

Petition for *Inter Partes* Review of
U.S. Patent No. 8,585,476 B2

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC.,
Petitioner

v.

MULLEN INDUSTRIES LLC,
Patent Owner.

Case IPR2025-00737
Patent 8,585,476 B2
Issue Date: November 19, 2013

Title: LOCATION-BASED GAMES AND
AUGMENTED REALITY SYSTEMS

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OF U.S. PATENT NO. 8,585,476 B2**

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List of Exhibits

Exhibit No.	Description of Document
1001	U.S. Patent No. 8,585,476 B2 to Jeffrey D. Mullen (filed Nov. 16, 2005, issued Nov. 19, 2013) (“ 476 ” or “ 476 patent ”)
1002	Declaration of Jeremy Cooperstock, Ph.D. (“ Cooperstock ”)
1003	U.S. Patent No. 6,166,744 to Ivan J. Jaszlics and Sheila L. Jaszlics (filed Sep. 15, 1998; issued Dec. 26, 2000) (“ Jaszlics ”)
1004	Wayne Piekarski et al., “Integrating Virtual and Augmented Realities in an Outdoor Application,” in Proceedings, 2nd IEEE and ACM International Workshop on Augmented Reality (1999) (“ Piekarski ”)
1005	U.S. Patent No. 6,951,515 B2 to Toshikazu Ohshima and Kiyohide Satoh (filed Feb. 17, 2000; issued Oct. 4, 2005) (“ Ohshima ”)
1006	U.S. Patent No. 6,361,438 B1 to Shigeki Morihira (filed Jul. 24, 1998; issued Mar. 26, 2002) (“ Morihira ”)
1007	U.S. Patent App. Pub. No. 2004/0002843 A1 to James O. Robarts and Cesar A. Alvarez (filed May 13, 2003; published Jan. 1, 2004) (“ Robarts ”)
1008	Int’l Patent App. Pub. No. WO 2001/042809 A2 to Martin Muendel (filed Dec. 6, 2000; published Jun. 14, 2001) (“ Muendel ”)
1009	Wayne Piekarski et al., “Tinmith - Augmented Reality With Wearable Computers Running Linux,” in Linux Conf Au 2001 - 2nd Australian Linux Conference (2001) (“ Piekarski 2001 ”)
1010	Paul Milgram and Fumio Kishino, “A Taxonomy of Mixed Reality Visual Displays,” in IEICE Transactions on Information Systems, Vol. E77-D, No.12 (December 1994) (“ Milgram ”)
1011	U.S. Provisional Patent App. No. 60/066,904 (“ Jaszlics Provisional ”)
1012	Excerpts from Microsoft Computer Dictionary (5th ed. 2002)
1013	J. P. Rolland et al., “A Comparison of Optical and Video See-Through Head-Mounted Displays,” SPIE Vol. 2351 Telemanipulator and Telepresence Technologies (1994), pp.293-307 (“ Rolland ”)

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Exhibit No.	Description of Document
1014	Excerpts from <i>The Legend of Zelda: A Link to the Past: Prima's Official Strategy Guide</i> (2002)
1015	Excerpts from New Penguin Dictionary of Computing (2001)
1016	'476 Patent File History
1017	Declaration of Ingrid Hsieh-Yee, Ph.D. (“ Hsieh-Yee ”)
1018	Proof of Service of Complaint

I. MANDATORY NOTICES UNDER §42.8(A)(1)

A. Real Party-In-Interest under §42.8.(b)(1)

Meta Platforms, Inc. is the real party-in-interest to this IPR petition.

B. Related Matters under §42.8(b)(2)

The '476 patent is the subject of pending litigation involving Petitioner: *Mullen Industries LLC v. Meta Platforms, Inc.*, Case No. 1:24-cv-00354-DAE (W.D. Tex.). Petitioner was served on April 5, 2024. (EX1018, p.003.)

Petitioner is filing IPR petitions against twelve related patents asserted by Patent Owner in the pending litigation involving Petitioner:

U.S. Patent No.	IPR Case
8,585,476 B2	IPR2025-00737
9,744,448 B2	IPR2025-00738
10,179,277 B2	IPR2025-00739
10,828,559 B2	IPR2025-00740
10,967,270 B2	IPR2025-00702
11,033,821 B2	IPR2025-00703
11,376,493 B2	IPR2025-00741
11,904,243 B2	IPR2025-00742
11,947,716 B2	IPR2025-00743
12,019,791 B2	IPR2025-00744
9,662,582 B2	IPR2025-00745
10,974,151 B2	IPR2025-00746

C. Lead and Back-Up Counsel under §42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

This Petition is being served by Federal Express to the attorney of record for the '476 patent, 32733 - JEFFREY D. MULLEN, 2212 Hassinger Lane, Glenshaw, PA 15116. Petitioner consents to electronic service at the addresses provided above for lead and back-up counsel.

II. FEE PAYMENT

Petitioner requests review of 7 claims, with a \$51,875 payment.

III. REQUIREMENTS UNDER §§ 42.104 AND 42.108 AND CONSIDERATIONS UNDER §§ 314(A) AND 325(D)

A. Grounds for Standing

Petitioner certifies that the '476 patent is available for IPR and that Petitioner is not barred or otherwise estopped.

B. Identification of Challenge and Statement of Precise Relief Requested

Petitioner requests IPR institution based on:

Ground	Claims	Basis for Challenge under §103
1	1, 4, 5, 13	Jaszlics (EX1003) in view of Piekarski (EX1004)
2	2	Ground 1 Prior Art + Morihira (EX1006)
3	4	Ground 1 Prior Art + Ohshima (EX1005)
4	6-7	Ground 1 Prior Art + Robarts (EX1007)
5	17	Ground 1 Prior Art + Muendel (EX1008)

Submitted with this Petition is the Declaration of Jeremy Cooperstock, Ph.D. (EX1002) (“Cooperstock”), a qualified technical expert. (EX1002, ¶¶1-18, Appendix A.)

C. Considerations Under §§ 314(a) and 325(d)

§314(a): The *General Plastic* factors are not relevant as this is the first and only IPR petition filed by Petitioner with respect to the '476 patent.

Nor do the *Fintiv* factors support discretionary denial under §314(a). The pending litigation against Petitioner is in relatively early stage, with little substantive

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discovery having taken place to date and claim construction proceedings ongoing. Trial is scheduled to start October 5, 2026—over eighteen months from now—and a motion to transfer the case by Petitioner to the Northern District of California is currently pending, which if granted would likely result in an even later trial date. Petitioner also intends to move to stay the litigation pending resolution of the IPRs. Additionally, to allay concerns over duplication of efforts, Petitioner represents that, in the event of institution, it will not pursue in litigation any invalidity defense that was or could have been raised in IPR.

§325(d): *Advanced Bionics* does not apply to either reference relied upon in **Ground 1**—Jaszlics (**EX1003**), Piekarski (**EX1004**)—because neither reference was presented during prosecution. For the same reason, *Advanced Bionics* does not apply to Muendel (**EX1008**).

With respect to Ohshima (**EX1005**), the Examiner repeatedly rejected pending claims as anticipated by and obvious over Ohshima. (EX1016, 00203-00209, 00249-00255.) The Examiner ultimately concluded, however, that Ohshima failed to disclose limitations recited in claim 1. (EX1016, 00299.) But as shown below **Part VI.C**, Petitioner does not rely on Ohshima for claim 1—the limitations that the Examiner concluded were not disclosed in Ohshima are disclosed by and obvious in view of Jaszlics.

With respect to Morihira (**EX1006**), the Examiner cited it solely in connection with claim 2, which was not disputed by the applicant. (*See* EX1016, 00156-00157 (Oct. 2, 2009 Non-Final Rejection, pp.7-8) (“Morihira teaches a video game transparency control system (abstract) which varies the transparency of game images based on perceived distances through varying the amount of pixels displayed. It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify game images transparencies as taught by Morihira in order to convey virtual object distance.”), 00186-00187 (Apr. 2, 2010 Applicant Response, pp.18-19) (not disputing Morihira).)

With respect to Robarts (**EX1007**), it appears that a similar published application to Robarts (US 2005/0009608 A1) was listed among approximately fifty-five other references on a post-allowance applicant-submitted IDS. (EX1016, 00349-00352.) It was not otherwise cited or discussed during prosecution.

For these reasons, Petitioner respectfully submits that the cited prior art does not raise § 325(d) issues that would warrant discretionary denial of the Petition.

IV. OVERVIEW OF THE PATENT

A. Level of Ordinary Skill

A person of ordinary skill would have possessed a bachelor’s degree in electrical engineering, computer science, or similar field, with two years combined experience in designing and/or developing interactive location-based computer

systems/software, such as video games or other simulations incorporating location information (such as GPS information associated with a user's physical location), and in designing and/or developing computer systems/software involving graphical virtual and/or augmented reality. A person could also have qualified as a person of ordinary skill in the art with some combination of (1) more formal education (such as a master's of science degree) and less technical experience, or (2) less formal education and more technical or professional experience. (EX1002, ¶¶21-25.)

B. Specification Overview

The '476 patent states that it provides "a location-based game system in which the physical location (or physical movement) of a user on a physical playfield" obtained by, for example, a GPS device, "determines the virtual location (or virtual movement) of a virtual character on a virtual playfield." ('476, 7:6-12.) The system may include a head-mounted display so that "video game indicia may be overlaid onto the user's physical playfield," such as the user's "physical environment." ('476, 3:41-43; *see also id.*, 1:51-55 (listing "the physical world, a physical environment, or a defined physical playfield" as examples of a "physical playfield").) "The physical environment can then be manipulated by a processor such that, for example, virtual indicia (e.g., a video game character or component is added) is added to the physical environment." ('476, 3:50-53.)

The '476 patent further states that "[a] landscape detector may be provided

with a location-based game system such that information on the physical terrain of the user's physical environment may be utilized by the gaming system.” ('476, 4:8-11.) Figure 4, reproduced below, “is an illustration of landscape detection constructed in accordance with the principles of the present invention”:

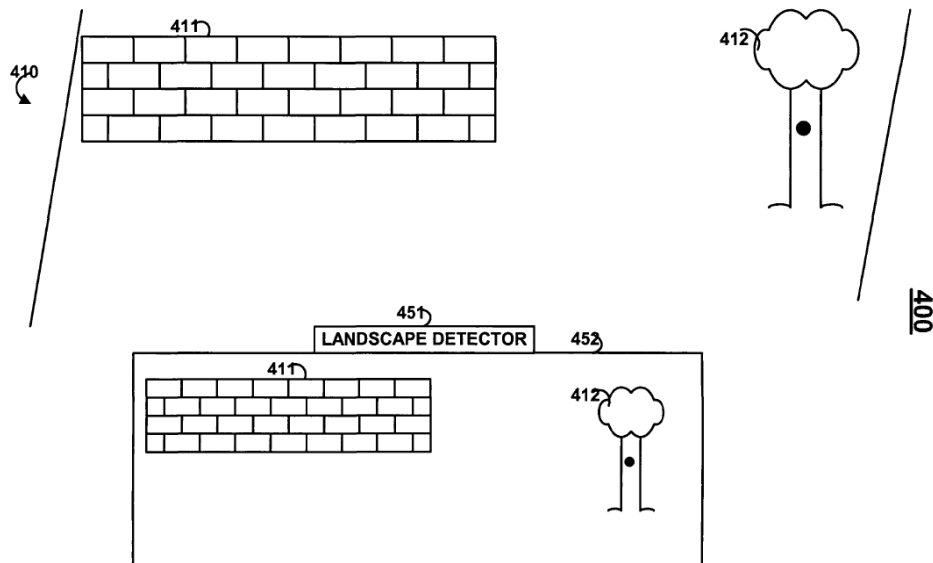
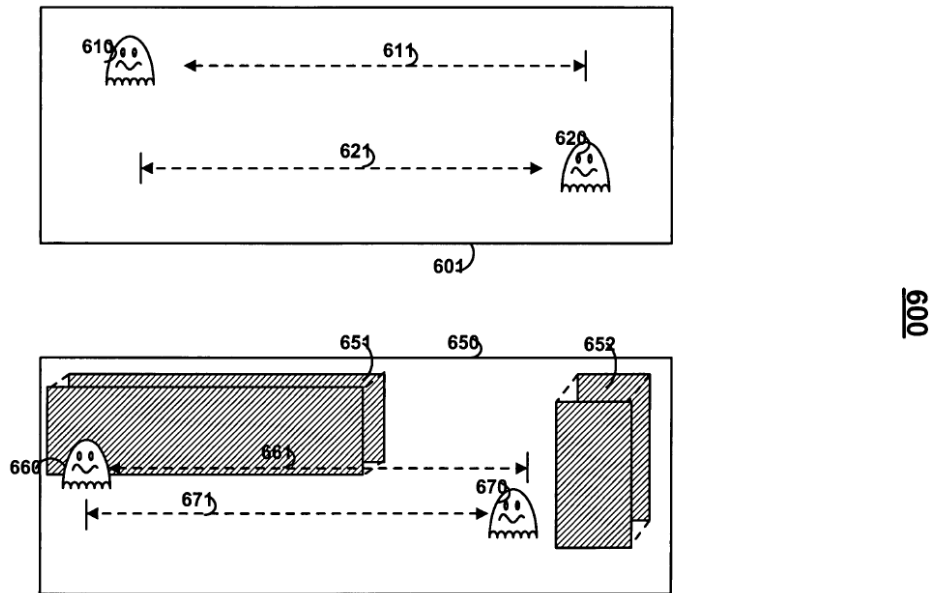


FIG. 4

('476, Fig. 4, 5:66-67; *see also id.*, 14:57-66.) “The information provided by the landscape detector may be utilized, for example, to position where portions of a video game playfield, objects, and characters may be positioned on a display (e.g., on a head-mounted display).” ('476, 4:14-17.) “Such information may also be used, for example, to control the movement characteristics of computer-controlled video game characters and indicia.” ('476, 4:17-20.) For example, Figure 6, reproduced below, “is an illustration of computer-controlled character positioning and movement based on detected landscape objects constructed in accordance with the

principles of the present invention”:



(’476, Fig. 6, 6:5-8.) Referring to Figure 6, the ’476 patent states that “[i]n environment **650**, actual environmental object may be present and stored in memory as virtual objects **651** and **652**.” (’476, 17:50-51.) “If the stored location of virtual objects **651** impedes on the planned movement of virtual characters, then program logic (e.g., game code) may manipulate the movement path of virtual characters around these virtual objects.” (’476, 17:56-60.)

V. CLAIM CONSTRUCTION

Petitioner does not believe express claim construction is necessary at this time. The prior art cited herein, as demonstrated below, renders the challenged claims obvious under any reasonable construction. Petitioner therefore respectfully submits that, for purposes of this IPR, express constructions are not required.

VI. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Overview of Grounds

The challenged claims attempt to lay claim to techniques for location-based video games in which a user sees their real-world surroundings combined with virtual objects. But these techniques were well-known before the '476 patent.

All grounds rely on Jaszlics (**EX1003**), which as its title demonstrates, describes a “system for combining virtual images with real-world scenes.” The augmented reality gaming and simulation system it describes is remarkably similar to the '476 patent. (Cooperstock, ¶52.) Jaszlics is a strong reference that discloses the majority of the claim limitations. Focusing on war gaming applications, but also making clear that the system is broadly applicable to outdoor location-based augmented reality gaming, Jaszlics provides a “combined reality” experience for a user by combining real-time, real-world imagery of a user’s physical surroundings with images of virtual entities, such as tanks. (*Id.* (citing Jaszlics, 1:64-67, 2:60-63).) For example, Jaszlics describes how, using data collected with a range scanning device (such as a modified infrared surveyor’s ranging laser), the distance and shape of real-world physical features around the user are detected and used to more realistically overlay virtual entities in the real-world scene. (*Id.* (citing Jaszlics, Fig. 1, 4:12-23).) The combined imagery—for example, as shown by Figure 1d below—can then be presented via head-mounted display to the user.

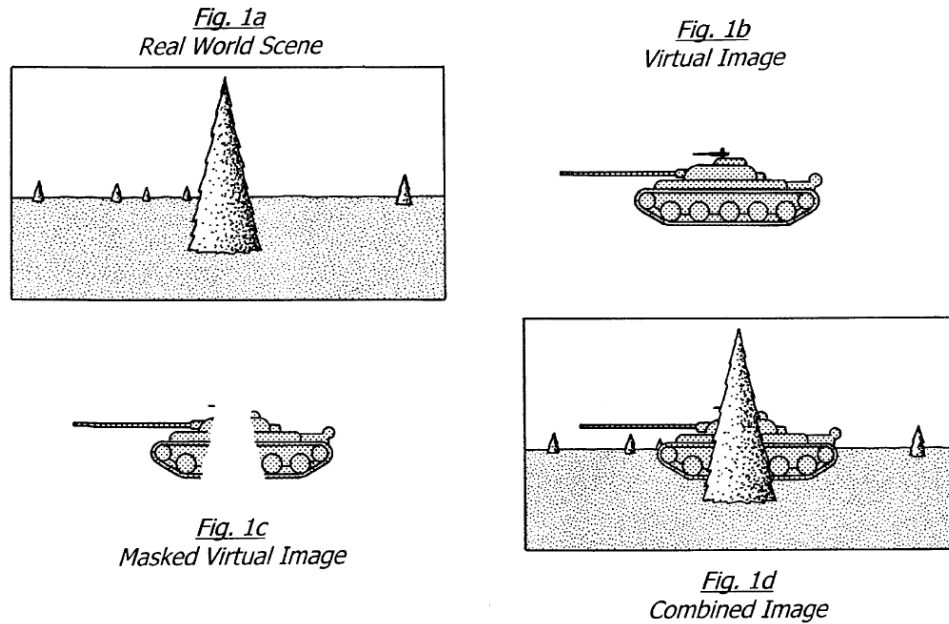


Fig. 1

(*Id.* (citing Jaszlics, 9:36, 9:48-57, 2:10-13).)

All grounds also cite to Piekarski (**EX1004**), which describes an actual implementation of a wearable, outdoor augmented reality system. (Cooperstock, ¶¶57-58 (citing Piekarski, e.g., pp.006 (“Abstract”), 009 (Fig. 3 (at right)))).) Piekarski confirms the obviousness of a “**wearable**” processor, and of using an optical see-through head-mounted display device that “**overlays virtual indicia onto a physical playfield.**” (Cooperstock, ¶¶58-59.)

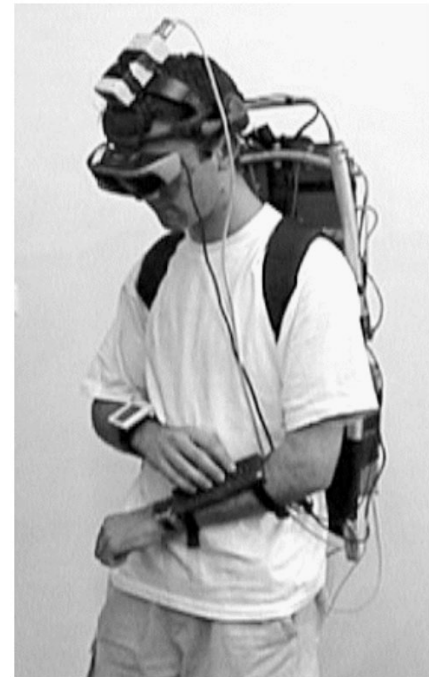


Figure 3. Users of the wearable computer see through a Sony PLM-100 transparent head-mounted display, and enter commands on a Phoenix forearm keyboard.

The additional references are cited for ancillary features cited in dependent claims. Morihira (**EX1006**) is cited in Ground 2 for dependent claim 2, Ohshima

(EX1005) in Ground 3 for an alternate mapping against dependent claim 4, Robarts (EX1007) in Ground 4 for dependent claims 6-7, and Muendel (EX1008) in Ground 5 for dependent claim 17.

B. Prior Art Status of Relied-Upon References

Pre-AIA law applies to the challenged claims, and each reference cited in the grounds listed in **Part III.B** qualifies as prior art to the '476 patent. Jaszlics and Morihira qualify as prior art under § 102(b) because they issued more than one year before the priority date.¹ Piekarksi also qualifies as prior art under § 102(b) because it was published more than one year before the priority date, as evidenced by public library availability. (See EX1017, ¶¶26-58.) Muendel also qualifies as prior art under § 102(b) because it is a PCT application published more than one year before

¹ The '476 patent claims priority to a provisional application (no. 60/628,475) filed November 16, 2004. For purposes of this Petition, Petitioner has assumed a priority date of November 16, 2004. Petitioner at this time expresses no opinion on whether the '476 patent is actually entitled to the benefit of the provisional application filing date. This issue is not relevant here because all of the prior art references relied upon predate November 16, 2004. In the event entitlement to the provisional filing date or another earlier priority date may later become relevant, Petitioner reserves the right to respond at that time.

the priority date. Ohshima and Roberts qualify as prior art under § 102(e) because they issued or were published from applications filed before the priority date.

C. Ground 1: Claims 1, 4-5 and 13 Are Obvious Over Jaszlics in view of Piekarski

1. Independent Claim 1: “An augmented reality game system comprising:” (1[pre])

Assuming the preamble provides a claim limitation, Jaszlics discloses it.

To start, Jaszlics discloses an “**augmented reality...system,**” which Jaszlics refers to as “combined reality.” (Jaszlics, col. 21, Table 7 (“Glossary of Terms” defining “combined reality” as “Apparent reality, with virtual elements projected into the image of the real world. Virtual and live elements may interact through simulation.”); Cooperstock, ¶85.) In particular, Jaszlics discloses “systems for combining virtual images with real-world scenes” where “[t]he resulting combined image is presented in [a display]” to a user. (Jaszlics, 1:13-15, 2:40-56.) Figure 1d of Jaszlics illustrates an example of a combined image, where a virtual image of a tank is rendered in a real-world scene to appear as though it is behind a tree:

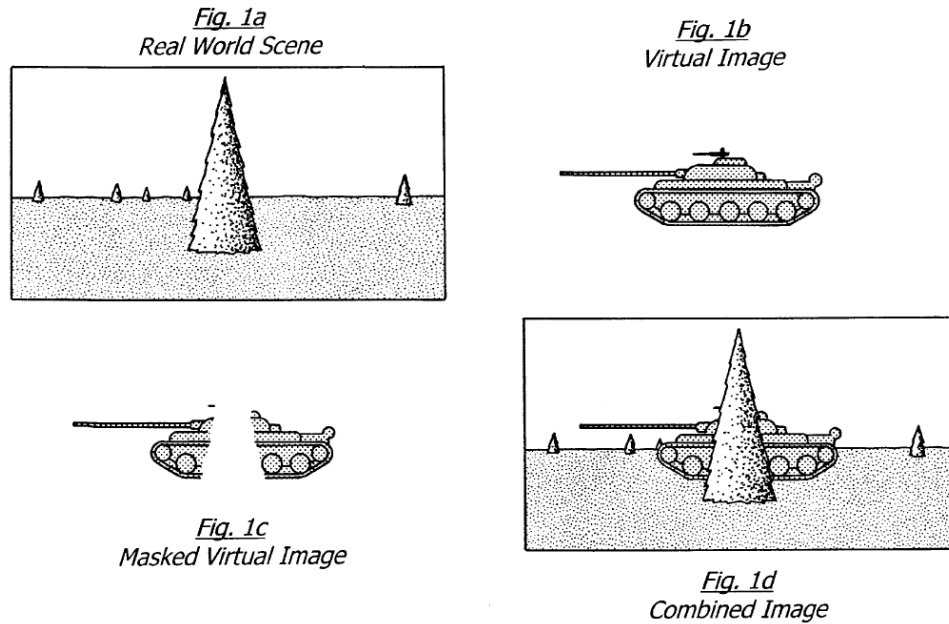


Fig. 1

(Jaszlics, Fig. 1; *see also id.*, 3:13-16 (“FIGS. 1a through 1d are examples of the real-world scene, a virtual image, the resulting masked virtual image, and combined images, respectively.”).) The display can take the form of “electronic display goggles,” where “three-dimensional virtual elements” are injected “into the view of the real world.” (Jaszlics, 2:10-13.)

A person of ordinary skill in the art would have understood that Jaszlics’ disclosure of combining virtual images with real-world scenes describes “augmented reality” (or “AR”). (Cooperstock, ¶86.) For example, like Jaszlics’ “combined reality,” the ’476 patent similarly states that “Augmented Reality (AR) systems are provided in which video game indicia are overlaid onto a user’s physical environment.” (’476, Abstract.) More generally, Jaszlics’ description of “combined

reality” is consistent with the ordinary understanding in the art of “augmented reality.” (Cooperstock, ¶86 (citing EX1010, p.007).)

Jaszlics further discloses and renders obvious an “**augmented reality game system**.” (Cooperstock, ¶87.) For starters, Jaszlics specifically describes using its system for virtual war games, and related game play, such as engaging in a virtual tank battle. (Jaszlics, e.g., 10:15-25, 11:4-6, 15:15-30.) This is just like the ’476 patent, which similarly states that “an AR game system may be utilized in the military training of soldiers” and specifically recognizes this sort of military simulation as “game play.” (’476, 5:10-11; *see also id.*, 5:11-14 (“game is played.”), 15:12-14 (“game play.”).)

More specifically, Jaszlics explains that “[t]he present invention can be used in these war games to generate virtual tanks that appear to move about the terrain. This can completely eliminate the need, for example, for live tanks representing the enemy force in a war gaming exercise. Virtual vehicles and real vehicles can appear in the same scene.” (Jaszlics, 1:53-58.) Jaszlics describes military simulation game play that includes a player/user (which Jaszlics refers to as an “observer”²) engaging a virtual combat vehicle and taking damage or getting “killed.” (Jaszlics, 10:15-25

² See Jaszlics, 10:11-17 (“The observer **113** of the display is assumed to be the user of the invention....”).

(“An example of such direct interaction is the engagement of a virtual opponent from a combat vehicle, such as a battle tank.”), 11:59-63 (“For example, if one of the virtual tanks represented in this simulation engage the avatar of the observer’s tank, the resulting damage information will activate damage displays, or a ‘killed’ indicator in the observer’s sensors and controls suite.”); *see also id.*, 11:4-6 (“virtual battle damage”), 15:53-56 (“The virtual entities implemented by the virtual simulation and control software are capable of engaging the avatar of the observer’s vehicle, depending on the scenario loaded in.”), 15:25-30 (“engaging the virtual T-80s operated by the virtual simulation”), 10:39-44 (engaging virtual tank).) Jaszlics’ disclosure of using its augmented reality system for simulated war games therefore discloses an “**augmented reality game system.**” (Cooperstock, ¶88.)

Putting aside its military-specific gaming applications, Jaszlics expressly teaches that its system can be used as “an interactive, recreational device,” and is broadly applicable to gaming generally, explaining that, for example, “[a]nother possible field of use is in games, such as laser tag, so that virtual players, objects, and special effects can be combined with real players and real objects in the playing field.”³ (Jaszlics, 1:64-67, 18:48-55; *see also id.*, 15:21-25 (“Other scenarios not related to tanks, or military training, can be selected by a user...”).) Jaszlics

³ All underlining added to quoted material unless noted.

therefore discloses and renders obvious an “**augmented reality game system**” in which users can play laser tag-like and other games involving the user’s physical surroundings and virtual elements. (Cooperstock, ¶89.)

(a) “**a head-mounted display that overlays virtual indicia onto a physical playfield;**” (1[a])

Jaszlics’ augmented reality system includes “**a head-mounted display,**” such as “electronic display goggles,” “virtual reality goggles or visors worn by the observer [i.e., the user of the system].” (Jaszlics, 9:48-57; *see also id.*, 2:10-13 (“The present invention can be used with electronic display goggles to greatly extend this entertainment medium by injecting, in real time, three-dimensional virtual elements into the view of the real world.”), 9:34-39 (“The display **111** may be any display system capable of displaying the combined image, such as...an electronic goggle or visor...”), 10:52-57 (“The position and orientation of the observer (including the movement and attitude of the vehicle, if any, housing the observer) is sensed by observer sensors and controls **115** such as a magnetic or infrared head tracker system used in conjunction with virtual reality goggles.”).) Jaszlics therefore discloses “**a head-mounted display,**” as claimed. (Cooperstock, ¶90.)

With respect to “**overlay[ing] virtual indicia onto a physical playfield,**” the ’476 patent describes “**physical playfield**” as broadly including “the physical world, a physical environment, or a defined physical playfield[.]” (’476, 1:51-55.)

Jaszlics teaches that the “electronic display goggles” or “visors” (“**head-mounted display**”) “**overlay[] virtual indicia onto a physical playfield,**” by for example, displaying virtual tanks (“**virtual indicia**”) overlaid within a physical landscape surrounding the user (“**physical playfield**”) for participating in a virtual war games exercise, as illustrated in Figure 1:

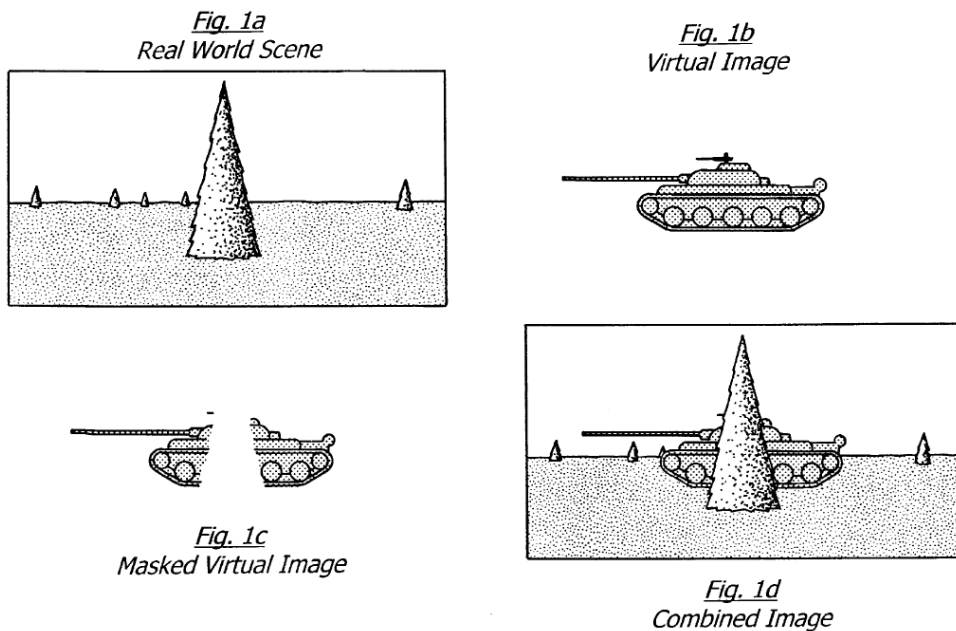


Fig. 1

(Jaszlics, Fig. 1; *see also id.*, 4:19-23 (“The masked virtual image and the image of the real world are then combined in such a manner that in the resulting combined image (FIG. 1d) the virtual object will appear to exist and move in the real world at its virtual position.”), 8:53-56 (“In this step **110** of FIG. 2, the virtual images constructed in the virtual image generation step **109** are combined with the real-world image **114** originating from the video camera **100**.”), 8:7-16 (“three battle tanks are animated.”); Cooperstock, ¶92.)

As another example, Figure 14 of Jaszlics (below) illustrates virtual tanks **162** (“**virtual indicia**”) overlaid on hills **160** of the user’s physical environment (“**physical playfield**”):

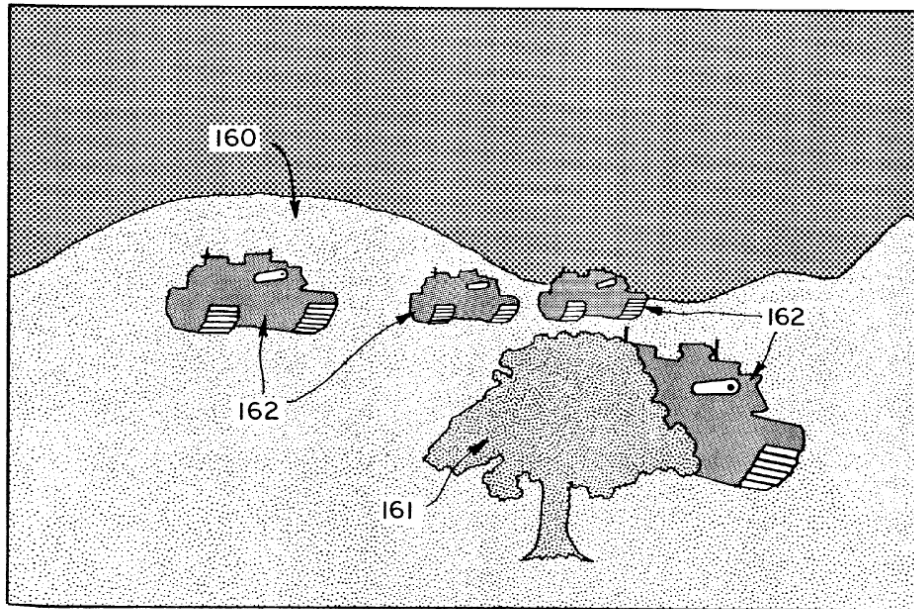


Fig. 14

(Jaszlics, Fig. 14; *see also id.*, 3:49-51, 9:60-62 (describing Fig. 14); EX1011 (Jaszlics Provisional), 00152, Fig. 14 (identifying **160** as “Hills” and **162** as “Virtual Entities”); Cooperstock, ¶93.)

As a third illustration, referring to Figure 15 (below), Jaszlics explains how the overlaid “**virtual indicia**” can be a variety of virtual elements, such as a path marker **172**, a unit boundary **173**, a navigational marker **174**, and a phase line **175**, which are overlaid on terrain **170**:

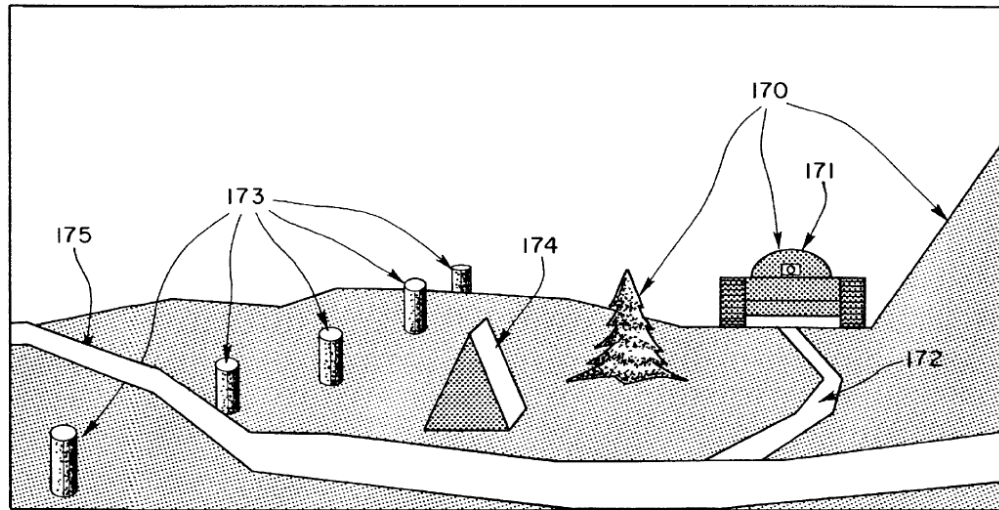


Fig. 15

(Jaszlics, Fig. 15; *see also id.*, 9:64-10:9 (“The virtual entities generated by a virtual entity simulation do not necessarily represent a real-world object. For example, they may represent fictional characters or entities, or views of conceptual objects. An example of conceptual virtual entities is shown in FIG. 15. In FIG. 15, the real-world objects 170 include the terrain, a tree, and a battle tank, in which the observer or observers 171 of a combined reality view presented to them are located. The conceptual virtual entities in the figure are conceptual objects: a path marker 172, a unit boundary 173, a navigational marker 174, and a phase line 175. The present system positions the conceptual virtual entities in the display in such a manner that they appear to be present in the landscape visible to the observer(s).”); Cooperstock, ¶94.)

And as noted, Jaszlics is not limited to games involving military simulations. Jaszlics more broadly describes combining “virtual players, objects, and special

effects” with “real players and real objects in the playing field.” (Jaszlics, 1:64-67; *see also id.*, 4:23-27 (“While FIGS. 1a through 1d show a battle tank, the method of the invention has been also demonstrated using many other virtual objects, including animated human figures, geometric figures, or injection of three-dimensional building plans into a real-world environment.”), Cooperstock, ¶95.)

Jaszlics therefore teaches an augmented reality game system that includes “**a head-mounted display**” (such as electronic display goggles or visors worn by the user) that “**overlays virtual indicia**” (virtual elements such as animated vehicles and humans, and conceptual objects such as markers) “**onto a physical playfield**” (the physical environment surrounding the user, such as hills and other terrain). (Cooperstock, ¶96.)

Moreover, Piekarski, discussed in more detail in connection with claim 1[c] below, confirms the obviousness of a head-mounted display that “**overlays virtual indicia onto a physical playfield.**” (Cooperstock, ¶97.) Piekarski discloses a wearable, outdoor augmented reality computing system in which virtual indicia are “overlaid” on a “physical world view.” (Piekarski, e.g., p.006 (“An application in simulated combat training is described, where the AR users are soldiers with wearable computers ...”); *see also id.* (“The advent of wearable computers [3,8,15,16] and lightweight head-mounted displays (HMDs) has made augmented reality applications feasible outdoors. Augmented reality (AR) is the process of a

user viewing the physical world and virtual information simultaneously, where the virtual information is overlaid and aligned to the physical world view [1].”).) Figure 3 of Piekarski, below, illustrates the wearable computer system, including head-mounted display:



Figure 3. Users of the wearable computer see through a Sony PLM-100 transparent head-mounted display, and enter commands on a Phoenix forearm keyboard.

(Piekarski, p.009, Fig. 3.)

With respect to claim 1[a]’s recitation of a head-mounted display that **“overlays virtual indicia onto a physical playfield,”** Piekarski’s system includes a commercially available “Sony PLM-100 transparent display, worn on the user’s head” that “allows the video output of the computer to superimpose images over the real world.” (Piekarski, p.009 (“3.1 Hardware Components”).) Because Piekarski’s head-worn transparent display (**“head-mounted display”**) enables the computer to “superimpose images over the real world,” Piekarski discloses a “head-mounted

display” that “**overlays virtual indicia onto a physical playfield.**” (Cooperstock, ¶98.)

The rationale and motivation to combine Jaszlics and Piekarski is detailed below in connection with claim 1[c], and fully applies here as well. (Cooperstock, ¶¶99, 110-114.) In addition, as to claim 1[a], the combination would have predictably resulted in Jaszlics’ system using a transparent head-mounted display that overlays virtual indicia onto the physical environment as taught by Piekarski. (*Id.*) In fact, Jaszlics’ disclosure of electronic display “goggles” and “visors” at a minimum suggests a transparent head-mounted display. (Cooperstock, ¶99 (citing Jaszlics, e.g., 23:56-59 (claim 4), 25:3-6 (claim 15)).) As similar systems, a person of ordinary skill in the art, looking to implement or adapt Jaszlics would have been motivated to look to Piekarski for its related teachings. (Cooperstock, ¶99.) In addition, a transparent head-mounted display, such as the commercially available Sony PLM-100 described in Piekarski, would have been obvious to try. (*Id.*) It was well known at the time that there were primarily two types of head-mounted displays capable providing a user a view of their surroundings: (1) optical see-through displays, where the wearer directly sees their physical surroundings; and (2) video see-through displays, where a camera is used to capture a user’s view of their environment. (*Id.* (citing EX1013, p.007).) As one of two known alternatives, an

optical see-through head-mounted display would have been obvious to try.
(Cooperstock, ¶99.)

A person of ordinary skill in the art would have had a reasonable expectation that the combination of Jaszlics and Piekarski would have been successful. For example, the combination would have involved at most the straightforward application of known computer programming techniques and use of commercially available hardware systems, such as the Sony PLM-100. (Cooperstock, ¶100.)

(b) “memory comprising video game logic that provides a video game;” (1[b])

Jaszlics describes its augmented reality game system as using a conventional computing system, such as “a personal workstation running two 266 MHz Pentium II processors[,]” to execute software including “virtual simulation and control software” for providing a virtual simulation (or “scenario”). (Jaszlics, 14:13-18, 14:66-15:1, 15:53-56, 17:11-14; Cooperstock, ¶101.)

Because memory and software are basic components of a conventional computing system, a person of ordinary skill in the art would have understood and found it obvious that Jaszlics’ system would have included a “**memory**” (such as a hard drive and/or RAM) comprising the “**video game logic that provides a video game,**” including the logic associated with the system’s “virtual simulation and control software” and virtual simulations executed by the software, such as various

“scenarios” providing war game simulations. (Cooperstock, ¶102 (citing EX1012, pp.007-008 (entry for “microprocessor”))).⁴

- (c) **“a wearable processor that utilizes said video game logic to provide video game indicia to said head-mounted display based on said video game logic, wherein said processor is coupled to said memory and said head-mounted display;” (1[c])**

As explained below, claim 1[c] would have been obvious over Jaszlics in view of Piekarski [EX1004].

To start, Jaszlics discloses a **“processor that utilizes said video game logic to provide video game indicia to said head-mounted display based on said video game logic,”** as claimed. (Cooperstock, ¶105.) As discussed for claim 1 [b], Jaszlics describes using conventional computing components, including a “virtual simulation computer” having a processor for executing “virtual simulation and control software” to provide a virtual simulation (e.g., a video game). (Jaszlics, 14:13-18,

⁴ In addition, Jaszlics’ provisional application includes exemplary source code excerpts for military war game simulation software that repeatedly refers to “memory,” thus further confirming the understanding of a person of ordinary skill in the art that Jaszlics’ system would comprise **“memory comprising video game logic that provides a video game.”** (Cooperstock, ¶103 (citing EX1011, 0047, 0048, 0052, 0090).)

14:66-15:1, 15:53-56.) Jaszlics discloses that those conventional computing components include a **“processor.”** (Jaszlics, 14:13-18 (“virtual simulation computer **210** (e.g., a personal workstation running two **266** MHz Pentium II processors).”) And a person of ordinary skill in the art would have therefore understood and found it obvious that Jaszlics’ **“processor”** would **“utilize[] said video game logic to provide video game indicia to said head-mounted display based on said video game logic,”** *i.e.*, execute the video game software to provide a game and associated video game indicia (such as a virtual tank, virtual player or other character) to the user via a head-mounted display (e.g., “electronic display goggles” or “visors worn by the observer” (Jaszlics, 2:10-13, 9:48-57; Cooperstock, ¶105.) It would also have been apparent and obvious that the provision of video game indicia would have been **“based on said video game logic,”** *i.e.*, provided by the system’s virtual simulation and control software and the virtual simulations executed by the software, such as various “scenarios” providing war game simulations. (Cooperstock, ¶105.)

Jaszlics also discloses and renders obvious that **“said processor is coupled to said memory and said head-mounted display,”** as claimed. (Cooperstock, ¶106.) A person of ordinary skill in the art would have understood and found it obvious that, consistent with conventional computer operation, in order for Jaszlics’ system to provide a virtual simulation to a user, the processor of Jaszlics’ system would

have been coupled both (1) to the memory comprising the video game logic (“**said logic**”), such as the system’s “virtual simulation and control software,” in order to execute that logic, and (2) to the display provided by “electronic display goggles” or “visors worn by the observer” (“**said head-mounted display**”). (*Id.*) This would have been obvious to any skilled artisan based on elementary functions of computing systems; in order for “**said processor**” to execute the software stored in “**said memory**,” and accordingly produce the virtual indicia for presentation on “**said head-mounted display**,” the processor would have been coupled to both the memory (in order to allow it to retrieve the software instructions for execution) and the head-mounted display (in order to allow it to cause the virtual indicia to be presented). (*Id.*) It would have been obvious, in any computing system that has a processor, memory, and display, that there would have been at least a logical and functional coupling of these components to enable data to be communicated between and among them. (*Id.*)⁵

⁵ Although not required by the claim, it would also have been obvious that these components would have been physically coupled via wires or a bus, consistent with how computer components are conventionally coupled. (Cooperstock, ¶106 (citing Jaszlics, 14:56-69; EX1012, pp.005-006 (entry for “bus”))).)

Jaszlics does not appear to expressly describe a “**wearable processor**,” but this would have been obvious based on Jaszlics alone or in view of Piekarski. (Cooperstock, ¶107.) Jaszlics discloses one embodiment in which the processor is part of virtual simulation computer **210**, which in one embodiment, takes the form of a personal workstation. (Jaszlics, *e.g.*, 14:13-18.) But it would have been obvious for the processor to have been “**wearable**,” as Jaszlics itself describes a user wearing electronic display goggles or visor and further discloses that the user can be a mobile individual—not necessarily an individual located in a vehicle. (Cooperstock, ¶107 (citing Jaszlics, *e.g.*, 10:63-67 (“For moving observers, who may be individuals moving in the real world, or housed in a vehicle...”), 5:13-18 (“dynamic scenes with a moving observation point and mobile elements within the real-world scene”), 11:16-18 (“State vectors (three dimensional position, angles, velocity, and angular velocities) are generated for the observer, and for the observer’s vehicle (if any).”), 1:64-67 (describing laser tag)).) Accordingly, although Jaszlics does not appear to expressly state that its system includes a “**wearable**” processor, it would have been obvious to a person of ordinary skill in the art to have included a wearable processor to enable game play involving mobile individuals (for example individuals who are moving in the real world outside of a vehicle). (*Id.*) Without the ability to wear the computing system, a user’s freedom of movement in the physical environment

would have been limited, undermining the user experience and Jaszlics' goal of providing a realistic simulation. (*Id.*)

By November 2004, “**wearable**” computing systems (and thus “**wearable**” processors) were neither novel nor non-obvious, and in fact were fairly unremarkable. (Cooperstock, ¶108.) For example, five years earlier, the development of a wearable augmented reality computer system for outdoor applications such as military simulations was described in “Integrating Virtual and Augmented Realities in an Outdoor Applications” by Wayne Piekarski et al. (“**Piekarski**”) [EX1004]. Piekarski explains that “[t]he advent of wearable computers [3,8,15,16] and lightweight head-mounted displays (HMDs) has made augmented reality applications feasible outdoors.” (Piekarski, p.006 (“Introduction”).) Piekarski describes “[a]n application in simulated combat training...where the AR users are soldiers with wearable computers.” (Piekarski, p.006 (“Abstract”); *see also id.*, p.007 (“We use AR to supply the soldier with easily understood information about his battlefield environment, for example: indications of threats, the location of friendly forces, and the status of aircraft as they approach.”), p.006 (“Abstract”).)

Figures 2 and 3 of Piekarski, below, illustrate the wearable computer system:



Figure 2. Photograph of the Tinmith-II wearable computer.

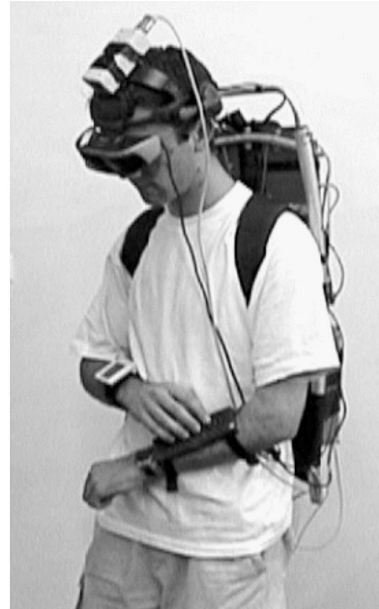


Figure 3. Users of the wearable computer see through a Sony PLM-100 transparent head-mounted display, and enter commands on a Phoenix forearm keyboard.

(Piekarski, pp.008-009, Figs. 2 & 3.) Piekarski explains that the wearable computer system, called “Tinmith-II,” is “built upon a Toshiba 320CDS notebook running the freely available LinuxOS.”⁶ (Piekarski, p.009 (“3.1 Hardware Components”); *see*

⁶ Petitioner notes that Piekarski’s wearable computer system appears fairly bulky. But a subsequent paper by Piekarski in 2001 describing its wearable computer system correctly observes that “[g]iven sufficient manufacturing and financial resources it would be straightforward to produce a smaller footprint device containing all the components fully integrated, but this is not the area of interest. Some companies are starting to produce hardware for this application and so it is

also id., p.008 (“Wearable Computer System”).) “The laptop is about the size of an A4 book and fits comfortably on a wearer’s back” and “[a] Sony PLM-100 transparent display, worn on the user’s head as shown in Figure 3, allows the video output of the computer to superimpose images over the real world.” (Piekarski, p.009 (“3.1 Hardware Components”).) A person of ordinary skill in the art would have understood that a conventional computer such as a Toshiba 320CDS notebook laptop would include a “**processor**” and “**memory**.” (Cooperstock, ¶109 (citing EX1012, pp.007-008 (entry for “microprocessor”))).) Piekarski therefore discloses a “**wearable processor**” that is coupled to both memory and a head-mounted display. And thus to the extent there is any question that a “**wearable processor**” as claimed would have been obvious over Jaszlics alone, it would have been obvious in view of Piekarski. (Cooperstock, ¶109.)

Rationale and Motivation to Combine (Jaszlics and Piekarski). It would have been obvious to a person of ordinary skill in the art to combine Piekarski’s teachings regarding a body-worn wearable computer for an augmented reality system with Jaszlics. (Cooperstock, ¶110.) The combination would have involved the straightforward substitution of Jaszlics’ computer system with the wearable

only really a matter of time.” (EX1009, p.002 (“2.1 Integration”); Cooperstock, ¶109 n.6.)

computer system disclosed in Piekarski and would have predictably resulted in Jaszlics' virtual simulation system in which the computer providing the virtual simulation for a user was worn by the user. The combination therefore discloses and renders obvious the “**wearable processor**” as claimed. (*Id.*)

Jaszlics and Piekarski are both analogous references to the '476 patent, in the same field and reasonably pertinent to problems facing the '476 patent inventor. (Cooperstock, ¶111 (citing '476, 1:15, 1:59-63; Jaszlics, e.g., 1:13-15, 10:63-67; Piekarski, e.g., p.006 (“Abstract”)).)

A person of ordinary skill in the art would have been motivated to make the combination. (Cooperstock, ¶112.) Jaszlics, as noted, already teaches a virtual simulation system that can be used outdoors by a mobile user wearing electronic display goggles. The advantages that a wearable, mobile computing system could provide, including increased mobility and interaction as a result of being untethered to a stationary computing system, would have been readily apparent to a person of ordinary skill in the art reviewing Jaszlics. Piekarski notes, for example, that their simulated combat training system provided “the illusion of a rich environment at relatively low cost, yet users of wearable computers are not restricted to training indoors as they might have been with VR equipment.” (Piekarski, p.0014 (“6. Conclusions”)). A person of ordinary skill in the art would have therefore naturally looked to a reference such as Piekarski for additional disclosures about the design

and operation of such a wearable computing system. (Cooperstock, ¶112.) In fact, Piekarski describes a wearable computing system that includes many of the pertinent components described in Jaszlics, including an HMD, GPS device, and control device (e.g., keyboard). (Piekarski, p.009 (“3.1 Hardware Components”).)

Moreover, Piekarski provides express motivation to combine and confirmation that a “wearable processor” would have been obvious to try, explaining that “[t]he advent of wearable computers [3,8,15,16] and lightweight head-mounted displays (HMDs) has made augmented reality applications feasible outdoors.” (Piekarski, p.006 (“Introduction”); Cooperstock, ¶113.) The fact that Piekarski and Jaszlics are both directed to augmented reality applications in general, and military war game simulations in particular, provides further motivation to combine—like Jaszlics, Piekarski’s wearable computing system enable users to interact with “synthetic battle environments in simulated exercises.” (Piekarski, p.007 (“2. Augmented Reality Meets Virtual Reality”); Cooperstock, ¶113.) In Piekarski, “[a] synthetic battle[,]” like Jaszlics, “may, of course, involve fictitious entities (soldiers, vehicles, and aircraft) as well as the real entities actually participating in the exercise.” (Piekarski, p.007.) Piekarski provides further motivation by explaining that a purpose of their work was to “investigat[e] technology that may improve the effectiveness of the dismounted combat soldier.” (Piekarski, p.007 (bottom left column); Cooperstock, ¶113.) A person of ordinary skill in the art would be

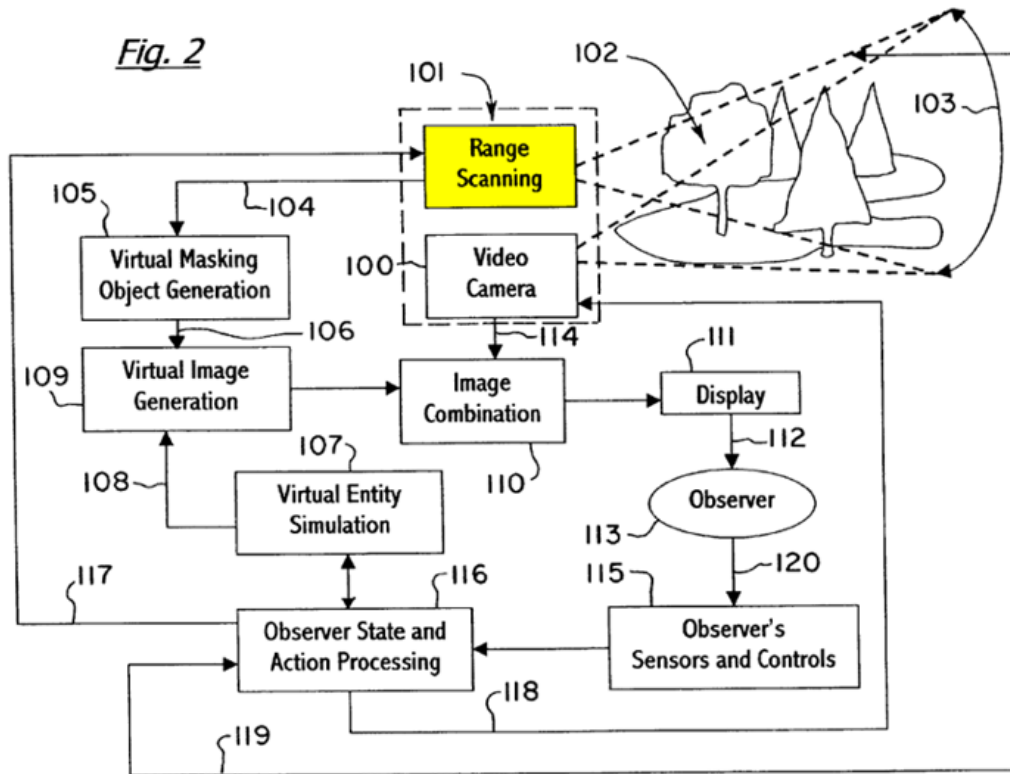
motivated to implement or adapt Piekarski's teachings, including wearable computing systems, to obtain similar improvements for Jaszlics' system. (Cooperstock, ¶113.)

A person of ordinary skill in the art would have had a reasonable expectation that the combination would have been successful, as it would have involved the simple and straightforward combination of existing, commercially available computing components used according to their conventional, established functionality. (Cooperstock, ¶114 (citing Piekarski, p.009 ("3.1 Hardware Components"); EX1009, p.002 ("2.1 Integration")).)

- (d) **“a detector that determines landscape characteristics of said physical playfield, wherein said video game logic utilizes said landscape characteristics in providing said video game; and” (1[d])**

Jaszlics discloses **“a detector that determines landscape characteristics of said physical playfield”** in the form of a range scanner, such as a laser range scanner or other technology for scanning a real-world outdoor scene to determine characteristics of the scene, such as “the shape and distance of real-world objects within a field of regard of interest to the observer using the apparatus.” (Jaszlics, 2:41-46; *see also id.*, 12:19-13:44 (detailing laser scanner functionality, including transmitter and receiver sections for emitting and detecting, respectively, laser pulses); Cooperstock, ¶¶115-116.)

For example, Figure 2 of Jaszlics depicts a Range Scanning component **101** within Jaszlics' system:



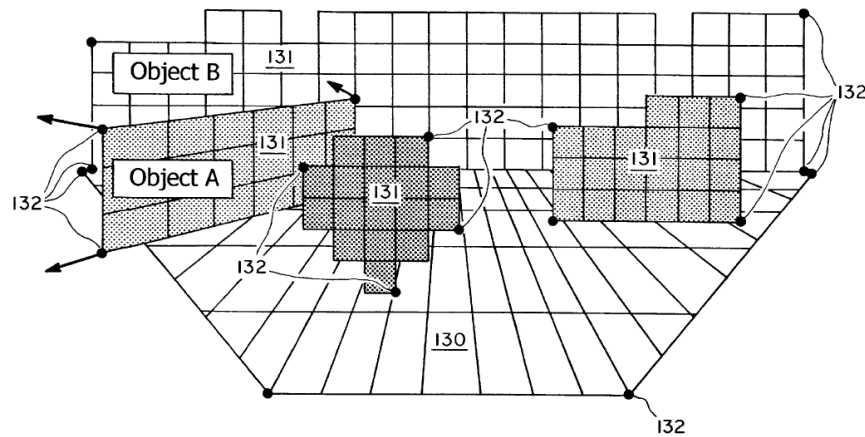
(Jaszlics, Fig. 2 (highlighting added); *see also id.*, 4:35-37 (“[A] range scanner **101** determines the distance of the entities present in a real-world scene **102** within small ranging sectors.”).) Jaszlics explains that “[r]ange scanning may be performed by a laser range scanner (as in the reference apparatus shown in FIGS. 16-22) or by other means that can determine the distance of objects within the angular space of ranging sector.” (Jaszlics, 4:43-46; *see also id.*, Figs. 16 (illustrating Laser Scanner **203**), 17 (illustrating transmitter section of laser scanner), 18 (illustrating receiver section of laser scanner), 4:60-5:6 (describing other methods for landscape detection).) The

range scanner can be “a modification of a commercially available solid-state infrared surveyor’s ranging laser[.]” (Jaszlics, 12:19-20; *see also id.*, 12:34-36 (“The scanner elements are built from commercially available components[.]”).)

The written description of the ’476 patent provides further confirmation that Jaszlics’ range scanner is “**a detector that determines landscape characteristics of said physical playfield**” as claimed. (Cooperstock, ¶117.) Jaszlics’ description of a range scanner that determines “the shape and distance of real-world objects” (Jaszlics, 2:41-46) in the user’s physical environment is remarkably similar to the ’476 patent’s own description of a “landscape detector” that “may measure the distance to objects and the shape of the object.” (’476, 14:57-66.)

Jaszlics also discloses “**said video game logic utilizes said landscape characteristics in providing said video game.**” Jaszlics’ system uses the distance and shape information provided by range scanning data (“**said landscape characteristics**”) to generate “virtual masking objects” that it uses to present a more realistic virtual simulation. (Jaszlics, 2:41-46 (“Virtual masking objects, which are simplified computer models of real-world objects, are derived from the range data.”), 4:50-55 (“Range scanning is an existing technology that provides range data necessary for virtual masking object generation.”); Cooperstock, ¶118.) Figure 9 of Jaszlics, below, illustrates how the range scanning data is used to generate virtual masking objects:

Fig. 9



(Jaszlics, Fig. 9.) Referring to Figure 9, Jaszlics explains that it “shows several virtual masking objects, including the apparent terrain 130 observed by range scanning, and other virtual masking objects 131, which include Object A located near to the observation point, and Object B located at the extreme range of range scanning.” (Jaszlics, 7:29-34.) Jaszlics uses these virtual masking objects to present a more realistic virtual simulation, by for example, using them to generate a combined reality image where a portion of a virtual object, such as a tank, is masked out such that it appears to be partially concealed behind a real-world object, such as a tree. (Cooperstock, ¶118.) Figure 1 of Jaszlics illustrates:

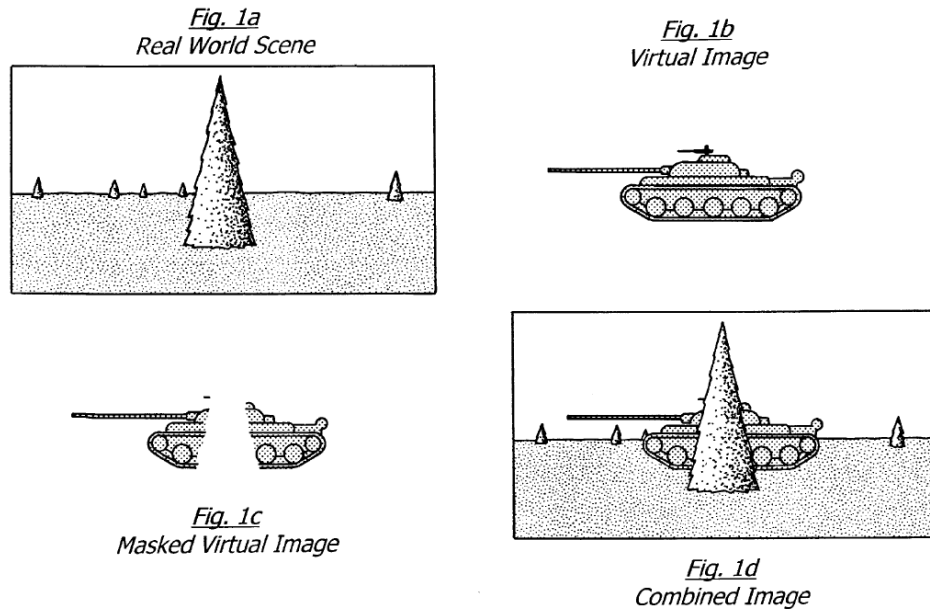
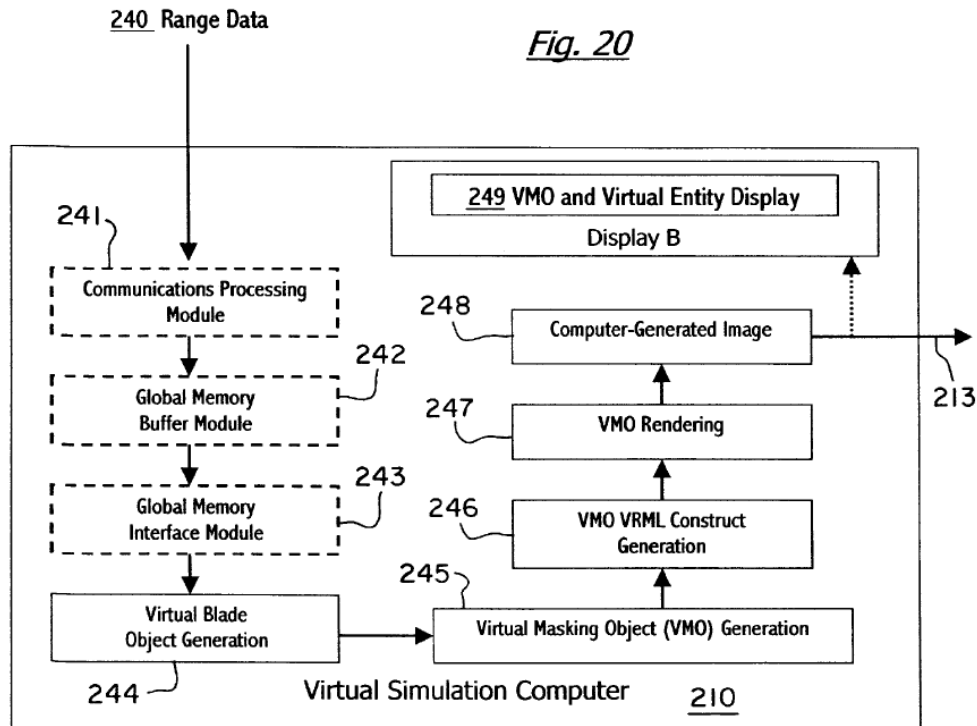


Fig. 1

(Jaszlics, Fig. 1; *see also id.*, 4:13-27 (describing Figs. 1a-1d).)

Figure 20 of Jaszlics further illustrates how the detected ranging data—Range Data **240**—is input into and processed by Virtual Simulation Computer **210**, which implements “[v]irtual entity simulation” “through the virtual simulation and control software” (“**said video game logic**”):



(Jaszlics, Fig. 20; *see also id.*, 3:64-65 (“FIG. 20 is a simplified block diagram of the virtual masking object (VMO) generation software.”), 14:32-52 (describing input and processing of ranging data), 14:66-15:1 (“Virtual entity simulation is implemented in the virtual simulation computer through the virtual simulation and control software.”); Cooperstock, ¶119.)

Jaszlics therefore teaches that ranging data corresponding to the distances and shapes of real-world objects in the user’s physical environment (“**landscape characteristics of said physical playfield**”) is utilized by Jaszlics’ virtual simulation and control software (“**said video game logic**”) in providing a virtual simulation, such as military or non-military games (“**in providing said video game**”). (Cooperstock, ¶120.)

- (e) **“a locating device that determines the physical location of said locating device on the physical playfield, wherein said video game logic utilizes the physical location of said locating device in providing said video game.” (1[e])**

With respect to **“a locating device that determines the physical location of said locating device on the physical playfield,”** the '476 patent identifies a GPS device as an example of a locating device. ('476, 4:11 (“If the locating device is a GPS device....”), 20:28-30 (“location devices (e.g., GPS, LPS, accelerometers, gyroscopes, inertial movement sensors, hybrid location systems) 1445”); Cooperstock, ¶121.)

Jaszlics likewise discloses GPS. Jaszlics discloses using “observer sensors” for sensing a user’s position, and that the observer sensors can include “a position determination system, such as a differential Global Positioning Satellite System (GPS).” (Jaszlics, 10:53-11:4; *see also id.*, 16:30-32 (“Global Positioning Satellite (GPS) receiver”).) Jaszlics therefore discloses the claimed **“locating device”** in the form of a device comprising a GPS receiver associated with the user and used to determine the receiver’s (and thereby, the user’s) physical location. (Cooperstock, ¶122.)

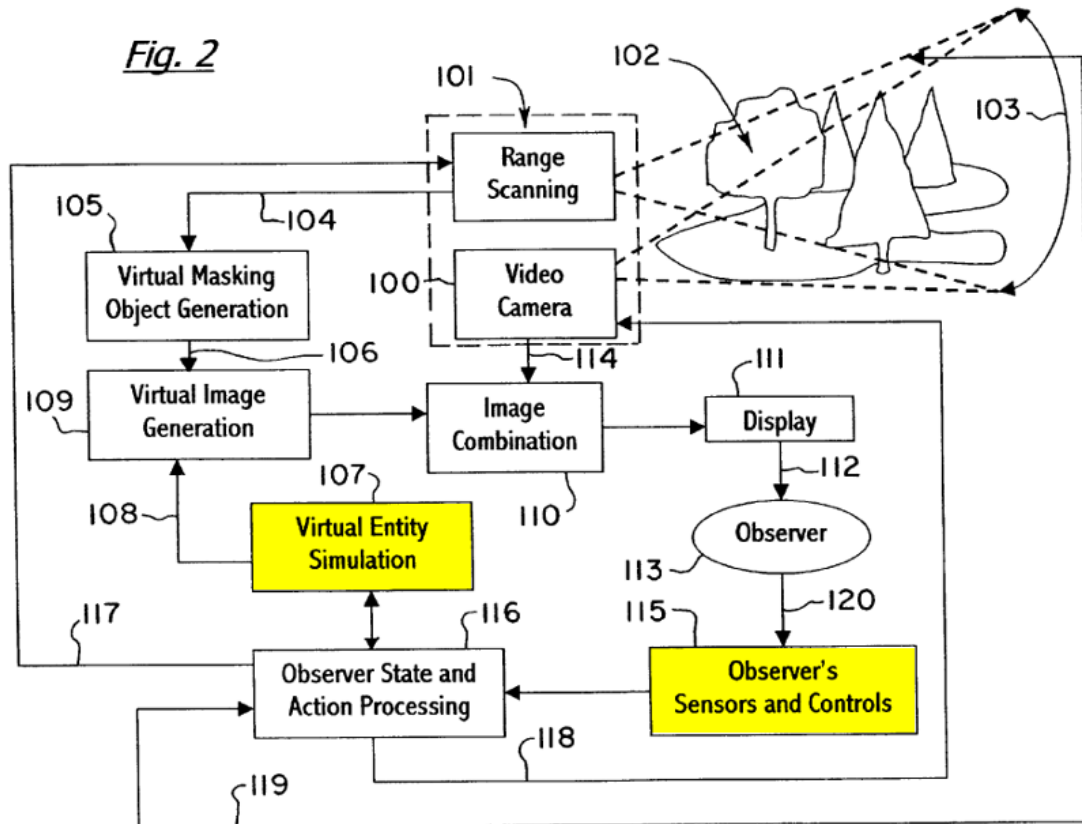
Jaszlics also teaches **“said video game logic utilizes the physical location of said locating device in providing said video game.”** (Cooperstock, ¶123.) Jaszlics explains that the system utilizes user sensor information that it receives, such as

position information, to update the simulation (“**said video game**”) accordingly, for example:

Changes in the position and orientation of the observer, of a vehicle housing the observer, or of movable elements of the vehicle (e.g. a tank’s turret) as sensed by the observer’s sensors and controls are processed by the observer state and action processing step. The virtual entity simulation receives this information for updating the simulation, in which the avatar of the observer, or the avatar of the observer’s vehicle is represented. Both the virtual entity simulation and the virtual masking object generation function will respond to the position and attitude changes of the observer, or the observer’s vehicle. Such changes will affect the angular orientation of the virtual entities and virtual masking objects, and the apparent distance from observer to virtual entities and masking objects.

(Jaszlics, 11:30-43; *see also id.*, 11:14-21 (“Observer actions sensed by the observer’s sensor and controls are transformed into data or control signals appropriate for responding to the observer’s actions.”).)

Figure 2 of Jaszlics, below, illustrates how information from observer sensors **115** (such as a GPS receiver) is input into a virtual entity simulation **107** provided by the virtual simulation and control software (“**said video game logic**”), which ultimately results in the combined reality image provided to the user:



(Jaszlics, Fig. 2 (highlighting added); *see also id.*, 14:66-15:1 (“Virtual entity simulation is implemented in the virtual simulation computer through the virtual simulation and control software.”); Cooperstock, ¶124.)

Jaszlics therefore teaches that system software including virtual simulation and control software (“**said video game logic**”) uses physical location information provided by a GPS receiver (“**utilizes the physical location of said locating device**”) to provide updated virtual simulation game play based on that information (“**in providing said video game**”). (Cooperstock, ¶125.)

2. Claim 4: “The augmented reality game system of claim 1, wherein said landscape characteristics are utilized to control a computer-controlled video game character.”

Jaszlics discloses **“a computer-controlled video game character”** in the form of, for example, virtual tanks and other vehicles, and virtual players operated by the virtual simulation. (Jaszlics, 1:53-64 (“virtual tanks,” “virtual vehicles,” “virtual aircraft”), 10:39-43 (“virtual tank[s]”), 11:59-63 (“virtual tanks”), 15:29-30 (“virtual T-80s operated by the virtual simulation”), 1:64-67 (“virtual players”); Cooperstock, ¶126.)

Jaszlics further discloses using distance and shape range scanning data (**“said landscape characteristics”**) to a **“control a computer-controlled video game character.”** (Cooperstock, ¶127.) In particular, the ranging data is used to control whether and how the video game character is presented to the user. As discussed above, Jaszlics’ system uses the distance and shape range scanning data to generate virtual masking objects that it uses to mask virtual entities (or portions of virtual entities) from being displayed to the user. (Jaszlics, e.g., 8:46-51.)

In addition, Jaszlics discloses that video game characters, such as a virtual tank, can be animated and appear to move around a physical environment. (Jaszlics, 4:19-23 (“the virtual object will appear to exist and move in the real world at its virtual position.”), 8:10-12 (“three battle tanks are animated”); *see also id.*, 4:25-26 (“animated human figures”), 4:29-30 (“rendering and animation algorithms of these

virtual entities”).) A person of ordinary skill in the art would have therefore understood that, as the animated virtual entity moved around the physical environment, the ranging data would be used to control updates of whether or how the virtual entity was masked by a virtual object. (Cooperstock, ¶128.) For example, if the virtual tank shown in Figure 1 were animated to appear to move across the physical terrain, the ranging data would be used to control what portion, if any, of the tank was masked from display:

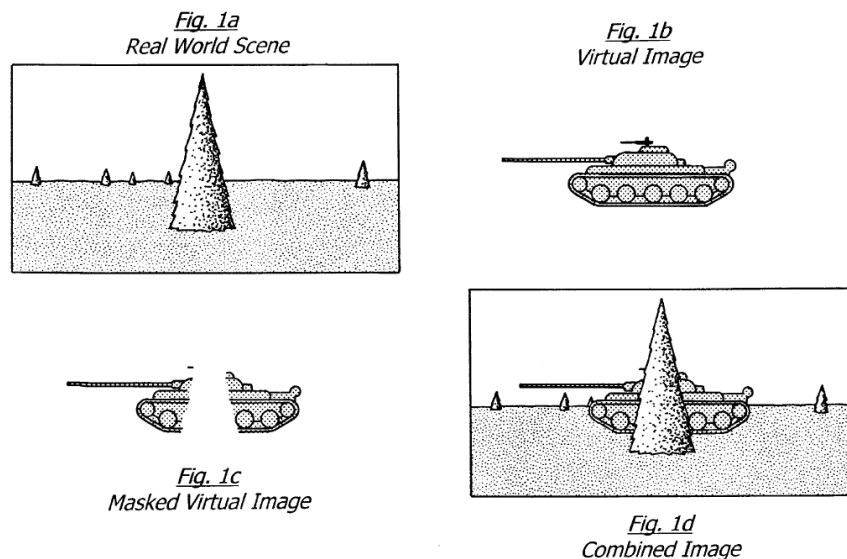


Fig. 1

(Jaszlics, Fig. 1; *see also id.*, 2:32-37 (“The masked virtual images and the real-world scene are combined and displayed in such a manner that the virtual images appear to be obscured, when appropriate for their simulated location relative to real-world objects.”).)

Moreover, it would have been obvious to a person of ordinary skill in the art to use the detected landscape characteristics to control a virtual entity by, for

example, affecting how the virtual entity—such as a virtual tank—would engage with the user. (Cooperstock, ¶129.) For example, Jaszlics explains that a virtual tank can engage the user, resulting in damage to the user’s avatar. (Jaszlics, 11:57-63.) Because a goal of Jaszlics’ system is to provide a realistic simulation, it would have been obvious for the system to use the landscape characteristics in determining whether or when the virtual tank should fire upon the user. (Cooperstock, ¶129 (citing Jaszlics, 2:57-59 (“A primary object of the present invention is to provide a system for realistically combining virtual images into real-world scenes as part of a computer simulation.”), 1:53-57).) For instance, if the virtual tank was completely obscured behind a large object, then the tank operator may opt to adjust how its weapon should be fired, or to decide that its weapon should not be fired. (Cooperstock, ¶129.) Similarly, Jaszlics describes how a user can fire upon a virtual tank and inflict damage. (Jaszlics, 11:51-56.) It would have been obvious to use the landscape characteristics in determining whether and to what extent a user inflicted damage on a virtual tank, consistent with providing a realistic simulation. (Cooperstock, ¶129.)

To the extent “**control**” in claim 4 is interpreted to mean affecting the behavior of the computer-controlled video game character, claim 4 would have also been obvious in view of **Ohshima**, which is discussed in connection with **Ground 3**.

3. Claim 5: “The augmented reality game system of claim 1, further comprising a wireless transmitter and receiver.”

To start, Petitioner notes that Claim 5 recites that the system comprises “**a wireless transmitter and receiver,**” but does not require the transmitter and receiver to provide any particular functionality, such as locating or communications functionality—any “wireless transmitter and receiver,” used for any purpose, would satisfy the claim. (Cooperstock, ¶131.)

As discussed above, Jaszlics discloses using GPS for determining a user’s location. (Jaszlics, e.g., 10:52-11:4, 16:30-32.) GPS was (and is) a commercially available system involving a constellation of satellites with radio transmitters whose signals are detected by a receiver and used to determine the receiver’s location. (Cooperstock, ¶132 (citing EX1015, p.005 (entry for “GPS”)).) Jaszlics therefore discloses that its virtual simulation system (“**augmented reality game system**”) comprises “**a wireless transmitter and receiver**” in the form of GPS satellite radio transmitters and a GPS receiver coupled to the user. (Cooperstock, ¶132.)

In addition, Jaszlics identifies laser tag as an example game that could be played with its system. (Jaszlics, 1:64-67.) As is well known, laser tag involves infrared-emitting light guns and infrared-sensitive signaling devices worn by each player. Therefore, Jaszlics also discloses a “**wireless transmitter**” in the form of a user’s infrared-emitting gun and a “[**wireless**] **receiver**” in the form of an infrared-

sensitive signaling device, since it receives the wireless signal transmitted by the gun. (Cooperstock, ¶133.)

Furthermore, it would have been obvious to a person of ordinary skill in the art for Jaszlics' system to include other sorts of wireless transmitters and receivers. (Cooperstock, ¶134.) The '476 patent identifies "blue tooth," "infrared," and "WiFi" as examples of transmitters and receivers. ('476, 20:25-33.) By November 2004, conventional computer systems commonly included wireless peripherals, such as a mouse connected via infrared or Bluetooth link, and wireless networking functionality, such as 802.11 WiFi. (Cooperstock, ¶134 (citing EX1015, p.004 (entry for "BlueTooth"), p.007 (entry for "mouse"), p.008 (entry for "Wi-Fi")).) It would have been obvious for Jaszlics' system to include such components (and thus their associated wireless transmitters and receivers) simply by virtue of the fact that such components were commonly included in computer systems and including them in Jaszlics' system would have been at least obvious to try. (Cooperstock, ¶134.) For example, Jaszlics describes how user input can be provided by control devices such as a joystick or mouse. (Jaszlics, 10:34-38, 11:9-13.) It would have been obvious to at least try to use a wireless joystick or mouse. (Cooperstock, ¶134.)

Moreover, Jaszlics provides motivation to use wireless components, such as wireless networking devices and wireless input devices. (Cooperstock, ¶135.) For example, Jaszlics describes how users "may be individuals moving in the real world"

and also how a simulation may involve multiple real players. (Jaszlics, 10:53-11:4, 1:64-67 (“[V]irtual players, objects, and special effects can be combined with real players and real objects in the playing field.”).) It would have been obvious to a person of ordinary skill in the art that such multiplayer systems involving mobile users would greatly benefit, if not require, wireless networking devices in order for the system to effectively provide gameplay to each user. (Cooperstock, ¶135.) In fact, Piekarski expressly discloses a wearable augmented reality computing system that includes WiFi wireless networking functionality. (Piekarski [EX1004], p.0010 (“Lucent WaveLan 2.4GHz wireless network cards at the base station and in each wearable form the basis for a high-speed (faster than 2Mbps) network.”).) Similarly, with respect to wireless input devices, reducing the number of wires accompanying a mobile user would have resulted in an easier to use and more realistic simulation experience—for example, without wires, a user would be less likely to get caught on obstacles and other objects. (Cooperstock, ¶135.) In addition, the risk of connection failure resulting from stress on wires would be reduced. (*Id.*)

4. Independent Claim 13

Claims 1 and 13 are substantially the same (and therefore Petitioner’s analysis for claim 1 fully applies here), except that claim 13 does not require a “**wearable**”

processor⁷ or “**memory**” and adds the limitation, “**a handheld controller for providing at least one control signal to said video game.**” (Cooperstock, ¶¶136 (chart comparing claims 1 and 13), 137.) A “**handheld controller**” as claimed is disclosed by and obvious over Jaszlics. (Cooperstock, ¶137.)

Jaszlics discloses various devices that can be used to provide signals to control a virtual simulation (“**said video game**”), including “control devices such as joysticks and pushbuttons” and well as a “mouse control device.” (Jaszlics, 10:34-38, 11:9-13.) A person of ordinary skill in the art would have recognized that a “mouse control device” is a type of “**handheld**” controller. (Cooperstock, ¶138 (citing EX1015, p.007 (entry for “mouse”)).) It was also routine and conventional at the time for joysticks and push buttons to be provided in a handheld form factor, such as the controllers provided with Atari and Nintendo game consoles in the 1970s-1990s. (*Id.* (citing EX1015, p.006 (entry for “joystick”)).) More generally, “**handheld**” controllers were a well-known, routine and conventional way for a user to control video game systems. (Cooperstock, ¶138.) A person of ordinary skill in the art would have therefore considered use of a handheld controller to be one of a

⁷ Because independent claim 13 does not recite a “**wearable**” processor—for which the Petition cited Piekarski in the analysis of claim 1—claim 13 would have also been obvious over Jaszlics alone, without Piekarski’s teachings.

finite number of known ways of controlling a video game and therefore obvious to try. (*Id.*)

The obviousness of using a “**handheld**” controller is further confirmed and motivated by Jaszlics’ teaching that its system is broadly applicable to games, including those involving mobile individuals such as laser tag. (Cooperstock, ¶139 (citing Jaszlics, 1:64-67).) It would have been obvious, for example, for a controller in a laser tag-like embodiment to have a form factor resembling a handheld gun (for example, as shown in the image at right).⁸ (Cooperstock, ¶139.)



D. Ground 2: Claim 2 Is Obvious Over Ground 1 Prior Art in View of Morihira

- 1. Claim 2: “The augmented reality game system of claim 1, wherein a virtual object is overlaid by said head-mounted display on said physical playfield and said virtual object is displayed at different transparencies depending on the perceived distance of said virtual object from said head-mounted display.”**

As discussed above for claim 1[a], Jaszlics discloses the first portion of claim 2—an “**augmented reality game system**” wherein “**a virtual object**” such as a virtual tank, person, boundary or marker “**is overlaid by said head-mounted**

⁸ Image from
<https://web.archive.org/web/20031205055746/http://www.lasergames.nl/intersphere/hetspel.htm>.

display on said physical playfield.” (*See, e.g.,* Jaszlics, Fig. 1, 9:48-57, 2:10-13.)

With respect to the second portion of claim 2, displaying the virtual object “**at different transparencies depending on the perceived distance of said virtual object from said head-mounted display,**” this would have been obvious over Morihira [EX1006]. (Cooperstock, ¶140.)

Petitioner notes that, as discussed in Part III.C above, the examiner cited Morihira for this limitation during prosecution, which was not disputed by the applicant. (*See* EX1016, 00156-00157, 00186-00187.)

Morihira, entitled “Video Game Transparency Control System for Images,” describes techniques for varying the transparency of displayed virtual objects depending on the perceived distance of the object from the viewer. (Cooperstock, ¶142.) Morihira explains the problem of how virtual objects in a user’s field of view can block the user’s view of important game play:

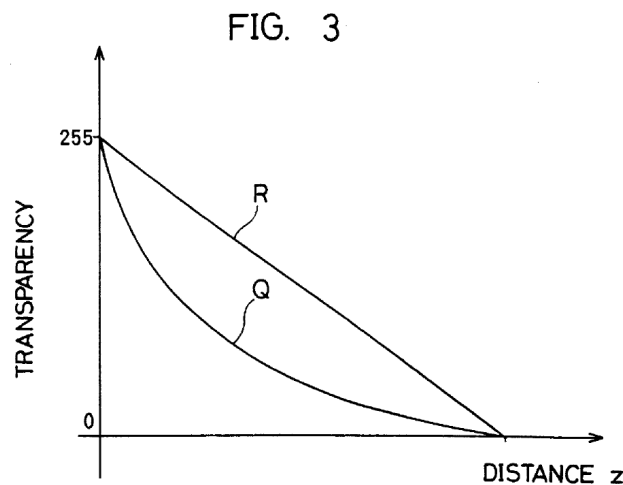
One problem with conventional combat video games is that when the viewpoint of a hypothetical camera is located at a certain position in the field of the pseudo-three-dimensional space, an object model such as a pillar in the field comes in front of the viewpoint of the hypothetical camera, concealing on the display screen important battle information of a game character which represents whether the game character is squatting or jumping.

(Morihira, 1:41-48.) To address this problem, Morihira explains that the virtual

object blocking the user's view can be switched to a translucent rendition. (Morihiro, 1:49-55.) Morihiro proposes a further improvement to this idea, where the amount of transparency of the virtual object's translucent rendition depends on distance from the viewpoint to the object:

Specifically, the transparency of an object model can be changed depending on the distance from the viewpoint of the hypothetical camera to the object model, e.g., the transparency of an object model can be lowered as the distance from the viewpoint of the hypothetical camera to the object model becomes greater. This process is referred to as a translucent fogging process.

(Morihiro, 8:28-34; *see also id.*, 7:23-44, 10:13-19.) Figure 3 of Morihiro illustrates an example of how object transparency (represented on the vertical axis below) can change depending on viewpoint distance (represented on the horizontal axis):



(Morihiro, Fig. 3; *see also id.*, 9:28-40 (describing Fig. 3).)

Rationale and Motivation to Combine (Ground 1 Prior Art with Morihira). It would have been obvious to a person of ordinary skill in the art to combine Morihira’s teachings regarding virtual object transparency with Jaszlics and Piekarski. (Cooperstock, ¶143.) The combination would have involved the straightforward incorporation of Morihira’s techniques for adjusting the transparency of displayed virtual objects based on perceived distance from the viewpoint of the user and would have predictably resulted in a virtual simulation system as taught by Jaszlics and Piekarski in which the transparency of virtual entities (such as vehicles, players, markers and boundaries) varied depending on their perceived distance from the user wearing their head-mounted display. (*Id.*) The combination therefore discloses and renders obvious displaying a virtual object **“at different transparencies depending on the perceived distance of said virtual object from said head-mounted display”** as claimed. (*Id.*)

Morihira is an analogous reference to the ’476 patent, in the same field and reasonably pertinent to problems facing the ’476 patent inventor. (Cooperstock, ¶144 (citing Morihira, 1:6-15).)

A person of ordinary skill in the art would have been motivated to combine. (Cooperstock, ¶145.) Morihira addresses a known issue for video games involving a movable viewpoint in a three-dimensional space—what to do when a virtual object, based on its distance to the user’s viewpoint, obscures the user’s view. Such

a problem, left unresolved, can impair user experience and realism, as well as risk player safety. (*Id.*) A person of ordinary skill would have recognized that this same issue is applicable to Jaszlics. (*Id.*) For example, Jaszlics describes displaying virtual elements that have no corresponding object in the real world environment, such as boundaries **173** and markers **174** (highlighted in yellow below):

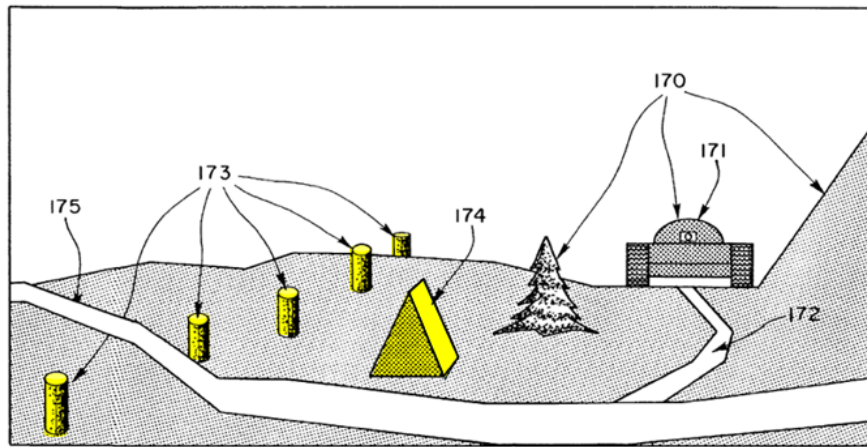


Fig. 15

(Jaszlics, Fig. 15; *see also id.*, 9:64-10:9.) A person of ordinary skill in the art would have recognized that, as the user approached these virtual elements, reducing their transparency accordingly would enable the user to better focus on real-world objects as well as more pertinent aspects of game play, such as engaging virtual opponents. (Cooperstock, ¶145.) A person of ordinary skill in the art would have further recognized that, as a user approaches a virtual object, there can come a point where continuing to display the object in front of the user no longer provides a realistic experience or may unduly risk player safety. (*Id.*) In those cases, applying

Morihira’s techniques would improve game play by allowing the user to see beyond the virtual object. (*Id.*) These benefits are expressly discussed in Morihira, which explains “[s]ince the obstacle in front of the game character is translucent, the viewpoint of the hypothetical camera can be moved without concern over the presence of the obstacle, and the game player can easily recognize the combat situation for the game character and hence can maneuver the game character easily for fighting against the opponent character.” (Morihira, 9:14-20; Cooperstock, ¶145.)

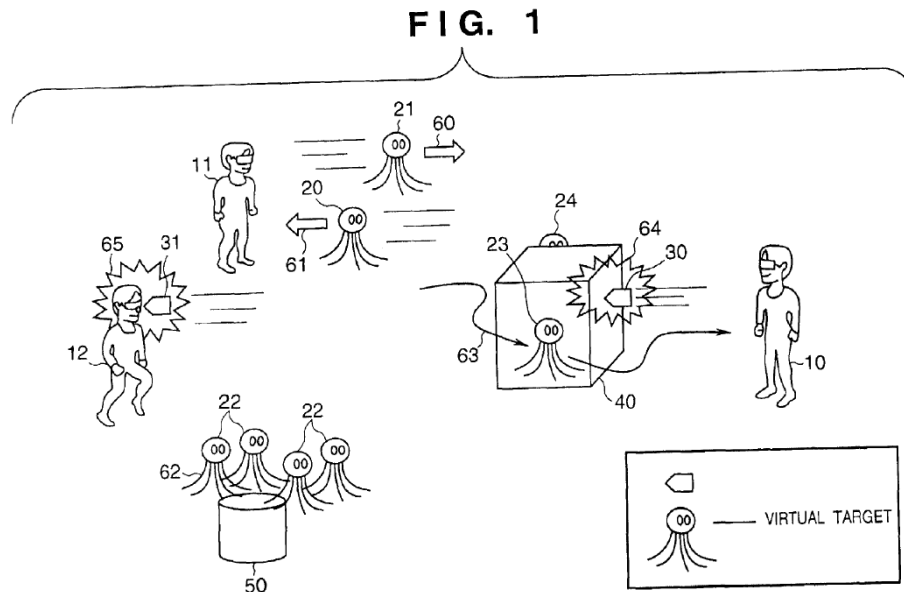
A person of ordinary skill in the art would have had a reasonable expectation that the combination would have been successful, as it would have involved the routine application of conventional software programming. (Cooperstock, ¶146.)

E. Ground 3: Claim 4 Is Obvious Over Ground 1 Prior Art in View of Ohshima

1. Claim 4: “The augmented reality game system of claim 1, wherein said landscape characteristics are utilized to control a computer-controlled video game character.”

As noted above in the Ground 1 analysis of claim 4, to the extent “**control**” in this claim is interpreted to mean affecting the behavior of the computer-controlled video game character, utilizing Jaszlics’ range scanner shape and distance data (“**said landscape characteristics**”) to control virtual entities such as virtual tanks and players (“**a computer-controlled video game character**”) would have also been obvious in view of Ohshima [EX1005]. (Cooperstock, ¶¶147-149.)

Ohshima, entitled “Game Apparatus for Mixed Reality Space, Image Processing Method Thereof, and Program Storage Medium,” describes an augmented reality gaming system. (Ohshima, 1:8-14.) In one embodiment, real-world players and objects interact with virtual objects called “targets.” (Ohshima, 5:60-67.) Referring to Figure 1 (reproduced below), Ohshima describes the interactions and how the behavior of the targets (20-24)—such as movement patterns—can be controlled by real objects in the physical environment:



(Ohshima, Fig. 1.) Ohshima explains:

[R]eferring to FIG. 1, three players **10**, **11**, and **12** join the game. In this game, a cubic real object **40** and columnar real object **50** are provided. In this game, virtual “spacemen” (to be referred to as targets hereinafter) 20 to 24 as opponents are displayed....

In this case, each virtual object makes unique movements or actions. That is, the target **21** as a spaceman runs away (**60**) by sensing the

presence of the player **11**. Or the target **21** comes on or chases the player **11** **(61)**. The target **23** dodges not to collide against the real object **40** **(63)**. The plurality of targets **22** gather around the real object **50** **(62)**. The target **24** hides behind the real object **40** by sensing the presence of the player **10**....

In this manner, the virtual objects that appear in the game system of this embodiment make actions such as collision, explosion, movement, dodge, and the like in consideration of the presence, location, layout, and behavior of the real objects or the location, behavior, and line of sight of the player.

(Ohshima, 5:60-6:17.)

Ohshima goes on to describe how target behavior is controlled to perform various movement patterns and other actions based on real objects, such as “hide behind a still object” and “move while dodging a real object.” (Ohshima, 8:18-29; Cooperstock, ¶149.) Referring to Figures 11 and 12, Ohshima explains an example of a “hide action” of a virtual object, in which the real object closest to the virtual object is selected for the virtual object to hide behind when the system determines that the virtual object falls within a player’s field of view. (Ohshima, 9:28-52.) Referring to Figures 15 and 16, Ohshima describes another movement action where, by determining that the virtual object has collided with a real object, the virtual object’s movement is controlled so as to “bounce[] off” the real object. (Ohshima, 10:18-32.) Referring to Figures 17 and 18, Ohshima describes detecting whether a

virtual object has collided with a real object, and causing the virtual object to explode and disappear if there is a collision. (Ohshima, 10:33-49.) And referring to Figure 19, Ohshima describes another movement action by which a virtual object's movement is controlled to avoid colliding with a real object. (Ohshima, 10:50-11:16 (“In this manner, the virtual object can detour the real object while maintaining distance that keeps it away from the real object.”).)

Rationale and Motivation to Combine (Ground 1 Prior Art with Ohshima). It would have been obvious to a person of ordinary skill in the art to combine Jaszlics and Piekarski with Ohshima's teachings regarding controlling the behavior of virtual objects based on real objects in a physical playfield. (Cooperstock, ¶150.) The combination would have the straightforward incorporation of Ohshima's teachings and techniques to improve the Jaszlics-Piekarski system in the same way, and would have predictably resulted in the behavior of Jaszlics' virtual entities being controllable based on detected real objects, such as hiding behind and going around trees and other objects based on shape and distance information collected using a range scanner (“**said landscape characteristics**”). (*Id.*) The combination therefore discloses and renders obvious “**said landscape characteristics are utilized to control a computer-controlled video game character**” as claimed. (*Id.*)

Like Jaszlics, Ohshima is an analogous reference to the '476 patent, in the same field and reasonably pertinent to problems facing the '476 patent inventor. (Cooperstock, ¶151 (citing Ohshima, 1:8-13, 6:12-17).)

A person of ordinary skill in the art would have been motivated to make the combination. (Cooperstock, ¶152.) As discussed, improved realism in a virtual simulation is a goal of Jaszlics' system. Having the behavior of virtual entities be controlled based on detected real world objects would further that goal, advantageously enabling, for example, a virtual tank to attempt to hide behind a tree or other detected object, or to appear to move around a real world obstacle. (*Id.*) Moreover, Ohshima provides express motivation to combine—simply put, a system under the proposed combination would be “more fun to play.” (Ohshima, 11:17-26, 12:3-7 (“the game becomes more fun to play”); Cooperstock, ¶152.)

A person of ordinary skill in the art would have had a reasonable expectation of success, as the combination would have involved the routine application of conventional software programming to use range scanning data already collected and used by Jaszlics' system to control the behavior of virtual entities. (Cooperstock, ¶153.)

F. Ground 4: Claims 6-7 Are Obvious Over Ground 1 Prior Art in View of Robarts

- 1. Claim 6: “The augmented reality game system of claim 1, wherein a computer-controlled video game character is overlaid by said head-mounted display on said physical playfield and said computer-controlled video game character is limited to visibility within a certain area.”**

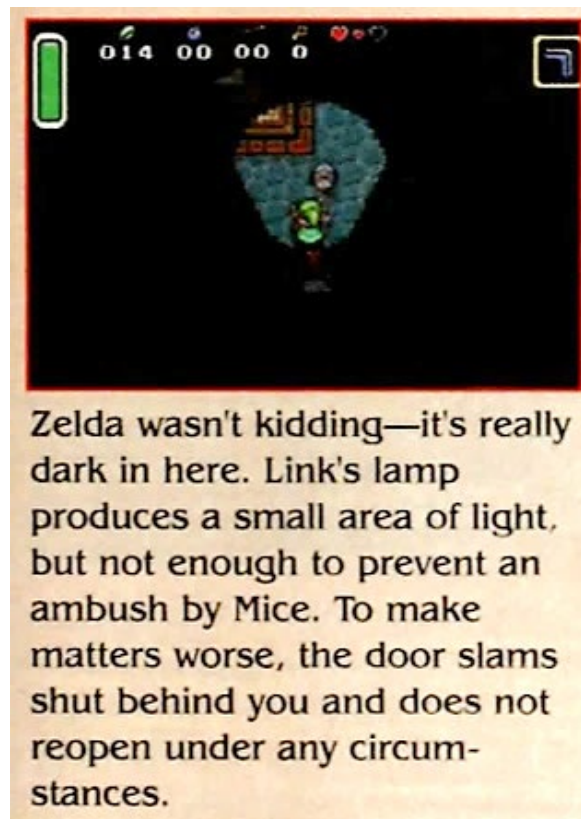
As discussed for claim 4, Jaszlics discloses **“a computer-controlled video game character”** in the form of, for example, virtual tanks and other vehicles, and virtual players operated by the virtual simulation. (Jaszlics, 1:53-64 (“virtual tanks,” “virtual vehicles,” “virtual aircraft”), 10:39-43 (“virtual tanks”), 11:59-63 (“virtual tanks”), 15:29-30 (“virtual T-80s operated by the virtual simulation”), 1:64-67 (“virtual players”).) As discussed for claim 1[a], Jaszlics further teaches that the computer-controlled video game character **“is overlaid by said head-mounted display on said physical playfield.”** As explained, Jaszlics’ augmented reality system includes **“a head-mounted display,”** such as “electronic display goggles” or “visors worn by the observer [i.e., the user of the system],” and teaches that virtual entities, such as virtual vehicles, are visually overlaid on the user’s physical surroundings. (Jaszlics, e.g., Fig. 1, 4:19-23 (describing Fig. 1), 8:53-56 (virtual images combined with real-world image originating from video camera), 9:48-57 (“virtual reality goggles or visors worn by the observer”), 2:10-13 (“electronic display goggles”).)

With respect to the limitation **“said computer-controlled video game character is limited to visibility within a certain area,”** neither Jaszlics nor Piekarski appears to expressly disclose a video game character limited to visibility within a certain area. However, both Jaszlics and Piekarksi make clear their broad applicability to gaming and virtual simulations. (Jaszlics, e.g., 1:64-67 (“Another possible field of use is in games...”); Piekarski, p.007 (section “2. Augmented Reality Meets Virtual Reality,” describing “synthetic battles”); Cooperstock, ¶155.) As explained below, a **“computer-controlled video game character [] limited to visibility within a certain area”** would have been obvious. (Cooperstock, ¶155.)

For starters, even casual users of video games from the 1990s and early 2000s would recall computer-controlled video game characters whose visibility and interactions with the user were limited to a certain area, such as a particular room or area circumscribed by a distance from the user’s in-game avatar. (Cooperstock, ¶156.) For example, the 1991 video game *The Legend of Zelda: A Link to the Past* included game play where the visibility of computer-controlled characters (in the screenshot below, “Terrorpins” (red turtle-like enemies) blocking the user’s “Link” character avatar) was limited to a certain area surrounding the user’s “Link” character avatar:



(Cooperstock, ¶156.) This functionality is described in *The Legend of Zelda: A Link to the Past: Prima's Official Strategy Guide* (2002) [EX1014], which explains that “Link’s lamp produces a small area of light, but not enough to prevent an ambush by Mice”:



Zelda wasn't kidding—it's really dark in here. Link's lamp produces a small area of light, but not enough to prevent an ambush by Mice. To make matters worse, the door slams shut behind you and does not reopen under any circumstances.

(EX1014, p.0022.) It would have been obvious to a person of ordinary skill in the

art to incorporate these same conventional video game features into the game play provided by Jaszlics' system to obtain the same features and game play benefits, including additional variety, challenge, and suspense. (Cooperstock, ¶156.)

A “**computer-controlled video game character [] limited to visibility within a certain area**” is also disclosed by and would have been obvious over **Robarts** [EX1007]—in at least three separate and distinct ways, as explained next. (Cooperstock, ¶157.)

Robarts, entitled “Method and System for Interacting with Simulated Phenomena,” describes a location-based gaming system involving “enhanced computer- and network-based methods and systems for interacting with simulated phenomena using mobile devices.” (Robarts, ¶0036; Cooperstock, ¶158.) “Example embodiments provide a Simulated Phenomena Interaction System (‘SPIS’), which enables users to enhance their real world activity with computer-generated and computer-controlled simulated entities, circumstances, or events, whose behavior is at least partially based upon the real world activity taking place.” (Robarts, ¶0036.)

With respect to a “**computer-controlled video game character**,” Robarts explains that “a simulated phenomenon includes any computer software controlled entity, circumstance, occurrence, or event that is associated with the user’s current physical world, such as persons, objects, places, and events. For example, a simulated phenomenon may be a ghost, playmate, animal, particular person, house,

thief, maze, terrorist, bomb, missile, fire, hurricane, tornado, contaminant, or other similar real or imaginary phenomenon, depending upon the context in which the SPIS is deployed.” (Robarts, ¶0037; Cooperstock, ¶159.)

As an example, Robarts describes a game called “Spook” in which simulated phenomena (“SP”) in the form of “ghosts” “are scattered about a real world environment in which the user is traveling with the mobile device, for example, a park.” (Robarts, ¶0042; Cooperstock, ¶160.) Robarts explains that the object of the “Spook” game is to find ghosts, which are detected depending on the player’s physical location, and interact with them in order to find a particular ghost that needs help. (Robarts, ¶0042; Cooperstock, ¶160.) Referring to Figure 3 (reproduced with highlighting at right), Robarts details how detection and visibility of ghosts is **“limited to a certain area”**

around the ghost and player. In particular, Figure 3 shows a display of a “spectra-meter” that “indicates the locations of each simulated phenomena (‘SP’) that was detectable and detected by the device 300”—in this

Detection
&
Measurement

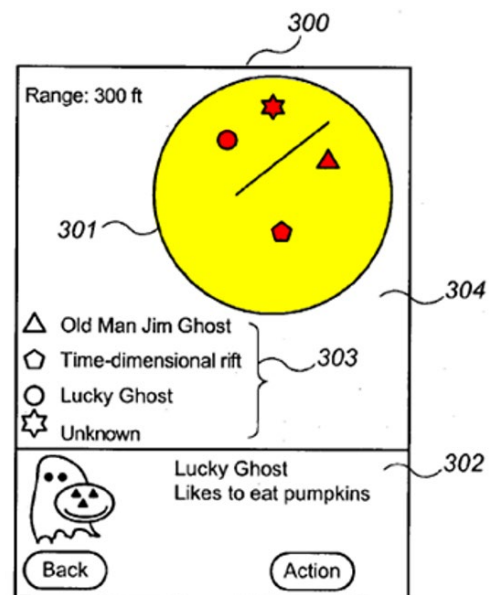


Fig. 3

example, simulated phenomena within 300 feet of the user. (Robarts, ¶0043.) As

the figure shows, four different ghosts (highlighted in red) were detected in that area (highlighted in yellow) and are displayed by the spectra-meter. (Robarts, ¶0043.) Therefore, Robarts explains that the visibility of a “simulated phenomenon” (“**computer-controlled video game character**”) is “**limited to a certain area**”—for example, the area corresponding to a 300 foot range surrounding the user. (Cooperstock, ¶160.) This is the first way that Robarts discloses “**computer-controlled video game character [] limited to visibility within a certain area.**” (*Id.*)

As a second way, building on the concept of detecting and displaying a simulated phenomenon within a certain area around the player, Robarts further describes how detection and display of a simulated phenomenon can be based on an “agitation” attribute of the simulated phenomenon. (Cooperstock, ¶161.) Referring to Table 2 (reproduced below), Robarts explains how the detectability of a simulated phenomenon using an “agitation” attribute is based on the player (more specifically, the player’s device) being within a certain area associated with the simulated phenomenon (i.e., within a circular area having a radius equal to the value of “range”):

TABLE 2

```
SensitivityAgitation(SP_ID, dev_ID)
{
    Position positionDev, positionSP;
    long range, dist;
    int agitationSP;
    agitationSP = GetAgitationStateFromSP(SP_ID);
    positionSP = GetPositionOfSP(SP_ID);
    positionDev = GetPositionFromDevice(dev_ID);
    range = agitationSP * 10;
    dist = sqrt((positionSP.x - positionDev.x)^2 +
(positionSP.y - positionDev.y)^2);
    if (dist <= range) then
        return Detectable;
    else
        return Not_Detectable
}
```

(Robarts, ¶¶0080, 0081; Cooperstock, ¶161.) Referring to the function in Table 2 above, Robarts explains that the function “retrieves a current position from the SP characterization data repository, and receives a current position of the device from the device characterization data repository.” (Robarts, ¶0081.) That information is then used to “perform[] a set of calculations based upon these retrieved values to determine whether, based upon the actual location of the device relative to the programmed location of the SP, the SP agitation value is ‘within range.’” (Robarts, ¶0081.) “If so, the function sends back a status of detectable; otherwise, it sends back a status of not detectable.” (Robarts, ¶0081.) The visibility (“Detectable” or “Not_Detectable”) of a simulated phenomenon based on the area associated with the simulated phenomenon’s agitation attribute is a second way that Robarts discloses a **“computer-controlled video game character [] limited to visibility within a**

certain area.” (Cooperstock, ¶161.)

As a third way that Robarts discloses this limitation, Robarts also discloses that the player’s device can take the form of a head-mounted display to provide an augmented reality environment where simulated phenomena are overlaid on a display of the user’s physical surroundings. (Cooperstock, ¶162.) Figure 16 (reproduced below), for instance, “is an example illustration of an example field of vision on a display of a wearable device” where “[t]he user’s actual vision is the area demarcated as field of vision **1601**” while “[t]he apparent field of vision supported by the device is demarcated by field of vision **1602**”:

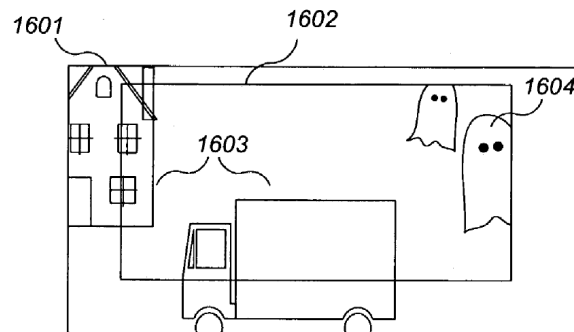


Fig. 16

(Robarts, ¶0088, Fig. 16; *see also id.*, ¶0069 (“One skilled in the art will recognize that a variety of mobile devices may be used with the SPIS include[ing]...3-D wireless (e.g., headmounted) glasses...”).) As Robarts explains, with a head-mounted display, the visibility of a simulated phenomenon is limited to the area provided by field **1602** shown in Figure 16, such that a simulated phenomenon will

not be visible in the area **1601** that is outside **1602**. (Robarts, ¶0088.)

Rationale and Motivation to Combine (Ground 1 Prior Art with Robarts). It would have been obvious to a person of ordinary skill in the art to combine Robarts’ teachings regarding simulated phenomena limited to visibility within a certain area with the Jaszlics-Piekarski virtual simulation system described for claim 1. (Cooperstock, ¶163.) The combination would have involved the straightforward application of Robarts’ techniques to Jaszlics’ similar virtual entities in the system under the proposed combination, such as Jaszlics’ virtual vehicles and players, or to incorporating a “Spook”-like game described in Robarts into the Jaszlics-Piekarski system. (*Id.*) The combination would have predictably resulted in game play in which a **“computer-controlled video game character [was] limited to visibility within a certain area,”** as claimed. (*Id.*)

Robarts is an analogous reference to the ’476 patent, in the same field and reasonably pertinent to problems facing the ’476 patent inventor. (Cooperstock, ¶164 (citing Robarts, ¶¶0036-0037, 0068-0069 (describing mobile devices, including portable computing devices and “3-D wireless (e.g., headmounted) glasses”))).)

A person of ordinary skill in the art would have been motivated to combine. (Cooperstock, ¶165.) As discussed, Jaszlics, Piekarski, and Robarts make clear that their systems are applicable to a wide range of gaming and simulation experiences.

(*See also* Roberts, ¶0048 (“Many other gaming, training, and computer aided learning experiences can be similarly presented and supported using the techniques of a Simulated Phenomena Interaction System.”).) Recognizing the strong similarities in these systems, a person of ordinary skill in the art would have readily appreciated and been motivated to incorporate features and techniques in one system to another in order to obtain the same or similar benefits. (Cooperstock, ¶165.) For example, incorporating a computer-controlled video game character limited to visibility within a certain area as taught by Roberts would have provided additional possibilities for game play, including increased variety, challenge and suspense. (*Id.*) Even when limited to a realistic war gaming context, there are readily apparent examples of virtual objects whose visibility should be limited to a certain area, such as proximity-triggered mines and other hidden traps, or a hidden virtual player that attacks or flees only once the user is within a certain range. (*Id.*) Moreover, as noted, limiting a video game character to visibility within a certain area was routinely employed in commercially available video games, and accordingly would have been obvious to try and to implement in a video gaming system. (*Id.*)

With respect to the third way in which Roberts discloses a **“computer-controlled video game character [] limited to visibility within a certain area”**—a limited field of view for the area provided by a head-mounted display to show overlaid virtual elements—for economic and technological reasons, it was common

for that area to be only a portion of the field of view provided by the HMD. (Cooperstock, ¶166.) In view of these economic and technological pressures, limiting the visibility of a computer-controlled video game character to be only (within) a portion of the field of view of the HMD would have been obvious to a person of ordinary skill in the art. (*Id.*)

A person of ordinary skill in the art would have had a reasonable expectation of success, as the combination would have involved at most the routine application of conventional software programming. (Cooperstock, ¶167 (citing Roberts, ¶0088).)

2. **Claim 7: “The augmented reality game system of claim 1, wherein a computer-controlled video game character is overlaid by said head-mounted display on said physical playfield, said computer-controlled video game character is limited to visibility within a certain area, and said computer-controlled video game character provides a reaction to said physical location when said physical location corresponds to entering said certain area.”**

As explained for claim 6, the combination of Jaszlics, Piekarski, and Roberts discloses and renders obvious an augmented reality game system **“wherein a computer-controlled video game character is overlaid by said head-mounted display on said physical playfield [and] said computer-controlled video game character is limited to visibility within a certain area.”**

The combination also discloses and renders obvious the remainder of claim 7: **“said computer-controlled video game character provides a reaction to said**

physical location when said physical location corresponds to entering said certain area.” (Cooperstock, ¶¶168-169.)

In particular, Robarts explains that a simulated phenomenon (“**computer-controlled video game character**”) can react to a player entering a certain physical area in a variety of ways, such as “jump[ing] away” from the player or remaining present when the player enters a particular spot such as a room:

Once the location of the device is sensed, this location can in turn be used to model the behavior of the SP in response to the different interaction requests. For example, the position of the SP relative to the mobile device may be dictated by the narrative to be always a multiple from the current physical location of the user’s device until the user enters a particular spot, a room, for example. Alternatively, an SP may “jump away” (exhibiting behavior similar to trying to swat a fly) each time the physical location of the mobile device is computed to “coincide” with the apparent location of the SP. To perform these type of behaviors, the simulation engine typically models both the apparent location of the SP and the physical location of the device based upon sensed information.

(Robarts, ¶0083.) For example, it would have been obvious for a simulated phenomenon to provide a “jump away” reaction when the user entered the simulated phenomenon’s “agitation” area, or to do so until the user entered a particular spot. (Cooperstock, ¶170.) Likewise, it would have been obvious for a simulated phenomenon to provide a “jump away” reaction as a result of the simulated

phenomenon entering the detection area surrounding the user. (*Id.*) In the realistic war gaming context discussed above in the analysis of claim 6, other reactions would have also been obvious, such as activation of proximity-triggered virtual mines and traps, as well as virtual players attacking or fleeing. (*Id.*)

The rationale and motivation to combine discussed in connection with claim 6 applies here as well. (Cooperstock, ¶¶163-167, 171.)

G. Ground 5: Claim 17 Is Obvious Over Ground 1 Prior Art in View of Muendel

1. Claim 17: “The system of claim 13, wherein said locating device comprises: a positioning system; and an inertial movement system.”

As discussed for claim 1[e] above, Jaszlics’ “**locating device**” includes the GPS positioning system. GPS, as its name says, is a “**positioning system.**” (*See also* ’476, 3:26 (“a positioning system such as a GPS system”).) As explained below, it would have been obvious in view of **Muendel** for Jaszlics’ “**locating device**” to also comprise “**an inertial movement system.**” (Cooperstock, ¶172.)

Petitioner notes that inertial sensors have many uses and can be used for determining a user’s location as well as for determining a user’s orientation (such as the direction they are facing). (Cooperstock, ¶173.) Jaszlics discloses using a magnetic head tracking system to sense the position and orientation of the user (Jaszlics, 10:52-57), and could be referring to a magnetic inertial movement system such as a sensor based on a magnetometer, but Jaszlics’ magnetic head tracking

system is likely used for tracking the user's head orientation, as opposed to tracking the user's location. (Cooperstock, ¶173.)

Because claim 17 recites that the “**locating device**” comprises “**an inertial movement system,**” the claim appears to be describing an inertial sensor for determining a user's location. (Cooperstock, ¶174.) This is consistent with the written description of the '476 patent, which describes a “hybrid locating system” that uses both GPS and an “inertial positioning system.” ('476, 3:9-13; *see also id.*, 3:23-29.)

Muendel, entitled “GPS Athletic Performance Monitor Methods and Apparatus Thereof,” describes a system for automatic monitoring of real-time athletic performance of a user. (Muendel, Abstract.) The system includes a portable personal trainer unit having a GPS receiver and able to monitor a user's athletic performance in real time. (Muendel, Abstract, 10:9-11 (“[A] GPS personal trainer 100...that is typically carried on or by a user during a particular training session.”).) Muendel also discloses that the portable personal trainer unit can be used for virtual, location-based gaming, explaining that “a virtual competition can be held whereby users at different locations and/or at different times can conduct a virtual competition using the athletic performance monitor coupled to a server computer.” (Muendel, Abstract; *see also id.*, 10:1-8 (“...the user can...be a part of a virtual community of athletes each of whom interact with each other in either a real time basis or in some

cases, during what is referred to as a virtual competition, such as a race.”), 27:22-25, 28:5-9; Cooperstock, ¶175.)

Muendel further discloses the use of “**an inertial movement system**” for determining the user’s location, explaining that “[i]n some embodiments, the GPS personal trainer **100** can optionally include one or more dead reckoning devices **108** to provide direction information or change of location information. Such dead reckoning devices include altimeters, accelerometers, cadence measurements sensors and the like.” (Muendel, 10:21-24; *see also id.*, 21:3-5 (“In the described embodiment, the GPS enhancement driver **124** provides selected ones of the GPS enhancement factors, including DEM data and inertial sensor data, to the GPS processor **122**.”); Cooperstock, ¶176.) Muendel explains the need for and benefits of including an inertial sensor, such as an accelerometer, for tracking the user’s location, even when a positioning system, such as GPS, is already included in the system:

In a preferred embodiment, the dead reckoning devices **108** includes an accelerometer or other inertial sensor....The purpose of this sensor is further to enhance the performance of the system during periods of partial or complete satellite blockage, as well as to enable smoothing and enhanced accuracy of GPS velocity results. During the periods when the GPS system is generating accurate velocity measurements, these measurements are used to calibrate the inertial sensor, e.g. to establish a relationship between user’s speed and the frequency of the

rhythmic motion. During these periods, the inertial measurements may also be used to smooth and enhance the GPS results. During periods when the GPS measurements are compromised by satellite blockage, the inertial sensor readings are used in conjunction with the calibration results to extrapolate the user's speed and distance traveled, until contact with GPS is reestablished.

(Muendel, 20:1-15.) Muendel therefore discloses a “**locating device**” that includes both a “**positioning system**” (GPS) and an “**inertial movement system**” (comprising an inertial sensor, such as an accelerometer). (Cooperstock, ¶176.)

Rationale and Motivation to Combine (Ground 1 Prior Art with Muendel). It would have been obvious to a person of ordinary skill in the art to combine Muendel’s teachings regarding using an inertial sensor to supplement GPS-based location data with the location-based virtual simulation system taught by Jaszlics and Piekarski. (Cooperstock, ¶177.) The combination would have involved the incorporation of inertial sensor data according to known techniques to Jaszlics’ methods for determining user location, and it would have predictably resulted in the Jaszlics-Piekarski system comprising a “**locating device**” comprising both “**a positioning system**” and “**an inertial movement system**” as claimed. (*Id.*)

Muendel is an analogous reference to the ’476 patent, in the same field and reasonably pertinent to problems facing the ’476 patent inventor. (Cooperstock, ¶178 (citing Muendel, Abstract, 10:1-8, 27:22-25, 18:18-22).)

A person of ordinary skill in the art would have been motivated to combine. (Cooperstock, ¶179.) As discussed, Jaszlics describes a virtual simulation system that can be used by an individual mobile user and that uses the user's GPS-determined location in providing game play. Muendel provides express motivation to incorporate an inertial movement sensor system for determining a user's location, using an inertial sensor "enhance[s] the performance of the system during periods of partial or complete satellite blockage, [and] enable[s] smoothing and enhanced accuracy of GPS velocity results." (Muendel, 20:5-7; Cooperstock, ¶179.) "During periods when the GPS measurements are compromised by satellite blockage, the inertial sensor readings are used in conjunction with the calibration results to extrapolate the user's speed and distance traveled, until contact with GPS is reestablished." (Muendel, 20:11-15.) A person of ordinary skill in the art would have appreciated that using Jaszlics' virtual simulation system could also involve periods of times when GPS measurements are unavailable or inaccurate, such as being indoors or other environments where GPS signals could be blocked or unreliable, such as in a forest or among tall buildings. (Cooperstock, ¶179.) If not addressed, these conditions would result in impaired game play and loss of realism. (*Id.*) A person of ordinary skill in the art would have therefore recognized that, by incorporating an inertial movement system, Jaszlics' virtual simulation system could obtain the same benefits as those described in Muendel. (*Id.*)

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A person of ordinary skill in the art would have had a reasonable expectation of success, as the combination would have entailed the straightforward incorporation of known techniques for acquiring and integrating (e.g., with other sensor data) inertial movement data. (Cooperstock, ¶180.)

VII. CONCLUSION

Petitioner respectfully requests IPR institution.

Dated: March 25, 2025

Respectfully submitted,

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CERTIFICATE OF COMPLIANCE WITH WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), I certify that this petition complies with the type-volume limits of 37 C.F.R. § 42.24(a)(1)(i) because it contains 13,889 words, according to the word-processing system used to prepare this petition, excluding the parts of this petition that are exempted by 37 C.F.R. § 42.24(a) (including the table of contents, a table of authorities, mandatory notices, a certificate of service or this certificate word count, appendix of exhibits, and claim listings).

DATED: March 25, 2025

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CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. Sections 42.6 and 42.105, that a complete copy of the attached **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 8,585,476 B2**, including all exhibits (**Nos. 1001-1018**) and related documents, are being served via Federal Express on the 25th day of March, 2025, the same day as the filing of the above-identified document in the United States Patent and Trademark Office/Patent Trial and Appeal Board, upon Patent Owner by serving the correspondence address of record with the USPTO as follows:

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UNITED STATES

And, via Federal Express upon counsel of record for Patent Owner in the litigation pending before the U.S. District Court for the Western District of Texas entitled *Mullen Industries LLC v. Meta Platforms, Inc.*, Case No. 1:24-cv-00354-DAE (W.D. Tex.) as follows:

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