Filed on behalf of: Meta Platforms, Inc., et al.

Entered: August 9, 2024

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.

Case IPR2023-01023
Patent 10,798,509 B1

PETITIONERS' REPLY

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TABLE OF ABBREVIATIONS

Term	Abbreviation
wearable electronic device	WED
head mounted display	HMD
portable electronic device	PED
handheld portable electronic device	HPED
three-dimensional	3D
sound localization point	SLP
head-related transfer function	HRTF
virtual reality	VR
augmented reality	AR
graphical user interface	GUI
Petition	Pet.
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Patent Owner	PO
Preliminary Patent Owner's Response	POPR.
Patent Owner's Response	POR.
Person of ordinary skill in the art	POSA

Exhibit List

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1001	U.S. Patent No. 10,798,509 ("'509 patent")
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1003	Declaration of Dr. Gregory Welch in Support of Petition for *Inter Partes* Review of the '509 Patent ("Welch")
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1006	U.S. Patent No. 8,520,872 ("Jang")
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I. Introduction

The Petition demonstrated that every challenged claim would have been obvious. The POR merely repackages assertions the Board already rejected and offers unsupported—because PO disclaims its expert—and meritless attorney argument.

II. The Petition Demonstrated Each Challenged Claim's Obviousness

PO argues the Petition did not "follow the analysis prescribed by the courts." POR.3-4, 33. But the Petition addressed the "scope and content of the prior art" and "differences between the prior art and the claims at issue" (Pet.5-8, 11-46, 49-70), "the level of ordinary skill in the pertinent art" (*id.*4-5), "motivation[s] to combine or modify prior art with a reasonable expectation of success" (*id.*9-11, 46-58),[1] and the absence of "objective indicia of non-obviousness" (*id.*70). *B/E Aerospace, Inc. v. C&D Zodiac, Inc.*, 962 F.3d 1373, 1379 (Fed. Cir. 2020). Applying this rubric, the Petition showed that every challenged claim should be cancelled.

III. Dr. Welch's Well-Reasoned Opinions Stand Unrebutted

The opinions of Petitioners' expert, Dr. Welch, are the only expert opinions in this proceeding because PO disclaimed its expert. POR.2. And Dr. Welch's

[1] In the POR, PO does not contest Petitioners' explanations for why POSAs would have been motivated to combine the prior art, or that the prior art is analogous art. Welch.Supp.¶¶12-18, 104-108.

opinions now stand unrebutted because they are challenged by mere attorney argument, which "is not evidence." *Icon Health & Fitness v. Strava*, 849 F.3d 1034, 1043 (Fed. Cir. 2017) (citation omitted).

PO tries—but fails—to discredit Dr. Welch. PO argues Dr. Welch did not understand or carefully analyze the challenged claims (POR.4). Dr. Welch, however, thoroughly evaluated the challenged claims, applying "the plain and ordinary meanings of the claim terms in the '509 [] patent[], as a person of ordinary skill in the art would have understood them." Welch¶38. Dr. Welch repeatedly confirmed this during his deposition. Ex.2012, 192:13-193:4, 305:18-306:4. He also correctly explained that he did not need to propose constructions for particular terms to understand the claims or reach his conclusions. *Id.*190:19-193:4, 41:17-42:6, 54:19-55:3, 76:14-77:2. Indeed, as the Board already recognized, "no express constructions of the claims are necessary" here. ID.10.

Similarly, Dr. Welch did not improperly "deconstruct" the claims or use "conclusory assertions" to "supply key limitations missing from the prior art" (POR.5). Dr. Welch's opinions are well-reasoned and firmly grounded in supporting evidence; they share no similarities with the unsubstantiated "verbatim restatement[s]" found insufficient in *Xerox v. Bytemark*, IPR2022-00624, Paper 9 (PTAB Aug. 24, 2022). Welch.Supp.¶¶7-11.

IV. Ground 1: Pedrotti, Jang, and Begault

A. Claim 9

Consistent with the ID, this Reply addresses independent claim 9 first.

Before institution, PO argued the Ground 1 art does not render claim 9 obvious because Pedrotti discloses embodiments using base stations. POPR.21-22. The Board rejected this argument, recognizing that claim 9 recites "a method 'comprising' determining, '***with***' the WED, when the user is located inside the zone and leaving the zone"—it "does ***not*** expressly preclude other devices from being involved in those determinations." ID.18. Now, PO admits limitations 9[b] and 9[c] do ***not*** preclude use of a base station. POR.29. Yet PO nevertheless argues that, regardless of the presence of a base station, the Ground 1 art does not suggest a WED that "exclusively" performs recited determinations. POR.29-30. The Board's earlier reasoning applies equally to PO's slightly reframed argument, which thus fails. *See also* Welch.Supp.¶¶20-27.

Furthermore, even if limitations 9[b] and 9[c] require determinations "be made ***exclusively*** with the WED" (POR.30), the Petition demonstrated that Pedrotti teaches that, or at the very least renders it obvious. Pedrotti's system comprises a processor that tracks the HMD and controllers and determines when the user is leaving the zone, which may be "in the HMD"—i.e., in the WED. Pet.18-19,

28, 37. There is simply no merit to PO's contention that this processor cannot be in the WED. *Id.*; ID.20 (rejecting PO's contention); Welch.Supp.¶¶28-32.

PO asserts the Petition "merely aim[ed] to show that Pedrotti determines whether ***the controllers*** are inside the zone" (POR.30). As the Petition explained, however, Pedrotti teaches determining the locations of both (i) controllers ***and*** (ii) the HMD worn on the user's head—i.e., the user. Pet.18-19, 28, 37; Welch¶¶293-301, 311-313. Even PO's pre-institution expert conceded that Pedrotti discloses using trackers, on the HMD and controllers, "[t]o determine ***the user's*** position within the 'safe zone.'" Ex.2001 ¶27.

PO argues the Petition "assumes" the processor in Pedrotti's HMD "must necessarily" perform claimed determining steps. POR.31. But the Petition neither makes, nor invites the Board to make, such an assumption. The Petition established that it would have been obvious (not "necessar[y]") for that processor to perform the recited determinations. Pet.18-19, 28, 37; Welch¶¶90, 221, 252 (tracking capabilities commonly contained in HMDs).

PO contends Pedrotti does not suggest an HMD that can "track itself or the user without the use of a separate base station." POR.31-32. But, as noted, PO elsewhere—rightfully—abandons the argument that claim 9 precludes use of base stations. ID.18; POR.29. And, PO's contention is wrong. Pedrotti's base station can be "only a cradle or dock" with "the processor… located elsewhere," e.g., "in

the HMD." Pedrotti, 5:64-6:1; 16:20-24; Ex.2012, 240:22-242:7; Welch.Supp.¶¶24-25. Further, POSAs would have known this processor "determine[s] whether the user leaves the zone," contrary to what PO argues (POR.31). That is how Pedrotti's "safe area" method works. Pet.5-6, 18-19, 28, 37- 38; Welch¶¶254-259, 297-301, 312-313, 367-368.

B. Claims 1, 10, and 11

PO argues the Ground 1 art does not render limitations 1[c] and 1[d] and claims 10 and 11 obvious because it does not suggest (1) highlighting an SLP when a handheld PED is pointed at the SLP while a user is located in the zone, or (2) playing binaural sound in response to pointing. POR.5-11, 32-33. PO is wrong.

1. Highlighting an SLP at Which a PED is Pointed (cls. 1[c], 11)

Pedrotti discloses virtual images at boundaries, including a "virtual fence" and "other shapes," that are highlighted—e.g., their "brightness… may increase"—as a user approaches the boundary. Pet.20; Pedrotti.12:66-13:11, Welch¶¶267-269. PO incorrectly argues such disclosures do not suggest the claimed highlighting because "Pedrotti's virtual fence is not a sound localization point." POR.6.

Petitioners and PO agree that an SLP is a "***location*** where a listener localizes sound" (Ex.1126, 2; Ex.1127, 3), and the '509 patent teaches that such a "location" can be a "point," "area," or "shape." '509 Patent, 14:58-61, 28:19-22, Fig.13, 37:19- 31; Ex.2012, 197:12-200:1. Thus, Pedrotti's virtual fence is (or is obviously)

an SLP—it has a set "location" and "shape" and accompanying sound (Pedrotti.15:56-58), which, in view of Jang and/or Begault, would have been binaural. Pet.19-20, 22-24. So, when Pedrotti's system (combined with Jang and/or Begault) increases the brightness of the fence, it highlights an SLP. *Id.*; Welch.Supp.¶¶33-38.

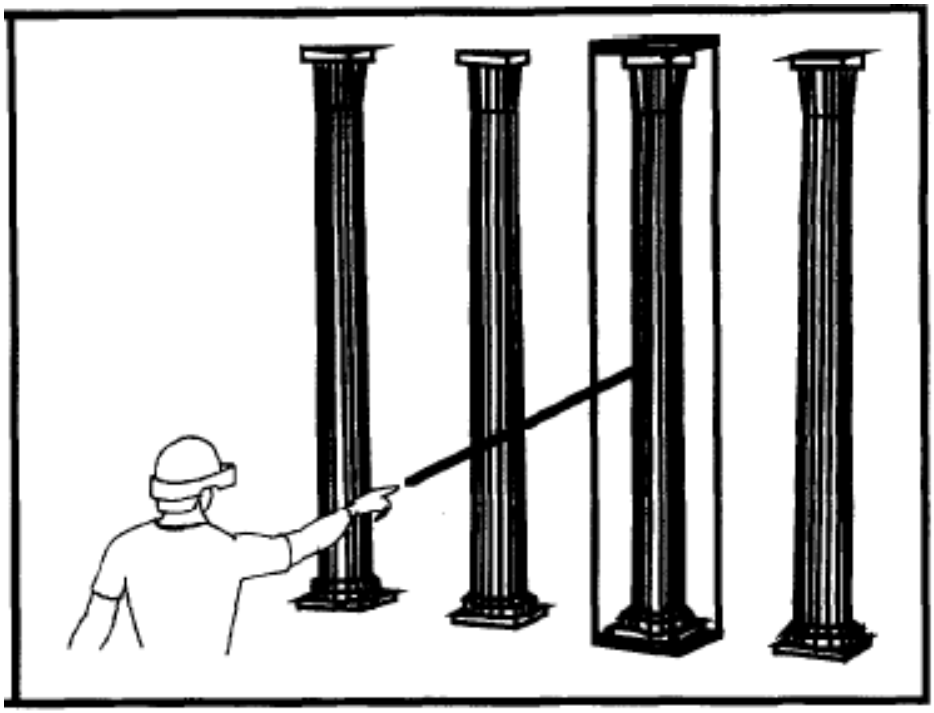
Furthermore, POSAs would have known such highlighting happens (or obviously happens) when the user's PED is pointed at the fence. Pedrotti's fence is displayed when a controller is "within a preselected distance of the boundary" and is highlighted when the user "get[s] still closer." Pedrotti.12:51-13:11, 15:30-32. Accordingly, POSAs would have known that Pedrotti's system would highlight the fence when a user extends his/her controllers toward the boundary, pointing—or obviously pointing—at the fence's SLP(s). *Id.*; Welch¶¶266-267; Welch.Supp.¶¶39-40.

POSAs also would have used Pedrotti's system to highlight other SLPs, such as Pedrotti's virtual "weapon[s]," "sporting implement[s]," and "other toy[s] or device[s]" (Pedrotti.9:26-40, 16:33-42), Jang's "avatar[s], [] character[s], and [] objects," (Jang, 6:44-47), or the "sound inputs" displayed with a Begault-type GUI (Begault.72, Fig.5.12), including when Pedrotti's controllers are pointed at such objects. Pet.20-22; Welch¶239 (POSAs knew "virtual objects in games (e.g., Pedrotti's sword or other another 'virtual weapon,' as well as VR characters) could

and would have associated binaural sounds that would move with them to multiple locations (multiple SLPs)."). Highlighting sound-producing virtual objects—i.e., highlighting SLPs—including before and to facilitate (not just after, or as a result of) selection was routine. Pet.20-22; Welch¶¶267-271, 276.

In fact, Pedrotti discloses the types of interactions in which POSAs would have understood that pointing and highlighting is advantageous. For example, in Pedrotti's system, the HMD can "display a virtual weapon," and a user can "extend[]" his/her hands "to cause [] corresponding virtual hand(s) to 'reach for'" the weapon. Pedrotti.9:26-40. Then, the user can "activat[e] a proper command," "e.g., by pressing a button on the controller"—***which the user is already holding***—and the HMD will "display the user's virtual hand(s) 214 as 'picking up'" the weapon. Pedrotti.9:32-40, 9:41-52, Fig.8; Welch¶¶270-271. POSAs would have understood the user's extension of his/her hands (with controllers) to be pointing the controllers at the virtual weapon to be picked up. Welch.Supp.¶40. And it would have been obvious to highlight that weapon when the user pointed at it, to communicate that it could be picked up or selected. Pet.21-22; Welch¶¶270-271, 274-276. POSAs knew that such highlighting, which confirms that a user is sufficiently pointing at a target virtual image, was "essential." Welch¶78; Welch.Supp.¶¶40-43.

Indeed, multiple additional prior art references—which were cited in the Petition's discussion of limitation 1[c] (Pet.19-22) and Dr. Welch's related opinions (Welch¶¶262-279, ¶¶74-76, 83-84, 88)—show that highlighting virtual objects at which controllers are pointing was "within the general knowledge of a skilled artisan," *Koninklijke Philips v. Google*, 948 F.3d 1330, 1337-38 (Fed. Cir. 2020), and thus confirm that POSAs would have known and been motivated to use such highlighting in the Ground 1 combinations:



Mine ISAAC, Fig.1 (column at which user is pointing is highlighted).

Mine Exploiting Proprioception 1997, Fig.6.1 (cow at which user is pointing is highlighted).

Welch, *No Silver Bullet*, Fig.12 (menu option at which user is pointing is highlighted); *see also* Mullen, 11:18-26 (controller may be used as "a pointer" with

"a virtual laser emanat[ing] out of [its] end," which causes objects with which it intersects to "appear highlighted"); Welch.Supp.¶¶45-49.

PO argues Pedrotti's virtual objects are just "virtual representation[s] of the controller[s]." POR.7. But, as noted, Pedrotti discloses extending controllers toward (i.e., pointing at) virtual objects, and then pressing buttons to pick them up. The target objects are not just "virtual representation[s] of the controller" (*id.*). Also, POSAs would have known that Pedrotti's controllers would still be used to point at and interact with other virtual objects and SLPs after virtual weapons are picked up. Pet.13-14, 20, Welch¶¶239, 265-266, 79 (controllers "can be rejiggered to be guns, lightsabers, laser pointers," etc., and "[a] known gun-type controller…, or the like may be used as the pointing device"); Welch.Supp.¶44.

PO asserts Pedrotti lacks a disclosure of highlighting "***only*** while the user is in the zone" (POR.9), but that is immaterial. As Pedrotti's system is used by a user in a "safe area" for gameplay, the highlighting rendered obvious by the Ground 1 art would obviously occur "while" the user is in that zone, as claimed. Pet.19.

Turning to Jang, PO argues Jang "does not disclose anything regarding the selection or emphasis of images associated with [] sounds." POR.6. Jang, however, discloses a sound system that operates based on "priorities of the sound sources" in interactive virtual environments. Jang.6:35-38, 11:3-8. And POSAs would have known, including in view of Begault, that "a 3-D sound system," like Jang's, would

"involve[] the positioning of each of a number of sources individually." Begault.4, Fig.5.12; Pet.16-17. Jang also discloses that its techniques are useful for games like "Second Life" (Jang.1:57-67), which POSAs knew (i) would be played on HMDs like Pedrotti's and (ii) provided an immersive 3D environment allowing interactions with moveable virtual objects. Pet.10 (citing Welch¶216). And POSAs would have known and been motivated to use highlighting and sound in such interactions. Welch¶216 (citing *How to Use Oculus Rift with Second Life*, YOUTUBE.COM (May 22, 2014) (discussing users interacting with objects and interfaces in Second Life) (Ex.1163)); Second Life: The Official Guide, 146-47, Fig.7.9 (2007) (Ex.1151) (depicting moveable virtual objects that are "highlighted" to facilitate selection); Welch.Supp.¶¶50-64.

Additionally, POSAs would have known and been motivated to use Pedrotti's controllers to "arrang[e] [] various sound inputs in virtual auditory space"—i.e., to arrange SLPs—with GUIs or other menus. Begault.172-173, Fig.5.12; Pet.21-22. And it would have been obvious to highlight SLPs in such interfaces when they were pointed at. Pet.21-22; Welch¶¶270, 276-278; Begault.159 (depicting, in Fig. 5.1, two touch panel pages, including one (on top) with a menu display distinguishing selectable tabs); Ex.1151.Figs.7.2-7.4 (UIs with highlighted items); Welch.Supp.¶¶56-59, 65-68.

For these reasons, the Ground 1 art renders the challenged claims' highlighting obvious. In fact, even if PO were correct that the art is "completely silent on highlighting" (POR.6)—to be clear, PO is wrong—the claimed highlighting would have been obvious; it is "nothing more than the predictable application of known technology." *B/E Aerospace*, 962 F.3d at 1379-80; Welch.Supp.¶¶40-43, 45-49, 64, 68-69.[2]

2. Binaural Sound Playback (cls. 1[d], 10)

In addressing the claimed binaural sound playback, PO repeats its contention that the Ground 1 art "do[es] not disclose pointing to an SLP." POR.10. For reasons discussed, that contention fails. §IV.B.1.

[2] In the ID, the Board remarked that certain statements in the Petition about highlighting appeared to be supported by only the VR Book and Dr. Begault's deposition testimony. ID.31. The Petition, however, relies on Pedrotti, Jang, and Begault, which render the claimed highlighting obvious, with or without the VR Book or Dr. Begault's testimony. The VR Book and Dr. Begault's testimony, like other background references, simply confirm that such highlighting "was not only in the prior art, but also within the general knowledge of a skilled artisan." *Koninklijke*, 948 F.3d at 1337-38; Welch.Supp.¶¶40-43, 45-49, 64, 68-69.

PO also incorrectly argues the Ground 1 art does not render obvious playing binaural sound "in response to" a user pointing at an SLP. POR.10. First, POSAs would have known that, with the Ground 1 combinations, when a user points a controller at virtual boundary images, SLPs are highlighted and play binaural sound. Pedrotti discloses that both a visual and an audio warning will be provided to the user approaching the fence, e.g., when (or at a minimum obviously when) the user's pointing hand and controller extends to within the predetermined distance that triggers the fence and its sound. And the Ground 1 combinations demonstrate the sound would obviously be binaural. Pet.23-24; Pedrotti.15:56-58; Welch¶¶282, 287; §IV.B.1; Begault.171 ("auditory information," e.g., "a bumping or crashing sound," known for notifying users that a "boundary has been violated"); Welch.Supp.¶¶70-74.

Second, POSAs would have known that binaural sounds would, like highlighting, be used to facilitate interaction with, and selection of, other sound-producing virtual objects disclosed by Pedrotti, Jang, and Begault. Pet.22-24; Welch¶¶280-289, 239 ("[V]irtual objects in games… could and would have associated binaural sounds that would move with them to multiple locations (multiple SLPs)."), 539 ("a user partaking in a virtual sword fight may 'point' or direct the controller (e.g., the sword shown in Pedrotti) to strike a virtual enemy, which in turn emits a sound of defeat"); Welch.Supp.¶¶75-77 (different weapons in

a virtual armory would obviously generate binaural sounds, e.g., a gun loading sound or a lightsaber buzz, as a user pointed at each, considering which to select).

Third, POSAs would have known that binaural sound playback would be used for interface navigation, such as when a user points a controller at different virtual objects and their SLPs, e.g., to facilitate—not just after, or as a result of—selection. Pet.23-24; Begault.Fig.5.12. Such playback could be sounds associated with the virtual objects, or it could be as simple (and obvious) as the binaural "menu selection" sounds that Begault discloses, which PO ignores. *Id.*; Begault.159-160 ("spatialized" sounds, such as "clicks," used with menus); Welch.Supp.¶¶78-82.

C. Claim 2

The POR does not include a section specifically directed to claim 2. However, in a section purportedly addressing claims 17-20, PO advances arguments about limitation 2[a]. POR.§§ II.A.3. For organizational clarity, PO's incorrect assertions about that limitation are addressed here.

The Petition demonstrated that limitation 2[a]—which recites, "tracking, with one or more sensors in the WED worn on the head of the user, the PED to determine when the PED moves outside the zone"—would have been obvious. Pet.24-25. Pedrotti discloses trackers in controllers, e.g., "light-emitting trackers," that "provide position and orientation information" to sensors, e.g., "a camera mounted on a base station or elsewhere," and that "essentially any type of [known] tracker" can be used

in its system. *Id.*; Pedrotti.5:8-24; Welch ¶¶88-98, ¶¶294-302. The sensors in Pedrotti's system, which POSAs would have known could and should be on Pedrotti's HMD, sense controller locations when the controllers move outside Pedrotti's "safe area," so Pedrotti's processor can trigger boundary images. Pet.25-26; Pedrotti.4:37-44, 12:35-13:2; Welch¶¶294-296 (POSAs would have been "significantly motivated" to "us[e] Pedrotti's light-emitting components (e.g., LEDs) on the controllers and one or more cameras on the HMD" for tracking, including to reap benefits relating to decreased occlusions, high signal-noise ratio, constant error behavior, and speed), 297-301.

PO argues Pedrotti's disclosures are insufficient because "[l]imitation 2[a] expressly requires that the WED's sensors track the PED." POR.15, 18. But this unsupported attorney argument departs from the plain language of limitation 2[a], which requires only tracking "with" sensors, and the intrinsic record. *Compare* '509 patent, cl. 2 ("tracking, ***with*** one or more sensors in the WED …, the PED") (emphasis added) *with id.*, cl. 17 ("sensors that sense"); *see also* Fig. 15 (depicting "Sensors 1580," which sense, and distinct "Location Tracker 1582" and "Processing Unit 1574" components); Welch.Supp.¶¶83-85. Just as claim 9 "does not expressly preclude other devices," e.g., base stations, "from being involved in [its] determinations," ID.18, limitation 2[a] does not expressly preclude other devices, e.g., a processor, from being involved in its tracking. *Id.*¶86. Indeed, PO's

contention that "the WED's sensors track"—which undergirds all of PO's limitation 2[a] arguments—is technologically flawed. *Id.*¶¶86-88. In a system like the '509 patent's or Pedrotti's, sensors, such as Pedrotti's cameras, sense; they do not track. Other components, such as Pedrotti's processor, make determinations and track "with" information from the sensors. Pedrotti.4:37-39, 5:8-24; Welch.Supp.¶¶83-88.

PO attacks "13 paragraphs from Dr. Welch's declaration" (Welch¶¶130-142) cited in the Petition's discussion of limitation 1[b]—not limitation 2[a]. POR.16. In his evaluation of limitation 2[a], however, Dr. Welch discussed multiple references demonstrating that sensors on HMDs for sensing user and controller locations were well-known and known to be beneficial, confirming limitation 2[a]'s obviousness. Welch¶¶88-98, 292-296. PO contends that three of those—Ambrus, McCulloch, and The VR Book—are off-target. POR.25-28. But even PO's contentions about those references fail: Ambrus's HMD sensors do not only track the HMD itself; McCulloch's sensors are not limited to tracking only a user's head;[3] and the VR Book correctly notes that "[t]racked hand-held controllers" "have been used for decades," frequently with "inertial, electromagnetic, ultrasonic, or optical (camera) technologies," like those disclosed in Pedrotti. Welch¶¶88-100;

[3] Section V.E further explains why PO's McCulloch-related arguments are meritless.

Welch.Supp.¶¶89-96; VR Book.314-15. Moreover, the background references Dr. Welch discussed in his declaration, including but not limited to Ambrus, McCulloch, and the VR Book, show that limitation 2[a]'s sensors and the benefits of same were "within the general knowledge of a skilled artisan," *Koninklijke*, 948 F.3d at 1337-38, and thus confirm that Pedrotti's disclosures—on their own—render this limitation obvious. There has been no "incorporation by reference in violation of 37 C.F.R. §42.6(a)(3)," as PO argues (POR.16-17).

PO concedes Pedrotti discloses tracking with a camera or sensor located in a base station "or elsewhere" (POR.20). Yet PO incorrectly asserts that Pedrotti's "elsewhere" is "certainly ***not the WED***" (POR.20-23 (PO's emphasis)). The only support for PO's assertion is an embodiment involving "sensing an electromagnetic field generated from a local base station, video game console, or other apparatus" that Pedrotti explicitly teaches is just an "example." Pedrotti.4:49-58; 3:22-24, 3:34-37; Ex.2012, 254:10-257:18. Pedrotti renders limitation 2[a] (and limitations 9[c] and 17[e]) obvious because it also discloses, *inter alia*, other types of sensors, such as cameras, and that its system works with any known tracking system, and, as discussed, POSAs would have known and been motivated to use sensors on the HMD for controller tracking. Pet.24-26; Welch¶¶292-296 Welch.Supp.¶¶83-88, 97.

PO contends Petitioners "confuse[]" (i) "the act of tracking with sensors located in the WED" and (ii) "the act of determining with the processor." POR.29.

Petitioners did no such thing. As explained above, sensors sense. Other components, such as Pedrotti's processor, make determinations and track "with" information from sensors. And all of these activities would have been obvious to POSAs over Pedrotti. Welch.Supp.¶¶83-97.

PO argues Dr. Welch's declaration and deposition testimony "undermined" the Petition (POR.24). But PO misreads Dr. Welch's declaration and resorts to repeatedly invoking snippets of testimony taken out of context. First, Dr. Welch did ***not*** state that "there are only two ways for tracking a user's head using sensors and trackers" (*id.*). As Dr. Welch repeatedly testified during his deposition, the figure he discussed in paragraph 87 of his opening declaration—which is what PO relies on for its incorrect argument—"is just an illustration" that was "meant to help somebody understand that one needs to consider where you put sources and sensors." Ex.2012, 212:21-222:20, 232:20-233:15. Neither that figure nor Dr. Welch's discussion of it supports PO's assertion that an HMD with sensors for tracking controllers was not obvious. Such systems were well known. Welch¶¶88-98, 292-296; Welch.Supp.¶¶98-99.

Second, Dr. Welch did ***not*** testify that "track[ing] a tracker attached to a part of the user's body by sensors mounted on the user's head" would be "pretty hopeless," or that "no sane person… would ever attempt to do that" (POR.25). Rather, Dr. Welch testified that the hypotheticals PO posed during his deposition

were inapposite and would not be attempted. Ex.2012, 227:5-228:13, 233:17-235:10; Welch.Supp.¶¶100-101 (reproducing—in full—testimony PO cites).

D. Claim 17

The POR addresses one limitation in claim 17—limitation 17[e], which requires a WED that "includes one or more sensors that sense when the PED leaves the zone." For the same reasons limitation 2[a] would have been obvious over the Ground 1 art, limitation 17[e] would have been obvious. §IV.C; Pet.42; Welch¶392.

PO argues the Petition failed to show limitation 17[e] was obvious because it cross-referenced discussions of limitations 2[a] and 9[c]. POR.11-12. Those discussions, however, demonstrated that each of these limitations would have been obvious. Pet.24-26, 37-38, 42. And the Petition addressed differences in their recitations. Pet.42 ("POSAs would have considered equally obvious sensing that a PED 'moves outside the zone (2[a]) and sensing that a PED 'leaves the zone' (17[e])."). Neither Petitioners nor Dr. Welch "fail[ed]… to understand the meaning[s]" of limitations 2[a], 9[c], and 17[e], as PO contends (POR.12).

Further, as explained above, PO's attempts to conjure purportedly meaningful differences between limitations 2[a], 9[c], and 17[e]—e.g., PO's repeated assertion that "[l]imitation 2[a] expressly requires that the WED's sensors track the PED" (POR.15)—depart from the challenged claims' language and are grounded in only technologically flawed attorney argument. §IV.C; Welch.Supp.¶102. Pedrotti

renders obvious a WED (HMD) with sensors (e.g., cameras) that sense when a PED (a controller) leaves the zone (Pedrotti's "safe area"). Pet.24-25, 42. POSAs would have known this is how—or at a minimum is obviously how—Pedrotti's system works. *Id.*; Welch¶¶294-302, 392.

E. Other Claims

PO does not advance any arguments relating to dependent claims 3-8, 12-14, and 18-20 other than the incorrect arguments it advances for independent claims, which fail for reasons discussed above.[4]

V. Ground 2: McCulloch, Pedrotti, and Flaks

A. Claim 9

In the context of Ground 2 and claim 9, PO addresses only limitation 9[b], which recites, "determining, with a wearable electronic device (WED) worn on a head of a user, when the user is located inside the zone."

In discussing limitation 9[b], PO refers back to its arguments about the Ground 1 art (POR.46), which fail. *See* §IV.A. Beyond that, PO presents two sentences of conclusory attorney argument that McCulloch's disclosures are insufficient. POR.46. That does not, and as a matter of law cannot, rebut the Petition's and Dr. Welch's explanations of how McCulloch and Flaks, like Pedrotti,

[4] The highlighting and binaural sound playback of claims 18 and 20 would have been obvious for reasons explained in the Petition and further discussed in Section IV.B.

render limitation 9[b] obvious. Pet.53, 65; Welch.Supp.¶¶110-113. PO's argument also is directly contradicted by its pre-institution expert, who recognized that McCulloch "specifically teaches using depth sensors on the HMD," and "that depth data… is used to… track the HMD"—i.e., the user—"within the environment." Ex.2001 ¶61.

B. Claims 1, 10, and 11

In discussing Ground 2, PO again argues the prior art does not render limitations 1[c] and 1[d] and claims 10 and 11 obvious. POR.33-34, 47. As explained, however, Pedrotti renders obvious the claimed highlighting and sound playback, which, in view McCulloch and Flaks, would have been binaural. §IV.B; Pet.51-52; Welch ¶¶443-446; Welch.Supp.¶¶114-116.

Additionally, McCulloch renders obvious the claimed highlighting and binaural sound playback. Pet.54-56. POSAs would have known that with a McCulloch system, a user would point a controller at an SLP, e.g., a sound-producing virtual image. *Id.* For example, McCulloch depicts and describes a virtual basketball that is controlled by a user, including when the user points his controller at the basketball, as shown in Figure 8B, and when the user points the controller at a virtual television into which the basketball collides, as shown in Figure 8D. McCulloch.Figs.8A-8D, 28:51-29:63; Welch¶¶460-463. POSAs also would have known that virtual images at which the user points (e.g., the basketball,

the television, a helicopter), could and would be highlighted. Pet.55-56. McCulloch discloses a "visual effects library" that stores "routines for… highlighting" for "actions, pre-collision events and collision events." McCulloch.23:4-7; Welch ¶¶464-468. POSAs further would have known that a user's pointing would trigger binaural sound playback. Pet.56-57. For example, as Figure 8D shows, a virtual basketball collides with a virtual television as a result of a user pointing a controller at the television. McCulloch.23:4-7, Fig.8D. When that happens, the user's pointing will (or at a minimum obviously will) result in binaural sound—the collision sound—playing from the location (the SLP) pointed at. McCulloch.21:34-38, 22:66-23:4; Welch ¶¶470-471; Welch.Supp.¶¶117-122.

Petitioners are not relying on "playing [sound] based upon selection" (POR.34). For example, the collision sound discussed above plays in response to pointing, not selection. Nor are Petitioners relying on the VR Book "to cure… deficiencies" (*id.*). The VR Book is just one of multiple background references that confirm the claimed highlighting and binaural sound playback would have been "nothing more than the predictable application of known technology." *B/E Aerospace*, 962 F.3d at 1379-80.

PO argues McCulloch does not teach limitation 10[a], which recites "determining, with the WED, when the PED is pointed at one of the SLPs while the user is located in the zone." POR.47. But PO's attorney argument about

McCulloch's disclosures, including PO's assertion that those disclosures do not "***necessarily***" disclose what is claimed, does not (and cannot) rebut the Petition's and Dr. Welch's explanations of how McCulloch renders this limitation obvious. Pet.66; Welch¶¶535-537; McCulloch.Fig.2A, 8:1-16, Figs.8B, 8D; Welch.Supp.¶¶123-129.

C. Claim 2

In discussing Ground 2, the POR again addresses limitation 2[a] only in a section purportedly directed to claims 17-20. POR.§III.B.2. Regardless, the Petition demonstrated that the Ground 2 art renders limitation 2[a] obvious, and PO's contrary arguments fail.

For reasons discussed in the Petition and above, limitation 2[a] would have been obvious over Pedrotti, and PO's arguments about Pedrotti should be rejected. §IV.C. But to be clear, in Ground 2, the Petition did not "advance[] identical argument[s] ***based exclusively on Pedrotti***" for limitation 2[a] (and limitation 17[e]), as PO argues (POR.35 (PO's emphasis)).

Rather, after referencing Pedrotti's teachings, the Petition explained why McCulloch likewise renders limitation 2[a] obvious, including through its disclosure of capture devices in its HMD, such as cameras and infrared transceivers (sensors), for detecting and tracking infrared light, which may be emitted by a controller. Pet.57-58; McCulloch.7:24-67, 8:7-39, 5:19-36 ("companion processing module 4"

"may be integrated in" "display device 2," i.e., McCulloch's HMD, and communicates with "controller devices 21," including via infrared), Fig.2A (depicting cameras 113 on the HMD); Welch ¶¶474-477.

PO argues two passages from McCulloch cited in the Petition's discussion of limitation 1[b]—McCulloch.4:25-31 and 13:52-18:7—do not disclose controllers "tracked with sensors in the HMD." POR.36-37. Those two passages, however, do render obvious limitation 2[a], including when considered with the multiple additional disclosures in McCulloch that PO ignores. *E.g.*, McCulloch.4:25-31 (disclosing types of controllers), 13:52-14:11 (McCulloch's HMD comprises an object recognition engine and a gesture recognition engine), 14:13-22 (McCulloch's HMD comprises memory for "receiving image data captured from the outward facing capture devices," e.g., cameras on the HMD), 17:32-36 (McCulloch's HMD's object recognition engine "detects, tracks and identifies real objects in the display field of view and the 3D environment"); *see also* Pet.50, 57-58 (citing McCulloch.5:19-36, 7:34-67, 8:17-39, 12:18-21, 22:4-8, 28:5-11, Figs.4A, 8B, 8D); Welch ¶¶425-432, 475-476; Welch.Supp.¶¶133-134.

PO asserts Petitioners tried to "mislead the Board" with a "truncated quotation" from McCulloch (POR.38). But PO's erroneous assertion is based on a single parenthetical from a discussion of limitation 1[b]—not limitation 2[a]—that correctly explained that McCulloch discloses that "[i]nertial motion sensors… in the

handheld real controller device 19 identify parameters like speed, acceleration and direction of motion… which is sent as data to the display device system 8." Pet.50. Petitioners did not "truncate[]" this quote to "omit[]" that the inertial motion sensors mentioned are in the controller (POR.38); that is expressly stated in the quote presented. More importantly, this single citation does not impact the other McCulloch disclosures that the Petition explained render limitation 2[a] obvious, including in discussions actually pertaining to that limitation. Pet.57-58; Welch¶¶474-477; Welch.Supp.¶¶130-135.

PO argues McCulloch does not teach tracking a PED to (i) "determine when the PED moves outside the zone" or (ii) "sense when the PED leaves the zone." POR.39, 42-43. PO, however, misunderstands the Ground 2 combinations. Those claim elements would have been obvious over McCulloch ***in view of Pedrotti***, because Pedrotti's safe area method discloses them. Pet.58. "[O]bviousness… cannot be overcome by attacking references individually where the rejection is based upon the teachings of a combination of references." *Bradium Techs. v. Iancu*, 923 F.3d 1032, 1050 (Fed. Cir. 2019) (citations and quotations omitted); *In re Mouttet*, 686 F.3d 1322, 1333 (Fed. Cir. 2012) (similar).

PO contends Petitioners must "explain if and how McCulloch's use of inertial sensors in the HMD" for sensing head position "is somehow the same as (or works functionally the same as) sensing the controllers in the hands of the user" (POR.40,

43). But Petitioners do not contend that inertial sensors for sensing head position are what render limitation 2[a] obvious. Likewise, Petitioners need not explain that McCulloch's controllers are "***necessarily***" tracked with sensors in the HMD (POR.41, 43); it is enough that POSAs would have known and been motivated to so track them, as the Petition showed. Pet.57-58 ("[T]echniques using sensors on HMDs to track controllers… were well known and widely used due to their accuracy advantages."); Welch¶¶474-476, 88-98, 295-296.

PO again tries—and fails—to discredit Dr. Welch. Dr. Welch did not "completely den[y]" (POR.42) that McCulloch renders obvious an HMD that tracks controllers. Rather, during his deposition, Dr. Welch was repeatedly asked whether three McCulloch passages cited at the end of a single sentence in one paragraph in his declaration (¶476) "***expressly*** say that [an] HMD in McCulloch track[s] controllers." Ex.2012, 274:22-275:3, 272:3-5, 273:8-9. In response, Dr. Welch explained that those passages disclose an HMD comprising capture devices, including cameras and infrared transceivers, that detect and track infrared light, which POSAs would have known may be emitted by controllers—as stated in his opening declaration. Ex.2012, 270:18-277:6; Welch¶476. PO ignored at Dr. Welch's deposition, and again ignores in the POR, Dr. Welch's explanations and opinions about other McCulloch disclosures that further render obvious HMD-tracked controllers. Welch¶¶434-437; Ex.2012, 265:22-268:7, 268:10-269:11,

303:15-305:10 (discussing Ex.1143 ¶¶464, 469, which cite McCulloch.5:32-36, 7:14-16, 13:56-60, 24:28-35, 25:25-28, 28:63-66, 29:4-63, Figs.8B, 8D); Welch.Supp.¶¶132-135.

PO asserts that McCulloch's Figure 9 undercuts the Petition's evidence of obviousness. POR.43-44. But that figure is merely a high-level block diagram of "[s]ome examples of hardware components" in "one embodiment" of a computing system that could be used in a McCulloch system, "[i]n its most basic configuration." McCulloch.5:25-26, 30:4-26. Also, PO's contention that Figure 9 shows that McCulloch's HMD "does not include a sensor" (POR.44) is wrong. McCulloch discloses that the "device 900" depicted in Figure 9 "may also have additional features/functionality," and sensors are obvious "input device(s) 914." McCulloch.Fig.9, 30:4-26; Welch.Supp.¶¶136-137.

D. Claim 17

In discussing Ground 2, limitation 17[e] is once more the only limitation from claim 17 the POR addresses. And for limitation 17[e], PO merely advances the same arguments it advances for limitation 2[a], which are misplaced and unavailing. *See* §§IV.C and V.C. The Petition demonstrated that the Ground 2 art renders limitations 2[a] and 17[e] obvious. Pet.57-58, 68; Welch.Supp.¶¶138-140.

E. Other Claims

PO does not advance any arguments relating to dependent claims 3-8, 12-14, and 18-20 other than the incorrect arguments it advances for independent claims, which fail for reasons discussed above.[5]

VI. Conclusion

The Board should cancel each of the challenged claims.

Respectfully submitted,

Dated: August 9, 2024

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[5] The highlighting and binaural sound playback of claims 18 and 20 would have been obvious for reasons explained in the Petition and further discussed in Section V.B.

CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that this Petitioners' Reply complies with the word count limitation of 37 C.F.R. § 42.24(c)(1) because the Petitioners' Reply contains 5,589 words using Microsoft Word's counting feature, excluding the cover page, signature block, and the parts of the Reply exempted by 37 C.F.R. § 42.24(c).

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6(e), I certify that on this 9th day of August, 2024, a true and correct copy of the foregoing **Petitioners' Reply and all Exhibits** were served by electronic mail on Patent Owner's lead and backup counsel at the following email addresses:

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