

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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META PLATFORMS, INC.,  
Petitioner,

v.

MULLEN INDUSTRIES LLC,  
Patent Owner.

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Case No. IPR2025-00743  
U.S. Patent No. 11,947,716

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**PATENT OWNER'S PRELIMINARY RESPONSE**

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Mullen Industries LLC (“Patent Owner” or “Mullen”) submits this Preliminary Response to the Petition for *Inter Partes* Review (“Petition”) of U.S. Patent No. 11,947,716 (“the ’716 Patent”) filed by Meta Platforms, Inc. (“Petitioner”).

## **I. Introduction**

The Petition raises two grounds. Ground 1 challenges independent claim 16 and dependent claim 18, and Ground 2 challenges independent claim 1 and dependent claim 8. Both grounds fail to establish likelihood of invalidity and the Board should thus deny institution under 35 U.S.C. § 314(a).

As to Ground 1 and claim 16, the Petition fails to establish disclosure in the alleged prior art of numerous claim limitations.

**First**, neither Ronzani nor Ohshima discloses or renders obvious “a first virtual object [that] is operable to be displayed on said head-mounted display and controlled with manual input,” as claimed. The Petition concedes that Ronzani does not disclose the claimed element, and relies on Ohshima to supply it. In Ohshima, the reference relied upon to supplement the base reference Ronzani, which the Petition concedes lacks this element, a user causes the creation of a virtual bullet by pulling a trigger on a controller. However, such action neither controls the virtual bullet, as the virtual bullet does not exist at the time of the pulling of the trigger, nor does it control the virtual bullet while it is displayed, which the proper claim

construction requires. Further, there is no motivation to combine Ohshima with the base reference, Ronzani, because Ohshima is a gaming system incorporating computer-driven virtual objects such as virtual spacemen opponents to implement a game, and Ronzani concerns applications such as firefighting, military operations, mining, and chemical plant maintenance without use for anything taught in Ohshima.

***Second***, the Petition concedes that Ronzani lacks “a head-mounted movement sensor” as claimed, relying on Horton for that element, but there is no motivation to add the alleged head-mounted movement sensor from Horton. Horton describes a sensor for use in a virtual “immersive simulation,” wherein the tracking enhances the realism of the game in a “virtual world,” whereas Ronzani is concerned with providing a non-immersive apparatus that does not hinder a user’s view of the real world for first-responder training and applications, without any “virtual world.” A POSITA would not modify Ronzani with Horton given those differences and downside of adding additional unnecessary equipment that weighs down the user’s head in Ronzani for no benefit in any application of Ronzani, which the Petition fails to establish.

As to Ground 2 and claim 1, the Petition likewise fails to demonstrate disclosure in the alleged prior art of several claim limitations.

***First***, the alleged combination of Ronzani and Natoli fail to disclose a “display [that] is operable to display a virtual object and to allow said wearer of said head-

wearable device to view, simultaneously with said virtual object, a portion of said wearer's actual world environment.” The Petition concedes Ronzani fails to disclose the element, and relies on Natoli. But Natoli fails to disclose the element as well, as it describes a fully immersive display in which the user cannot simultaneously view the virtual object and the actual world environment. Its focus is providing a virtual-reality “office setting” with virtual keyboard and monitor and no representation of the real world. There is also no motivation to combine Ronzani and Natoli for that reason: a POSITA would not look to a fully immersive office simulation to combine with a first-responder training tool that critically does not fully immerse the user.

***Second***, Ground 2 fails to disclose “a camera pointed in a field-of-vision of said wearer and operable to capture an image of said portion of said wearer's actual world environment,” as it relies on combining Ronzani with Peli, a reference directed to a completely different goal: correcting camera images to account for a user's “cataracts or macular degeneration” or other similar visual impairments, for example “to improve the visibility of television images.”

***Third***, the combination of Ronzani and Horton to allegedly disclose “a movement sensor, wherein said movement sensor comprises an accelerometer” fails for the same reasons as in Ground 1.

Grounds 1 and 2 thus fail and the Petition should be denied.

## **II. Prior Art Problem And Patented Solution**

Virtual reality (VR) and augmented reality (AR) are technologies that present virtual content to a user. VR has traditionally been used in entertainment and gaming applications, and AR has been more commonly applied to real-time information delivery.

Despite advancements in portable devices usable in VR and AR applications, prior art systems suffered from significant limitations—size limitations on its input controls and output displays negatively impacted their usability. Although it was desirable “to fabricate portable devices as small as possible,” it was equally important “to maximize the size of input components (e.g., keyboards) and output components (e.g., display components).” Ex. 1001, 1:33–37. Prior art solutions were constrained by the fact that “the size of a device’s input and display components” were limited to “dimensions of the device’s housing.” *Id.*, 1:37–39. That is, the ways that users could interact with the system through input controllers were suboptimal because they were too small, restricting how, for example, a user in VR and AR applications could interact with virtual objects on a screen. Similarly, displays or other outputs were limited in size and thus inferior for practical application. This created a need for “improved portable devices (e.g., wireless devices) with input and output components that are larger than the housing of the

portable device itself.” *Id.*, 1:39–42. That way, while a virtual object was being displayed, a user could more effectively interact with it.

The ’716 patent solves prior art problems and improves prior art systems through manual control of virtual objects as they are displayed on the screen, using improved manual inputs. The patent discloses, for example, a “detachable/mateable input device [that] may be separated from such a head mounted device so that a user can hold this input device in his hand to provide control information” allowing for intuitive interaction with displayed content, while avoiding the prior art problem whereby “the size of a device’s input and display components” were limited by the “dimensions of the device’s housing.” *Id.*, 1:37–39, 2:24–27; *see id.*, claim 16 (“a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input”); claim 1 (“a manual input operably coupled to said head-wearable device.”).

Prior art AR and VR systems also lacked intelligent and responsive movement tracking capabilities, particularly in head-mounted contexts. The ’716 patent addresses this limitation by disclosing the use of inertial movement detection systems, including “accelerometers” and “tilt sensors,” within the housing of the head-mounted device. *Id.*, 12:39–45. These sensors track the position and angle of the user’s head and can translate physical gestures into control inputs, such as “nodding YES” or “nodding NO” to make selections. *Id.*, 12:50–54. The motion

signals from these sensors can be utilized as control signals to support interactions with virtual elements. *See id.*, 12:39–54.

The '716 patent also describes that a “camera” may be positioned to capture the user’s actual field of view. *Id.*, 14:55–64. Multiple types of cameras, including “video,” “still picture,” “infrared,” and “night vision,” can be used to display the surrounding environment to the user when the camera “is provided on a head-mounted device.” *Id.*, 2:39–43, 14:55–59. In this way, “a non-transparent display screen can be utilized” to provide “a transparent feature by feeding in video information” in the user’s field of vision in “real time.” *Id.*, 14:61–64.

The '716 patent also solves the problem of switching between virtual and physical environments by disclosing systems that allow simultaneous interaction with both. For example, the patent describes virtual bifocals “such that a user can work in a virtual world” to perform virtual tasks such as checking email or browsing the web while “working in an actual world.” *Id.*, 2:31–38. The specification further discloses configurable displays with transparent and non-transparent portions, allowing users to “walk down the street and see his/her environment and look at a display screen when he/she wants to.” *Id.*, 13:52–14:2. In some implementations, the “virtual objects are limited to a particular portion of a display” so a “user can maximize his/her virtual work area.” *Id.*, 14:7–21. The system can even lock virtual objects so that it “always appears in the same location, at the same distance, from a

user,” for instance, a browser window always appears twenty yards in front of the user regardless of their movement, using location and movement sensors to anchor the display. *Id.*, 14:22–30.

These features not only distinguish the invention from prior art, but they also address concrete usability problems faced by users in real-world environments. For example, the ’716 patent describes scenarios in which a user is walking down the street while checking email or browsing the web using the invention. *See id.*, 2:33–38, 14:35–45. In this setting, simultaneous viewing of the “virtual world” and the “actual world” allows the user to remain aware of their environment, such as walking down a street, while engaging with virtual applications like checking email or browsing the internet. *Id.*, 2:31–38, 13:59–62. A camera aligned with the user’s field of view supports this functionality by capturing “the environment in the user’s field of vision” in real time, enabling embodiments with non-transparent displays to function as if it were transparent and other embodiments to limit the particular portion of the display which would show virtual objects. *Id.*, 14:55–64. Meanwhile, head-mounted movement sensors such as “accelerometers, or other inertial detection” systems provide pitch and tilt-based control, allowing the system to maintain virtual content at a fixed “distance and pitch,” and to remove it from view when the user looks away, such as when bending down to pick up a wallet. *Id.*, 12:39–54, 14:30–48. Together, these technologies make it possible for users to

fluidly interact with virtual content in motion without sacrificing awareness of the real world, thereby solving the display and input limitations present in earlier systems.

The above-described features are reflected in the claims. For example, claim 16 recites:

16. *A head-mounted device* comprising:

a head-mounted power source;

a head-mounted manual input;

a head-mounted processor;

*a head-mounted movement sensor;*

a top-of-the-head mounting structure;

a behind-the-head mounting structure;

a head-mounted display operable to cover at least a portion of at least one eye of a wearer of said head-mounted device, wherein *a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input* and a second virtual object is operable to be displayed on said head mounted display and controlled autonomously by said processor; and

a head-mounted camera, *wherein information from said head-mounted camera is operable to be displayed on said*

***head-mounted display simultaneously with said first virtual object and said second virtual object.***

*Id.*, claim 16. Similarly, claim 1 recites:

1. An apparatus comprising:

***a head-wearable device*** comprising at least one housing,  
said at least one housing comprising:

a speaker;

a microphone; and

***a movement sensor, wherein said movement sensor comprises an accelerometer;***

a manual input operably coupled to said head-wearable device;

wherein said head-wearable device further comprises:

***a display operable to cover at least a portion of at least one eye of a wearer of said head-wearable device, wherein said display is operable to display a virtual object and to allow said wearer of said head-wearable device to view, simultaneously with said virtual object, a portion of said wearer's actual world environment; and***

*a camera pointed in a field-of-vision of said wearer and operable to capture an image of said portion of said wearer's actual world environment;*

wherein said display is operable to display said image of said wearer's actual world environment taken by said camera simultaneously with said virtual object.

*Id.*, claim 1.

### **III. The Proper Claim Construction**

Patent Owner submits that the Board should construe the phrase “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input” in claim 16.

#### **A. Claim 16 — “Wherein A First Virtual Object Is Operable To Be Displayed On Said Head-Mounted Display And Controlled With Manual Input”**

The phrase “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input” in claim 16 requires that the first virtual object is operable to be controlled with manual input *while it is being displayed* on said head-mounted display. In other words, the claim language means that the user can control and manipulate the virtual object while it is being displayed on a display screen, which is the only reasonable interpretation of the claim language. The claim does not cover, for example, implementations in which virtual objects are not yet displayed at the time of manual input or are only displayed after

a manual input is provided and are not controllable during the period they are displayed. To hold otherwise would ignore all the patent's intrinsic evidence. Patent Owner submits that construing this term is necessary because, as discussed in Section V below, the meaning of this limitation is central to demonstrating that the Petition has failed to establish obviousness under at least Ground 1 of the Petition.

Like the plain language of the claim, the specification also supports Patent Owner's proposed construction. The patent states that “*a user can control and manipulate virtual objects displayed on a display screen.*” Ex. 1001, 15:36–37. The patent further states that “*virtual objects are placed on a display* without a background *such that a user can interact* both in a virtual world and an actual environment at the same time.” *Id.*, 13:65–14:1. The specification thus further confirms that virtual objects are displayed so that the user can interact with them. The specification further contemplates the user “moving” the virtual objects, and restricting such movement to particular areas of the screen: “By limiting virtual objects on just a portion of a display (e.g., the portion above perimeter 1565), a user may not only be prohibited from *moving virtual objects* outside this perimeter, but a virtual bifocal feature may be provided such that when a user looks up . . . an augmented environment is provided and when the user looks forward, an actual environment is provided.” *Id.*, 14:12–18. Thus, again, the specification confirms that the virtual object is on the screen while it is being manipulated by manual input

from the user. Further, “[t]he user may, for example, be visually prompted (e.g., remotely notified) that a call is being received via a Bluetooth connection. That *user may then click a YES virtual object instead of a NO virtual object* using remote control 1850 to connect the call.” *Id.*, 16:4–8. Yet again, the virtual object is clearly being displayed while it is being controlled with the manual input.

The specification thus confirms the plain language of the claims, which is that the phrase “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input” in claim 16 requires that the first virtual object is operable to be controlled with manual input *while it is being displayed* on said head-mounted display.

#### IV. The Petition

The Petition asserts two grounds:

| Ground | Claims    | Basis for Challenge under §103              |
|--------|-----------|---------------------------------------------|
| 1      | 16 and 18 | Ronzani in view of Horton and Ohshima       |
| 2      | 1 and 8   | Ronzani in view of Horton, Natoli, and Peli |

The independent claims are 1 and 16 and are addressed in this preliminary response.

##### A. Ronzani

Ronzani describes a head-mounted display (“HMD”) system that is built around video-based display technology. Ronzani describes a head-mounted display that can play a video from a “video source,” such as a camera, through a monocular

or binocular screen. Ex. 1003, ¶¶ [0002], [0006], [0009], [0093]. Similarly, Ronzani discloses that “signals from the video signal source are provided to a video interface” and that “if discrete color (e.g., RGB) signals are not supplied by the video source (e.g., NTSC composite video signal), then a single encoded video signal must be supplied by the video source.” *Id.*, ¶ [0251].

A primary objective in Ronzani is to deliver this video feed without significantly obstructing the user’s view of the real world. The disclosure emphasizes that the “display needs to be as non-intrusive as possible” and a “lightweight and compact system” while still delivering high-quality images “in high-resolution format similar to that of a computer monitor.” *Id.*, ¶ [0004]. This includes careful consideration of ergonomic factors such as the device’s weight, size, and center of gravity. For example, Ronzani states that “of particular importance, is the desirability of keeping the center of gravity of the display from extending upward and forward from the center of gravity of the head and neck of the wearer” and notes concerns with displays that “may bump into other instruments during use.” *Id.*, ¶ [0003].

These design considerations are particularly critical in the operational scenarios that Ronzani explicitly targets. For instance, Ronzani describes a firefighter entering a burning building and receiving video while maintaining visibility of his surroundings. *See id.*, ¶¶ [0174]–[0176]. In such a high-stakes, low-

visibility environment, any obstruction to the firefighter’s natural field of vision or increase in cognitive load could pose a direct safety risk. Accordingly, Ronzani emphasizes non-intrusive displays and minimal encumbrance, tailored to complement—not interfere with—life-preserving tasks.

These concerns are echoed for other users Ronzani targets, including police officers, chemical workers, nuclear plant operators, coal miners, military personnel, astronauts, survivalists, and various types of repair and maintenance workers. *Id.*, ¶¶ [0179]–[0207].

## **B. Horton**

The Petition attempts to combine Ronzani with Horton. Horton concerns virtual reality systems using “immersive simulations” in a “virtual world,” as contrasted with Ronzani’s intentional desire to avoid immersing the user in a virtual world so that he or she can still see the real world, as explained above. Ex. 1004, 1:13–19. The Petition relies on Horton in both asserted grounds solely to purportedly supply an accelerometer for use with Ronzani’s head-mounted display. The Petition devotes minimal attention to Horton, offering only a cursory explanation of how Horton’s accelerometer might be integrated or function within the combined system. Horton is treated as a generic source of an accelerometer, without any discussion of relevance to the claim limitations involving manual input or virtual display behavior.

### C. Ohshima

The Petition attempts to combine Ronzani with Ohshima. Ohshima describes a game apparatus designed for mixed reality gaming, where players interact with both real and virtual objects in a shared space. Real objects include “the player himself or herself” or “a plurality of players who operate the game apparatus” and “share a single mixed reality space.” Ex. 1005, 2:51–56. Virtual objects are limited to game-specific elements like “‘spacemen’ (to be referred to as targets hereinafter)” and virtual “bullet[s].” *Id.*, 5:62–65. Players wear a head-mounted display and use a gun-shaped controller to play the game. *See id.*, 6:46–63. When the trigger is pulled, a virtual bullet is generated and displayed, which may “explode” upon hitting a real or virtual object. *Id.*, 6:8–11. Object geometry, including “player size,” is approximated using a database and used for hit detection. *Id.*, 8:31–40.

Notably, Ohshima’s system is narrowly focused on an entertainment application, namely, shooting-style gameplay, where virtual objects are limited to predefined game elements like “spacemen” and virtual “bullet[s].” *Id.*, 5:62–65. The Petition acknowledges this, describing the “spacemen and virtual bullets” as the only alleged virtual objects. Pet., 35. The virtual bullet in Ohshima is tightly integrated into the game mechanics and is generated and appears only after a specific player action such as firing a trigger. *See* Ex. 1005, 5:64–65, 6:8–10, 7:19–24. In contrast to Ronzani’s industrial and professional context which emphasizes non-

intrusive, high-resolution video displays for use by firefighters, miners, or military personnel, Ohshima is a consumer-focused, game-specific system with purpose-built virtual content and an entertainment-centered interface model.

#### **D. Natoli**

The Petition attempts to combine Ronzani with Natoli. Natoli discloses an immersive virtual reality input system comprising a “VR headset” and a “VR keyboard system.” Ex. 1007, 5:28–30. The system is designed to “provide the user with full multi-hand functionality for VR keyboard inputs,” allowing users to “manipulate the VR keyboard in view of the user.” *Id.*, 5:61–64, 6:66–67. The VR headset uses one or more “liquid crystal display[s]” to keep the user in the immersive virtual environment. *Id.*, 5:32–41. The system displays a fully virtual “VR world,” including a “VR office setting and/or a VR desktop with a VR representation of a computer monitor/display” and a “bookcase for accessing information indexed through VR books.” *Id.*, 9:16–24.

Notably, Natoli’s system is focused on a fully immersive virtual reality environment, where the user is primarily engaged within a completely simulated digital space without the ability to see the real world. The input method relies on specialized VR gloves that enable precise, multi-finger manipulation of virtual keyboards and other virtual objects within this closed VR setting, which are depicted to the user, obstructing at least part of his or her version of the virtual environment,

and providing no ability to see the real world together with such virtual environment. In fact, to see the real world, the user must look away from the LCD screens that display the virtual environment, as explained below.

**E. Peli**

The Petition attempts to combine Ronzani with Peli. Peli discloses methods and apparatus for correcting for “visual impairment, e.g., cataracts or macular degeneration” for example “to improve the visibility of television images.” Ex. 1006, 2:34–36, 2:52–55. Other applications include patients suffering from Retinitis Pigmentosa who “also suffer from night blindness or loss of night vision” for which Peli provides “an infrared night vision device that displays a bright image of a natural scene on one screen, and a minified cartoon version of the image . . . on the same or another screen” *Id.*, 14:23–28. Peli’s focus is not on maintaining the user’s natural situational awareness, as in Ronzani, but rather on substituting and re-rendering the environment through enhanced digital processing, for example, to compensate for significant visual impairment. And Peli’s system is limited to enhancing only a portion of the wearer’s field of view, typically the central portion, further making it incompatible with Ronzani. *See id.*, 9:23–55.

**V. Board Should Deny Institution Because The Petition Does Not Establish The Required Reasonable Likelihood Of Success**

**A. Ground 1: Ronzani In View Of Horton And Ohshima**

**1. Ground 1 Fails To Disclose “Wherein A First Virtual Object Is Operable To Be Displayed On Said Head-Mounted Display And Controlled With Manual Input” (Claim 16)**

As to the limitation “a head-mounted display operable to cover at least a portion of at least one eye of a wearer of said head-mounted device, wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input and a second virtual object is operable to be displayed on said head mounted display and controlled autonomously by said processor,” the Petition only argues Ronzani discloses “a head-mounted display operable to cover at least a portion of at least one eye of a wearer of said head-mounted device,” and relies on Ohshima for the rest of the limitation, in particular, “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input.” Pet., 33–43.

The Ground fails for two reasons as to this element. First, as explained below, Ohshima fails to disclose “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input,” whether or not Patent Owner’s proposed construction is adopted. Second, there is no motivation to combine Ronzani (or Ronzani and Horton) with Ohshima. For each of these

independent reasons, Ground 1 fails to disclose the above claim limitation, which is required in claim 16 and thus all challenged claims of Ground 1, and thus Ground 1 as a whole fails.

***a. The Petition Concedes Ronzani And Horton Do Not Disclose Any Virtual Objects***

The Petition does not allege Ronzani or Horton contain any virtual objects, and instead relies only on Ohshima for the claimed first virtual object and the alleged control of it with manual input. Pet., 33–43.

***b. Ohshima (And Therefore The Combination) Fails To Disclose The Element If Patent Owner’s Proposed Construction Is Adopted***

The Petition argues that Ohshima discloses “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input.” Pet., 35–43. The Petition argues “specifically, Ohshima discloses a ‘virtual bullet’ (‘a first virtual object’) is both ‘displayed on said head-mounted display’ and ‘controlled with manual input’ (controlled with the user’s manual input using a gun-shaped controller).” *Id.*, 35.

However, in Ohshima, the bullet is not controlled by a user while the bullet is displayed on the screen, as required under Patent Owner’s construction. Ex. 1005, 5:64–67, 6:57–63, 7:17–38. The virtual bullet (the “first virtual object”) is displayed only after the trigger action, which is the alleged action that meets the “controlled

with manual input” requirement, and is not controlled in any way once displayed. *Id.* And, there is no disclosure, suggestion or motivation in Oshima for the user to control the virtual bullet after it is displayed, and the Petition points to none. Rather, the virtual bullet merely proceeds to move along a trajectory established before it was displayed without any control by a manual input while it is displayed.

Thus, neither Ronzani nor Ohshima disclose or suggest manual control of a virtual object while it is being displayed.

As explained above, the ability to control a virtual object while it is displayed provides the technical effect of enabling real-time, interactive control of virtual objects by the user through manual input, a central feature of the claimed invention. This interactive control allows the user to dynamically alter the position, movement, or state of virtual objects within the mixed reality environment as they are being viewed, creating a sense of control and immersion, as explained above. By comparison, the prior art references fail to show such control of displayed virtual objects.

***c. Ohshima (And Therefore The Combination) Fails To Disclose The Element Even If Patent Owner’s Proposed Construction Is Not Adopted***

Even if the Board declines to adopt Patent Owner’s proposed construction, such that the “first virtual object” need only be displayed at some point in time and controlled at some other, potentially different point in time via manual input, the

combination of Ronzani and Ohshima still fails to disclose or suggest this requirement.

The only argument the Petition relies on is that in Ohshima, a user pulls the trigger of a gun-shaped controller, the system then creates a virtual bullet, and then displays it. Pet., 35–38.

But whether or not the claims require the virtual object to be displayed while it is controlled with manual input, the virtual object needs to *exist* in order for it to be controlled. If the manual input comes entirely before the existence of the virtual object, the manual input at most causes the creation of the virtual object but cannot also control the virtual object which does not yet exist. That is what happens in Ohshima: “a trigger signal indicating whether or not the trigger has been operated [is] *input to a game management/virtual image generation unit 3003. This unit generates* virtual images such as targets, *bullets*, and the like” after the trigger has been detected as having been pulled. Ex. 1005, 7:17–38.

Accordingly, the Petition has not identified in either Ronzani or Ohshima or in combination the claim requirement “wherein a first virtual object is operable to be displayed on said head-mounted display and controlled with manual input.”

***d. There Is No Motivation To Combine Ronzani With Ohshima***

The Petition argues that a POSITA would have been motivated to combine the fundamentally different systems of Ronzani and Ohshima because Ronzani allegedly describes its invention as being able to run virtual reality simulations. Pet., 39–43.

That is incorrect. The Petition cites paragraphs 2, 5, and 170 for its assertion. *Id.*, 40. Those paragraphs do nothing to describe Ronzani as being used for virtual reality applications, nor does any other part of Ronzani. Paragraph 2 says the prior art describes “virtual imaging,” but says nothing about Ronzani’s purported application to virtual reality. Paragraph 5 states the invention relates to “commercial, industrial, and entertainment purposes,” insufficient to establish that Ronzani is usable in virtual reality simulations. Paragraph 170 has the sole reference to “virtual reality” in the nearly-300-paragraph specification, where it states “[t]he wearer can control the operation of the CPU 712 through the input device 718. The input device 718 can include a keyboard, a mouse, a joystick, a pen, a track ball, a microphone for voice activated commands, a virtual reality data glove, an eyetracker, or other suitable input devices.” This minimal entry in a laundry list of input devices without anything further about virtual reality in Ronzani whatsoever is insufficient to disclose that Ronzani runs virtual reality simulations. The glove is

treated just like a keyboard or a mouse, without any discussion that there is a virtual reality simulation being run in Ronzani. It is solely described as useful for a “virtual keyboard.” Ex. 1003, ¶ [0007]. That limited use does not imply a virtual reality simulation that would support looking to an “immersive” virtual reality simulation reference like Horton, much less imply the need for a “head-mounted movement sensor.” That is, the Petition’s attempt to turn the limited discussion of a virtual glove used for a virtual keyboard into a virtual reality simulation that would benefit from a head-mounted movement sensor fails. Even the Petition concedes that Ronzani “does not provide full details of implementations for those applications” and “does not focus on details of the ‘virtual reality’ and/or ‘entertainment’ applications” Pet., 40.

Ronzani and Ohshima are further from entirely different fields and a POSITA would not look to Ohshima to modify Ronzani. Ronzani focuses on utilitarian and mission-critical applications such as firefighting, military operations, mining, and chemical plant maintenance. *See* Ex. 1003, ¶¶ [0174]–[0205]. These examples involve the delivery of remote video via a head-mounted display intended to augment situational awareness without impairing vision. *See id.*, ¶¶ [0174]–[0205]. There is no discussion of anything like that in Ohshima—which is strictly about virtual gaming. Despite a passing reference to “entertainment” in Ronzani, there is insufficient basis to look to Oshima; the Petition concedes that Ronzani “does not

focus on details of the ‘virtual reality’ and/or ‘entertainment’ applications.” Pet., 40. Merely mentioning “entertainment” in boilerplate language in one paragraph does not justify importing complex virtual gameplay mechanics and manual control of virtual gaming objects into a system designed for industrial safety and first-responder usage. This would be a wholesale redesign of Ronzani’s entire system and the Petition fails to justify such a massive change.

Further, the suggestion that Ohshima merely supplies implementation details that Ronzani omits fails because Ohshima does not merely fill in technical blanks; it introduces an entirely different purpose, architecture, and user experience. Ohshima’s system is fundamentally different in form and function. It features a head-mounted display, a gun-shaped controller, and virtual objects (bullets and spacemen) to play a game. Ex. 1005, 5:62–65, 6:52–63. The virtual “spacemen,” for example, in Ohshima move independently and simulate behavior “as if the virtual object [spacemen] had its own will.” *Id.*, 2:33–38. Ronzani, in contrast, discloses no concept of a virtual object and the Petition cites none, much less one that moves independently of user control. It is implausible, and impermissible hindsight, to suggest that a POSITA would have been motivated to transform Ronzani’s lightweight, utility headset used to receive a video feed for firefighter-type applications into a mixed reality gaming apparatus displaying virtual spacemen with artificial autonomy from the device itself.

Lastly, the systems are technically incompatible with each other in terms of their hardware, and Ronzani would require complete redesign of its hardware without any justification or explanation of how it would be done in the Petition. Using the immersive gaming system of Ohshima in Ronzani would require more than trivial adaptation, including replacing what the Petition calls Ronzani's "transparent" display, which is a "partially transmissive mirror," used in order to avoid obstructing "the users [sic] existing field of view" (Ex. 1003, ¶¶ [0010]–[0011], [0276]; Pet., 60–61) with a headset in Ohshima that provides a "mixed reality space" by superimposing "virtual objects" on "real space" within the headset, incorporating autonomous virtual object generation which "is not seen by a third party at an objective viewpoint position who does not join the game," and overhauling the user interface and visual rendering systems. *See e.g.*, Ex. 1005, 4:20–25, 6:34–56, 7:22–24. The Petition's assertion that such a transformation would be "relatively straightforward" ignores the fundamental design divergence between the two systems. *See* Pet., 42.

In sum, the Petition's reasoning fails. The proposed combination is not a natural extension of either reference, but rather an exercise in impermissible hindsight reconstruction guided by the claims rather than the art. The references disclose incompatible objectives, disparate architectures, and distinct user

experiences, and the Petition offers no evidence, technical or conceptual, that a POSITA would have been motivated to unify them into a single system.

**2. Ground 1 Fails To Disclose “A Head-Mounted Movement Sensor” (Claim 16)**

The Petition concedes that Ronzani lacks “a head-mounted movement sensor,” relying on Horton for that element. Pet., 19–24. But there is no motivation to combine Ronzani and Horton, as explained below. This is fatal to the combination and to Ground 1 as a whole, as claim 16, and thus all claims challenged in Ground 1, require “a head-mounted movement sensor.”

***a. No Motivation To Combine Ronzani And Horton***

The Petition argues there is a motivation to combine Ronzani and Horton because there is a motivation in Ronzani to add “a movement sensor comprising accelerometers.” The Petition asserts that Ronzani describes “virtual reality” applications and uses this as the main reason why Horton would be applicable. Pet., 27–30. As explained with respect to Ronzani and Ohshima, the Petition is incorrect and the cited portions of Ronzani are irrelevant. *See* Section V.A.1.d.

Further, Horton concerns virtual reality systems using “immersive simulations” in a “virtual world,” as contrasted with Ronzani’s intentional desire to avoid immersing the user in a virtual world so that he or she can still see the real world and maintain situational awareness, as explained above, which is critically

important in its particular applications of first-responder type scenarios. Ex. 1004, 1:13–19; Section IV.A.

Moreover, there is no motivation to add an accelerometer to Ronzani: the Petition simply asserts without explanation that it “would increase the available functionality and utility of the device, making it useful for a wider variety of applications for which it may be useful to track motion sensing of the head-mounted device (or the user’s head)” without stating why that would be beneficial in Ronzani. Pet., 28. It argues that “[i]n other words, it would have been obvious to implement Horton’s functionality as a beneficial and useful available feature in Ronzani’s device even if not every application of Ronzani’s device would necessarily make use of that functionality,” but it presumes without demonstrating that there are *any* disclosures or applications of Ronzani’s technology that would benefit from an accelerometer. *Id.*, 28. The Petition attempts to turn a lack of disclosure of virtual reality discussion in Ronzani (“the details of implementing virtual reality applications are not a focus of Ronzani”) into a reason to use an accelerometer, but the Petition has it backward. *Id.*, 29, 42. There would need to be a reason or motivation to use an accelerometer (or other movement sensor), and there is none.

Moreover, Ronzani is explicitly concerned with overloading the user’s head with equipment. Ronzani states that “of particular importance, is the desirability of keeping the center of gravity of the display from extending upward and forward from

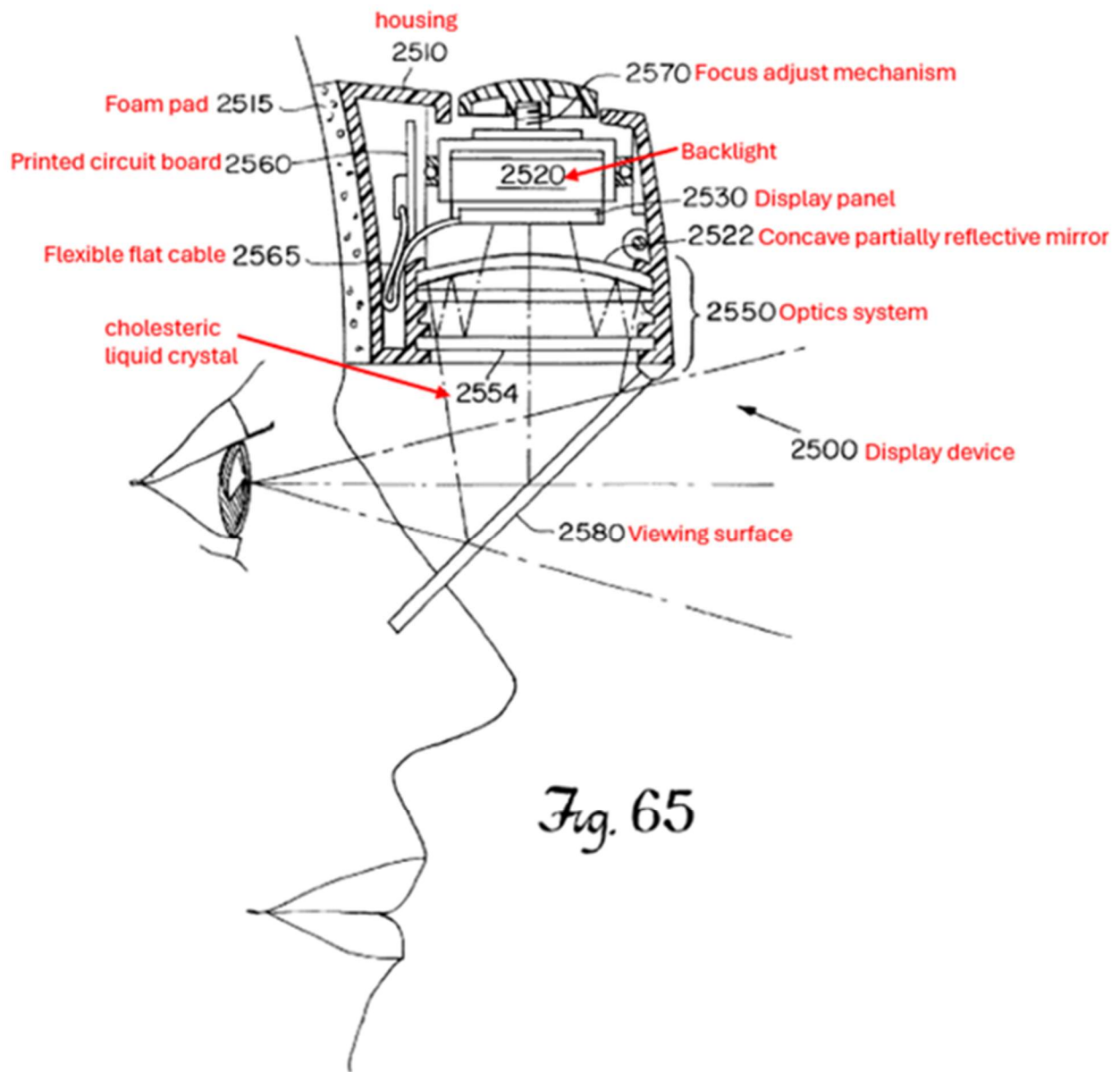
the center of gravity of the head and neck of the wearer” and notes concerns with displays that “may bump into other instruments during use.” Ex. 1003, ¶ [0003]. It would go directly against such concerns to add a movement sensor to the user’s head-worn equipment.

**B. Ground 2**

**1. Ground 2 Fails To Disclose “A Display Operable To Cover At Least A Portion Of At Least One Eye Of A Wearer Of Said Head-Wearable Device, Wherein Said Display Is Operable To Display A Virtual Object And To Allow Said Wearer Of Said Head-Wearable Device To View, Simultaneously With Said Virtual Object, A Portion Of Said Wearer’s Actual World Environment” (Claim 1)**

The Petition concedes that Ronzani does not disclose any virtual objects, nor does it disclose “wherein said display is operable to display a virtual object and to allow said wearer of said head-wearable device to view, simultaneously with said virtual object, a portion of said wearer’s actual world environment.” Pet., 60–68. As to what each reference discloses, the Petition argues “Ronzani teaches optical see-through (also called ‘direct view display’) embodiments with ‘transparent’ or ‘partially transmissive’ displays covering one or both eyes, where an image is overlaid onto the display and the wearer can also see the actual world environment through the display.” *Id.*, 60–61. Notably absent is any argument that it discloses a virtual object, as was missing in Ground 1. *Id.*, 60–64.

For the first and only time in the Petition, in arguing (only) *motivation to combine* as to this element, the Petition argues incorrectly that Ronzani implies “creation of a virtual object.” *Id.*, 66. The Petition does this by virtue of the statement, “‘the image created by the display device 2500 appears to the viewer to float in the viewer’s field of vision’ (Ronzani, ¶ [0280]).” *Id.*, 66 (citing Ronzani, ¶ [0280]). Contrary to the Petition’s argument, this statement in Ronzani is that the “image,” *i.e.*, a frame of the video feed (see Section IV.A), is “created,” *i.e.*, converted from a video signal to an image and displayed, by display device 2500. There is no allegation regarding what any virtual object in Ronzani would be, nor any discussion of virtual objects in the reference. *Id.*, 60–68. It is instead clear that in Ronzani, display device 2500 does not create any virtual objects. Rather, it merely turns the video feed into a visible image. In addition, none of Ronzani’s components contain anything other than ordinary video display capabilities—there is no logic that could create a virtual object. Figure 65 of Ronzani identifies the components of display device 2500:



Ex. 1003, Fig. 65, ¶¶ [0274]–[0280]; *see also* Figs. 66–70. Nothing in display device 2500 is described as being, or is in fact, capable of creating a virtual object. Thus, the Petition both lacks a reliance on any alleged virtual object in Ronzani as meeting any claim limitation, only arguing it as a motivation to combine, and even

then the Petition is incorrect as to the merits; there is no teaching or suggestion of virtual object creation in Ronzani.

Instead, the Petition relies on Natoli for the requirement of the virtual object and the requirement that “wherein said display is operable to display a virtual object and to allow said wearer of said head-wearable device to view, simultaneously with said virtual object, a portion of said wearer’s actual world environment.” Pet., 60–64 (“Ronzani teaches optical see-through (also called ‘direct view display’) embodiments with ‘transparent’ or ‘partially transmissive’ displays covering one or both eyes, where an image is overlaid onto the display . . . Ronzani in view of **Natoli** renders obvious the display of a “**virtual object**” on the transparent see-through display.”) (emphasis in original).

Specifically, the Petition argues that “[i]t would have been obvious to a POSITA to combine Natoli’s teachings of displaying a virtual keyboard on a semi-transparent head-mounted display with Ronzani’s head-mounted camera and display disclosures (including under the proposed combination with Horton), predictably incorporating Natoli’s virtual keyboard into Ronzani’s head-mounted display device” to provide “a display operable to cover at least a portion of at least one eye of a wearer of said head-wearable device, wherein said display is operable to display a virtual object and to allow said wearer of said head-wearable device to view,

simultaneously with said virtual object, a portion of said wearer's actual world environment." *Id.*, 64–65.

This argument fails for two reasons. First, neither Ronzani nor Natoli discloses displaying a virtual object and allowing a user to view the virtual object simultaneously with the user's actual world environment. Second, there is no motivation to combine Ronzani (or Ronzani and Horton) and Natoli.

***a. Neither Ronzani Nor Natoli Allow A User To View A Virtual Object Simultaneously With The User's Actual World Environment***

As explained above, and as with Ground 1, the Petition correctly does not allege that Ronzani discloses any virtual objects or display of them in identifying what portions of the references disclose the claimed elements, and as to motivation to combine, the Petition is incorrect that Ronzani discloses virtual objects. Pet., 60–68. Instead, the Petition relies on the argument that the “Natoli discloses the display of a virtual keyboard—a ‘virtual object’ as claimed—on a semi-transparent head-mounted display.” *Id.*, 62. However, Natoli contains no such disclosure. There is no “semi-transparent” display in Natoli, only an opaque display, an LCD panel. The quote that the Petition so heavily relies on, that the user “may view the actual physical environment through the LCD,” explains in the unquoted parts, that it does not mean literally through an LCD or any screen that is transparent. Instead, the user tilts his or her eye to see the real world. The full quote is:

For example, the display may be a liquid crystal display (LCD), known in the art, for generating images with depth and/or perspective to display a VR representation of a keyboard 12, as shown in FIG. 2, as well as VR worlds and environments. The LCD may be visible to one or both eyes and/or may be bifocal; that is, *the user may view the VR world and/or keyboard by titling an eye in one direction toward the LCD, and may view the actual physical environment through the LCD by tilting an eye in another direction.*

Ex. 1007, 5:32–41. Thus, the user does not see the real world because the LCD screen is semi-transparent as the Petition alleges. The user looks at the virtual world “by titling an eye in one direction **toward the LCD**,” and looks at the actual world “by tilting an eye in another direction,” *i.e.*, **away from the LCD**. There is no explanation in the reference that the LCD used is semi-transparent as the Petition alleges. The Petition also argues that “the VR keyboard may be ‘superimposed in the view of the user,’ and may be superimposed ‘over the actual display,’ consistent with a display overlaid on an optical see-through HMD,” but Natoli does not state the keyboard may be superimposed over an actual display; rather it discusses primary and secondary GUI windows, and simply displaying a VR display on an actual display, and thus the reference again fails to teach a virtual keyboard viewed

through a semi-transparent screen, which is what it seeks to import into Ronzani. Pet., 66; Ex. 1007, 7:2–12.

Thus, the wearer of the Natoli device never sees any virtual object simultaneously with any portion of said wearer’s actual world environment. The user tilts his or her eyes in one direction to see the virtual world and in another direction (at another time) to see the actual world.

Because the disclosure from Natoli that the Petition seeks to import into Ronzani does not actually contain the functionality it seeks to import, the combination fails, and thus Ground 2 fails.

***b. There Is No Motivation To Combine Ronzani And Natoli***

The Petition argues that a POSITA would have been motivated to combine the fundamentally different systems of Ronzani and Natoli for the same reasons as the combination of Ronzani and Ohshima, *i.e.*, that Ronzani describes its invention as being able to run virtual reality simulations and that Ronzani “contemplates” a virtual keyboard using motion sensitive gloves and a virtual reality data glove. Pet., 64–68. That is incorrect, as explained above with respect to the combination of Ronzani and Ohshima. Section V.A.1.d.

While Ronzani mentions the possible use of a virtual keyboard using motion-sensitive gloves, there is no disclosure or teaching of the keyboard itself being

displayed. The reference points out that the gloves simulate a virtual keyboard to clarify how they are used, as the other examples in the list (joystick, trackball, etc.) are clear enough without discussion of what the user will do to interact with the system. *See* Ex. 1003, ¶¶ [0007]. Notably, the “user interface” is not a graphical user interface. Rather, the phrase “user interface” is used in the sense of a way the user interacts with the system, as seen in the other examples (*e.g.*, a joystick). *Id.*, ¶¶ [0007]. Merely mentioning “virtual keyboard using motion sensitive gloves” and “virtual reality data glove” in boilerplate language in one paragraph for each does not justify importing complex virtual reality mechanics, including the fully-immersive VR system of Natoli into a system designed for industrial safety and first-responder usage.

Moreover, as with Horton, Natoli’s fully immersive nature makes it fundamentally incompatible with Ronzani. Ronzani’s disclosure focuses on utilitarian and mission-critical applications such as firefighting, military operations, mining, and chemical plant maintenance, wherein a user’s vision must not be impaired and he or she must maintain situational awareness. *See id.*, ¶¶ [0174]–[0207]. Natoli discloses a system operating entirely within a virtual reality environment with no ability to see the real world without looking to the side, away from the VR system, as explained above. Section V.B.1.a. Natoli uses a VR headset and gloves to simulate data entry through a virtual keyboard and mouse, rendering a

fully immersive VR interface. *See* Ex. 1007, 5:28–41. The system displays a fully virtual “VR world,” including a “VR office setting and/or a VR desktop with a VR representation of a computer monitor/display” and a “bookcase for accessing information indexed through VR books.” *Id.*, 9:16–24. Natoli is premised on the complete occlusion of the physical world where the user is visually and functionally isolated from their physical surroundings and instead engages entirely with virtual constructs. *See id.*, 5:28–41. The system relies on a closed VR headset, not a transparent or pass-through display, and it lacks any mechanism for integrating or displaying real-world content. *See id.*, 5:32–41. The result is a fundamentally different technological paradigm, one that prioritizes immersion over real-world awareness.

This fundamental difference between Ronzani and Natoli highlights that the combination lacks compatibility and would not have motivated a POSITA to combine them to meet the claimed feature of simultaneous viewing and interaction. Ronzani’s display aims to be non-intrusive and allow the user to see his or her environment as a critical aspect of its operation, whereas Natoli’s VR system attempts to immerse the user entirely in a virtual environment, isolating him or her from the real world. *See* Ex. 1003, ¶ [0004]; Ex. 1007, 5:28–41. These contrasting approaches show a lack of synergy and a lack of a reason to use Natoli’s immersive keyboard visualization in Ronzani.

And it is not simply that the references are different. There would be no benefit and indeed substantial drawback to using a virtualized keyboard in Ronzani, which would partially obstruct the user's view. Introducing a virtual keyboard into Ronzani's mission-critical system would create unacceptable visual interference. Ronzani is designed specifically to preserve situational awareness, enabling the user to respond to dynamic, potentially hazardous real-world environments. While displaying a virtual keyboard in a sedentary "VR office" setting as in Natoli may be a beneficial use of screen space, doing so in the active environment of Ronzani would risk obscuring important real-world cues, impair depth perception, and introduce cognitive load that could delay reaction times, all for no benefit. In high-risk contexts such as firefighting or military operations, even momentary visual obstruction could have life-threatening consequences. A POSITA would understand that such a design choice would fundamentally undermine the core objectives of Ronzani's system.

Moreover, there is simply no need for such a visually-displayed virtual keyboard in Ronzani, because Ronzani already describes sufficient input methods for a user to interact with the system, *e.g.*, Ex. 1003, ¶ [0007], and the Petition points to no benefit outweighing the significant disadvantages.

**2. Ground 2 Fails To Disclose “A Camera Pointed In A Field-Of-Vision Of Said Wearer And Operable To Capture An Image Of Said Portion Of Said Wearer’s Actual World Environment;” (Claim 1)**

***a. Lack Of Motivation To Combine Ronzani And Peli***

The Petition argues that a POSITA would have been motivated to combine the fundamentally different systems of Ronzani and Peli rests on similar arguments as the combination of Ronzani and Horton, and Ronzani and Natoli, *i.e.*, that Ronzani describes its invention as being able to run virtual reality simulations and that Ronzani “contemplates” a camera. Pet., 71–76. The former is incorrect, as explained above with respect to the combination of Ronzani and Ohshima. *See* Section V.A.1.d. And the Petition concedes that Ronzani “does not expressly describe an infrared camera” or any camera. *Id.*, 73.

The Petition’s proposed combination of Ronzani and Peli to meet Claim 1[f][2] lacks a sufficient motivation to combine and employs impermissible hindsight reconstruction. While both references involve head-mounted displays, their technological objectives, operational environments, and core design philosophies are fundamentally incompatible.

Ronzani’s head mounted display is toward mission-critical, real-world applications such as firefighting, law enforcement, chemical, and nuclear work. *See* Ex. 1003, ¶¶ [0174]–[0207]. Its system is designed to deliver a remote video feed

to a user in a non-intrusive way while minimizing obstructions and prioritizes non-intrusiveness, safety, and situational awareness, with substantial emphasis on ergonomic considerations and practical usability in hazardous environments. *See id.*, ¶¶ [0003]–[0004]. There is no camera described in Ronzani as being mounted in the field-of-view or as being used for the purpose of capturing real-time images for display alongside virtual content. In fact, the Petition concedes that “Ronzani does not provide details on uses of the head-mounted camera.” Pet., 47.

In contrast, Peli discloses a technology system intended to enhance vision for patients with visual impairments such as, cataracts, macular degeneration, or Retinitis Pigmentosa or to enhance TV or the real world. *See* Ex. 1006, 2:34–58. Peli’s focus is not on maintaining the user’s natural situational awareness but rather on substituting and re-rendering the environment through enhanced digital processing, for example, to compensate for significant visual impairment. And there is no indication that Ronzani would be used by the same or similar types of individuals or in similar use cases, *e.g.*, people with vision impairment.

This fundamental difference in purpose and context undermines the rationale for combining the two. A POSITA designing a head-wearable display for first responders or industrial professionals, *i.e.*, someone working in Ronzani’s domain, would not look to Peli, a reference designed for patients with visual impairments. The ergonomic and functional priorities between the two are misaligned. Ronzani

requires real-time, non-intrusive visual integration that avoids overwhelming the user's perception. *See* Ex. 1003, ¶ [0004]. Peli, by contrast, explicitly *alters* the captured scene, often displaying a “minified cartoon version” or contrast-enhanced version of the environment. *See* Ex. 1006, 14:23–42.

The Petition does not explain how Peli's processing-heavy, visually abstracted display could be meaningfully integrated into Ronzani's system, which is built around delivering real-time video from external sources, not reprocessed feeds from an onboard, field-of-view camera. Peli's system does not simply display raw infrared images. Rather, it deliberately transforms them such as by contour enhancement, luminance edge extraction, and even minification to emphasize object boundaries for users with impaired vision. *See id.*, 13:43–14:28. These distortions compromise the immediacy that Ronzani's high-stakes, real-time environments demand. *See e.g.*, Ex. 1003, ¶¶ [0174]–[0207]. The Petition concedes that Ronzani “does not provide details on uses of the head-mounted camera,” “does not further describe potential applications,” and “does not expressly describe an infrared camera.” Pet., 47, 68, 73. These concessions underscore the speculative nature of the proposed combination.

***b. There Is No Motivation To Combine Ronzani, Horton, Natoli, And Peli***

In addition to a lack of motivation to combine Ronzani with each of Horton, Natolia, and Peli, as described above, there is no motivation for a four-reference combination, because the references are substantially different. The Petition’s attempt to combine Ronzani, Horton, Natoli, and Peli to meet the limitations of Claim 1 lacks any unifying rationale and instead cobbles together disparate technologies whose respective goals, contexts, and technological approaches are fundamentally incompatible.

Ronzani is designed for mission-critical, real-world applications such as firefighting, law enforcement, and hazardous environment operations, where situational awareness and real-time, unobstructed visual perception are essential. Ex. 1003, ¶¶ [0179]–[0207]. Natoli and Horton present a stark contrast in that they describe they describes closed, immersive “VR worlds,” including a “VR office setting and/or a VR desktop with a VR representation of a computer monitor/display.” Ex. 1004, 1:13–19; Ex. 1007, 9:16–24. Peli introduces a third, wholly distinct goal and design philosophy. It is not concerned with either immersive VR or tactical mixed-reality displays that maintain situational awareness, but rather digitally modifying a user’s view to compensate for vision problems in examples like watching TV. Ex. 1006, 13:43–14:28.

The Petition’s approach reflects a retrospective effort to assemble discrete features from dissimilar systems, in a manner that none of the references themselves suggest to a POSITA. This type of reasoning risks the kind of hindsight reconstruction the Supreme Court cautioned against in *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007), where “[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning.” Accordingly, the proposed combination of Ronzani, Horton, Natoli, and Peli lacks a sufficiently grounded motivation to combine and should not be adopted.

**3. Ground 2 Fails To Disclose “A Movement Sensor, Wherein Said Movement Sensor Comprises An Accelerometer”**

The Petition argues that this limitation is met by Ronzani and Horton for the same reasons as in Ground 1, which fails for the same reasons as described above in connection with the element “a head-mounted movement sensor” in claim 16[d]. See Section V.A.1.a.

**VI. Conclusion**

For the above-described reasons, Patent Owner respectfully requests that the Board deny institution.

Dated: August 7, 2025

Respectfully submitted,

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**CERTIFICATE OF WORD COUNT**

The undersigned certifies that the portions of the above-captioned PATENT OWNER'S PRELIMINARY RESPONSE specified in 37 C.F.R. § 42.24 have 9,094 words, in compliance with the 14,000 word limit set forth in 37 C.F.R. § 42.24(b)(1). This word count was prepared by the word-processing program used to prepare this paper (Microsoft Word).

Dated: August 7, 2025

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**CERTIFICATE OF SERVICE**

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