

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.

IPR2023-01021
Patent 10,917,737 B2

Before JUSTIN T. ARBES, LYNNE H. BROWNE, and
SCOTT RAEVSKY, *Administrative Patent Judges*.

BROWNE, *Administrative Patent Judge*.

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

I. INTRODUCTION

Meta Platforms, Inc., Meta Platforms Technologies, LLC, and Twisted Pixel Games, LLC (“Petitioner”) filed a Petition (Paper 2 (“Pet.”)), seeking *inter partes* review of claims 1–20 (the “challenged claims”) of U.S. Patent No. 10,917,737 B2 (Ex. 1001 (“the ’737 patent”)). *See* Pet. 1. Eight KHZ, LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our prior authorization (Ex. 1144), Petitioner filed a Preliminary Reply (Paper 7, “Prelim. Reply”) and Patent Owner filed a Preliminary Sur-Reply (Paper 8, “Prelim. Sur-reply”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any 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.” 35 U.S.C. § 314(a); *see* 37 C.F.R. § 42.108. Upon consideration of the Petition and Preliminary Response we conclude that the information presented shows that there is a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one challenged claim of the ’737 patent.

A. Related Matters

The parties indicate that the ’737 patent is involved in *Eight kHz, LLC v. Meta Platforms, Inc.; Meta Platforms Technologies, LLC; Twisted Pixel Games, LLC*, 6:22-cv-00575-ADA (W.D. Tex. 2022) (“the related District Court litigation”). Pet. 71; Paper 4.

The parties identify U.S. Application Nos. 17/988,808 and 17/169,481 as applications related to the ’737 patent. Pet. 71; Paper 4. Petitioner additionally identifies U.S. Application Nos. 62/348,164, 15/365,880,

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15/429,131, and 15/635,166 as applications related to the '737 patent.
Pet. 71.

Patent Owner identifies U.S. Patent Nos. 9,800,990, 9,699,583, and 9,749,766 as patents related to the '737 patent. Paper 4.

Additionally, the following proceedings before the Board involve the same parties as the instant proceeding: IPR2023-01003 (U.S. Patent No. 9,226,090 B1), IPR2023-01004 (U.S. Patent No. 9,282,196 B1), IPR2023-01005 (U.S. Patent No. 9,674,628 B1), IPR2023-01019 (U.S. Patent No. 10,368,179 B1), IPR2023-01020 (U.S. Patent No. 10,448,184 B1), IPR2023-01022 (U.S. Patent No. 11,172,316 B2), IPR2023-01023 (U.S. Patent No. 10,798,509 B1), and IPR2023-01024 (U.S. Patent No. 11,290,836 B2).

B. The '737 Patent (Ex. 1001)

The '737 patent, for “Defining a Zone with a HPED and Providing Binaural Sound in the Zone,” relates to three-dimensional (“3D”) sound localization. Ex. 1001, code (54), 1:7–18. The '737 patent discloses a handheld portable electronic device (“HPED”) that “defines a zone that extends from a floor and around a user wearing a wearable electronic device ([“]WED[”]) and “designates a location in the zone for where binaural sound originates to the user.” *Id.*, code (57). The '737 patent further discloses that “[s]ounds are assigned to different zones or different sound localization points ([“]SLPs[”]) and are convolved so the sounds localize as binaural sound into the assigned zone or to the assigned SLP.” *Id.* at 1:23–26. To process or convolve the sounds, the '737 patent uses sound localization information (“SLI”) that may include, for example, head related transfer functions (“HRTFs”). *Id.* at 5:38–40, 6:21–40.

C. Challenged Claims

Petitioner challenges claims 1–20 of the '737 patent. Pet. 4–70. Of the challenged claims, claims 1, 8, and 14 are independent. Independent claim 1 is reproduced below with Petitioner's labeling of the limitations for ease of reference.

1. 1[pre] A method executed by one or more electronic devices, the method comprising:

1[a] tracking, with a wearable electronic device (WED) worn on a head of a user, movement of a handheld portable electronic device (HPED) held in a hand of the user such that the movement of the HPED defines a size and a shape of a three-dimensional (3D) zone that extends from a physical floor and around the user;

1[b] designating, with the HPED held in the hand of the user, a sound localization point (SLP) in empty space in the zone above the physical floor from where binaural sound originates to the user;

1[c] tracking, with the WED worn on the head of the user, the HPED held in the hand of the user such that the HPED provides a location to the WED of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user;

1[d] processing, by a processor, sound with head-related transfer functions (HRTFs) to generate the binaural sound that externally localizes to the user at the location of the SLP in empty space in the zone above the physical floor; and

1[e] displaying, with the WED worn on the head of the user, a virtual image at the location of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user.

Ex. 1001, 66:7–32.

D. The Alleged Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability (Pet. 2):¹

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–20	103	Pedrotti, ² Jang, ³ Begault ⁴
1–20	103	McCulloch, ⁵ Pedrotti, Flaks ⁶

E. Evidence

In support of its proposed grounds, Petitioner relies on the Declaration of Gregory F. Welch, Ph.D. (“Dr. Welch”). In support of its Preliminary Response, Patent Owner relies on the Declaration of John C. Hart, Ph.D. (“Dr. Hart”). In our analysis below, we consider Dr. Welch’s and Dr. Hart’s testimony.

II. ANALYSIS

A. Discretion under 35 U.S.C. § 314(a)

Patent Owner argues that we should exercise discretion under § 314(a) to deny institution in light of the related District Court litigation. Prelim. Resp. 34–43.

We consider the following factors when determining whether to deny institution under § 314(a) based on a parallel district court proceeding:

¹ Petitioner supports its challenge with the Declaration of Dr. Gregory F. Welch. Ex. 1003.

² U.S. Patent No. 9,851,786 B2, filed July 7, 2015, issued December 26, 2017 (Ex. 1005, “Pedrotti”).

³ U.S. Patent No. 8,520,872 B2, issued August 27, 2013 (Ex. 1006, “Jang”).

⁴ DURAND R. BEGAULT, NAT’L AERONAUTICS AND SPACE ADMIN., 3D SOUND FOR VIRTUAL REALITY AND MULTIMEDIA (2000) (Ex. 1007, “Begault”).

⁵ U.S. Patent No. 9,041,622 B2, issued May 26, 2015 (Ex. 1008, “McCulloch”).

⁶ U.S. Patent No. 8,767,968 B2, issued July 1, 2014 (Ex. 1009, “Flaks”).

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court's trial date to the Board's projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board's exercise of discretion, including the merits.

Apple Inc. v. Fintiv, Inc., IPR2020-00019, Paper 11 at 5–6 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). We also consider “several clarifications” made by the Director of the United States Patent and Trademark Office (“USPTO”). See USPTO Memorandum, Interim Procedure for Discretionary Denials in AIA Post Grant Proceedings with Parallel District Court Litigation, 2 (June 21, 2022) (“Director’s Memo”).⁷

The Director’s Memo provides that “[c]onsistent with *Sotera Wireless, Inc.*,^[8] the PTAB will not discretionarily deny institution in view of parallel district court litigation where a petitioner presents a stipulation not to pursue in a parallel proceeding the same grounds or any grounds that could have reasonably been raised before the PTAB.” Director’s Memo 3. With our authorization, Petitioner has filed a stipulation which stipulates that

⁷ Available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

⁸ *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 18–19 (PTAB Dec. 1, 2020) (precedential).

If the PTAB institutes the pending IPR in IPR2023-01021 challenging the patentability of claims 1-20 of the '737 patent, then [Defendants Meta Platforms, Inc., Meta Platforms Technologies, LLC, and Twisted Pixel Games, LLC] will not pursue as to the challenged claims any ground raised or that could have been reasonably raised in the IPR in the above-captioned district court litigation (No. 6:22-cv-00575-ADA).

Ex. 1141, 3.

Patent Owner concedes that Petitioner has filed a “*Sotera*-like stipulation” but argues that it is insufficient because it “leaves the door open to a duplication of efforts and the possibility of conflicting decisions.” Prelim. Sur-reply 1–2 (citing Ex. 1141, 4 (“This stipulation is not intended . . . to limit Meta’s ability to assert . . . invalidity under 35 U.S.C. §§ 102 and 103 not available in IPR and under 35 U.S.C. §§ 101 and 112[], regardless of whether IPRs are instituted.” (emphasis omitted))). Namely, Patent Owner argues that Petitioner’s stipulation carves out the “right to assert overlapping system art in the [parallel] district court [proceeding],” such that institution here would not address the risk of “inconsistent outcomes between the PTAB and the district court.” *Id.* at 4–5.

We disagree with Patent Owner, as Petitioner’s stipulation sufficiently comports with the language of the Director’s Memo, consistent with *Sotera Wireless, Inc.* See Director’s Memo 3. Patent Owner’s argument invites us to disagree with the reasoning of *Sotera* itself and the Director’s Memo, which we are bound to follow. Accordingly, Patent Owner’s argument is unavailing.

Patent Owner also urges us not to accept a “late” *Sotera* stipulation. Prelim. Sur-reply 5. We disagree that Petitioner’s *Sotera* stipulation is late. It is within our discretion to permit Petitioner to file a stipulation prior to

institution. *See NXP USA, Inc. v. Impinj, Inc.*, IPR2021-01556, Paper 13 (PTAB Sept. 7, 2022) (precedential).

We therefore decline to discretionarily deny institution in view of the related District Court litigation.

B. Legal Standards

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).

A claim is unpatentable for obviousness if “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103; *see also 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.⁹ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

C. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art (“POSITA”) “would have had a Bachelor’s degree in computer science/engineering, or a

⁹ The parties have not directed our attention to any objective evidence of obviousness or non-obviousness.

related field, and at least two years of industry experience, or academic research experience, in virtual/augmented reality, including visual and audio modeling and rendering” and that “[a]dditional education can compensate for less experience, and vice-versa.” Pet. 3 (citing Ex. 1003 ¶¶ 34–40). Patent Owner “applies Petitioner’s characterization of a POSITA.” Prelim. Resp. 2.

For purposes of this Decision, we also adopt Petitioner’s proposal as reasonable and consistent with the prior art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art may reflect an appropriate level of skill in the art).

D. Claim Construction

We apply the same claim construction standard used in district court actions under 35 U.S.C. § 282(b), namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b). In applying that standard, claim terms generally are given their ordinary and customary 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*, 415 F.3d at 1312–13. “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner asserts that “[t]he prior art relied on in this Petition discloses the subject matter of the challenged claims under any reasonable construction, including their plain meaning.” Pet. 4. We understand

Petitioner's position to be that no claim construction is required. *See id.*

Patent Owner disagrees with Petitioner's contention that we should apply "any reasonable construction," and instead argues that "[t]he claim terms should be given their 'ordinary and customary meaning' as understood by a POSITA in view of the patent claims, specification[,] and prosecution history." Prelim. Resp. 2–3 (citations omitted). Patent Owner further argues that "[h]ere, no express constructions of the claims are necessary." *Id.* at 3.

We agree with Patent Owner that at this point in this proceeding, "no express constructions of the claims are necessary." Prelim. Resp. 3.

E. Ground One: Alleged Obviousness of Claims 1–20 in View of the Combined Teachings of Pedrotti, Jang, and Begault

Petitioner contends that claims 1–20 are unpatentable over the combined teachings of Pedrotti, Jang, and Begault. Pet. 4–46. For the reasons discussed below, Petitioner demonstrates a reasonable likelihood of prevailing on this ground.

1. Pedrotti (Ex. 1005)

Pedrotti is a U.S. patent for a "System and Method for Assisting a User in Remaining in a Selected Area While the User is in a Virtual Reality Environment" that seeks to aid a user in avoiding physical obstacles while in a virtual environment. Ex. 1005, codes (54), (57). Pedrotti discloses an embodiment in which the user "wear[s] a head-mounted display (["HMD"]) and hold[s] a handheld controller" that includes a tracker that "provides information regarding a position of the handheld controller." *Id.* at 2:44–49.

Pedrotti further discloses determining a selected area, for example, a "safe area," in "which the user or another person has determined is clear of

physical obstacles in the physical world so that the user may move freely without coming into contact with such physical obstacles.” Ex. 1005, 4:32–36. Additionally, Pedrotti discloses that the handheld controller may be in the shape of an object that appears in the virtual world. *Id.* at 16:35–42.

2. *Jang (Ex. 1006)*

Jang is a U.S. patent for an “Apparatus and Method for Sound Processing in a Virtual Reality System.” Ex. 1006, code (54). Jang describes the generation of sound in a virtual reality system, which “may use a localization technique capable of expressing the virtual location.” *Id.* at 1:42–45. Specifically, Jang uses a sound processing unit to generate a sound output from a “focus area” that is different from a sound output generated from an “unfocused area.” *Id.* at 2:32–3:4. For example, as a control unit detects a space shift from a first space to a second space in the virtual reality space, the volume of sound from the first space may be gradually decreased as the volume of sound from the second space is gradually increased. *Id.*

3. *Begault (Ex. 1007)*

Begault is a book titled “3-D Sound for Virtual Reality and Multimedia.” Ex. 1007, 1–2. Begault discloses “a sound subsystem in a virtual reality system” that includes a signal source, a signal processor, and active noise cancellation technology. *Id.* at 12–13.

Begault discloses an example in which “[a]ll types of sonic input could be directionalized to a specific location, controlled by the user.” Ex. 1007, 172. In this example, “the audio spatial mapping can correspond to a prioritization scheme.” *Id.* (emphasis omitted). Begault further discloses that the user may hear different sound inputs from different spatial locations,

such that “spatial location informs the listener as to the prioritization” of the sound. *Id.* at 172–173.

4. Rationale to combine Pedrotti, Jang, and Begault

Petitioner asserts that “Pedrotti discloses ‘sight and sound’ as the ‘most commonly used’ senses in virtual environments ([Ex. 1005], 1:14-20) but does not address sound processing.” Pet. 8. Petitioner reasons that a person of ordinary skill in the art “would have been motivated to look to references, like Jang and Begault, which disclose advantageous sound processing techniques providing ‘a higher sense of realism’ and enabling ‘a rich auditory environment.’” *Id.* (citing Ex. 1006, 1:42–56, 2:9–11, 2:26–28; Ex. 1007, 10–11, 13). Petitioner reasons further that “[a]dding Jang and Begault’s sound processing techniques would have amounted to no more than applying known techniques (e.g., binaural sound processing) to a known device (Pedrotti’s HMD) ready for improvement to yield predictable results (spatialization of sound for an immersive VR experience).” *Id.* (citing Ex. 1003 ¶¶ 212–213, 220).

Petitioner also reasons that a person of ordinary skill in the art “would have understood that providing binaural sound would enhance the sense of ‘presence’ for users, making the VR experience more immersive” and that “binaural sound was known to enhance perception of space, distance, and size within virtual environments.” Pet. 9. In addition, Petitioner asserts that “binaural sound, as disclosed by Jang and Begault, was a computationally efficient way of achieving these goals.” *Id.* (citing Ex. 1007, 11; Ex. 1139; Ex. 1003 ¶¶ 221–224).

Noting that “Pedrotti and Jang are Sixense and Samsung patents, respectively,” Petitioner reasons that a person of ordinary skill in the art

“would have known that both companies were working on VR systems, including in concert and on complementary technologies” such that a person of ordinary skill in the art “would have reasonably expected to succeed in combining the teachings of these references, which disclose well-known hardware.” Pet. 9–10 (citing Ex. 1003 ¶¶ 215–217; Ex. 1086; Ex. 1080).

Patent Owner contends that “Petitioner has failed to establish that a POSITA would have been motivated to combine Pedrotti with Jang . . . as Jang does not address a virtual reality user physically moving in a physical space but instead is directed to sound processing when a character moves within a virtual world to minimize lag.” Prelim. Resp. 5.

Patent Owner’s arguments are unavailing as they do not address Petitioner’s reasoning in support of the proposed combination. Petitioner relies on Jang’s teachings regarding use of sound processing techniques that provide more realism and a rich auditory environment in a virtual reality environment. Pet. 8–9. Even assuming that Patent Owner is correct that Jang is directed to sound processing when a character moves within a virtual world to minimize lag, we agree with Petitioner at this stage that it would have been obvious to apply Jang’s technique to Pedrotti’s method. *KSR*, 550 U.S. at 417 (“if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill”). On the record before us, we determine that Petitioner has articulated sufficient reasoning in support of the proposed combination at this stage of the proceeding.

5. Independent Claim 1

Petitioner asserts that the combined teachings of Pedrotti, Jang, and

Begault disclose or suggest all of the limitations of claim 1. Pet. 10–25.

a. Undisputed Limitations

Patent Owner does not dispute Petitioner’s assertions regarding the preamble to claim 1 or limitations 1[b], 1[d], or 1[e]. Prelim. Resp. 5–23. We summarize Petitioner’s assertions below.

- i. 1[pre]: A method executed by one or more electronic devices, the method comprising:*

For the preamble to claim 1, Petitioner assert that “Pedrotti disclosed methods implemented with electronic devices, including a ‘HMD’ and ‘handheld controller[s].’” Pet. 10 (citing Ex. 1005, 2:27–59; Welch ¶¶ 226–228).

- ii. 1[b]: designating, with the HPED held in the hand of the user, a sound localization point (SLP) in empty space in the zone above the physical floor from where binaural sound originates to the user;*

For limitation 1[b], Petitioner asserts that “Pedrotti disclosed using an HPED to move virtual objects in its zone, including in empty space above a physical floor” and that “Pedrotti’s controllers are ‘use[d] to control certain actions or events in the virtual world,’ including by ‘moving’ virtual objects such as virtual weapons and sports equipment.” Pet. 14 (citing Ex. 1005, 4:4–15, 5:25–36, 8:14–35, 9:26–52, 16:33–42, Fig. 8; Ex. 1003 ¶ 243). Petitioner reasons that a person of ordinary skill in the art “would have known to associate binaural sounds with Pedrotti’s VR objects and have sound move with them because these were fundamental features of VR before June 2016.” *Id.* (citing Ex. 1003 ¶¶ 241, 251–253). Petitioner asserts further that “Jang confirms the obviousness of moving binaural sound-producing virtual objects, e.g., characters” in that “Jang disclosed ‘game joystick[s]’ and ‘controller[s]’ and that a user ‘may see, hear, and otherwise

sense the virtual environment’ and ‘interact with’ it, including ‘other avatars, characters, objects, or features.’” *Id.* at 15 (citing Ex. 1006, 1:35–38, 6:35–38, 6:44–47).

Petitioner provides further reasons why limitation 1[b] would have been obvious to a person of ordinary skill in the art. Pet. 15–19. As Patent Owner has not contested Petitioner’s assertions regarding limitation 1[b] we do not reproduce Petitioner’s further assertions regarding this limitation.

- iii. *1[d]: processing, by a processor, sound with head-related transfer functions (HRTFs) to generate the binaural sound that externally localizes to the user at the location of the SLP in empty space in the zone above the physical floor; and*

For limitation 1[d], Petitioner asserts that “Jang disclosed, or at a minimum rendered obvious, processing, by a processor, sound with HRTFs to generate binaural sound that externally localizes to a user at SLPs.” Pet. 21. In support of this assertion, Petitioner contends that “Jang taught that, ‘to give the sense of reality to the sound,’ one can use ‘a localization technique capable of expressing the virtual location’ of ‘a sound-generating object’ and HRTFs” and that Jang “disclosed a ‘sound processing unit’ comprising processors that ‘process sound’ and identify ‘exact sound-generating location[s].’” *Id.* (citing Ex. 1006, 1:42–51, 1:52–56, 7:38–63, 8:54–9:3). Petitioner reasons that “it would have been obvious that designated SLPs would be ‘in empty space in the zone above the physical floor,’” that a person of ordinary skill in the art “would have known that Pedrotti’s processor could and would manage sound, including as Jang described,” that “Pedrotti recognized that ‘sight and sound’ are ‘the senses most commonly used [] to create virtual reality,’” and that “it was commonplace before June 2016 to use a processor to process sound with

HRTFs to generate binaural sound.” *Id.* (citing *id.* at 13–19; Ex. 1006, 1:18–20; Ex. 1003 ¶¶ 293–296).

Petitioner further asserts that “Begault confirms this” and provides further reasoning as to why limitation 1[d] would have been obvious to one of ordinary skill in the art. Pet. 22.

- iv. 1[e]: displaying, with the WED worn on the head of the user, a virtual image at the location of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user.*

For limitation 1[e], Petitioner asserts that “Pedrotti disclosed displaying virtual images with its HMD” and that

Jang disclosed outputting “audio, sound, and/or other sensory data” “to the user to represent the virtual environment,” and that its sound system “check[s] sound source information on other characters and other objects existing in [] virtual reality spaces” to “provide[] the virtual reality apparatus 110 with sound sources occurring in real time according to the relative locations or situations of the character in the virtual reality environment.”

Pet. 23 (citing *id.* at 10–13; Ex. 1006, 6:17–20, 6:36–42, 7:24–32). Thus, according to Petitioner, a person of ordinary skill in the art “would have known that when Pedrotti’s controller is used to move virtual objects, for example to position audio sources in a Pedrotti-Jang . . . system . . . such a system would (or at a minimum obviously would) display virtual images at the locations to which the virtual objects were moved and/or assigned (SLPs).” *Id.* at 23–24 (citing Ex. 1003 ¶¶ 308–311).

Petitioner provides further reasons why the combined teachings of Pedrotti, Jang, and Begault would have rendered limitation 1[e] obvious. Pet. 24–25. As Patent Owner has not contested Petitioner’s assertions

regarding limitation 1[e] we do not reproduce Petitioner’s further assertions regarding this limitation.

v. Conclusion For Uncontested Limitations

For the preamble of claim 1 and limitations 1[b], 1[d], and 1[e], we have reviewed Petitioner’s assertions including the cited portions of Pedrotti, Jang, and Begault, as well as, Dr. Welch’s testimony in support of these assertions. We determine that, on this record, the combination of Pedrotti, Jang, and Begault discloses the preamble (whether or not limiting) and these limitations. *See LG Elecs., Inc. v. Conversant Wireless Licensing S.A.R.L.*, 759 F. App’x 917, 925 (Fed. Cir. 2019) (nonprecedential) (“The Board is ‘not required to address undisputed matters’ or arguments about limitations with which it was never presented.”) (quoting *In re NuVasive, Inc.*, 841 F.3d 966, 974 (Fed. Cir. 2016)).

b. Disputed Limitations

Patent Owner contends that the combination fails to teach fully-integrated tracking by a wearable electronic device. Prelim. Resp. 5–23. In particular, Patent Owner contends that the proposed combination would not have rendered limitations 1[a] and 1[c] obvious to a person of ordinary skill in the art. *Id.* at 16–23. We first summarize Petitioner’s positions regarding these limitations and then address Patent Owner’s arguments below.

- i. 1[a]: tracking, with a wearable electronic device (WED) worn on a head of a user, movement of a handheld portable electronic device (HPED) held in a hand of the user such that the movement of the HPED defines a size and a shape of a three-dimensional (3D) zone that extends from a physical floor and around the user;*

Petitioner asserts that “[u]sers of Pedrotti’s system ‘wear a head-mounted display (HMD)’ (WED), and ‘hold a handheld controller’ (HPED)”

and that “Pedrotti’s handheld controller includes a ‘tracker,’ which ‘provides information regarding a position of the handheld controller.’” Pet. 11 (citing Ex. 1005, 2:44–49, 15:7–12; 4:49–5:24). Petitioner asserts further that “Pedrotti’s system also includes a processor that tracks the controllers, determining ‘the position of the handheld controller . . . using information from the controller tracker’” and that “[t]his processor, which may be ‘in the HMD,’ ‘knows where the user’s head and hands are located.’” *Id.* (citing Ex. 1005, 12:29–39, 12:49–57, 16:22–24). Thus, according to Petitioner, “Pedrotti’s HMD tracked (or at a minimum obviously tracked) movement of an HPED.” *Id.* (citing Ex. 1003 ¶¶ 229–232).

Petitioner further asserts that “Pedrotti’s HMD-tracked controller ‘defines a size and a shape of a three-dimensional (3D) zone that extends from a physical floor and around the user’” in that Pedrotti’s system “can determine ‘a boundary of a selected area’ in a virtual environment, so users ‘may move freely’ and without contacting ‘obstacles.’” Pet. 11 (citing Ex. 1005, 2:49–51, 4:32–36).

- ii. *1[c]: tracking, with the WED worn on the head of the user, the HPED held in the hand of the user such that the HPED provides a location to the WED of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user;*

Petitioner asserts that “Pedrotti taught tracking controllers (HPEDs) with its HMD (a WED).” Pet. 19 (citing *id.* at 10–13). Petitioner reasons that a person of ordinary skill in the art “would have known and understood that when a Pedrotti controller is used to move virtual objects, for example to position sound sources in a Pedrotti-Jang (or Pedrotti-Jang-Begault) system, that action would (or at a minimum obviously would) provide Pedrotti’s HMD the locations to which the virtual objects were moved

and/or assigned (SLPs).” *Id.* (citing Ex. 1003 ¶¶ 281, 286–289). Petitioner asserts further that “Pedrotti’s processor, ‘in the HMD,’ ‘us[es] information’ it receives ‘from the controller tracker[s],’ including to ‘generate and output’ appropriate instructions to the HMD.” *Id.* (citing Ex. 1005, 2:49–59). Based on these assertions, Petitioner reasons that a person of ordinary skill in the art “would have known that Pedrotti’s processor could and would receive locations of SLPs provided by Pedrotti’s controllers, so binaural sounds could be processed to originate from assigned locations, which, as noted, would obviously include locations in ‘empty space’ and ‘above a physical floor’ in Pedrotti’s zone.” *Id.* at 19–20 (citing *id.* at 13–19; Ex. 1003 ¶¶ 290–291; Ex. 1006, 4:19–39).

Petitioner provides two examples in support of its position. First, Petitioner asserts that “if Pedrotti’s handheld controller designates locations for an announcer or a pep band in Jang’s virtual basketball court, the HPED making these designations could and would provide the locations for these sensory elements’ binaural sound.” Pet. 20 (citing Ex. 1003 ¶ 292; Ex. 1006, 10:32–43). Second, Petitioner asserts that “if Pedrotti’s controller controls an interface facilitating ‘spatial audio mapping,’ as described by Begault, that too could and would provide positions for the generation of binaural sound.” *Id.* (citing *id.* at 13–19; Ex. 1003 ¶¶ 289–290; Ex. 1007, 172–173, Fig. 5.12).

In addition, Petitioner asserts that “[Patent Owner] has asserted in district court that limitation 1[c] requires only a WED that tracks an HPED that ‘cause[s] a game character to move.’” Pet. 20 (citing Ex. 1121, 6). According to Petitioner, “[u]nder that interpretation, limitation 1[c] would

have been obvious for the same reasons as limitations 1[a] and 1[b].” *Id.* (citing *id.* at 10–18; Ex. 1003 ¶¶ 282–285).

iii. Patent Owner’s Contentions

First, Patent Owner contends that Pedrotti “does not disclose tracking, *with the WED worn on the head of the user*, the HPED to provide the location of the SLP in the zone, as required by claim 1.” Prelim. Resp. 16. Specifically, Patent Owner contends that “Pedrotti consistently refers to the ‘processor’ used for tracking purposes as something outside of the HMD – the processor in the stationary base station, not a processor in the HMD.” *Id.* According to Patent Owner, “[a]ll of Pedrotti’s teachings on tracking involve the stationary base station. Pedrotti teaches that whether by electromagnetic fields, light emitting trackers, or other forms, the HMD and handheld controller is tracked in relation to their distance from a base station.” *Id.* (citing Ex. 1005, 4:49–58, 5:7–24).

Patent Owner contends further that Petitioner takes Pedrotti’s “statement that a processor ‘may be located . . . in the HMD’” out of context. Prelim. Resp. 20. In support of its position, Patent Owner quotes Pedrotti’s statements that

There may be a single processor, or multiple processors performing different functions of the functions described herein. As above, a processor may be located in the base station, or in a separate location, or even in the HMD or one of the controllers if desired. One of skill in the art will appreciate how to determine which and how many processors will be appropriate for a specific intended application.

Ex. 1005, 16:20–26. According to Patent Owner, “in context, Pedrotti’s statement that a processor may be located ‘even in the HMD,’ merely remarks that processors may be located in virtually any devices associated

with the system to perform any number of ‘different functions of the functions described herein.’” Prelim. Resp. 20 (citing Ex. 1005, 16:20–22).

Second, Patent Owner contends that “tracking the handheld controller with the HMD while worn on the head to define a safe area with the system disclosed by Pedrotti is directly contrary to Pedrotti’s teachings emphasizing the safety of the user by avoiding collisions with physical obstacles in the safe area.” Prelim. Resp. 18. Patent Owner contends further that “tracking to generate a safety boundary cannot be provided via a processor within Pedrotti’s HMD because once the user is wearing the HMD, the *user cannot see* the physical world to navigate the chosen perimeter and avoid physical obstacles.” *Id.* According to Patent Owner, “Petitioner’s position, which would have a user walking in the physical world but unable to see any physical obstacles *is contrary to the explicit teachings* in Pedrotti of methods to *avoid collisions with physical obstacles.*” *Id.*

In addition, Patent Owner contends that “Pedrotti teaches away from using a fully-integrated tracking system within the HMD.” Prelim. Resp. 21. In support of this contention, Patent Owner quotes Pedrotti’s statement that

If components such as the electromagnetic field source or camera used to determine the position of the HMD and controller trackers relative to the base station are not located in the base station, it will be desirable for the base station to also contain a tracker similar to those used in the HMD and controllers, so that the position of the base station is known and thus the positions of the HMD and controllers relative to the base station can be determined.

Id.; Pet. 21–22; Ex. 1005, 6:3–10. Thus, according to Patent Owner, “Pedrotti’s tracking system depends on the presence of the stationary base station, which determines the positions of the HMD and the handheld controllers relative to the base station.” *Id.* at 22.

Third, Patent Owner contends that “Pedrotti’s light-emitting trackers in the controller are used by a camera mounted on the HMD to track the position of the controller . . . [and] would not track the position of the controller in relation to the ‘safe area,’ but instead would merely track the position of the controller relative to the HMD.” Prelim. Resp. 19 (citing Ex. 2001 ¶ 35). Patent Owner contends further that “[t]his would frustrate the purpose of Pedrotti of keeping a user in a safe area.” *Id.* (citing Ex. 2001 ¶¶ 36–37). According to Patent Owner, “the only component that could be practically employed to track a boundary using relative position data would be a stationary device, such as the base station as described throughout Pedrotti.” *Id.* at 19–20 (citing Ex. 1005, 4:49–57, 5:7–11, 6:3–10, 7:66–8:2, 10:20–27, 14:7–10, 14:13–23).

Thus, according to Patent Owner, “Pedrotti does not teach or suggest zonal tracking of a user with a WED worn on the head of a user, let alone specifically tracking when the user is located inside the zone with the WED.” Prelim. Resp. 22. Patent Owner contends further that “Jang and Begault, alone or in hypothetical combination with Pedrotti do not obviate this deficiency of Pedrotti.” *Id.*

iv. Discussion

At this stage of this proceeding, we find Petitioner’s arguments persuasive and do not find Patent Owner’s arguments compelling. Patent Owner’s argument that all of Pedrotti’s teachings regarding tracking involve the use of a stationary base is not compelling because even assuming that Patent Owner is correct, nothing in claim 1 precludes the use of a stationary base in addition to the required WED and HPED. Ex. 1001, 66:7–32. Claim 1 merely recites a method “comprising” tracking, “with” the WED,

movement of the HPED, but does not expressly preclude other devices from being involved in the tracking.

Patent Owner's second argument is not compelling for similar reasons because it is based on removal of Pedrotti's stationary base from its system. Claim 1, however, does not require that tracking to generate a safe boundary be performed only by a processor in the WED. Claim 1 merely requires that the WED track the movement of the HPED to define a size and shape of a three-dimensional zone that extends from the physical floor and around the user and that the HPED provides a location to the WED of a SLP in the zone. Ex. 1001, 66:9–14, 66:19–23.

Further, Patent Owner's argument that Pedrotti teaches away from a “fully-integrated tracking system within the HMD” is inapposite, as claim 1 does not require a “fully integrated tracking system within the HMD.” Prelim. Resp. 21.

Patent Owner's third argument is also not compelling. Claim 1 does not require the WED to track the position of the HPED relative to a safe area. Rather, claim 1 requires that the WED track the position of the HPED to define a zone and to provide a location of a SLP. Ex. 1001, 66:9–14, 66:19–23.

v. *Conclusion For Disputed Limitations*

For limitations 1[a] and 1[c], we have reviewed Petitioner's assertions including the cited portions of Pedrotti, Jang, and Begault, as well as, Dr. Welch's testimony in support of these assertions. We have also considered Patent Owner's arguments as discussed above. We determine that, on this record, the combination of Pedrotti, Jang, and Begault discloses these limitations.

c. Conclusion For Claim 1

On the record before us for the reasons discussed above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing for claim 1.

6. Claims 2–20

Petitioner asserts that the combined teachings of Pedrotti, Jang, and Begault disclose or suggest all of the limitations of claims 2–20. Pet. 25–46.

Patent Owner does not separately dispute Petitioner’s assertions regarding these claims. Patent Owner contends that limitations 8[a] and 8[c] are similar to limitations 1[a] and 1[c] and that limitation 14[b] is also similar to limitations 1[a] and 1[c] and that as Pedrotti fails to teach limitations 1[a] and 1[c] it does not teach limitations 8[a], 8[c], and 14[b] as well. Prelim. Resp. 23. In addition, Patent Owner contends that based on their dependency from claim 1, claims 2–7 are not rendered obvious by Pedrotti, based on their dependency from claim 8, claims 9–13 are not rendered obvious by Pedrotti, and based on their dependency from claim 14, claims 15–20 are not rendered obvious by Pedrotti. *Id.*

As we have determined that Petitioner has demonstrated a reasonable likelihood of prevailing for claim 1, Patent Owner’s arguments for these claims are likewise unconvincing. We have reviewed Petitioner’s assertions for claims 2–20, the evidence in support of these assertions, as well as, Dr. Welch’s testimony in support of them. On the record before us, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing for claims 2–20.

F. Ground Two: Alleged Obviousness of Claims 1–20 in View of the Combined Teachings of McCulloch, Pedrotti, and Flaks

Petitioner contend that claims 1–20 of the '737 patent are unpatentable over the combined teachings of McCulloch, Pedrotti, and Flaks. Pet. 46–70. For the reasons discussed below, Petitioner demonstrates a reasonable likelihood of prevailing on this ground.

1. McCulloch (Ex. 1008)

McCulloch is a U.S. Patent for “Controlling a Virtual Object with a Real Controller Device” and relates to the use of a real controller device that controls an object displayed by a near-eye, augmented reality display. Ex. 1008, code (54), 1:19–20. Figure 8B, reproduced below, is a perspective view of a user controlling a virtual object with a real controller device.

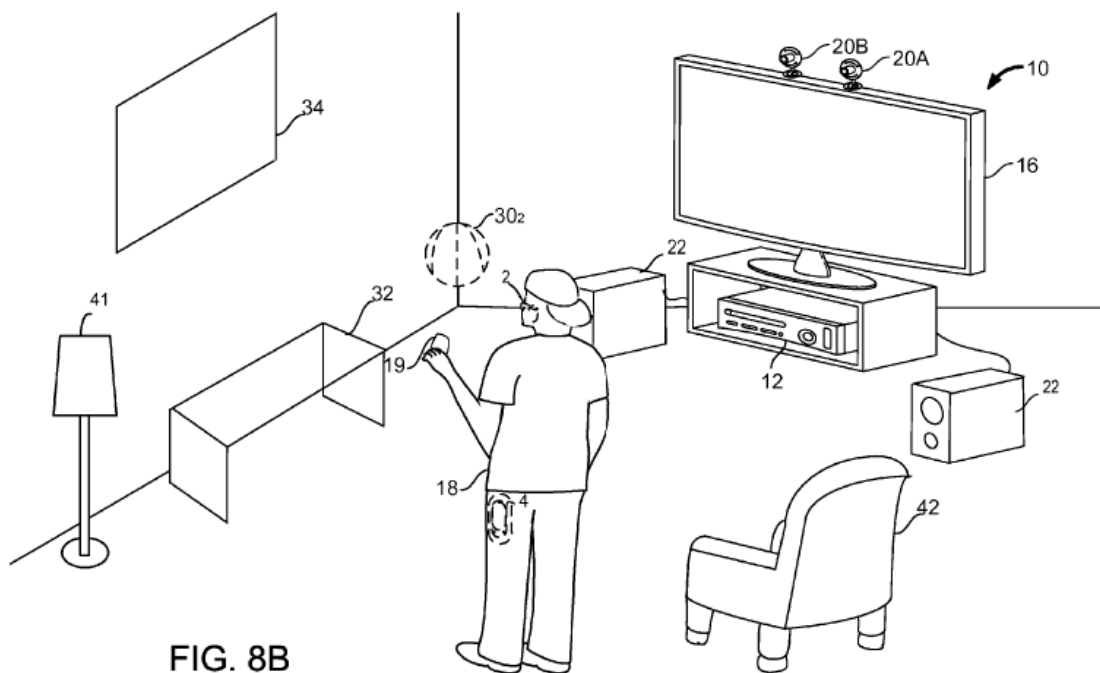


Figure 8B shows user 18 in his living room which includes lamp 41, table 32, wall hanging 34, basketball 30, chair 42 and home entertainment system

10 including 3D image capture devices 20A and 20B, television 16, speakers 22, and game console 12. Ex. 1008, 28:55–60. User 18 wears head mounted display device 2, has companion processing module 4 in his pocket, and holds real controller device 19 in his left hand. *Id.* at 28:63–66, Fig. 8B.

As further shown in Figure 8B, virtual object 30₂ is controlled with real controller device 19. Ex. 1008, 29:4–6. “The changes in position and orientation of the handheld controller causes its inertial motion unit to generate one or more signals which are converted by the handheld IMU real controller device 19 to be user input requesting display of an action by the virtual object 30₂.” *Id.* at 29:6–10.

2. Flaks (Ex. 1009)

Flaks is a U.S. Patent for a “System and Method for High-Precision 3-Dimensional Audio for Augmented Reality.” Ex. 1009, code (54). Flaks collects data from sensors, including a listener’s location within a room and the room’s characteristics, in order to generate a three-dimensional (“3D”) audio signal. *Id.* at code (57). Flaks further discloses that “[i]n some embodiments, sensor data may be used to collect physical characteristics of the listener such that a suitable HRTF may be determined from a library of HRTFs.” *Id.*

3. Rationale to combine McCulloch, Pedrotti, and Flaks

Petitioner asserts that “McCulloch incorporates, and thus includes as part of its own disclosures, Flaks’s ‘3D audio engine.’” Pet. 47 (citing Ex. 1008, 21:21–28). Based on this assertion, Petitioner reasons that a person of ordinary skill in the art “would have known to combine McCulloch’s system with Flaks’ 3D audio engine because McCulloch says to do so, and to

enhance the VR immersive experience using 3D audio.” *Id.* (citing *id.* at 46–47; Ex. 1003 ¶¶ 455–456). Petitioner reasons further that a person of ordinary skill in the art “would have been motivated to combine McCulloch’s system (including Flaks’s 3D audio engine) with Pedrotti’s method for assisting a user in remaining within a selected area” because “McCulloch taught ‘identifying boundaries for a playspace.’” *Id.* at 48 (citing Ex. 1008, 20:11–13). In addition, Petitioner asserts that a person of ordinary skill in the art “would have recognized that Pedrotti describes an advantageous method for defining boundaries for virtual environments, including to protect users.” *Id.* (citing *id.* at 4–6; Ex. 1003 ¶¶ 443–454).

In addition, Petitioner opines that “[i]n AR and VR environments, immersivity is key, and users risk personal injury and property damage due to collisions and tripping hazards” and that “Pedrotti’s methods help users stay within boundaries and avoid such collisions, without disrupting immersive experiences.” Pet. 48 (citing *id.* at 4–6; Ex. 1003 ¶¶ 446–452; Ex. 1005, 11:66–12:3; Ex. 1008, 26:35–48, 20:28–29, 23:39–51). Petitioner also asserts that McCulloch, Flaks, and Pedrotti are analogous to each other in that they are all “directed to systems and methods for providing immersive, interactive virtual experiences and use motion-tracked HMDs and controllers.” *Id.* at 48–49 (citing *id.* at 4–6, 46–47; Ex. 1003 ¶¶ 444–445).

In conclusion, Petitioner reasons that a person of ordinary skill in the art “combining the teachings of McCulloch (including with Flaks) with Pedrotti’s methods would have had a reasonable expectation of success” as “[t]hese references disclosed hardware that was well known before June 2016, such as HMDs, controllers, and processors, and common methods of

using such hardware, e.g., to set boundaries and process sound with HRTFs.” Pet. 49 (citing *id.* at 4–6, 46–47). Petitioner reasons further that “combining the teachings of McCulloch, Flaks, and Pedrotti to implement Pedrotti’s ‘safe area’ system would have been obvious to try and well within common sense, and would have been routine, requiring no more than combining known elements with known functions, to improve similar devices in known ways.” *Id.* (citing Ex. 1003 ¶¶ 453–454).

Patent Owner contends that a person of ordinary skill in the art “would not be motivated to combine McCulloch’s system with Pedrotti’s method for assisting a user in remaining within a selected area” because “[t]he motive in McCulloch for defining a playspace with boundaries is unrelated to user safety as within Pedrotti.” Prelim. Resp. 27 (citing Ex. 2001 ¶ 51). According to Patent Owner, “[t]he critical difference between Pedrotti’s and McCulloch’s motivation is related to how a user interacts with the real world when wearing an HMD or WED.” *Id.* Based on this understanding of the prior art, Patent Owner contends that “Pedrotti is clear that the HMD it describes completely obstructs the user’s view of the real world making it hazardous to move freely in a real-world space that has obstructions and walls,” whereas “the McCulloch HMD *always* permits the user to see the real world while wearing the HMD such that it replicates or does not meaningfully obstruct the user’s natural field-of-view (‘FOV’).” *Id.* (citing Ex. 1005, 2:25–26; 4:6; Ex. 1008, 3:54–4:3). Thus, according to Patent Owner, “there is no need for producing the safety barrier using the McCulloch device, contrary to Petitioner’s assertion.” *Id.* (citing Ex. 2001 ¶ 51). Patent Owner contends further that “the method for setting such a boundary in McCulloch is adequate and environmentally based on the user’s

needs, eliminating the necessity to add Pedrotti's invention to its system.”
Id.

Patent Owner contends that “[t]he creation of a virtual safety fence is not only counter to the objectives of the McCulloch invention, but also unnecessary.” Prelim. Resp. 28. Patent Owner contends that “McCulloch describes an invention that is meant to blur the lines of reality and fiction” and if “a virtual wall [was] to suddenly appear, this would serve as [a] sudden and violent break with the immersive experience McCulloch is trying to create.” *Id.* (citing Ex. 1008, 29:36–63). Patent Owner contends further that “beyond the fact that a user would be able to see the couch wearing the McCulloch HMD in Petitioner’s hypothetical, McCulloch specifically teaches using depth sensors on the HMD and other parts of the system to produce a 3D map of the objects in the user’s environment” such that McCulloch’s “HMD can easily predict a potential collision with a physical object, know whether the object is seen by the user, and alert the user to the presence of the object if necessary.” *Id.* at 28–29. Thus, according to Patent Owner, a person of ordinary skill in the art “would not be motivated to combine McCulloch’s boundary setting method with the Pedrotti boundary method.” *Id.* at 29.

We do not find Patent Owner’s argument to be convincing. Although we agree with Patent Owner that McCulloch’s HMD allows the user to see their surroundings, we do not agree that this obviates the need for further safety measures such as those taught by Pedrotti. On the record before us, we determine that Petitioner has articulated sufficient reasoning in support of the proposed combination at this stage of this proceeding.

4. Independent claim 1

Petitioner asserts that the combined teachings of McCulloch, Pedrotti, and Flaks disclose or suggest all of the limitations of claim 1. Pet. 50–57.

a. Undisputed Limitations

Patent Owner does not dispute Petitioner’s assertions regarding the preamble to claim 1 or limitations 1[b], 1[d], or 1[e]. Prelim. Resp. 30–34. We summarize Petitioner’s assertions below.

- i. 1[pre]: A method executed by one or more electronic devices, the method comprising:*

For the preamble to claim 1, Petitioner assert that “McCulloch disclosed methods executed by electronic devices, including an HMD and controllers.” Pet. 50 (citing Ex. 1008, 4:49–55, 6:55–61, Figs. 1A–1B; Ex. 1003 ¶¶ 457–458). Petitioner further asserts “[s]o did Pedrotti.” *Id.* (citing *id.* at 4–6; Ex. 1003 ¶ 459).

- ii. 1[b]: designating, with the HPED held in the hand of the user, a sound localization point (SLP) in empty space in the zone above the physical floor from where binaural sound originates to the user;*

For limitation 1[b], Petitioner asserts that “McCulloch disclosed multiple examples of handheld controllers moving virtual objects.” Pet. 52 (citing Ex. 1008, 12:49–13:51, 25:6–50, 29:4–17, Figs. 3A–3E, 8A–8D). Petitioner asserts further that “McCulloch also disclosed that sound for its virtual objects—e.g., the basketball smashing the television, or helicopters crashing into walls—should be produced ‘as if coming from the direction of the virtual object.’” *Id.* at 53 (citing Ex. 1008, 21:21–38, 14:53–67, 24:67–26:34, 26:7–9, Figs. 5, 8A–8D).

Petitioner asserts that “[a]dditionally, McCulloch incorporates Flaks’s positional 3D audio engine ([Ex. 1008], 21:29–34), which processes sound

with HRTFs to ‘localize a sound as coming from a virtual sound source,’ i.e., to generate binaural sound for McCulloch’s HPED-controlled virtual objects at those objects’ locations (SLPs).” Pet. 53 (citing Ex. 1009, 1:44–46, 1:62–64, 13:55–14:4; Ex. 1003 ¶¶ 447–483).

Petitioner reasons that a person of ordinary skill in the art “would have known that locations from which sounds for McCulloch’s virtual objects are perceived to originate (SLPs) are, or at a minimum obviously would be, in ‘empty space in the zone above the physical floor.’” Pet. 54.

- iii. *1[d]: processing, by a processor, sound with head-related transfer functions (HRTFs) to generate the binaural sound that externally localizes to the user at the location of the SLP in empty space in the zone above the physical floor; and*

For limitation 1[d], Petitioner asserts that “McCulloch’s HMD includes a 3D audio engine for producing audio ‘projected from a 3D space position of the virtual object,’ i.e., binaural sound, and McCulloch incorporated Flaks for implementation details.” Pet. 56 (citing Ex. 1008, 13:52–14:5, 14:59–64, 21:21–38, 25:60–26:19, Fig. 4A). Petitioner asserts further that “[t]hose details include Flaks’s disclosure that 3D audio, i.e., binaural sound, is generated by processing HRTFs as claimed.” *Id.* (citing *id.* at 21–23; Ex. 1009, 2:6–20; Ex. 1003 ¶¶ 492–497, 105–112, 498; Ex. 1136, 196:12–197:18).

- iv. *1[e]: displaying, with the WED worn on the head of the user, a virtual image at the location of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user.*

For limitation 1[e], Petitioner asserts that “McCulloch and Pedrotti both disclosed HMDs that display virtual images.” Pet. 56 (citing *id.* at 23–25; Ex. 1008, Fig. 8B, 8:40–46, 16:49–65, 13:52–14:5, Fig. 4A; Ex. 1005,

code (57)). Petitioner asserts further that “McCulloch discloses, or at a minimum renders obvious, displaying virtual images, e.g., a basketball or a helicopter, at the locations for the images’ binaural sounds (SLPs), e.g., where the basketball smashes a television or where helicopters crash into walls, including in empty space in a zone above a physical floor.” *Id.* at 56–57 (citing *id.* at 52–56; Ex. 1009, 4:10–20; Ex. 1003 ¶¶ 500–505).

v. Conclusion For Uncontested Limitations

For the preamble of claim 1 and limitations 1[b], 1[d], and 1[e], we have reviewed Petitioner’s assertions including the cited portions of McCulloch, Pedrotti, and Flaks, as well as, Dr. Welch’s testimony in support of these assertions. We determine that, on this record, the combination of McCulloch, Pedrotti, and Flaks discloses the preamble (whether or not limiting) and these limitations. *See LG Elecs.*, 759 F. App’x at 925.

b. Disputed Limitations

Patent Owner contends that the combination fails to teach using a wearable electronic device to track a handheld device. Prelim. Resp. 23–34. In particular, Patent Owner contends that the proposed combination would not have rendered limitations 1[a] and 1[c] obvious to a person of ordinary skill in the art. *Id.* at 30–34. We discuss these limitations below.

- i. 1[a]: tracking, with a wearable electronic device (WED) worn on a head of a user, movement of a handheld portable electronic device (HPED) held in a hand of the user such that the movement of the HPED defines a size and a shape of a three-dimensional (3D) zone that extends from a physical floor and around the user;*

Petitioner asserts that “McCulloch disclosed a ‘display device system 8’ comprising a ‘head mounted display device 2’ (WED) worn on a user’s head.” Pet. 50 (citing Ex. 1008, Fig. 1B, 4:49–55, 8:1–46; Ex. 1001, 41:65–

67). Petitioner asserts that “McCulloch’s HMD (WED) tracks handheld controllers (HPEDs)” and that McCulloch’s “HMD has ‘[c]ontrol circuitry 136’ comprising a ‘processing unit 210’ including ‘one or more processors.’” *Id.* at 51 (citing Ex. 1008, Fig. 2A, 8:1–16). Petitioner asserts that McCulloch’s HMD “comprises an ‘image and audio processing engine 191’” and that the “engine receives inertial and positional data from McCulloch’s ‘handheld IMU controller[s],’ i.e., it tracks them (or at a minimum obviously tracks).” *Id.* (citing Ex. 1008, Fig. 4A, 13:52–18:7, 4:25–31, 28:63–66, 29:4–63, 24:28–35, Figs. 8B, 8D). In addition, Petitioner asserts that “McCulloch further taught that its HMD tracks the controllers relative to the HMD and surrounding environment, as the HMD tracks its own position and uses image and depth data to track objects, e.g., controllers, in front of the user.” *Id.* (citing Ex. 1008, 7:34–59, 8:17–30, 12:18–21, 22:4–8, 28:5–11; Ex. 1003 ¶¶ 460–471).

Petitioner reasons that “it would have been obvious for McCulloch’s HMD to track controllers, particularly for the gaming applications McCulloch describes, because that functionality was common before June 2016.” *Id.* at 51–52 (citing Ex. 1003 ¶¶ 87–104, 472; Ex. 1063, 315). In addition, Petitioner reasons that “implementing McCulloch’s system with Pedrotti’s ‘safe area’ zone would render limitation 1[a] obvious, including the requisite HPED movement defining a 3D zone, in view of the Pedrotti disclosures discussed for limitation 1[a] in Ground 1.” *Id.* at 52 (citing *id.* at 10–13, 47–50; Ex. 1003 ¶¶ 473–474).

- ii. *1[c]: tracking, with the WED worn on the head of the user, the HPED held in the hand of the user such that the HPED provides a location to the WED of the SLP in empty space in the zone above the physical floor from where the binaural sound originates to the user;*

Petitioner asserts that “McCulloch’s HMD-tracked handheld controllers (HPEDs) move virtual objects and the locations for those objects’ sounds (SLPs).” Pet. 54 (citing *id.* at 50–54). Thus, according to Petitioner, a person of ordinary skill in the art “would have known that McCulloch’s controllers provide the HMD locations of SLPs in empty space and above a physical floor.” *Id.* (citing Ex. 1003 ¶¶ 485–487).

In support of this assertion, Petitioner asserts that in McCulloch’s basketball example which “depicts ‘the virtual basketball 30₃ collid[ing] with the display of [a] television’ because the user ‘moved the handheld IMU device with such an intensity in the direction of the television 16,’” the “collision emits a crash sound from where the basketball hits the television, i.e., a binaural sound.” Pet. 54–55 (citing Ex. 1008, Figs. 8B–8D, 21:34–38, 29:36–30:30). Based on this example, Petitioner reasons that a person of ordinary skill in the art “would have understood that for this sound to be localized to that location (SLP), McCulloch’s HMD would have to (or would obviously) receive the collision’s location from the HMD-tracked controller—i.e., the HPED would provide the WED the location of the SLP.” *Id.* at 55 (citing Ex. 1003 ¶¶ 488–490). Petitioner reasons further that “SLPs in a McCulloch-Pedrotti (or McCulloch-Flaks-Pedrotti) implementation would be, or at a minimum obviously would be, in empty space in a zone above a physical floor.” *Id.* (citing *id.* at 52–54; Ex. 1003 ¶ 491).

iii. Patent Owner’s Contentions

Patent Owner contends that “[i]rrespective of whether a POSITA would be motivated to combine McCulloch and Pedrotti, McCulloch does not fill in Pedrotti’s gaps.” Prelim. Resp. 30. According to Patent Owner,

limitations 1[a] and 1[c] would not have been obvious in view of Pedrotti for the same reasons as discussed in regard to Ground 1. *Id.*

Patent Owner contends further that McCulloch does not disclose a WED that tracks the controller. Prelim. Resp. 30. Rather, according to Patent Owner, “McCulloch teaches that controller position tracking is unnecessary in the context of its claimed invention.” *Id.* Patent Owner contends further that “[b]ecause McCulloch does not teach tracking of an HPED at all, McCulloch cannot be cited in combination with Pedrotti to resolve the Pedrotti inadequacy of failing to teach a WED tracking the movement PED or HPED.” *Id.* at 31 (citing *id.* at 12–14).

Patent Owner also contends that neither McCulloch nor Pedrotti can track movement of the HPED with their WEDs without the use of additional trackers and that they cannot define a zone with HPED movement tracked by a WED without the use of a base station. *See* Prelim. Resp. 31–34.

iv. Discussion

Patent Owner’s contention regarding Pedrotti’s alleged “gaps” is unconvincing for the reasons discussed above in Section II.D.5.b.iv above. The fact that Pedrotti discloses more than is claimed (i.e. a base station) does not preclude Pedrotti from teaching these limitations. Patent Owner’s contention that McCulloch does not solve an alleged inadequacy in Pedrotti’s teaching pertaining to tracking is similarly unconvincing as we see no such inadequacy in Pedrotti’s teachings, based on the current record.

Patent Owner’s contention that McCulloch and Pedrotti require the use of additional trackers and a base station is unavailing because claim 1 does not preclude the use of additional trackers or a base station.

v. Conclusion for Disputed Limitations

For limitations 1[a] and 1[c], we have reviewed Petitioner's assertions including the cited portions of McCulloch, Pedrotti, and Flaks, as well as, Dr. Welch's testimony in support of these assertions. We have also considered Patent Owner's arguments as discussed above. We determine that, on this record, the combination of McCulloch, Pedrotti, and Flaks discloses these limitations.

c. Conclusion for Claim 1

On the record before us for the reasons discussed above, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing for claim 1.

5. Claims 1–20

Petitioner asserts that the combined teachings of McCulloch, Pedrotti, and Flaks disclose or suggest all of the limitations of claims 2–20. Pet. 57–70.

Patent Owner does not separately dispute Petitioner's assertions regarding these claims. Patent Owner addresses limitations 8[a] and 8[c] and 14[b] with limitations 1[a] and 1[c]. Prelim. Resp. 30–34. In addition, Patent Owner contends that because claims “2–7 depend from independent claim 1, claims 9–13 depend from independent claim 8, and claims 15–20 depend from independent claim 14 and rely on the Pedrotti and McCulloch for teaching tracking of the independent claims,” they are not rendered obvious for the same reasons as claim 1. Prelim. Resp. 34.

As we have determined that Petitioner has demonstrated a reasonable likelihood of prevailing for claim 1, Patent Owner's arguments for these claims are likewise unconvincing. We have reviewed Petitioner's assertions for claims 2–20, the evidence in support of these assertions, as well as,

Dr. Welch's testimony in support of them. On the record before us, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing for claims 2–20.

III. CONCLUSION

Based on the current record, we determine Petitioner has shown a reasonable likelihood of prevailing with respect to at least one claim of the '737 patent. Accordingly, we institute *inter partes* review of all claims challenged on all of the grounds in the Petition. *See Consolidated Trial Practice Guide* (Nov. 2019), 64.¹⁰

IV. ORDER

Accordingly, it is:

ORDERED that pursuant to 35 U.S.C. § 314, an *inter partes* review is hereby instituted as to claims 1–20 of the '737 patent based on the unpatentability challenges presented 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 commencing on the entry date of this decision.

¹⁰ Available at www.uspto.gov/sites/default/files/documents/tpgnov.pdf.

IPR2023-01021
Patent 10,917,737 B2

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