

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC., META PLATFORMS TECHNOLOGIES, LLC, and
TWISTED PIXEL GAMES, LLC,
Petitioner,

v.

EIGHT KHZ, LLC,
Patent Owner.

IPR2023-01019
Patent 10,368,179 B1

PATENT OWNER'S RESPONSE TO THE PETITION
35 U.S.C. §316(a)(8), and 37 C.F.R. § 42.120

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EXHIBIT LIST

Ex.	Description
2001	Defendants' Preliminary Invalidity Contentions
2002	U.S. District Court Order in <i>Eight kHz, LLC v. Meta Platforms, Inc.</i> , No. 6:22-cv-00575-ADA-DTG (W.D. Tex. Jun. 3, 2022), Granting Motion to Extend Scheduling Order Deadlines
2003	Memorandum from Katherine K. Vidal on Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022)
2004	Lex Machina, Patent Cases (All Judges) Time to Trial, U.S. District Court for the Western District of Texas, September 9, 2023
2005	Lex Machina, Patent Cases (Judge Alan D. Albright) Time to Trial, U.S. District Court for the Western District of Texas, September 9, 2023
2006	Declaration of Dr. Durand R. Begault regarding U.S. Patent Nos. 10,368,179 and 10,448,184 (September 14, 2023) ("Begault")
2007	Curriculum Vitae (CV) of Dr. Durand R. Begault
2008	Defendant's Final Invalidity Contentions, Ex. E-10, October 18, 2023
2009	Defendant's Final Invalidity Contentions, Ex. D-10, October 18, 2023
2010	Defendant's Final Invalidity Contentions, October 18, 2023
2011	Defendant's Final Invalidity Contentions, Ex. F-09, October 18, 2023
2012	Declaration of Dr. Durand R. Begault regarding U.S. Patent Nos. 10,368,179 and 10,448,184 in support of Patent Owner's Response (April 2, 2024) ("Begault Supp.")
2013	Curriculum Vitae (CV) of Dr. Durand R. Begault (updated)
2014	Deposition transcript of Dr. Agnieszka Roginska, taken on February 27, 2024 ("Roginska Depo.")
2015	Excerpt from Merriam Webster's Dictionary, available at https://www.merriam-webster.com/dictionary/environment , accessed March 11, 2024

Patent Owner Eight KHZ, LLC submits this Patent Owner Response (“Response”) to the Petition for inter partes review (“IPR”) of claims 1-20 of U.S. Patent No. 10,368,179 (“‘179 patent”). Paper 2 (“Pet.”). Petitioner has not carried its burden of proving that any of the challenged claims is unpatentable; thus Patent Owner requests the Board issue a Final Written Decision finding all the challenged claims patentable.

I. INTRODUCTION

The ‘179 patent is entitled “Switching Binaural Sound,” and is generally directed to providing binaural sound to a user using a head mounted display (HMD), such as in a virtual reality environment, and altering the binaural sound after an event occurs. ‘179 patent (Ex. 1001); Begault Supp. ¶¶7, 13. The sound localization technology described in the ‘179 patent has applications in “augmented reality (AR), virtual reality (VR), ... and a host of other applications.” ‘179 patent, 2:50-55. The ‘179 patent discloses and claims a novel system and technique for modifying binaural audio when a user, wearing a wearable electronic device (WED), also referred to as a head mounted device (HMD), leaves an environment, as described further below.

As described in the ‘179 patent, binaural sound provides a user “with a superior ability to localize sounds in the 3D environment” because binaural sound accounts for “small differences to sound that arrives at one ear compared to sound

that arrives at the other ear.” ‘179 patent, 2:43-3:9. Thus, when a user wears the HMD, the user experiences generated binaural sound, which enhances the user experience. As acknowledged by Petitioner, binaural sound “enhance[s] realism and the sense of presence in VR environments.” Pet.4.

The ‘179 patent discloses using an alteration of the audio being provided to the user as an alert that the user is leaving an environment. In particular, the ‘179 patent describes that in response to an “event,” the binaural sound provided to the user is changed to stereo sound, mono sound, or altered binaural sound and that this change can serve as an alert to the user. ‘179 patent, 8:47-58, 25:21-34 (disclosing providing an audio or visual alert to a user). For example, the event may be a user moving from one virtual space to another virtual space, from one real space to another real space, or from one virtual space to a real space: “a person can receive binaural sound corresponding to one virtual or real or augmented space, and a switch occurs such that the person receives binaural sound from a second virtual or real or augmented space.” *Id.*, 12:45-49; *see also* Begault Supp., ¶31. The ‘179 patent provides numerous examples of events that may trigger the alteration of binaural sound provided to the user. *Id.*, 9:9-42; 28:9-18; Begault Supp. ¶¶34-47. Events “can be dynamic or static and selected by one or more of a user, a person, apparatus or machine, method, etc.” *Id.*, 9:5-8. Examples of events include:

- “a location (such as a location of ... a person listening to the sound ... position or movement or orientation of a person or head of the person (such as direction the person walks or head orientation of the person) ... safety (such as not localizing sound when the person is driving a vehicle), proximity to or being at a restricted area...” *Id.*, 9:12-34
- “a change in the ability to detect ... position in a physical or a virtual environment, or a change in the ability to detect an environment.” *Id.*, 28:9-18.

Furthermore, the ‘179 patent expressly states that “[e]xamples herein can take place in physical spaces, in computer rendered spaces (VR), in partially computer rendered spaces (AR), and in combinations thereof.” *Id.*, 44:55-57.

Systems in the prior art relied upon a stationary, external tracking device to determine when a user is leaving an environment, such as a stationary camera external to the wearable electronic device that defines the environment. *See, e.g.*, Clement (Ex. 1005) 4:22-27 (“a tracking device 310, such as, for example, a camera 310, is positioned in a physical, real world space 300, and is oriented to capture as large a portion of the space 300 as possible with its field of view. This tracking area 320 defined by, for example, the field of view and range of the tracking device 310...”). The invention as disclosed in the ‘179 patent, however, does not rely on a stationary tracking device to determine when a user is leaving the environment.

Instead, the ‘179 patent discloses using hardware/sensors in the wearable electronic device to make this determination, eliminating the need for a stationary, external tracking device. *Id.*, 15:34-37; 39:25-48; 40:51-41:14; 41:15-28; 41:58-42:6. Figure 20 shows a system including an electronic device 2002, which may be a wearable electronic device (e.g., a head mounted display). *Id.*, 39:9-12. The electronic device 2002 includes several components, such as a camera 2028, displays 2022, location or motion tracker 2032, sensors 2030, and a predictor 2042. The “location or motion tracker” 2032 includes, for example, several components that determine the user’s location without relying on a stationary tracking device, such as:

wireless electromagnet motion tracker, a system using active markers or passive markers, a markerless motion capture system, video tracking (e.g. using a camera), a laser, an inertial motion capture system and/or inertial sensors, facial motion capture, a radio frequency system, an infrared motion capture system, an optical motion tracking system, an electronic tagging system, a GPS tracking system, a compass, and an object recognition system (such as using edge detection)

Id. at 40:24-33.

The ‘179 patent provides many examples of events that trigger altering binaural sound. *Id.*, 13:57-60. In one embodiment, the ‘179 patent discloses using the predictor 2042 of the electronic device 2002 to predict or determine the events

using predictive models. *Id.*, 40:51-41:14. The predictive models use, for example, “artificial intelligence (including systems that use intelligent agents to *perceive environments and take action based on the perceptions*).” *Id.*, 41:15-28.¹ For example, an event occurs when a user leaves a physical environment, such as a user leaving a non-restricted area and entering an area that prohibits SLPs. *Id.*, 16:26-29. To determine when the user leaves the physical environment, the WED may use its onboard predictor to perceive an environmental boundary between non-restricted and restricted areas and when the user is crossing that environmental boundary, that is, when the user is leaving the environment. The WED may alternatively use other components in its location or motion tracker to make this determination. *Id.*, 40:24-33. The determination by the WED that the user is leaving the environment triggers alteration of the binaural sound. *Id.*, 13:47-59, 16:13-15.

The three independent claims of the ‘179 patent each recite warning/alerting the user that the user is leaving the environment or 3D virtual environment by changing the processing of the binaural sound. Claim 1 recites that the processing of the binaural sound is changed by “filtering ... the binaural sound to alter audio cues to prevent the user from experiencing external localization of the sounds.” Claim 7 recites that the processing of the binaural sound is changed by “altering

¹ Unless otherwise noted, emphasis has been added.

processing of the sound ... to degrade audio cues in order to prevent the user from experiencing external localization of the binaural sound.” And Claim 14 recites that the processing of the binaural sound is changed by “reducing a volume of the binaural sound that localizes from [a] virtual image and that is being provided to the user.” In addition, each of the independent claims requires sensing/determining when the user leaves the environment using the WED.

As established below, and as recognized by the Board in its Institution Decision (“Decision”; Paper 10), there is no motivation to combine the two primary prior art references—Clement and Sauk—because Sauk teaches away from the disclosure of Clement. Decision, 22; Begault, ¶39. First, Sauk is not directed to virtual reality games but instead discloses applications of its system in a real-life military reconnaissance mission. Sauk, 10:44-15:23; Roginska Depo. 254:2-255:3. Second, Sauk teaches *adding a binaural alert* to warn a user of a hazard so the user can determine direction of the hazard and move away. Decision, 20-21; Begault, ¶¶38-39. Sauk does not teach alerting or warning the user by altering the existing binaural audio to either lower the volume or prevent the user from experiencing external localization; indeed such actions would frustrate the purpose of Sauk because Sauk warns the user of the hazard by providing directional context to indicate the location of the hazard to the user. Accordingly, there is no motivation to

combine Sauk with Clement and thus, all of Petitioner's arguments that the challenged claims in Ground 1 are invalid based on this combination fail.

In addition, even if Clement and Sauk were a proper combination, they do not teach the following limitations, present in each independent claim:

- alerting or warning the user that the user is leaving the environment or 3D virtual environment by (i) altering the binaural sound provided to the user to “prevent the user from experiencing external localization” as required by claims 1 and 7 or (ii) reducing the volume of the binaural sound provided to the user as required by claims 1 and 14;
- determining, with the WED, when the user is leaving the environment, as required by claims 7 and 14, or sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment, as required by claim 1.

Thus, Petitioner failed to carry its burden of establishing that claims 1, 3-4, 6-10, and 14-19 are invalid over the prior art in Ground 1.

Petitioner's Ground 2 also fails because the immediate parent application to the '179 patent provides multiple examples and disclosures in which a POSITA would recognize a description of the claimed subject matter related to providing an alert that the user is leaving a physical environment and leaving a 3D virtual environment by modifying binaural sound properties. Thus, the disclosure in the

immediate parent application reasonably conveys possession of the invention to a POSITA, the '179 patent is entitled to its priority date of May 2, 2019, and Lyren and Reif are invalid prior art.

II. CLAIM CONSTRUCTION

Petitioner argues that no express claim constructions are required other than adopting Patentee's plain-meaning construction of "processing, by a [DSP]." Pet.6-7. In response to the Board's statements in the Decision, Patent Owner proposes certain claim constructions. Decision, 28.

In an IPR, claims are construed according to *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-17 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2020). In construing claims, courts look first to the intrinsic evidence. *See Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996). Courts may consider extrinsic evidence to resolve ambiguities that cannot be resolved through intrinsic evidence alone. *Id.* at 1583.

A. "Environment"

The term "environment" in independent claims 7 and 14 and associated dependent claims should be construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, to mean "physical surroundings in which a user operates."

The intrinsic evidence supports this construction. First, the specification explains that the term “environment” refers to *either* physical and/or virtual surroundings of the user. *See, e.g.*, ‘179 patent, 37:20-23 (explaining that environments are “physical and/or virtual”); *see also id.* at 30:56-60 (providing examples of a new environment including a game environment (e.g. virtual) or a busy street entered by a remote user (e.g., physical)). As discussed below, claim 1 uses a different term—3D virtual environment. Thus “environment” as used in claims 7 and 14 should be construed to mean physical environment. Second, the specification explains that even in physical environments, virtualized images and/or sounds may be presented, for example via a display and/or headphones. *See, e.g., id.*, 6:13-24 (displaying image of a friend while the friend’s voice is localized above the image); 6:35-37 (localizing sound to an empty passenger seat in a car); 7:12-15 (localizing sound and an image to an empty chair). For example, the specification provides a scenario where a user wears “an optical head mounted display ... during a conference call with four individuals, each individual being represented with a visual image and accompanying SLP.” *Id.*, 6:60-65. When one of the participants leaves the view of the user, the sound for that user is switched to mono and the visual image of the person is removed from the user’s display. *Id.*, 6:67-7:7. Thus, a physical environment may include virtual images and/or virtual sounds, as

contemplated by the claim language. *See, e.g.*, claims 7 and 14 “displaying ... a virtual image in an environment.”

The extrinsic record also supports this construction. Patent Owner’s expert agrees that the term “environment” as used in the ‘179 patent claims means physical environment. Begault Supp. ¶¶21-22. The dictionary definition of the word “environment” also supports this construction. *See, e.g.*, Webster’s Dictionary (Ex. 2015) (“the circumstances, objects, or conditions by which one is surrounded”).

B. “3D virtual environment”

The term “3D virtual environment” in independent claim 1 and associated dependent claims should be construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, to mean “three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound.”

The specification supports this construction. First, the specification explains that a “3D environment” may be a localized 3D soundscape where sounds can be localized to points around the listener. ‘179 patent, 2:40-46; see also Roginska Depo., 176:3-6 (acknowledging that a 3D soundscape could be a 3D virtual environment). Second, the specification discloses that the localized sound may be from a “virtual source of binaural sound to a point as being indistinguishable from a real-world source at the virtual point.” ‘179 patent, 3:36-39. Thus, the specification

clearly provides that the 3D virtual environment may be a virtual sound localized in a 3D soundscape.

The specification is replete with examples of virtual localized sound sources localized to virtual points within a 3D environment. *See, e.g.*, ‘179 patent, 6:13-24 (“the user 120 localizes the voice of the [intelligent personal assistant] to his left and localizes the voice of his friend in front of himself and above his laptop computer that is situated on his desk”); 6:34-40. The specification also describes that virtual images may be provided at these virtual points. ‘179 patent, 11:64-12:15; *see also* “scenario 110” (6:13-24) and “scenario 114” (6:60-65) (providing examples of visual images being presented such that they are perceived at the sound localization points). Notably, this disclosure in the specification shows that a 3D virtual environment does not require 3D visual immersion, or a “3D virtual world,” as suggested by the Board. Decision, 30. To the contrary, the specification provides that a 3D virtual environment may only include 3D audio, as shown above.

Further, the specification provides that each of these examples showing 3D virtualized images and/or audio (e.g., binaural audio presentation and/or adjustment) is not exclusive to “computer rendered spaces (VR)” but may also occur in “physical spaces” and “in partially computer rendered spaces (AR).” ‘179 patent, 44:55-57. Thus, based on the intrinsic record, “3D virtual environment” should be construed

to mean “three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound.”

This construction is also consistent with how a POSITA would interpret the term “3D virtual environment” at the time of filing the ‘179 patent (Begault Supp., ¶¶23-24; 27) and how the term “3D virtual environment” is used in the art. For example, one of the references relied upon by Petitioner, Sauk, states “[b]inaural audio ... provide[s] the listener with a three dimensional virtual audio environment,” that is, the user can perceive “sound[s] emanating from different spatial locations outside the listener’s head.” Sauk, 1:15-21.

C. “Determining, with the WED, when the user is leaving the environment”

The phrase, “determining, with the WED, when the user is leaving the environment” in claim 14, when construed consistently with its plain and ordinary meaning, as well as the intrinsic and extrinsic record, means “determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment.”

As explained above, the specification discloses that a wearable electronic device (WED) may include components, such as a memory, one or more displays, a processor, interfaces, a camera, sensors, a location or motion tracker, a GPS tracking system, speakers, a head tracker, an imagery system, a sound localization system, an

onboard predictor, and a microphone. ‘179 patent, 39:9-12, 39:25-48, 40:7-15; *see also* Figure 20. These components are all contained within the WED and can be used to determine when a user is leaving the environment. Thus, the specification clearly discloses that the WED determines a location of a user and when the user is leaving an environment and makes this determination independent of a stationary tracking device.

Accordingly, the term “determining, with the WED, when the user is leaving the environment” should be construed to mean “determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment.”

III. LEVEL OF ORDINARY SKILL IN THE ART

For this Response, Patent Owner accepts Petitioner’s definition of a POSITA. A POSITA at the time of the ‘179 patent’s priority date in 2015 would have had a Bachelor’s degree in computer science/engineering, music technology, or a related field, and at least two years of industry experience, or academic research experience, in virtual/augmented reality, audio engineering, or an equivalent.

IV. THE ASSERTED GROUNDS

Petitioner asserts the challenged claims are unpatentable based on the following grounds:

Ground	Challenged Claims	35 U.S.C. §	References
1	1, 3-4, 6-10, and 14-19	103	Clement (Ex. 1005) in combination with Osman (Ex. 1006) and Sauk (Ex. 1007)
2	1-20	103	Lyren (Ex. 1008) in combination with Reif (Ex. 1009)

Pet. 2.

V. GROUND 1 – THE HYPOTHETICAL COMBINATION DOES NOT ESTABLISH A *PRIMA FACIE* CASE OF OBVIOUSNESS

A. Legal Precedent

The ultimate determination of obviousness under 35 U.S.C. §103 is a question of law based on underlying factual findings. *In re Baxter Int’l, Inc.*, 678 F.3d 1357, 1362 (Fed. Cir. 2012) (citing *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966)). “To satisfy its burden of proving obviousness, a petitioner cannot employ merely conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380-81 (Fed. Cir. 2016). The “factual inquiry” into the reasons for “combin[ing] references must be thorough and searching, and the need for specificity pervades.” *In re NuVasive, Inc.*, 842 F.3d

1376, 1381-82 (Fed. Cir. 2016) (internal quotations and citations omitted). The specific reasoning must include some rational underpinning to combine the prior art elements as claimed to support the conclusion of obviousness. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). It is Petitioner's burden to demonstrate a motivation to combine, and a reasonable expectation of success. *See In re Magnum Oil Tools*, 829 F.3d at 1381. Mere conclusory statements are insufficient. *Id.* at 1380.

“It is improper to combine references where the references teach away from their combination.” M.P.E.P. §2145 (subheading X.D.2., entitled “References Cannot Be Combined Where Reference Teaches Away from Their Combination” and citing *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983)).

To render a claim obvious, the prior art taken as a whole must enable a skilled artisan to make and use the claimed invention. *See In re Kumar*, 418 F.3d 1361, 1368 (Fed. Cir. 2005). While a prior art reference asserted under §103 need not necessarily enable its own disclosure, i.e., be “self-enabling,” to be relevant to obviousness, the “evidence of record must still establish that a skilled artisan could have made the claimed invention.” *Raytheon Techs. Corp. v. Gen. Elec. Co.*, 993 F.3d 1374, 1381 (Fed. Cir. 2021). “In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon.” *Id.*

Petitioner bears the burden to demonstrate unpatentability, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed Cir. 2015).

B. The Prior Art Fails to Disclose or Teach the Invention as Claimed

1. Clement

Clement describes a system that detects when a user is “approaching a boundary of a tracking area” and initiates a “transition out of the virtual world and into the real world.” Clement, Abstract. The transition may include fading from presenting virtual world audio to ambient sounds of the real environment. *Id.*, 99:20-31. Clement provides, for example, that when transitioning from the virtual world to the real world, “audio content associated with the virtual world may fade out, accompanied by a fade in of ambient sound.” *Id.* 9:22-23; 9:27-31 (“the fade out of virtual audio content and the fade in of ambient sound may be accomplished serially, so that the ambient sound is not superimposed on, or output at the same time as, the virtual audio content”).

Clement does not disclose or teach that the audio is binaural, as Petitioner’s own expert acknowledged. Roginska Depo., 243:19-20 (“Q: Does Clement disclose binaural sound? A: So Clement does not disclose binaural sound.”); Begault, ¶27. In fact, Clement does not use the words “binaural” or “stereo” or “mono” at all. As such, Clement does not disclose anything about the location of sound or where the

sound is perceived to come from, as acknowledged by Petitioner's expert. Roginska Depo., 243:19-21 ("Q: Does Clement disclose anything about the location of the sound or where the sound is perceived to come from? A: I don't believe Clement discloses the location of sounds and where they're coming from."). Clement also does not disclose or teach warning/alerting the user by altering binaural audio and/or altering sound processing that produces binaural audio. Indeed, Petitioner's expert has admitted that Clement "provides little detail about the audio processing." Roginska, ¶97 (Ex. 1003).

Clement initiates a "transition out of the virtual world" that "is complete at or before the user electronic device reaches the boundary." Clement, 1:58-60. To determine when the user transitions out of the virtual world and into the real world, Clement discloses using a tracking device 310, such as a camera, that is separate from Clement's HMD and is positioned in the physical space. The tracking device 310 defines the tracking area 320: "a tracking device 310, such as, for example, a camera 310, is positioned in a physical, real world space 300, and is oriented to capture as large a portion of the space 300 as possible with its field of view. This tracking area 320 defined by, for example, the field of view and range of the tracking device 310." *Id.*, 4:22-27.

2. Osman

Osman relates to techniques for simulating the source of sound. Osman, Abstract. To provide sound localization, Osman discloses use of HRTFs. *Id.*, 4:48-67. Osman teaches that “a good HRTF model” is more important to “improve the accuracy of sound localization for objects outside the field of display” than visible objects, because “the brain uses the visual information to identify the sound origin” and “when the sound originates outside the field of view, the extra visual cue for sound localization is lost.” *Id.*, 7:31-42.

3. Sauk

Sauk relates to techniques for “producing, combining, and customizing virtual sound environments to provide the user with understandable information regarding their surroundings.” Sauk, 2:45-49. Notably, Sauk is not directed to virtual reality games but instead discloses several applications of its system in a real-life military reconnaissance mission. *Id.*, 10:44-15:23; Roginska Depo., 254:2-255:3; Begault Supp., ¶82.

In one application, “Alerts and Warnings,” Sauk discloses using binaural audio to warn or alert a user (e.g., a soldier) of a real-world hazard, for example, “a biological, nuclear, or chemical hazard.” Sauk, 12:14-51. The system in Sauk issues a warning to the user about the nature of the hazard using “a phrase like, ‘chemical toxin detected, stay away!’ and would be heard in the user’s 3-D sound

environment.” *Id.* Sauk discloses using a binaural warning to enable the user to localize the hazard:

The audible warning would thus alert the user that he is too close to the lethal toxin, and ***by listening to the 3-D binaural audio, the user would be able to ascertain a direction*** of the sensor 401 (and/or the associated hazard). Consequently, the user would know which direction to move away from in order to escape the affected area.

Id., 12:39-51; Begault, ¶36; Begault Supp., ¶¶84-86. Furthermore, the binaural audio warning is ***in addition*** to the audio the user is already experiencing; that is, the warning (“chemical toxin detected, stay away!”) is not an alteration of the pre-existing audio. *Id.*

In another application, “Selective Filtering Mode,” Sauk discloses using binaural audio to provide localization of other soldiers in a group. *Id.*, 10:32-62. For example, “[i]nstead of listening to all the various conversations occurring in the communications network, each group [of soldiers] could select their own binaural environment,” where they hear binaural audio from only their group members. *Id.*, 10:47-62. In this way, the soldiers of one group would still be aware of each group member’s location, based on the binaural audio, even after losing sight of each other. *Id.*, 10:52-55; Begault Supp., ¶84.

In another application, “Selective Relevance Mode,” Sauk discloses groups of soldiers using a system in which the user may pre-select audio dimensions “such as

3-D (binaural), 2-D (stereophonic), and 1-D (monophonic).” *Id.*, 11:28-36 (“For example, in certain circumstances, a user may not want to eliminate all background audio information. However, rather than keeping the less relevant audio in the same audio dimension with their desired binaural sound sources, a user could change the less relevant audio to a monophonic (1-D) or stereophonic (2-D) dimension.”); Begault Supp., ¶85. A commanding officer of the group could listen to the members of his own group in binaural audio so he is familiar with their locations but might wish to listen to the voices of the other three commanders in monophonic audio. *Id.*, 12:6-10. Thus, the commander could easily distinguish between the binaural voices of soldiers in his group and the monophonic voices of other commanders. *Id.* Sauk refers to this as “selective relevance mode” as opposed to “alerting/warning” and describes that the user can pre-select the audio dimension for the most relevant data (e.g., members of his own group in binaural audio) and the audio dimension for less relevant data (e.g., other commanders in monophonic audio). *Id.*, 11:25-14.

In Selective Relevance Mode, after the user selects for certain groups to be reproduced in different audio dimensions, the binaural sound system “can use received metadata to determine [the] group of a user from which enunciated data originated. Enunciated data received from various users within a user’s predetermined group will be presented in a binaural format.” *Id.*, 11:44-48. For example, the most relevant enunciation data may be reproduced in binaural audio

(e.g., voices of soldiers in same group), while less relevant enunciation data may be reproduced in stereo or mono (e.g., other commanding officers of other groups). *Id.*, 10:63-11:24; Begault Supp., ¶85. Thus, in Selective Relevance Mode, Sauk discloses a user may receive audio in a plurality of audio dimensions, such as 3-D (binaural), 2D (stereophonic), and 1-D (monophonic), depending on how the user has selected to perceive the audio. *Id.*, 11:26-38.

Notably, even in Selective Relevance Mode, Sauk does not change formatting from binaural to mono, for example, based upon changes in the listener's position with respect to the environment, as required by the claims of the '179 patent. Begault, ¶33-34; Begault Supp., ¶86. Instead, as shown above, the changes to the audio are made based on a user's selection. Further, even in Selective Relevance Mode, Sauk does not teach that prior reproductions made in one format and/or the processing that generates these prior reproductions are somehow altered. To the contrary, Sauk discloses generating a signal that includes enunciated data and metadata used to *generate a new binaural format* reproduction that enables a user to ascertain a direction of a real-world associated hazard, for example a biological, nuclear, or chemical hazard. Sauk, 12:14-51; Begault, ¶35.

4. There is No Motivation to Combine Clement with Sauk

Petitioner relies on a combination Clement with Sauk, arguing that (1) Clement teaches techniques for reducing the volume of virtual audio when

approaching boundaries of a tracking area and (2) Sauk teaches “converting” less relevant data from binaural audio to stereo or mono. Petitioner states it would have been obvious to modify Clement’s virtual non-binaural audio fade out with Sauk’s “conversion” of less-relevant audio from binaural audio to stereo and/or mono audio to arrive at the recited warning and/or alerting features of the current claims. Pet.23.

Petitioner’s argument, however, is based on a gross mischaracterization of the cited art and thus fails for several reasons. First, as recognized by the Board, “Petitioner incorrectly asserts that ‘Sauk teaches changing from binaural to stereo or monophonic sound to signal ‘relevancy or importance,’ such as warning of a ‘hazard.’” Decision, 21. And in direct contrast to Petitioner’s argument, as shown above, Sauk does not eliminate 3-D binaural audio to indicate a hazard, but instead Sauk “extolls the value of using 3-D binaural audio to alert a user to a hazard.” *Id.* Sauk discloses ***generating binaural audio alerts*** to increase awareness of real-world hazards. Begault Supp., ¶86. Thus Sauk teaches away from ***removing the binaural audio*** to alert the user he is leaving an environment, as required by the claims of the ‘179 patent. Sauk, 12:39-51 (explicitly advising the use of ***binaural alerts*** so that “the user would be able to ascertain a direction of the sensor 401 (and/or the associated hazard).”); Begault, ¶¶39-40; Roginska Depo., 272:18-273:1.

As recognized by the Board, “Petitioner provides no persuasive reason why one of ordinary skill in the art would have ignored Sauk’s disclosure of adding

binaural sound for alerts and instead look to *Sauk's non-alert context* for removing binaural sound.” Decision, 22. Even in Sauk’s non-alert context, the Selective Relevance Mode discussed above, the audio is switched *based on a user selection*, not based on a user’s position in an environment. Begault Supp., ¶87. And, even in Selective Relevance Mode, that the user is leaving the environment/virtual environment would be *very relevant* and thus Sauk would teach under Selective Relevance Mode that such audio be binaural, not mono or stereo. Begault, ¶¶36-39. There is thus no motivation to combine Sauk with Clement and thus Ground 1 fails. M.P.E.P. §2145 (“It is improper to combine references where the references teach away from their combination.”); *In re Grasselli*, 713 F.2d at 743.

5. Even if Sauk and Clement were a Proper Combination, the Hypothetical Combination Does Not Render Obvious Any Claim of the ‘179 Patent.

Even if Sauk and Clement were a proper combination, Clement, Osman, and Sauk, alone or in hypothetical combination, do not teach or render obvious each and every limitation of the challenged claims in the ‘179 patent.

First, as established above, Sauk expressly teaches to alert a user *by generating binaural audio alerts*, not by removing the binaural audio, as required by independent claims 1 and 7, and by dependent claims 3, 4, 6, 8-10, and 15-19. Sauk, 12:39-51 (explicitly advising the use of *binaural alerts* so that “the user would

be able to ascertain a direction of the sensor 401 (and/or the associated hazard).”); Begault, ¶39; Roginska Depo., 259:11-22; 266:9-17; 266:19-267:3; 267:2-6.

Second, as shown above, while Clement does not disclose binaural audio, Clement does disclose reducing the volume of the virtual audio (e.g., “fade-out”) as an alert to the user. Sauk, to the contrary, suggests that the volume of the binaural audio alert (“chemical toxin detected, stay away!”) would ***not be reduced*** to warn users of the real-world danger of a toxic chemical spill. Begault, ¶36; Roginska Depo. at 267:2-6; 268:11-269:1. Thus, Sauk is the only reference that discloses binaural audio serving as an alert, but Sauk does not disclose reducing the volume of the binaural audio alert to warn users and instead ***adds*** binaural sound for alerting. *Id.* Accordingly, even if Clement and Sauk were combined, the hypothetical combination posited by Petitioner actually ***teaches away*** from alerting by reducing the volume of binaural audio, as required by independent claims 1 and 14 and dependent claims 3, 4, 6, 8 and 15-19.

Third, the hypothetical combination of Clement, Osman, and Sauk also fails to teach or suggest determining, *with a wearable electronic device (WED)*, when a user is leaving an environment—as recited in independent claims 7 and 14—or sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment—as required in independent claim 1. The HMD of Clement does not determine when the user is leaving the environment independently of a stationary

tracking device. Instead, the HMD of Clement is dependent on a *stationary tracking device* that is separate from the HMD to determine when a user leaves an environment.

In view of these deficiencies, Clement, Osman, and Sauk, alone or in hypothetical combination, do not teach or render obvious each and every limitation of the challenged claims in the ‘179 patent and thus the challenged claims are not invalid.

a. Independent Claim 14

i. Clement and Sauk fail to teach alerting the user that the user is leaving the environment by reducing a volume of the binaural sound of limitation 14[e].

Petitioner relies on a combination of Clement and Sauk to teach limitation 14[e], which requires alerting the user that the user is leaving the environment by reducing a volume of the binaural sound. Pet.23 (citing Clement and Sauk in section discussing limitation 14[e]). As established above, there is no motivation to combine Clement with Sauk to teach alerting the user is leaving the environment by altering the binaural sound. Thus, Petitioner has not carried its burden regarding limitation 14[e].

Even if Clement were combined with Sauk, the hypothetical combination does not disclose limitation 14[e]. Clement discloses a “fade-out” but does not disclose

binaural audio. Begault Supp., ¶¶97. Clement’s fade-out is only based on the *x-y* location of the user in physical space and does not disclose a fade-out of specific sound localization points because Clement does not disclose binaural audio. *Id.* Sauk discloses using binaural audio to warn users of hazards, but does not teach or suggest lowering the volume of such binaural audio warning. Begault Supp., ¶¶96-97. To the contrary, to warn users of the real-world danger of a toxic chemical spill, Sauk suggests that the volume of the binaural audio alert (“chemical toxin detected, stay away!”) would not be reduced. *Id.* Petitioner’s expert agrees:

Q: Does Sauk disclose under this Alerts & Warnings section lowering the volume of a warning?

A: In Section C specifically under the Alerts & Warnings, Sauk I don’t believe talks about lowering the volume.

Roginska Depo., 267:2-6; *see also id.*, 268:16-269:1.

Sauk’s disclosure that in “Selective Relevance Mode,” the “decibel level of the 1-D, 2-D or 3-D audio can be adjusted *to whatever the listener desires* for that dimension” is clearly limited to the user’s pre-selected preferences for audio and does not teach or suggest reducing the “decibel level” as an alert or warning. *Compare* Pet.23-24, and Roginska, ¶167, *with* Begault Supp., ¶98. Indeed, Sauk’s disclosure of “Alerts & Warnings” does not teach or suggest reducing the volume as shown above. *See also* Begault Supp., ¶97.

Thus, even if Clement were combined with Sauk, the hypothetical combination does not teach or suggest alerting the user that the user is leaving the environment by reducing a volume of the binaural sound. *Id.*, ¶96.

For the foregoing reasons, Petitioner failed to carry its burden as to this limitation.

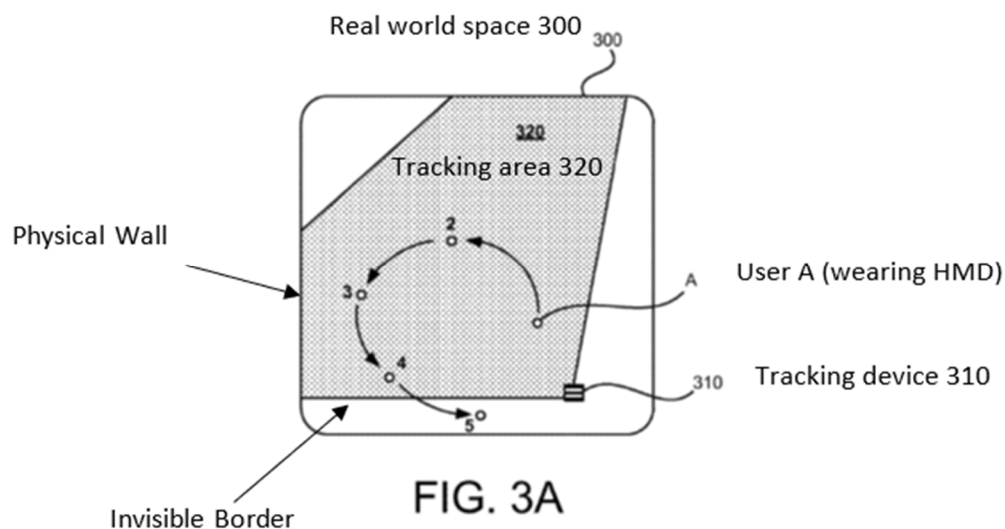
ii. Clement fails to teach determining, *with a wearable electronic device (WED)*, when a user is leaving an environment of limitation 14[d].

Limitation 14[d] recites, *inter alia*, “determining, *with the WED*, when the user is leaving the environment.” Petitioner alleges Clement alone teaches limitation 14[d]. Pet.22-23. Petitioner’s argument, however, is based on a mischaracterization of Clement, which fails to teach a *wearable electronic device (WED)* that determines when a user is leaving an environment independent of a stationary tracking device. Petitioner failed to establish that a skilled artisan could have made the claimed invention based on the disclosure of Clement, which nowhere describes how its HMD² could determine—without the use of the stationary tracking device in Clement—when a user is leaving an environment. Accordingly, Clement does not invalidate claim 14.

² The parties do not dispute that the term “HMD” as used in Clement corresponds to the term “WED” as used in the ‘179 patent claims.

As discussed above, consistent with the intrinsic record, the term “determining, with a WED, when a user is leaving an environment” should be construed as meaning “determining, with the WED and independent of a stationary tracking device, when the user is leaving the environment.”

Clement fails to teach or suggest an HMD determining, independent of the stationary tracking device 310, when the user is leaving the environment. Clement defines the tracking area 320 as a field of view and range of *the tracking device 310*. Clement, 4:26-29. The tracking device 310, such as a camera, is “positioned in a physical, real world space 300, and is oriented to capture as large a portion of the space 300 as possible with its field of view.” *Id.*, 4:21-26. FIG. 3A of Clement (reproduced below with context added) illustrates the tracking area 320 as defined by the field of view of the tracking device 310.



Clement, FIG. 3A. (textual labels added).

Indeed, each embodiment described in Clement determines proximity to a tracking area defined by the stationary tracking device 310. *See, e.g.,* Clement, FIGS. 3A-3C, FIG. 4, and FIGS. 5A-5B, each illustrating a tracking area 320 defined by and based upon capabilities of the stationary tracking device 310. Because the tracking area is defined by the stationary tracking device 310, the tracking device is *always used* in Clement to determine when the user is leaving the environment.

That is, for the HMD to know when the user is leaving the tracking area, the HMD must know the boundary of the tracking area. The boundary of the tracking area 320 is defined by a physical boundary of the real-world space 300 (e.g., physical wall) and *an invisible border* (context added in reproduced figure above) defined by the view of the tracking device 310. Clement fails to disclose *how* the sensors of the HMD would detect “*when the user is leaving the environment*” based on a proximity to a boundary of the tracking area 320 *with the HMD* without the tracking device 310. Instead, Clement *must* employ the tracking device 310 *for tracking a user’s position within the tracking area 320* along with the HMD for *tracking a user’s proximity to physical obstacles*, such as a wall. In other words, Clement does not disclose how its HMD detects when the user is leaving the tracking area 320 without relying on the tracking device 310.

In contrast to the WED of the ‘179 patent, which includes a GPS, location and movement trackers, and head trackers, Clement’s HMD fails to include any sensor capable of tracking its location without being dependent on the tracking device. *See* ‘179 patent, 39:37, 40:7-15 (disclosing the WED includes GPS, location tracker, and head tracker). The sensors included in Clement’s HMD cannot determine when user A is leaving the environment by crossing the invisible border without relying on the tracking device. Clement’s sensing system of the HMD is described as including a camera, light sensors, distance/proximity sensors, and an audio sensor. Clement, 3:30-33 and 54-57. Each of these types of sensors is only capable of detecting physical obstacles or objects and thus the sensors of the HMD in Clement are only able to detect a proximity to *physical boundaries of the tracking area 320*. Thus, although Clement’s HMD “include[s] a sensor that detects . . . the user’s proximity to a boundary of the tracking area 320,” Clement never explains how the sensors of its HMD can detect a boundary of the tracking area, much less an invisible border that is not a physical boundary. *Id.*, 7:4–16.

Petitioner’s reliance upon Clement’s passing mention that the “HMD 100 and/or the tracking device 310, or other component of the system, determines” the user’s position within the tracking area 320 is misplaced. *Id.*, 6:27-30; *see also* 12:20-23 (“the HMD 100 and/or the tracking device 310 may determine a current position of the user in the tracking area 320”); 13:20:22 (“the HMD 100 and/or the

tracking device 310 may also detect when the user re-enters the tracking area 320”). In each of these excerpts, Clement expressly says the HMD *and/or* the tracking device. Accordingly, although Clement mentions that the “HMD and/or the tracking device” determines the position of the user relative to the tracking area 320, for practical purposes, Clement’s HMD is incapable of determining when a user leaves the tracking area 320 without information provided by the tracking device 310 because the camera, light sensors, distance/proximity sensors, and audio sensor within Clement’s HMD are only capable of detecting physical boundaries and are incapable of detecting an invisible or virtual boundary defined by the tracking area 320. *Id.*, 6:28–31.

While Petitioner uses these excerpts to support its position that Clement discloses using only the HMD to determine the user’s location in the tracking area 320, Petitioner has not provided any supporting evidence to enable a POSITA to make the claimed invention. *Raytheon*, 993 F.3d at 1381 (“In the absence of such other supporting evidence to enable a skilled artisan to make the claimed invention, a standalone § 103 reference must enable the portions of its disclosure being relied upon.”). Petitioner’s expert does not provide any supporting evidence to enable a POSITA to use Clement’s HMD without the separate tracking device to determine when the user is leaving the environment but instead merely points to the inadequate disclosure in Clement in her Declaration. Roginska, ¶¶157-158. In her deposition,

Petitioner's expert admitted that Clement does not disclose "[h]ow specifically the technology works within all the components in the HMD" of Clement and *never identified how* a POSITA would make the claimed invention of using the HMD to determine when the user is leaving the environment without a stationary tracking device. When asked repeatedly at her deposition how a POSITA would know how to make Clement's HMD determine when a user is leaving an environment without the tracking device, Petitioner's expert could not provide an answer. Roginska Depo., 203:19-204:1; 221:16-222:1; 224:22-225:11; 225:12-226:6; 227:3-9.

Accordingly, Petitioner failed to produce any evidence of record that establishes a skilled artisan could have made the claimed invention in the '179 patent based on the disclosure of Clement, which discloses only using a tracking device that is *stationary* and separate from the HMD to detect when the user is within a proximity of a boundary of a tracking area throughout its disclosure, unlike the claims of the '179 patent. Clement, 1:31-42, 43-50; 4:15-19, 21-29, 49-53; 5:41-44, 55-60.

As a result, Clement is inoperable as a prior art reference to teach "determining, *with the WED*, when the user is leaving the environment," as recited in limitation 14[d].

For the foregoing reasons, Petitioner failed to carry its burden as to claim 14.

b. Independent Claim 7

i. Clement fails to teach determining, *with a wearable electronic device (WED)*, when a user is leaving an environment of limitation 7[d].

Limitation 7[d] recites, *inter alia*, “determining, *with the WED*, when the user is leaving the environment.” As shown above, this limitation should be construed consistent with the intrinsic record to mean “determining, with the WED and independent of a separate tracking device, when the user is leaving the physical environment.” As established regarding limitation 14[d], Petitioner failed to meet its burden with regard to Clement teaching a WED that determines when a user is leaving a physical environment independent of a stationary tracking device. That is, the HMD in Clement is incapable of detecting the proximity of a user to a boundary of the tracking area 320 without also using the stationary tracking device 310. Clement thus does not enable a POSITA to make the claimed invention and does not disclose this limitation.

ii. Clement and Sauk fail to teach alerting a user by degrading audio cues to prevent external localization of the binaural sound of limitation 7[e].

As established above, there is no motivation to combine Clement with Sauk to alert a user by degrading audio cues to prevent external localization of the binaural sound and as a result, Petitioner’s arguments regarding limitation 7[e], all of which rely on this combination, fail. Pet.27-28.

Additionally, even if Clement were combined with Sauk, the hypothetical combination does not teach or suggest “alerting the user that the user is leaving the environment by altering processing of the binaural sound to degrade audio cues in order to prevent the user from experiencing external localization of the binaural sound,” as recited in claim 7.

Petitioner specifically referenced Clement’s “fade out” from the virtual world when approaching obstacles (e.g., walls) and the alleged “degrading the ‘binaural [audio] to monophonic or stereophonic audio [to] signif[y] a different level of relevancy” described in Sauk 11:25-41 to teach these recitations. Pet.25. As established above, however, in contrast to Petitioner’s characterization that Sauk teaches alerting of immediacy or relevancy of the transition by degrading binaural audio to monophonic or stereophonic audio, Sauk teaches the opposite. The alerts described in Sauk teach *adding binaural audio alerts to increase* spatial awareness when the user is approaching a hazard. Sauk, 12:33-51; Begault, ¶38; Begault Supp., ¶86. That is, if a POSITA were to look at the alert options available in Sauk, the POSITA would find that rather than altering existing binaural sound experienced by the user to stereo or mono which prevents the user from experiencing localization, Sauk teaches the opposite and adds in new externalized binaural alerts to enable the user to experience localization. Decision, 21; Begault, ¶39.

In other words, even if Clement and Sauk were a proper combination, they would not be combined to *degrade audio cues to prevent the user from experiencing localization*, as recited in limitation 7[e], to provide a user a transition between the virtual world and the real world because the binaural sounds provided by Sauk *enhance* sound localization cues for a hazard.

For the foregoing reasons, Petitioner failed to carry its burden as to claim 7.

c. Independent Claim 1

i. Clement fails to teach sensing, *with one or more sensors in the HMD*, when the user leaves a 3D virtual environment of limitation 1[d].

As shown above with respect to limitation 14[d], Clement fails to teach “sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment,” as recited in limitation 1[d].

First, as discussed above, consistent with the intrinsic record, the term “sensing, with one or more sensors in the HMD, when the user leaves the 3D virtual environment” should be construed as “sensing, with one or more sensors in the HMD and independent of a stationary tracking device, when the user is leaving the environment.” Petitioner failed to meet its burden because Clement’s HMD depends on the stationary tracking device; that is, the sensors in the HMD in Clement, independent of a stationary tracking device, are incapable of detecting the proximity of a user to a boundary of the tracking area 320, as established above regarding

limitation 14[d]. Clement thus does not enable a POSITA to make the claimed invention and does not disclose this limitation.

- ii. **Clement and Sauk fail to teach warning the user that the user is leaving the 3D virtual environment by filtering, by the DSP, the binaural sound to prevent the user from experiencing external localization and by lowering the volume of limitation 1[e].**

Petitioner relies on a combination of Clement and Sauk to teach limitation 1[e], which requires warning the user that the user is leaving the 3D virtual environment by filtering, by the DSP, the binaural sound to alter audio cues to prevent the user from experiencing external localization of the sounds and by lowering a volume of the sounds being provided to the user. Pet.31 (referring to discussion of limitation 14[e] and claims 15-18, which cite Clement and Sauk). As established above, there is no motivation to combine Clement with Sauk to teach alerting the user is leaving the environment by altering the binaural sound to prevent the user from experiencing external localization of the sounds and by lowering a volume of the sounds being provided to the user. Thus, Petitioner has not carried its burden regarding limitation 1[e].

- **warning the user that the user is leaving the 3D virtual environment by filtering by the DSP, the binaural sound**

Even if Clement were combined with Sauk, Clement and Sauk fail to teach “warning the user that the user is leaving the 3D virtual environment by *filtering*, by the DSP, the binaural sound to *alter audio cues to prevent the user from experiencing external localization of the binaural sound*,” as recited in limitation 1[e]. As shown above with respect to limitation 7[e], Clement merely mentions fading out audio content associated with the virtual world *without any teaching or suggestion to filter* the binaural sound to alter audio cues to prevent the user from experiencing external localization of binaural sound, as recited in limitation 1[e]. That is, the fading out of the virtual world audio content in Clement does not include filtering the binaural sound to alter audio cues to prevent the user from experiencing external localization of the virtual sound. Begault, ¶41. Further, Sauk does not cure the above deficiency. Indeed, Sauk *generates 3D sound in a binaural audio environment* to increase spatial awareness. Sauk, 12:33-51; Begault, ¶39; Begault Supp., ¶86.

- **warning the user that the user is leaving the 3D virtual environment by preventing the user from experiencing external localization and by lowering the volume**

In addition, even if Clement were combined with Sauk, Sauk teaches the opposite of this limitation. That is, in contrast to Petitioner’s characterization that Sauk teaches alerting of immediacy or relevancy of the transition by degrading

binaural audio to monophonic or stereophonic audio, Sauk teaches *adding binaural audio alerts* to *increase* spatial awareness when the user is approaching a hazard. Sauk, 12:33-51; Begault, ¶38; Begault Supp., ¶86. Altering the audio cues to prevent the user from experiencing external localization would thus frustrate the purpose of Sauk because Sauk focuses on *providing localization* to indicate or alert to a user the location of the hazard, while degrading the audio cues would reduce the spatial context of the binaural sound. *Id.* That is, if a POSITA were to look at the alert options available in Sauk, the POSITA would find Sauk adds in new externalized binaural alerts to enable the user to experience localization, the opposite of altering binaural sound down to stereo or mono which prevents the user from experiencing localization. Decision, 21; Begault, ¶39.

In other words, even if Clement and Sauk were a proper combination, they would not be combined to *alter audio cues to prevent the user from experiencing localization*, as recited in limitation 1[e], to alert the user that the user is leaving the 3D virtual environment because the binaural alerts provided by Sauk *enhance* sound localization cues. Begault, ¶39.

Finally, as shown in the discussion above regarding limitation 14[e], the hypothetical combination of Clement and Sauk does not teach or suggest alerting the

user that the user is leaving the environment by reducing a volume of the sounds being provided to the user.

For the foregoing reasons, Petitioner failed to carry its burden as to claim 1.

d. Dependent Claims

As demonstrated above, Petitioner failed to carry its burden with respect to each independent claim. Therefore, based at least upon the virtue of their dependency from the independent claims, Petitioner failed to carry its burden with respect to dependent claims challenged in Ground 1. In addition, the prior art references relied upon in Ground 1 do not teach or suggest the limitations in the dependent claims, as shown in more detail below.

The dependent claims in the '179 patent can be broken in to four general categories: (1) claims that require alerting/warning the user by removing/degrading the binaural sound received by the user (claims 10, 15-19); (2) claims that require switching the binaural sound to stereo sound based on the virtual image (claims 4, 6, 9); (3) claim 3, which requires warning when the user is leaving a virtual area where the virtual image is located while remaining in the 3D virtual environment; and (4) claim 8, which requires alerting the user by reducing the volume of the binaural sound provided to the user, similar to the lowering the volume limitations in independent claims 1 and 14. Begault Supp., ¶89.

i. Dependent Claims that Require Alerting/Warning the User by Removing/Degrading the Binaural Sound Received by the User

These dependent claims all require alerting the user by altering the binaural sound received by the user. Begault Supp., ¶89. As shown above with respect to claims 1 and 7, the combination of Clement and Sauk teaches away from alerting the user that the user is leaving the environment by modifying binaural sound to provide *less external localization*. Sauk’s “Alerts and Warnings” generate binaural sounds to alert a user of a hazard such that the user “would be able to ascertain a direction of... the associated hazard.” Sauk, 12:33-51; Begault Supp., ¶¶86, 90. As such, in contrast to the limitations in these claims, Sauk teaches adding binaural sounds to alert the user of a direction of a hazard. *Id.*

Even in Sauk’s Selective Relevance Mode, which is based on a user’s pre-defined selection to make certain audio sources more relevant than others and not associated with Sauk’s “Alerts and Warnings,” Sauk discloses a *user* making a selection as to audio format and the system reproducing different formats of audio (binaural, stereophonic, monophonic) from received enunciation data. The audio format is not changed to alert the user. Begault Supp., ¶86. Furthermore, in Sauk’s Selective Relevance Mode, Sauk does not disclose changing the existing binaural audio that is provided to the user to a different format. Begault, ¶35. Instead, at

best, Sauk reproduces listener-specified formats of audio from received enunciation data. Thus, Sauk clearly does not disclose:

- alerting user by degrading the binaural sound (claim 15);
- alerting the user by altering processing of the binaural sound so the user perceives less external localization (claim 16);
- alerting user by removing/degrading ITDs (claim 17);
- alerting user by eliminating audio cues in the binaural sound (claim 18);
- alerting user by switching the binaural sound to stereo sound (claims 10, 19).

Begault Supp., ¶¶90-91.

e. Dependent Claims that Require Switching from Binaural Sound to Stereo Sound Based on the Visibility of the Virtual Image

Claims 4, 6, and 9 each require that the binaural audio received by the user is switched to stereo sound based on the visibility of the virtual image:

- when the virtual image is no longer visible to the user (claim 4);
- when the virtual image vanishes from the 3D environment (claim 6);

- when the WED no longer displays the virtual image during the game (claim 9).

Begault Supp., ¶89.

Petitioner maintains that Sauk teaches *converting* binaural sound to stereo to signify relevance. Pet.57, 62-64. However, as discussed above, the combination of Clement and Sauk teaches away from altering binaural audio to reduce external localization to alert the user that the user is leaving an environment. In the same way, the cited art combination teaches away from the recitations of claims 4, 6, and 9 that require switching from binaural sound to stereo sound when the virtual image is no longer visible to the user. While Clement teaches fading virtual audio content out when a user transitions between the virtual world and the real world, Sauk produces binaural sounds that *include directionality* so the user knows a direction in which the character may have disappeared into. Sauk, 12:42-51.

Additionally, even if Osman were combined with Sauk's Selective Relevance Mode, the hypothetical combination does not support Petitioner's argument. First, these claims do not recite switching from binaural sound to stereo based on relevancy but instead when the virtual image is no longer visible. The lack of display of a character on the screen does not inherently indicate a relevancy of the virtual image. To the contrary, a particular voice may be quite relevant despite the character not

being displayed by the WED. For instance, Sauk teaches the opposite with regard to removing binaural audio or spatial audio context when members of the same group “lose sight of each other.” Sauk, 10:52-60. That is, Sauk describes using a binaural sound environment for members of the same group, such that their voice communication would information everyone in the group of their approximate location by visualizing virtual positions for the speakers” after they “lose sight of each other” to keep members aware of each of their group member’s location. *Id.*

Moreover, Osman also teaches the opposite with regard to removing binaural audio or spatial audio context when virtual images are no longer in view. That is, Osman explains that providing that spatial awareness *is more important when objects are not in view*. Specifically, Osman discloses:

[A] good HRTF model will greatly improve the accuracy of sound localization for objects outside the field of display. This is because inaccuracies in virtual surround systems are ignored by the brain in the presence of visual feedback. However, when the sound originates outside the field of view, the extra visual cue for sound localization is lost. In this case, a good HRTF enhances sound localization for objects outside the field of view.

Osman, 7:31-42; Begault Supp., ¶88.

As such, since both Sauk and Osman teach *enhancing* sound localization for objects that are not in view, the hypothetical combination of the Osman and Sauk do not disclose the recited features of claims 4, 6, and 9. Begault Supp., ¶92.

f. Dependent Claim that Requires Warning When the User is Leaving a Virtual Area

Claim 3 recites that the warning occurs “when the user is leaving a virtual area where the virtual image is located while remaining in the 3D virtual environment.” None of the cited references teach or suggest this feature. Petitioner cited a portion of Jang (Ex. 1015), which describes audio conflict/changes between two environments, stating a POSA would have understood that transitions between virtual areas were commonplace in VR environments. Jang, however, does not disclose filtering, by the DSP, the binaural sound to prevent the user from experiencing external localization of the sounds. Begault Supp., ¶94. Furthermore, Jang is not cited by Petitioner as art relied upon for Ground 1, and as such, Petitioner’s reliance on Jang is improper. 37 C.F.R. § 42.104(b)(2).

Petitioner’s reliance on Clement is also misplaced. Clement’s fade out is not based upon leaving a virtual area that the virtual object is in while the user remains in the 3D environment. Instead, at best, Clement’s fade out transition is based upon a theoretical zone surrounding *the user* in the user’s physical space, when the theoretical zone encroaches the boundary of the tracking area 320. Clement, 5:17-

19; 5:40-54. This is not analogous to the warning occurring “when the user is leaving a virtual area where the virtual image [that the binaural sound localizes at] is located while remaining in the 3D virtual environment,” as recited by claim 3.

g. Dependent Claim that Requires Alerting By Reducing Volume

Dependent claim 8 requires alerting the user that the user is leaving the environment by reducing a volume of the binaural sound being provided to the user. As shown above with regard to the alerting by reducing the volume limitations in claims 1 and 14, neither Sauk nor Clement, nor a hypothetical combination, teaches this limitation.

h. Unopposed Claims

With respect to Ground 1, Petitioner failed to provide any reasoning as to the patentability of the recitations of claims 2, 5, 11-13, and 20 with respect to the cited references. As such, Petitioner failed to carry its burden as to these claims.

VI. GROUND 2 – LYREN IS INVALID PRIOR ART

Petitioner’s Ground 2 position asserts that the ‘140 Application lacks any teaching of alerting the user that the user is leaving the environment, thus breaking the chain of priority to Lyren, and then asserts Lyren as prior art against the ‘179 patent. Pet.35. A threshold question to Petitioner’s Ground 2 is thus whether the ‘140 Application contains adequate written description for the ‘179 patent claims.

If the ‘140 Application does contain adequate written description, then the priority chain is maintained, Lyren is invalid prior art, and Ground 2 fails.

Contrary to Petitioner’s assertion, the ‘140 Application provides multiple examples and disclosures in which a POSITA would recognize a description of the claimed subject matter, including:

Claims 7 and 14

- (1) using a WED to determine when a user is leaving a physical environment
and
- (2) alerting that the user is leaving a physical environment by modifying
binaural sound properties

Claim 1

- (3) using a WED to determine when a user is leaving a 3D virtual environment
and
- (4) alerting that the user is leaving a 3D virtual environment by modifying
binaural sound properties.

Begault, ¶42; Begault Supp., ¶62.

As a result, the ‘179 patent maintains its priority chain to Lyren via the ‘140 Application, thereby rendering Lyren invalid prior art and Ground 2 fails.

A. Background and Legal Precedent

The written description requirement is satisfied when “the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351–52 (Fed. Cir. 2010). The claims and the entire specification, including the specific embodiments and figures, should be reviewed to understand how applicant provides support for the various features of the claimed invention. M.P.E.P. §2163, II, A, 2. The subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) for the disclosure to satisfy the written description requirement. *See* M.P.E.P. §2163.02.

Further, while there is no *in haec verba* requirement, newly added claims or claim limitations must be supported in the specification through express, implicit, or inherent disclosure. M.P.E.P. 2163.I.B.

Petitioner bears the burden to demonstrate unpatentability, and that burden never shifts to Patent Owner. *Dynamic Drinkware*, 800 F. 3d at 1378.

Applying this legal standard, Petitioner’s assertion that the priority chain is broken at the ‘179 patent’s immediate parent, Application No. 16/106,140 (“140 Application”), and thus the ‘179 patent claims are not entitled to the benefit of any date earlier than the filing date of the ‘179 patent, fails. Pet.37.

B. Overview of Specification of ‘179 patent, ‘140 Application, and Lyren

The specification sections of the ‘179 patent, the ‘140 Application, and Lyren are identical. As such, although the references to various portions of the identical specifications will be discussed with reference to the ‘140 Application, it should be understood that the ‘140 Application and Lyren include the same disclosure.

As discussed above, the ‘140 Application is generally directed to providing binaural sound that localizes to a sound localization point (SLP) in empty space away from a person, such that the binaural sound changes (e.g., to altered binaural sound) when an “event” occurs. ‘140 Application (Ex. 1028), Abstract; Begault Supp., ¶¶7, 13. The ‘140 Application provides numerous examples of events that may trigger an action that alters the provided binaural sound. ‘140 Application, 106:25-29, 107:10-17:4; Begault Supp., ¶¶34-47; 52-58.

The events described in the ‘140 Application as triggering the change in binaural sound include, among other things,

- a user leaving a physical environment (i.e., a non-restricted area) and entering another physical environment (i.e., a restricted area). ‘140 Application, 120:1-26; Figure 6.

- “a change in the ability to detect ... position in a physical or a virtual environment, or a change in the ability to detect an environment.” ‘140 Application, 140:31-141:10.
- “cues detected in a user’s ... physical or virtual environment such as cues indicating a location, position, or orientation, or *a changing in them*, cues indicating ... a changing in a physical or virtual environment.” *Id.*
- “a degradation in the visibility of a user’s physical or virtual environment.” *Id.*, 141:15-20.

Begault Supp., ¶¶31, 57-58.

The ‘140 Application provides a method for determining whether to maintain binaural sound at the SLP or perform an action, such as altering binaural sound, for example based on movement of a person into a *restricted area*. ‘140 Application, 119:18-120:11. That is, Figure 6 describes a method for altering binaural sound when a user moves from a non-restricted area (one physical environment) into a restricted area (another physical environment). Begault Supp., ¶52.

Binaural sound provides the ability for a listener to localize sounds in a 3D environment or soundscape with applications in virtual reality. *Id.*, 96:11-25. While in the non-restricted area, the user thus experiences 3D sound, meaning the sound is localized to an SLP that is away from the user. *Id.*; Begault Supp., ¶52. The

discussion of Figure 6 expressly states that, at block 600, the user starts in an environment where “sound [is localized] to a sound localization point that is away from but proximate to the person,” or a 3D virtual environment. ‘140 Application, 119:21-23. When the user moves into a restricted area, or “an area, location, or a point that prohibits SLPs,” an event is detected, which causes the audio to alter the 3D sound being experienced by the user. *Id.* 119:25-32. Thus, when the user leaves one physical environment (i.e., the non-restricted area) and moves into another physical environment (i.e., the restricted area) the user is alerted by the change in the 3D sound being provided by the user. Begault Supp., ¶52.

In another example, the ‘140 Application describes a user, Alice, who is talking to Bob using binaural sound. *Id.*, 120:20-27. When the conversation starts, Bob’s voice is provided with binaural sound, thus generating a 3D virtual perception of Bob. *Id.* Then, Alice gets into her car. *Id.* After getting into her car, Bob’s voice in binaural sound is altered because Alice has entered a restricted area, as determined by the “GPS device or object recognition device.” *Id.*; Begault Supp., ¶52.

1. alerting the user that the user is leaving the physical environment

Claims 7 and 14 recite “alerting the user that the user is leaving the environment,” which as shown above means alerting the user that the user is leaving

the physical environment.³ The ‘140 Application has many examples disclosing alerting the user that the user is leaving the physical environment, including the examples discussed in connection with Figures 6 and 16. As shown in the example above, when Alice leaves the physical environment that is the non-restricted area and enters the restricted area, the sound she is experiencing changes from binaural to mono. *Id.*, 120:20-27. Thus, an event is detected when the user leaves the non-restricted area and enters the restricted area, such as a construction zone, as determined based on a physical location of the user. *Id.*; Begault Supp., ¶¶31, 52. Similarly, when discussing Figure 16, the ‘140 Application expressly discloses

³ As a preliminary matter, and as recognized by the Board, Petitioner erroneously asserts that “[a]ll of the ‘179 patent’s claims directly (or indirectly via their independent claims) recite the HMD/WED sensing or determining when the user is leaving the 3D environment, and alerting or warning that user of that fact by reducing the sound’s volume and/or otherwise altering it.” Pet. 37; Decision 28. The term “3D environment,” however is not used in any of the claims of the ‘179 patent: claims 7-20 use the term “environment,” and claims 1-6 use the term “3D virtual environment.” Accordingly, Petitioner failed to meet its burden with regard to establishing that the ‘140 Application fails to disclose these features and breaks the priority chain to Lyren.

actions, such as altering binaural sound, that may be taken in response to detecting an event, which includes a change in ability to detect positions in a physical environment. *Id.*, 140:2-3; Begault Supp., ¶¶51-55. Indeed, the Board acknowledged that “Figure 6’s ‘restricted area’ is a physical location.” Decision, 30. The Board also recognized “[t]o the extent that ‘environment’ may encompass a physical environment, Patent Owner’s argument regarding Figures 6 and 16 ... may have merit for these claims.” Decision, 34. Thus, the ‘140 Application clearly discloses “alerting the user that the user is leaving the physical environment” as required in claims 7 and 14. Begault Supp., ¶62. While interpreting the term “environment” in claims 7 and 14 to mean “physical environment” is the interpretation best supported by the specification and claim language, even if the Board determines the interpretation of “environment” in claims 7 and 14 includes the 3D virtual environment, the ‘140 Application provides sufficient disclosure as shown below.

2. alerting the user that the user is leaving the 3D virtual environment

In addition, the ‘140 Application discloses alerting the user that the user is leaving the 3D virtual environment, as required by claim 1. As shown above in the example of Alice talking to Bob, when the conversation starts, Bob’s voice is provided with binaural sound, thus generating a 3D virtual perception of Bob. *Id.*;

Begault Supp., ¶¶53-58. Alice is thus in a 3D virtual environment—meaning a “three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound”—because Alice perceives 3D localized virtual sound in her surroundings. When Alice gets into her car and Bob’s voice in binaural sound is altered, Alice has left a 3D virtual environment because Alice no longer perceives 3D localized virtual sound in her surroundings. *Id.*; *see also* Roginska Depo., 277:18-279:10; 280:2-21. The change in audio provides an alert or warning that Alice has left her 3D virtual environment and is triggered by Alice’s movement in the physical environment. Begault Supp., ¶59.

This example thus illustrates Alice moving from one physical environment (outside her car) into another physical environment (into her car). This example also demonstrates Alice leaving a 3D virtual environment (Alice no longer perceiving 3D localized virtual sound in her surroundings). When Alice no longer perceives the 3D localized virtual sound, triggered by Alice getting into her car, Alice is no longer in a “three-dimensional perceived surroundings in which a user operates that incorporates a virtual image and/or sound,” and thus Alice has left the 3D virtual environment. Begault Supp., ¶¶52-56; Roginska Depo., 277:18-279:10; 280:2-21. Thus, the event of leaving a 3D virtual environment may be detected when the user moves positions in the physical environment. *See* ‘140 Application, 119:21-26.

That the ‘140 Application describes an event as including a “change in . . . position *in* a physical...environment” does not foreclose that the detected change in the physical locations also corresponds to leaving the 3D virtual environment. *See* ‘140 Application, 141; Begault Supp., ¶¶52-56. To the contrary, leaving the 3D virtual environment may be triggered by the change in the person’s physical location within a physical environment where the person’s new location may be dangerous to localize sound as demonstrated above with Alice. *See* ‘140 Application, 120:2-11. That is, based on the change in the user’s physical locations, the user may leave the non-restricted area where 3D virtual audio is allowed (e.g., leave the 3D virtual environment with binaural sound at an SLP) and enter the restricted area where 3D virtual audio is prohibited (e.g., enter a 2D virtual environment with stereo sound not at an SLP).

While the Board decision states that “Figure 6 is insufficient to support limitation 1[d] because Figure 6’s ‘restricted area’ is a physical location, not a 3D virtual environment” (Decision, 30), the ‘140 Application expressly discloses that “[e]xamples herein can take place in physical spaces, in computer rendered spaces (VR), in partially computer rendered spaces (AR), and in combinations thereof.” *Id.* at 168:15-16. Accordingly, the examples in Figure 6 regarding the restricted area take place in a combination of physical spaces and virtual spaces; that is, the

“restricted area” corresponds to both a physical space and a virtual space where 3D audio is not permitted, as explained above. Begault Supp., ¶55.

Petitioner and Petitioner’s expert misinterpret the examples provided in the ‘140 Application and impermissibly ignore the specification as a whole. Pet.37-39; Roginska ¶¶225-229; M.P.E.P. §2163.II.A.2. Contrary to Petitioner’s assertion, these examples disclose leaving a 3D virtual environment—the Alice and Bob example discussed above expressly discloses Alice leaving a non-restricted 3D soundspace (a 3D virtual environment) to a restricted environment. Begault Supp., ¶¶63-64.

Petitioner’s argument that the user in the example moving from a non-restricted area to a restricted area is “not even wearing a HMD or other WED displaying a virtual environment” (Pet.38) ignores that a 3D virtual environment need not include a visual display but can instead include only 3D audio, i.e., binaural audio. As shown above, the example of Alice moving from a non-restricted area to a restricted area is an example of the user leaving a 3D virtual environment, as detected by an HPED, a “GPS device” or other location and movement tracker. Ex. 1028, 120. The ‘140 Application expressly discloses that the WED includes a “location or movement tracker” and other components (Ex. 1028, 70) and that “one or more of [the components of the electronic devices] can be distributed or included

in various electronic devices, such as some components being included in an HPED.” ‘140 Application, 168.

In addition, even assuming, *arguendo*, that the ‘140 Application does not explicitly provide an *example* that the WED determines that the user is leaving the 3D virtual environment, the ‘140 Application describes events related to the user’s physical and virtual environment that trigger altering binaural sound:

- “a change in the ability to detect ... *position in a physical or a virtual environment;*”
- “cues indicating ... *a changing in a physical or virtual environment;*”
and
- “a degradation in the *visibility of a user’s physical or virtual environment.*”

Ex. 1028, 140:31-141:10, 141:15-20.

Moreover, in view of the specific disclosure in the ‘140 Application that all of the disclosed examples “can take place in physical spaces, in computer rendered spaces (VR), in partially computer rendered spaces (AR), and in combinations thereof” (Ex. 1028 168:15-16), a POSITA would recognize that “a change in the ability to detect ... position in a physical or a virtual environment” as disclosed in the specification reasonably corresponds to a change in the ability to detect position in a physical environment, a virtual environment, or both. Begault Supp., ¶55.

Likewise, a POSITA would recognize that “cues indicating ... a changing in a physical or virtual environment” as disclosed in the specification reasonably corresponds to a change in the physical environment, a change in the virtual environment, a change from a physical environment to a virtual environment, or a change from a virtual to a physical environment. Begault Supp., ¶¶57-58. In addition, a POSITA would recognize that the “degradation in the visibility of a user’s physical or virtual environment” as disclosed in the specification reasonably corresponds to a degradation in the visibility of the 3D virtual environment triggered when the user leaves the 3D virtual environment. *Id.* Such degradation in the visibility of the user’s 3D virtual environment would be detected by the HMD worn by the user. As such, the ‘140 Application *explicitly* describes events including changes to physical and virtual environments that are detected by the HMD and performing actions, such as adjusting binaural sound, in response to a detected event.

3. “determining, with the WED, when the user is leaving” the physical environment or 3D virtual environment

The ‘140 Application also discloses that the WED determines when the user is leaving the physical environment, as required by claims 7 and 14, and when the user is leaving the 3D virtual environment, as required by claim 1. The detection of the event triggering the change in audio is based on the physical location of the user,

as can be tracked via a location and movement tracker of the WED. *See id.*, 120:20-27.

Petitioner asserts that the examples in which the user moves to a dangerous location do not describe the user wearing an HMD or WED displaying a virtual environment because they recite devices other than the WED or HMD as detecting various events. Pet.38. A POSITA would clearly understand that the embodiments described herein may be implemented with the WED or HMD. *See, e.g.*, ‘140 Application, 167:9-14 (disclosing that “[b]locks and/or methods discussed herein can be executed and/or made by ... an electronic device”); 159:5-16 (expressly including “wearable electronic devices” and “other portable and non-portable electronic devices” as an “electronic device”); Begault Supp., ¶¶56, 62. Moreover, since the WED is a type of electronic device described as performing the actions triggered by the detected events of the ‘140 Application, a POSITA would clearly understand that the ‘140 Application discloses the WED determining that the user is leaving the physical environment and/or leaving the 3D virtual environment. *Id.* Thus, contrary to Petitioner’s argument, the ‘140 Application adequately discloses limitations 7[d], and 14[d] that the HMD/WED senses or detects when the user is leaving the physical environment, and limitation 1[d] that the HMD/WED detects when the user is leaving the 3D virtual environment. Begault Supp., ¶62.

4. warning/alerting the user

The ‘140 Application also supports that the adjustments in binaural sound, such as a change in sound format from binaural to mono or stereo or the reduction in volume as disclosed in the ‘140 Application, would implicitly alert or warn the user that the user is leaving the environment/3D virtual environment. Begault Supp., ¶¶33, 51, 59-60; 66-70. As discussed above, the ‘140 Application describes events being triggered based on the user leaving a first environment that may be physical (e.g., outside of Alice’s car) or virtual (e.g., 3D virtual environment where SLPs are allowed) into a second environment that may be physical (e.g., inside Alice’s car) or virtual (e.g., 2D virtual environment where SLPs are not allowed). ‘140 Application, 119-120. Further, the ‘140 Application discloses that actions, such as altering binaural sound, may be taken in response to detecting an event. *Id.*, 115:31-116:6 (“In Figures 4-16, example actions include, but are not limited to, one or more of switch the sound from binaural sound to stereo sound, switch the sound from binaural sound to mono sound ... maintain binaural sound but alter the binaural sound, stop binaural sound, ... lower a volume of the sound, provide a sound or audio alert, provide a visual alert...”; *see also* Figure 16; Begault, ¶42; Begault Supp., ¶60. The ‘140 Application also describes examples of alerts:

By way of example, such alerts include, but are not limited to, one or more of a displaying a visual warning, providing an audible sound ... displaying a visual or perceivable

indication or warning ... and providing another indication
that notifies a user.

Id., 136:3-10; *see also id.*, 138:24-27. As such, the user would be implicitly alerted that the user is leaving the first environment, including leaving a physical environment and leaving a 3D virtual environment, due to the sound format change. Begault Supp., ¶59, 70.

Thus, in contrast to Petitioner’s assertion that the ‘140 Application “lacks any disclosure” of “alerting or warning that user that the user is leaving the 3D environment by reducing the binaural sound’s volume and also otherwise altering it,” the cited examples and portions of the ‘140 Application reasonably conveys possession of the claimed subject matter to a POSITA. Begault Supp., ¶62, 70.

C. All Claims of the ‘179 Patent are Supported by the ‘140 Application

1. Independent Claims

a. The ‘140 Application discloses sensing or determining that the user is leaving the environment/3D virtual environment using the HMD/WED

For the reasons explained above, Petitioner’s argument that “nowhere does the ‘140 application ... describe sensing or determining ... that the user is leaving the environment” using the HMD/WED as required by limitations 1[d], 7[d], and 14[d] (Pet.39) fails. The ‘140 Application specifies that the WED 2008 includes sensors 2080, a location tracker 2082, and a sound localization system 2092, which

can perform the methods (e.g., FIGS. 2-16) described in the specification. Ex. 1028, 151:7-8, 158:32-162:18. As established above, the ‘140 Application discloses a user leaving a physical environment (e.g., a user leaving a physical non-restricted area). The ‘140 Application also discloses a user leaving a 3D virtual environment, which is triggered by a user’s change in physical location (e.g., a user leaving a physical non-restricted area). Because the WED includes a location tracker and FIG. 6 discloses a user leaving a 3D virtual environment triggered by a user’s change in physical location, the ‘140 Application discloses using the HMD/WED to sense or determine the user is leaving a physical environment and to determine the user is leaving a 3D virtual environment. Begault Supp., ¶62.

b. The ‘140 Application discloses alerting/warning the user that the user is leaving the environment/3D virtual environment

As established above, the ‘140 Application discloses alerting the user that the user is leaving the environment, whether the environment is a physical environment as in claims 7 and 14 or a 3D virtual environment as in claim 1. The ‘140 Application also supports that the adjustments in binaural sound, such as a change in sound format from binaural to mono or stereo and/or the reduction in volume as disclosed in the ‘140 Application, would implicitly alert or warn the user that the user is leaving the environment/3D virtual environment. Thus, the ‘140 Application adequately discloses limitations 1[e], 7[e], and 14[e]. Begault Supp., ¶62.

2. Dependent Claims

As discussed in detail above, the ‘140 Application provides multiple examples and disclosures in which a POSITA would recognize a description of the claimed subject matter related to modifying binaural sound properties to provide an alert that the user is leaving an environment, including a 3D environment. As a result, the ‘179 patent maintains its priority chain to Lyren via the ‘140 Application. Because Petitioner relies on Lyren to teach claims 2-6, 8-13, and 15-20, and because Lyren is invalid prior art, Petitioner failed to carry its burden with regard to claims 2-6, 8-13, and 15-20.

D. Reif

As established above, because the ‘179 patent maintains the priority chain to the ‘140 Application, Reif is not a valid prior art reference because it was filed after the effective priority date of the ‘179 patent.

Accordingly, the ‘179 patent maintains the priority chain to the ‘140 Application, which includes the same specification as Lyren. Therefore, the ‘179 patent maintains the priority chain to Lyren, and Lyren is not valid prior art with respect to the ‘179 patent. Thus, Ground 2 fails.

VII. CONCLUSION

For the reasons above, Petitioner’s proposed grounds of unpatentability fail. Thus, Patent Owner asks the Board to find all challenged claims patentable.

Date: April 3, 2024

Respectfully submitted,

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CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), the undersigned hereby certifies that the foregoing Patent Owner's Response to the Petition contains 13842 words using the word count feature of Microsoft Word.

Dated: April 3, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §42.6(e), the undersigned hereby certifies that the above-captioned Patent Owner's Response to the Petition, and its cited exhibits, were served via electronic mail, as authorized by Petitioner's Mandatory Notices, on April 3, 2024 at the following email correspondence addresses of record:

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