presented by both Petitioner and Patent Owner, we determine that Petitioner has established a reasonable likelihood that it would prevail in showing that the subject matter of independent claim 1 would have been obvious over the first proposed ground of unpatentability over the collective teachings of Li (Ex. 1004) and Liao (Ex. 1005).

B. *Remaining Claims 2–12, 14, and 16–20*

Patent Owner does not separately and substantively argue claims 2–12, 14, and 16–20 of the '582 patent as considered under the remaining challenges. *See generally* Prelim. Resp. Because the Petition demonstrates there is a reasonable likelihood of prevailing in establishing the unpatentability of at least one challenged claim of the '582 patent, it is unnecessary for us to provide an assessment of remaining claims 2–12, 14, and 16–20.

VII. CONCLUSION

After considering the arguments presented in the Petition, the Preliminary Response, and the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving

that at least claim 1 of the '582 patent is unpatentable as obvious over Li and Liao.

Accordingly, we institute an *inter partes* review of *all* challenged claims 1–12, 14, and 16–20 on *all grounds* 1–4 set forth in the Petition. *See* 37 C.F.R. § 42.108(a).

Our determinations at this stage of the proceeding are based on the evidentiary record currently before us. This decision to institute trial is not a final decision as to the patentability of any claim for which we have instituted an *inter partes* review. *See Trivascular, Inc. v. Samuels*, 812 F.3d 1056, 1068 (Fed. Cir. 2016) (noting that “there is a significant difference between a [P]etitioner’s burden to establish a ‘reasonable likelihood of success’ at institution, and actually proving invalidity by a preponderance of the evidence at trial”). We will base any final decision on the full record developed during trial.

VIII. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is instituted for all claims 1–12, 14, and 16–20 of the '582 patent on all four unpatentability grounds asserted in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial, which commences on the entry date of this decision.

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