

Filed on behalf of: Giesecke+Devrient GmbH, *et al.*

Filed: May 15, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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GIESECKE+DEVRIENT GMBH,  
GIESECKE+DEVRIENT CURRENCY TECHNOLOGY GMBH, AND PA-  
PIERFABRIK LOUISENTHAL GMBH,  
Petitioners,

v.

LUMENCO, LLC,  
Patent Owner.

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Case No. IPR2024-00836  
U.S. Patent No. 10,189,294

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**PETITIONERS' REPLY TO PATENT OWNER'S RESPONSE**

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| Ex. 1001       | U.S. Patent No. 10,189,294                                                                                                                                                            |
| Ex. 1002       | File History of U.S. Patent No. 10,189,294                                                                                                                                            |
| Ex. 1003       | Declaration of Lambertus Hesselink, Ph.D.                                                                                                                                             |
| Ex. 1004       | U.S. Patent No. 62262767 Provisional                                                                                                                                                  |
| Ex. 1005       | DE102010048262A1                                                                                                                                                                      |
| Ex. 1006       | DE102010048262A1 Official Translation into English (“Fuhse262”)                                                                                                                       |
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| Ex. 1008       | U.S. Patent No. 10,639,925 to Fuhse (“Fuhse925”)                                                                                                                                      |
| Ex. 1009       | U.S. Patent Application Publication 2014/0367957 (“Jordan”)                                                                                                                           |
| Ex. 1010-1021  | RESERVED                                                                                                                                                                              |
| Ex. 1022       | WO2012048847A1_English (“Fuhse 847”)                                                                                                                                                  |
| Ex. 1023-1024  | Reserved                                                                                                                                                                              |
| Ex. 1025       | R. Lee, “Micromirror array nanostructures for anticounterfeiting applications,” Proc. SPIE 5310, Optical Security and Counterfeit Deterrence Techniques V, (3 June 2004)              |
| Ex. 1026       | Lee R.A., Leech P.W., “Development of Optically Variable Devices for Document Security in CSIRO Journal of the Coatings Association of Australia,” Vol. 42(8), August 2005, p. 22-27. |
| Ex. 1027       | <i>Optics</i> , Hecht, 4th Edition (2002)                                                                                                                                             |
| Ex. 1028       | Saleh and Teich. Fundamentals of Photonics (1st Edition 1991), Ch. 1                                                                                                                  |

| <b>Exhibit</b> | <b>Description</b>                                                                                   |
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| Ex. 1029       | Ebewele, R.O. (2000). Polymer Science and Technology (1st ed.). CRC Press.                           |
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| Ex. 1050       | Declaration of Eric E. Lancaster in Support of Petitioners' Motion                                   |

| <b>Exhibit</b> | <b>Description</b>                                                        |
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| Ex. 1052       | Hyperplane Definition Dectictionary.com                                   |
| Ex. 1053       | Hyperplane, Subspace and Halfspace Definition                             |
| Ex. 1054       | Annotations of Ex. 1001 (U.S. Patent No. 10,189,294) by Mikael Lindstrand |
| Ex. 1055       | Transcript of Deposition of Mikael Lindstrand (April 11, 2025)            |

**I. INTRODUCTION**

The Petition established that the challenged claims are unpatentable as obvious. In effort to avoid the prior art, PO misconstrues the prior art and responds not non-existent arguments. Moreover, PO's arguments are premised on concepts that are not discussed in the prior art or the '294 patent, and are irrelevant to whether the prior art satisfies the claims, including "diffusive light," explicit use of the term "voxel", interference effects, and "hyper planes."

PO argues that Petitioner's expert, Dr. Hesselink, is not a POSITA according to PO's proposed definition (limited to diffusive light). However, the POSITA should not be limited to a concept that is not only absent from the '294 patent but is directly contrary to what is taught by the '294 patent. Further, PO waived its ability to challenge Dr. Hesselink's qualifications and doesn't dispute that Dr. Hesselink is a POSITA according to Petitioner's proposed POSITA definition.<sup>1</sup> Dr. Hesselink is a POSITA.

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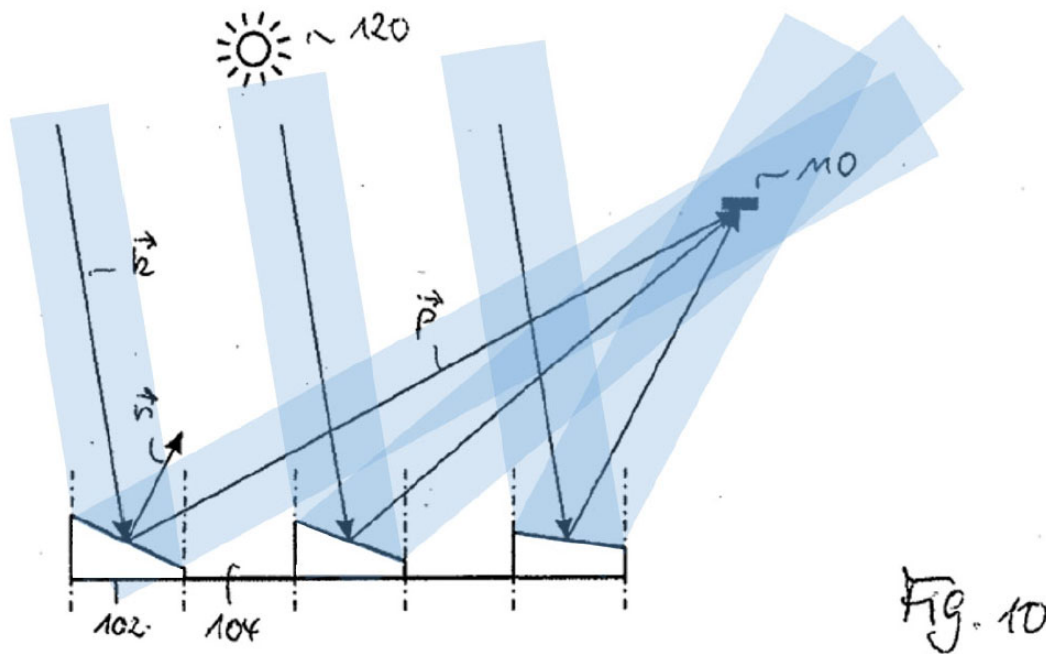
<sup>1</sup> While PO presents first its arguments on diffusive light (*see* POR, 8-13), Petitioner responds later in this Reply and focuses first on the merits of the claims.

**II. GROUND 1: CLAIMS 1, 6-13, 28, 32, 33, AND 35-38 ARE RENDERED OBVIOUS UNDER 35 U.S.C. §103 BY FUHSE262****A. Fuhse262 Teaches Elements [1b.5], [28b.5], [35b.4] and [35b.8]****1. Fuhse262 Teaches a Voxel**

Limitation [1b.5] recites “a voxel is created at each of the points on the plane via intersection of two or more beams of the reflected ambient light.” *See also* [28b.5], [35b.4] and [35b.8] (all reciting creation of voxels).

Fuhse262's images disclose light spots in three-dimensional space (**voxels**) defined by its center-point ( $x_0, y_0, z_0$ ) (**a point on the plane corresponding to one of the pixels**). Pet. 31-32; EX1003, ¶¶169-70; EX1006, ¶¶95-97. Figure 10 of Fuhse262 shows chief rays (the center rays of light for each optical element) for each micro-mirror (i.e., optical element) converging on light spot 110. Pet. 32; EX1003, ¶¶171-74; EX1006, ¶¶95-97, Fig. 10. As further discussed for element [1.b3], the reflected ambient light for each micromirror is given by “reflected light ray” of direction vector  $\vec{p}$ , as shown in Figure 10, which is the chief ray for each mirror. Pet. 26-29; EX1003, ¶¶153-56; EX1006, ¶¶95-97, Fig. 10.

Dr. Hesselink annotated Figure 10 to show a POSITA's understanding that while chief rays are very commonly used for simplicity, reflected light would form beams of light (**two or more beams of the reflected ambient light**) that reflect off the entire surface of the mirror, not just the center point.



Pet. 31-32; EX1003, ¶170. The micromirrors are oriented to reflect light towards point  $(x_0, y_0, z_0)$ , resulting in **intersection** of the beams to form a **voxel**. Pet. 32; EX1003, ¶171-172.

“The volume of the voxel corresponds to the intersection of beams” from the set of micromirror for the given voxel. Pet. 32. Dr. Hesselink explained that as “more micromirrors are added for a given pixel, the pixel or voxel becomes brighter and more defined.” Pet. 32; EX1003, ¶171.

PO does not dispute that the above teachings of Fuhse262 satisfy **intersection of two or more beams of the reflected ambient light** and occurs at **each of the points on the plane**. POR, 14-20. PO *only* alleges that Fuhse262 fails to teach or suggest a **voxel** is created at each of these points. *Id.*

## **2. PO's Unsupported Arguments Regarding "Voxel" Are Red Herrings**

PO argues that "Fuhse262 does not use the term 'voxel' and does not mention 'pixels with volume,' '3D pixels,' or any similar term." POR, 15. Tellingly, neither does the '294 patent.<sup>2</sup> However, whether Fuhse262 or the '294 patent uses the term "voxel" *ipsissimis verbis* is not the test. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) (the test for obviousness is what the teachings of "references would have suggested to those of ordinary skill in the art").

The parties agree that a "voxel" is a pixel with volume (hence, voxel). POR, 14-15; Pet. 31. In fact, PO states that "a voxel is a type, or subspecies, of a pixel," which, if anything, confirms that Fuhse262 to uses terms such as "pixel," "light spots," and "image points" to describe pixels with volume.

Fuhse262 discloses such a "voxel" as claimed. *See* Section II.A.1 and Pet. 31-33. It is the substance of what Fuhse262 teaches that matters, not whether it uses the

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<sup>2</sup> The '294 patent (other than the claims) does not use the term "voxel" or "volume," which further confirms that a POSITA would understand "pixels" as pixels with volume. In fact, during prosecution, PO added "voxel" to the claims to overcome a prior art rejection citing Raber, which disclosed sequentially displaying "2D images onto differing image planes" in the television context. EX1002, 421-22 (emphasis added); Pet. 31; EX1003, ¶¶167- 168.

exact same words as the claim. *Adasa Inc. v. Avery Dennison Corp.*, 55 F.4th 900, 909 (Fed. Cir. 2022) (“the reference need not disclose the elements in the very same terms used by the patent”); *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a “reference need not satisfy an *ipsissimis verbis* test”).

Next, PO argues that a “POSITA would understand Fuhse262’s consistent description of a pixel as an ‘image *point*’ as disclosure of a 2d pixel,” but PO does not rely on any expert opinion. *See* POR, 15. PO’s unsupported attorney argument should be ignored. Notwithstanding, the reasoning is flawed.

Specifically, PO’s attorney alleges that Fuhse262’s pixels are only “a specific *point* in space” (emphasis in original), which apparently means it is “a 2d pixel.” POR, 15. However, something cannot simultaneously be a “point in space” (0-dimensional) and “2D” (two-dimensional), which would require occupying both zero and two dimensions of space simultaneously. PO does not offer any explanation as to what two dimensions a “2d pixel” are supposed to occupy, and never reconciles how the pixel can both occupy two-dimensions and also exist as a point with no volume.

Fuhse262’s un rebutted teaching of a voxel as further understood by a POSITA is clear, and PO’s attempt to muddy the waters with unsupported attorney arguments should be ignored as red herrings.

### 3. PO's Mischaracterizes and Fails to Rebut

PO next mischaracterizes Petitioners' argument, supported by Dr. Hesselink's opinion, regarding Fuhse262's teaching of voxels as inherency (POR, 15-16) and relies on unsupported hyperbole instead of a reasoned rebuttal (POR, 16-17). Both arguments lack merit.

PO argues that Petitioners' rely on "inherency" and fail to meet this "high standard." POR, 15-16. Petitioner asserts obviousness, not inherency, for disclosure by Fuhse262. Pet. 31-33. Specifically, Petitioner explains why—*based on the disclosure of Fuhse262, and the testimony of Dr. Hesselink, and supporting evidence—* Fuhse262's pixels have a volume. *See id.*; *see also In re Preda*, 401 F.2d 825, 826 (CCPA 1968) ("[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom.").

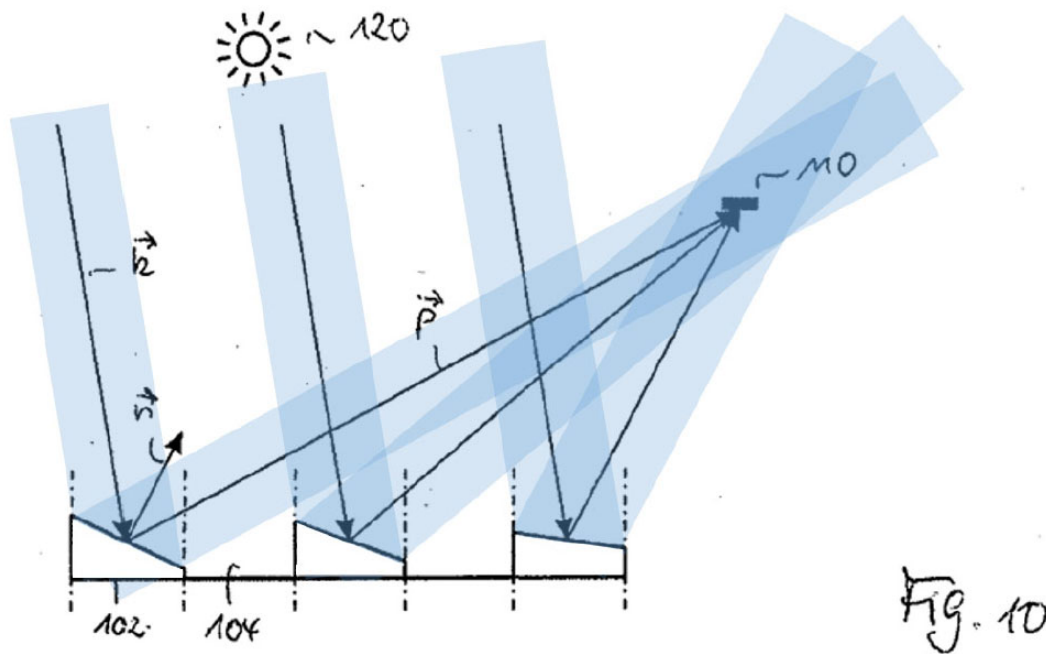
PO concludes that the Petition fails to meet this inherency standard (POR, 16-17) but as stated above, Petitioners don't rely on inherency.

In addition, PO fails to provide any reasoned rebuttal to Petitioners' argument, supported by Dr. Hesselink's opinion, of why Fuhse262 teaches voxels (discussed in II.A.1, *supra*). Indeed, PO provided no explanation of why a pixel formed from Fuhse262's reflected light beams all aimed at a common point would *not* have a volume. *See* Section II.A.1. Instead, PO relies on hyperbole and sensationalized

language, such as “haphazard,” “unintentional,” “random,” and “magically,” in a transparent attempt to overstate the complexity and improbability of the plain teachings of Fuhse262 and its application of basic optical principles.

Tellingly, PO does not rely on its expert, or any other evidence, for its unsupported statement that Petitioners' rely on “random light beams” and “magic[]” to establish Fuhse262's pixels have volume. In fact, the POR (spanning pages 16-17) is the *only time PO even references* Petitioners' and Dr. Hesselink's position of how Fuhse262 teaches voxels (discussed in III.1, *supra*). In other words, the single instance in PO's arguments that PO actually addresses Petitioners' and Dr. Hesselink's position of why Fuhse262 teaches voxels amounts to unsupported attorney argument characterizing basic optics as “random” and “magic[].”

As explained in Section II.A.1, the volumes of Fuhse262's pixels are defined by the intersection of light beams formed of reflected light from the entirety of each micro-mirror in the set.



Pet. 31-33; EX1003, ¶¶169-70; EX1006, ¶¶95-97. Far from magic, the volume of these pixels occurs because of the basic and undisputed operation of Fuhse262's structures. Specifically, PO does not dispute that Fuhse262 teaches:

- Arrays of micro mirrors that are illuminated with ambient light. *See* Pet. 18- 20; EX1003, ¶¶125-31.
- Forming floating images in space comprised of a plurality of “pixels” / “light spots” / “image points,” each with three-dimensional coordinates in space, with light reflected from the micro mirrors. *See* Pet. 21-23; EX1003, ¶¶132- 41.
- Each pixel is assigned a set of micro mirrors that reflect light towards it. *See* Pet. 23-24; EX1003, ¶¶144-47.

- Each micro mirror is individually oriented by setting its normal vector such that incident rays from a particular direction are reflected towards the coordinates of the pixel. *See* Pet. 25-29; EX1003, ¶¶148-57.
- Incident rays strike the entirety of the mirror surface and are reflected in beams of light corresponding to the entire mirror surface. *See* Pet. 29-31; EX1003, ¶¶158-65.
- The reflected beams of light for each micro mirror for a given set intersect at the coordinates of the pixel. *See* Pet. 31-33; EX1003, ¶¶166-75.

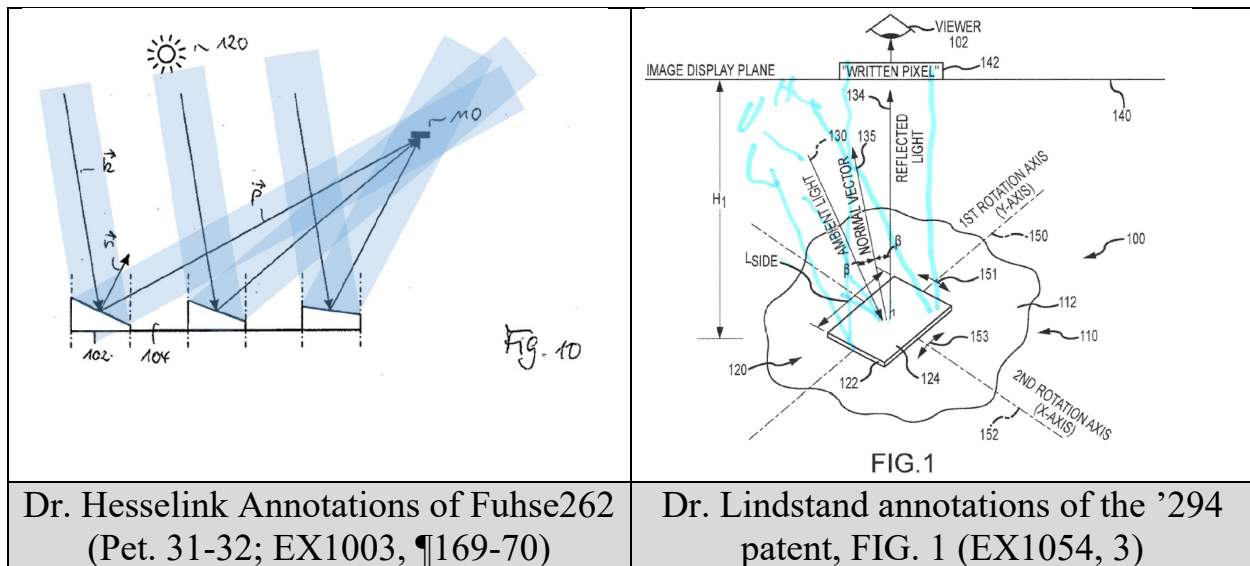
Thus, there is nothing “haphazard,” “unintentional,” or “random” about the pixel volume formed by Fuhse262’s reflected beams. PO’s sensationalized hyperbole is no replacement for reasoned rebuttal of any of these points, which establish how the pixel volume is formed.

Further, PO’s statement that “overlapping of random light beams does not magically create an image pixel or voxel” appears to imply that a “voxel” must include something other than a volume formed by intersection of reflected light beams from micro mirrors. *See* POR, 17. However, PO has provided no explanation what must be additionally included to form a voxel. Regardless, the experts are in agreement of how to form a voxel.

As explained below, on cross-examination, Dr. Lindstrand explained how the '294 patent teaches forming voxels. Thus, to the extent there are additional requirements to create a voxel (there are not) not explicitly taught by Fuhse262, they are not taught by the '294 patent because they would have been known to a POSITA. *See In re Epstein*, 32 F.3d 1559, 1568 (Fed. Cir. 1994) (“[T]he Board’s observation that appellant did not provide the type of detail in his specification that he now argues is necessary in prior art references supports the Board’s finding that one skilled in the art would have known how to implement the features of the references and would have concluded that the reference disclosures would have been enabling.”).

Dr. Lindstrand confirmed that Figure 1 of the '294 patent teaches forming a voxel by using: a micro-mirror (EX1055, 99:4-6; EX1001, 6:15-41), “ambient light 130” / “incoming ray 130” strikes the micro mirror at an angle  $\beta$  with the normal vector of the micro mirror (EX1055, 99:11-16; EX1001, 6:41-50), “reflected light 134” is reflected with the same angle  $\beta$  based on the law of reflection (EX1055, 105:15-107:14; EX1001, 6:41- 50), the angle of the reflected light is set so as to coincide with the coordinate of a pixel (EX1055, 107:16-109:5; EX1001, 6:51-65), this is done by orienting the normal vector of the micro mirror (EX1055, 108:1- 109:5; EX1001, 6:66-7:22), and this process is repeated for the set of micro mirrors for that pixel (EX1055, 108:1- 109:5; EX1001, 6:59-65).

Just as Fuhse262 does, the '294 patent for simplicity shows the center ray of the incoming rays. In agreement with Dr. Hesselink, Dr. Lindstrand agreed "the ambient light would not just strike the center of the surface, it would strike the entire surface." EX1055, 112:15-21. Further, there are "parallel" light rays of ambient light ray 130 "that fall into the area of the micro mirror" and "[a]ll those end up in the written pixel area within that space." EX1055, 118:21- 119:3. As shown below, Dr. Lindstrand further annotated Figure 1 below (EX1054) to show the parallel incident light "with the exact same angle of incidence, beta" just as Dr. Hesselink annotated Figure 10 of Fuhse262. Compare EX1055, 119:11-17, and EX1054, 3, with EX1003, ¶170.



**4. PO's "Technical Challenges" and "Diffusive Light"  
Discussions are Irrelevant and Unsupported**

PO makes irrelevant and unsupported arguments that have no basis in the '294 patent or Fuhse262.

PO alleges "technical challenges" in creating a voxel that are "above and beyond those required to create a pixel."<sup>3</sup> *See* POR, 17-18. However, these "technical challenges" are also irrelevant because they are not even purported to be solved by the '294 patent, or problems that would be faced in implementing Fuhse262. *See generally* EX1001. In particular, alleged technical challenges of "degradation" from "interference," "less information," and "extra computational and storage pay-load" are not addressed by the '294 patent. *See* POR, 17-18. In fact, PO does not cite or mention the '294 patent or Fuhse262. *Id.* All that PO does cite to in support of these "challenges" are Dr. Lindstrand's declaration, but Dr. Lindstrand could not "recollect" ever seeing these concepts addressed in the '294 patent or Fuhse262. *See* EX1055, 77:18-90:18. Thus, to the extent these "technical challenges" are at all

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<sup>3</sup> As an initial matter, these "technical challenges" would only plausibly be relevant if Petitioner was arguing that it would have been obvious to modify a teaching of two-dimensional pixels to teach pixels with volume. Petitioner does not have any such position because Fuhse62 teaches pixels with volume, and therefore these arguments are irrelevant and may be ignored.

relevant to the analysis of whether Fuhse262 satisfies this limitation (they are not), they are not taught by the '294 patent and would have been within the ordinary skill of a POSITA. *See In re Epstein*, 32 F.3d at 1568.

PO's discussion about diffusive and ambient light is also irrelevant. *See* POR, 19. PO does not dispute that Fuhse262 teaches use of ambient light, and as such, whether Fuhse262 discloses diffusive light is irrelevant. Further, PO only argues about what Dr. Hesselink would have understood but did not cross-examine Dr. Hesselink to determine what that understanding is. *Id.*, 19. This argument is also irrelevant.<sup>4</sup>

Further, PO is simply wrong that the "ambient light" in the patent refers to exclusively diffusive light and not parallel light, as discussed in Section III.A.

Finally, PO again invokes its inherency mischaracterization to argue that because Fuhse262 describes two-dimensional images, it cannot "*necessarily*" teach three-dimensional voxels. *See* POR, 20. This simply means that height is fixed to a single row; consistent with the plane such as in claim 35, where voxels form a "plane."

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<sup>4</sup> PO's argument is even only plausibly relevant as an evidentiary objection to Dr. Hesselink's testimony (*see* Section III.B), not as to whether Fuhse262 satisfies this limitation.

**B. Fuhse262 Teaches Element [35b.5]****1. Fuhse262 Teaches “a second image in a second plane spaced a distance apart from the plane displaying the image”**

By way of background,

- Claim 1 recites displaying an image in a plane: “displaying an image in a plane spaced a distance apart from the surface of the substrate” [1b.2]
- Claim 28 recites displaying two images that are each in a plane: “displaying a first image and a second image in a plane spaced a distance apart from the surface of the substrate” [28b.2].
- Claim 35 recites displaying two images in *spaced apart* planes: “displaying an image in a plane spaced a distance apart from the surface of the substrate” [35b.2] and “displays a second image in a second plane spaced a distance apart from the plane displaying the image” [35b.5].

PO disputes only element [35b.5]. For element [35b.5], Petitioner incorporated its position for [28b.2]. *See* Pet. at 43 (“Fuhse262 discloses displaying two images in the same plane. *See, supra*, Section VII.A.4.d ([28.b2]); EX1003, ¶220.”); EX1003, ¶220 (“This claim requires **a second image in a second plane spaced a distance apart from the plane displaying the image**, without any additional requirements of the second image that are not required of the image. As discussed in

element [28.b2], incorporated herein, Fuhse262 discloses displaying two images in the same plane. *See, supra*, Section X.A.2.b.iv ([28.b2]).”).

As explained in element [28b.2], *inter alia*, “Fuhse262 generates multiple images, including ‘a light-spot image A’ (the **image**) and ‘a light-spot image B’ (**a second image**).” Pet. 35-37; EX1006, ¶¶111-20; EX1003, ¶¶188-189. Element [1b.2] was further incorporated by reference to explain the details of generating those images. Pet. 35. Element [1b.2] explains how Fuhse262’s images are **display[ed] an image in a plane spaced a distance apart from the surface of the substrate**. Pet. 20-23; EX1003, ¶¶132-143. As discussed above, element [1b.2] recites these claim features in the first instance.

Element [1b.2] provides detailed explanation of the clear disclosures of Fuhse262 that establish that its images are in planes spaced apart from the substrate. For example, Fuhse262 teaches that “a light-spot image composed of a plurality of light spots” (**displaying an image...wherein the image comprises a plurality of pixels**), and explicitly teaches “all light spots in the light-spot image have the same floating height” (forming **a plane spaced a distance apart from the surface of the substrate**), such that a two-dimensional image is formed that “floats at a certain height above or below the substrate surface.” Pet. 20-23; EX1003, ¶¶132-143; EX1006, ¶¶10, 68. As another example, Fuhse262 teaches that the “height values  $Z_j$  above an  $xy$  plane” of image points  $P_j$  (pixels) may be “specified,” such that all

image points  $P_j$  have the same height values  $Z_j$  above the surface of the substrate, resulting in **displaying an image in a plane spaced a distance apart from the surface of the substrate**. Pet. 22; EX1003, ¶¶138-140; EX1006, ¶¶36, 125-28.

Accordingly, the incorporated teachings discussed in elements [28b.2] and [1b.2] together clearly establish displaying multiple images in planes. PO does not dispute these positions.

Thus, all that element [35b.2] requires apart from elements [28b.2] and [1b.2] is that the plane of the second image is spaced apart from the plane of the first image.

Fuhse262 clearly establishes this feature, as it explicitly explains that the two images are in the “foreground” and “background” of each other, meaning that they are **spaced a distance apart** from each other. Pet. 43; EX1003, ¶221; EX1006, ¶117.

The Petition also explains that to the extent that Fuhse262 only explicitly teaches three-dimensional image in the foreground of a two-dimensional image (*see* EX1006, ¶117), it would have been obvious to provide two two-dimensional images. Pet. 43; EX1003, ¶222; EX1006, ¶117. As Dr. Hesselink explained:

“As discussed in element [1b.2]..., by teaching any arbitrary three-dimensional image in space (*i.e.*, x, y, z space) can be constructed of pixels, a POSITA would understand that a two-dimensional image can be constructed by fixing the height (z) values of the pixels. Based on

Fuhse262's teachings that multiple images may be created in the foreground and background of each other, and that images may be two-dimensional, it would have been obvious to a POSITA to provide two two-dimensional images at different heights (*i.e.*, in different planes)."

*Id.*

## 2. PO Fails to Rebut the Petitioners' and Dr. Hesselink's Obviousness Position for element [35b.5]

Petitioners' mapping for element [35b.5] incorporates the mapping for element [28b.2], which teaches displaying multiple images in a plane. Pet. 35-36; EX1006, ¶¶111-20; EX1003, ¶¶188-189. Element [28b.2] incorporates element [1b.2], which teaches displaying an image in a plane. As discussed in element [1b.2], Fuhse teaches both "three-dimensional images" in which the pixels have different heights above the substrate, and two-dimensional images in which "all light spots in the light-spot image have the same floating height," for example, which is achieved by fixing the height value of all pixels in the image. Pet. 20-23; EX1003, ¶¶132-143; EX1006, ¶¶36, 68, 125-28. Petitioner and Dr. Hesselink clearly identified the latter (the two-dimensional image) as satisfying **an image in a plane spaced a distance apart from the surface of the substrate**. Pet. 21-23; EX1003, ¶¶132-143.

Thus, Petitioners' position for element [35b.2] are two two-dimensional images (*i.e.*, two images with fixed height values) that are in the "foreground" and "background" of each other satisfy this element. *See* Pet. 43; EX1003, ¶221; EX1006, ¶117.

PO never rebuts this position, which is dispositive for this element. To the contrary, PO only rebuts the text itself of ¶117 that refers to “a three-dimensional motif with a two-dimensional motif.” POR, 21. PO’s argument *exclusively* rebuts that this “three-dimensional motif with a two-dimensional motif” do not satisfy this element. *See* POR, 21 (“The cited paragraph of Fuhse262 discloses a single light-spot image that contains both a 3-D motif and a 2-D motif.”), 22 (“Fuhse262’s disclosure of a *single light-spot image* that *combines* a 3-D motif and a 2-D motif, a POSITA would understand...”), 23 (“This disclosure teaches a POSITA that the 3-D motif portion of the disclosed light-spot image extends into the background of the 2-D motif...”), 24 (“even if the 2-D motif were considered to be on its own 2-D plane, that 2-D plane would overlap or be contained within the 3-D plane on which the 3-D motif is displayed”). In fact, PO’s arguments are premised on this misunderstanding, as PO appears to allege that “the 3-D motif and the 2-D motif are both displayed *within the same three-dimensional plane*.” *Id.*, 22. This argument has no applicability to two images with fixed height values in the foreground and background of each other.

Further, Petitioners and Dr. Hesselink also include an independent obviousness position that “[t]o the extent it could be argued that Fuhse262 only explicitly discloses a three-dimensional image in the foreground of a two-dimensional image (*see* ¶117), it would have been obvious to provide two two-dimensional images.”

Pet. 43; EX1003, ¶222; EX1006, ¶117. PO also *never rebuts* this obviousness position, which is also dispositive for this element.

**3. To the extent PO attempts a belated rebuttal, the arguments should be rejected**

First, as mentioned above, PO alleges that “the 3-D motif and the 2-D motif are both displayed *within the same three-dimensional plane*.” POR, 21-22; EX2004, ¶¶63-65. This argument has no applicability to two images with fixed height values in the foreground and background of each other, as alleged by Petitioners, and therefore fails to rebut Petitioners positions.

Second, PO’s argument appears premised on its position that planes can be three-dimensional. POR, 21-22; EX2004, ¶¶63-65. However, even if true, the clear teaching of Fuhse262 is that the two images are in the foreground and background of each other, which leaves no doubt that the images are vertically offset from each other. Thus, even if Petitioner only mapped the two images to a “3-D motif and the 2-D motif” (it did not), PO’s argument does not rebut the clear teachings of Fuhse262.

Further, PO’s only evidence of three-dimensional planes is Dr. Lindstrand’s declaration, which concludes without evidence that three-dimensional planes “hyper planes.” POR, 21-22; EX2004, ¶¶63-65. However, “hyper planes” are not discussed

in the '294 patent or in Fuhse262.<sup>5</sup> Further, the term “hyper plane” appears to refer to a plane “of one dimension less than its ambient space” (i.e., “in an n-dimensional space, a hyperplane has n-1 dimensions”). EX1052; EX1053; EX1055, 127:6- 132:18 (finding no “problems” or “reason to contradict” these definitions). Thus, to the extent “hyper planes” are relevant, in ordinary three-dimensional space, a “hyper plane” would still only have two dimensions.

PO alleges that “the Petition admits that the ‘foreground’ and ‘background’ images are in the same plane.” POR, 22. That is false. PO’s alleged admission is Petitioners’ incorporation of element [28.b2], which requires displaying two images in the same plane. *See* Pet. 43 (“Fuhse262 discloses displaying two images in the same plane. *See, supra*, Section VII.A.4.d ([28.b2]); EX1003, ¶220.”); EX1003, ¶220 (“This claim requires **a second image in a second plane spaced a distance apart from the plane displaying the image**, without any additional requirements of the second image that are not required of the image. As discussed in element

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<sup>5</sup> It is not clear whether PO’s statement that “planes, like images, can be 2-D or they can be 3-D” is referring to the interpretation of the claim term “planes” or the scope of the teachings of Fuhse262 based on some (unidentified) usage of the term “planes.” POR, 21-22; EX2004, ¶¶63-65.

[28.b2], incorporated herein, Fuhse262 discloses displaying two images in the same plane. *See, supra*, Section X.A.2.b.iv ([28.b2]).”).

### **III. GROUNDS 2-8: CLAIMS 1, 6-13, 28, 32, 33, AND 35-38 ARE RENDERED OBVIOUS**

The POR has not addressed the merits of Grounds 2-8. POR, 24-27. Accordingly, Claims 1, 6-13, 28, 32, 33, and 35-38 are unpatentable for the reasons presented in the Petition. *See* Pet. 44-68.

### **IV. POSITA**

#### **A. Level of Ordinary Skill in the Art**

According to Dr. Hesselink, a POSITA “would have had a minimum of an undergraduate degree in electrical engineering, mechanical engineering, or physics and at least 2 years of experience in micro-optic based security features.” Pet. 12 (citing EX1003, ¶¶68-74). PO proposes to modify the level of skill in two ways: (1) the undergraduate degree of the POSITA may be in “a similar field,” and (2) the experience of a POSITA must be specifically in “diffusive light” micro-optic based security features. POR, 8-11. Both modifications should be rejected, and Petitioners’ level of ordinary skill should be adopted.

With respect to the undergraduate degree, PO’s argument is limited to an unsupported conclusion that other degrees in “a similar field” “would provide appropriate subject matter training.” POR, 8. However, PO doesn’t specify what that training is. To the contrary, Dr. Hesselink explained that his identified degrees –

electrical engineering, mechanical engineering, or physics – “would provide engineers in the field with a baseline knowledge of the optical and mechanical design principles underlying micro-optic based security features” and would be “sufficient exposure to optics principles to then work or conduct research in that area in academia or industry.” EX1003, ¶70. PO never explains how any other degree in a “similar” field would also provide the necessary “baseline knowledge of the optical and mechanical design principles underlying micro-optic based security features.” *Id.* Notwithstanding, PO nor its expert Dr. Lindstrand never explain how Dr. Lindstrand’s degree in computer science qualifies as a similar field. *See* POR, 9; EX2004, ¶25.

PO’s argument that the experience of a POSITA must be specifically in “diffusive light” micro-optic based security features (POR, 8) should also be rejected.

First, as Dr. Hesselink explained, a person with at least 2 years of experience in micro-optic based security features would be familiar with the problems typically encountered in the field, and correctly understood that the “patent concerns micro-optic design.” EX1003, ¶¶72-73. PO offers no evidence to rebut this assertion.

Second, PO is wrong that these patents are about “diffusive light,” let alone to the extent that “diffusive light” exclusively defines the field of invention. The claims of the ’294 patent recite a security feature that can be used with ambient light, not diffusive light. In fact, the term “ambient light” is exclusively used by the ’294

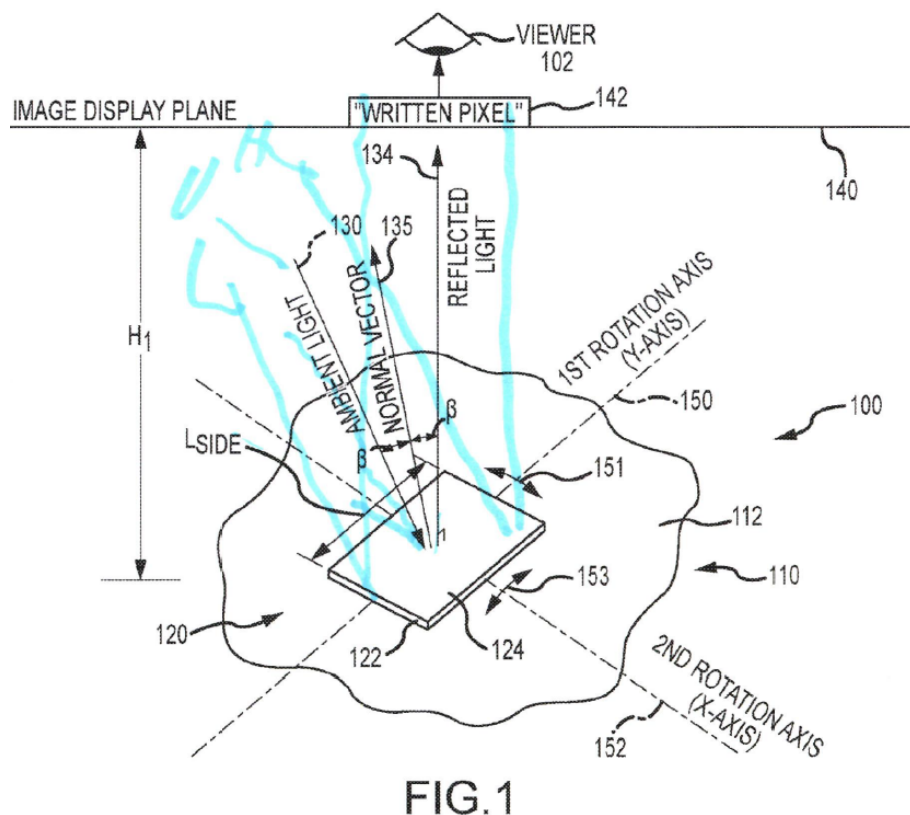
patent to describe the incident light environment, including in the claims, abstract, and specification.

While PO never states what “diffusive light” is, PO appears to present a dichotomy of all light as either “diffusive” or “collimated” (which PO defines as “rays of light are parallel to each other and the direction and angle of those rays of light are controlled and predictable”). POR, 8-11. PO hints that ambient light falls into “diffusive light systems,” as it uses terms such as “diffuse ambient light.” *Id.*, 9.

This dichotomy is false, and PO’s apparent characterization of ambient light as synonymous with diffuse light is also false. For example, PO admits that “outdoor light” is ambient (POR, 10), but upon cross-examination, Dr. Lindstrand admitted that for someone on earth, sunlight is “best approximated as a parallel light source.” EX1052, 96:1-7, 98:10-20. In fact, basic properties of ambient light make clear that ambient light environments contain significant parallel light components emanating from the source. EX1052, 96:12-97:19.

Not only does the general term “ambient light” refer to environments with parallel light, the intrinsic record confirms that as used in the ’294 patent, “ambient light” refers to the parallel components of light, as those are generally the components that form the images. For example, Figure 1 of the ’294 patent depicts ambient light 130 striking the reflective upper surface 124 of the micro mirror 120 *with a*

*single angle  $\beta$ .* EX1001, 6:34-50. As PO's expert Dr. Lindstrand agreed "the ambient light would not just strike the center of the surface, it would strike the entire surface" (EX1052, 112:15-21), and Dr. Lindstrand explained that there are "parallel" light rays of ambient light ray 130 "that fall into the area of the micro mirror" and "[a]ll those end up in the written pixel area within that space." EX1052, 118:21- 119:3. Dr. Lindstrand further annotated Figure 1 below (EX1055) to show the parallel incident light "with the exact same angle of incidence, beta." EX1052, 119:11-17.

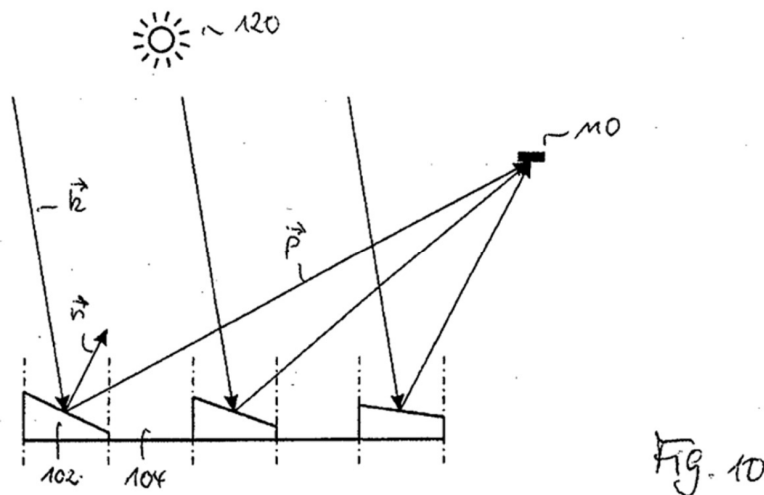


EX1054, 3.

Figure 1 of the '294 patent further depicts that the “same angle,  $\beta$ , as  $\angle$  formed between the normal vector 135 and the reflected light 134.” EX1001, 6:48-50. As Dr. Lindstrand agreed, this is a consequence of the Law of Reflection, which states that the angle of incidence and angle of reflectance of a mirror are the same. EX1052, 109:7-20, 106:1-107:6, 65:5-66:12; EX1003, ¶38. Accordingly, incident light at different angles would not form the pixel, as it does not satisfy the Law of Reflection.

There has been no evidence, opinion, or position put forth that incoming light at all different angles (i.e., what is presumed to be understood from PO's use of the term “diffuse light”) is used to form light for a pixel.

This is also consistent with Fuhse262, which explains that “[t]he position of the mirror surfaces, i.e. the normal vector  $n$ , is to be determined in such a way that the **light incident from a specified direction  $k$**  is reflected onto the focal point ( $x_0, y_0, z_0$ ) for all micromirrors 102 assigned to light spot 110,” as shown below.



EX1006, ¶¶95-97, FIG. 10; Pet. 26-27. Tellingly, PO does not dispute that Fuhse262 satisfies “ambient light” as recited in the claims.

#### **B. Dr. Hesselink is a POSITA**

PO’s argument that Dr. Hesselink is not a POSITA is flawed and should be rejected. POR, 11-13.

First, as an initial matter, PO only argues that Dr. Hesselink is not a POSITA under its definition that requires “diffusive light.” PO does not dispute that Dr. Hesselink is a POSITA under his definition. Thus, if the Board agrees with Petitioners’ POSITA definition, or at least agrees with the arguments above that restricting the field of invention to “diffusive light” is not only overly narrow but contrary to the intrinsic evidence, PO’s argument can be ignored.

Second, even if the Board were to adopt PO’s definition of a POSITA, PO’s arguments that “Dr. Hesselink is not a POSITA” should still be ignored because PO

waived any ability to exclude to Dr. Hesselink's opinions based on lack of qualifications (e.g., under F.R.E. 702). *See* POR, 11-13. PO failed to object to Dr. Hesselink's testimony by filing objections which preserves the right to motion to exclude Dr. Hesselink's testimony. *See Keep Truckin, Inc. v. Innovative Global Systems, LLC*, IPR2020-00692, Paper 29, at 44 (Aug. 16, 2021) ("Petitioner never moved to exclude [expert's] declaration (Exhibit 2006) and thereby waived any argument that he is not 'qualified as an expert by knowledge, skill, experience, training, or education [to] testify in the form of an opinion or otherwise' under Federal Rule of Evidence 702."); *Runway Safe Group AB v. Earthstone International, LLC*, IPR2019-01490, Paper 49, at 79 (Feb. 17, 2021); *Repro-Med Systems, Inc. v. EMED Technologies Corporation*, IPR2015-01920, Paper 65, at 87 (Jan. 12, 2017).

Third, even if the Board adopts PO's POSITA level and considers its arguments not waived, these arguments should be rejected because Dr. Hesselink clearly does have at least 2 years of experience with diffusive light micro-optic security features. EX1003, ¶¶5-9 (e.g., describing experience with optics and displays for security, founding three high-technology companies, working on repairing the Hubble Space Telescope). PO simply lists other experiences (*see* POR, 11-12), but never cross-examined Dr. Hesselink about his experience with diffusive light micro-optic security features. *See Apple Inc. v. Zipit Wireless, Inc.*, IPR2021-01130, Paper 30, at 41 (Dec. 20, 2022) (noting that "Patent Owner did not depose [Petitioner's expert]

or ask him about his [relevant] experience” in rejecting its motion to exclude Petitioners’ expert as not skilled in the art).

*Fourth*, even if the Board adopts PO’s POSITA definition and considers its arguments not waived, and does not find Dr. Hesselink to satisfy PO’s definition, his testimony should still be given weight because experts in IPR proceedings are “not required to have the exact experience in [the] adopted definition of the level of ordinary skill.” *Varian Medical Systems, Inc. v. Best Medical International, Inc.*, IPR2020-00072, Paper 71, at 21 (April 23, 2021); USPTO, Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019), *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated> (“TPG”), p. 34 (“There is ... no requirement of a perfect match between the expert’s experience and the relevant field.”).

## V. CONCLUSION

The Board should find all challenged claims unpatentable.

Dated: May 15, 2025

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**CERTIFICATE OF COMPLIANCE**

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that foregoing  
**Petitioners' Reply to Patent Owner's Response**, exclusive of the parts exempted  
as provided in 37 C.F.R. §42.24(c), contains 5,586 words and therefore complies  
with the type-volume limitations of 37 C.F.R. §42.24(a).

Dated: May 15, 2025

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**CERTIFICATE OF SERVICE**

The undersigned certifies that on May 15, 2025, a true and correct copy of the foregoing **Petitioners' Reply to Patent Owner's Response** was served by electronic mail on Patent Owner's counsel of record listed below, pursuant to its Mandatory Notices.

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