

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GIESECKE+DEVRIENT GMBH, GIESECKE+DEVRIENT CURRENCY
TECHNOLOGY GMBH, AND PAPIERFABRIK LOUISENTHAL GMBH,
Petitioners,
v.
LUMENCO, LLC,
Patent Owner

**PATENT OWNER'S PRELIMINARY RESPONSE TO THE PETITION
FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 10,901,191**

Filed on behalf of Patent Owner by:

C. Matthew Rozier (Reg. No. 63,429)
Kristin Whidby (Reg. No. 71,026)
1500 K Street, 2nd Floor
Washington, DC 20005
Email: matt@rhmttrial.com
Email: kristin@rhmttrial.com

ROZIER HARDT McDONOUGH PLLC

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EXHIBIT LIST

Exhibit	Description
2001.	January 21, 2021 Letter
2002.	Voxel Definition from Scientific Volume Imaging B.V. (Copyright 1992-2024)
2003.	“Chapter XXXIII - 3-D Visualization on Mobile Devices” Sanna and Lamberti, <i>from</i> Handbook of Research on User Interface Design and Evaluation for Mobile Technology, 3-D Visualization on Mobile Devices, 2008, DOI: 10.4018/978/1/59904-871-0.ch033

I. INTRODUCTION

Lumenco, LLC (“Lumenco” or “Patent Owner”) respectfully submits this Preliminary Response (the “Response”) to the Petition for *Inter Partes Review* No. IPR2024-00836 (Paper 1) (the “Petition” or “Pet.”) of U.S. Patent No. 10,901,191 (the “’191 patent”) filed by Giesecke+Devrient GmbH, Giesecke+Devrient Currency Technology GmbH, and Papierfabrik Louisenthal GmbH (collectively, “G+D” or “Petitioner”).

Institution should be denied because the Petition fails to demonstrate a reasonable likelihood that any claim of the ’191 patent is unpatentable at least because none of the references cited by Petitioner disclose or suggest the use of a micro mirror array to create “voxels” or “point sources of light,” both of which are required by every challenged claim of the ’191 patent.

II. FACTUAL BACKGROUND

Patent Owner Lumenco is a Colorado-based research and development company founded in 2012. Lumenco’s business focuses on micro-optic, micro mirror, lighting, and screen technologies. Over the past decade, Lumenco has provided a broad range of optical security products to governments and private companies around the world. For example, in 2015 Lumenco entered into a development agreement with the United States Bureau of Engraving and Printing. The collaboration lasted five years and involved micro-optical technologies for use

on banknotes, which allowed the United States to test in its currency one of the most advanced micro-optic arrays available.

Lumenco's patented micro mirror technologies have a wide array of applications across diverse markets and industries including banknote security, brand protection, lighting and screen technologies, and solar technologies, among others. In early 2017, Lumenco introduced its proprietary Dycyfer™ banknote security technology and its micro mirror patent portfolio to Petitioner. During Lumenco's discussions with Petitioner, Petitioner requested information and a demonstration of those technologies, which Lumenco provided, but ultimately, Petitioner informed Lumenco that they were not interested in pursuing a license or partnership. Approximately one year later, Petitioner announced that it would be offering a new line of micro mirror optical security products. Those new products, marketed under the brand name Galaxy®, infringed and continue to infringe Lumenco's United States patents, including the '191 patent.

On January 21, 2021, Lumenco sent Petitioner a letter notifying Petitioner of its infringement of the '191 patent. *See Exhibit 2001*. The infringement did not cease. Patent Owner eventually learned that Petitioner was importing infringing products into the United States and selling those products in the United States. In 2023, Patent Owner initiated patent infringement litigation against Petitioner. For jurisdictional reasons, Petitioner dismissed its original U.S. District Court complaint

and brought a new suit in the United States Court of Federal Claims (the “USCFC”).

In the USCFC complaint, Lumenco alleges that Petitioner imports and sells security threads and security patch technologies that infringe the ’191 patent.

III. STATEMENT OF THE PRECISE RELIEF REQUESTED

Patent Owner requests that the Board deny institution of the Petition with respect to all challenged claims and all asserted grounds. A full statement of the reasons for the relief requested is set forth in Section IV of this Response.

IV. THE PETITION SHOULD BE DENIED BECAUSE IT DOES NOT ESTABLISH A REASONABLE LIKELIHOOD OF SUCCESS ON ANY CHALLENGED CLAIM.

As detailed below, the Petition fails to demonstrate a reasonable likelihood that the Petitioner would prevail with respect to any claim of the ’191 patent. The Petition challenges independent claims 1 and 6 and dependent claims 2-5 and 7-11 through eight different §103 grounds, with further modifications based on the alleged knowledge of a POSITA. But the references and combinations thereof fail to disclose key limitations of each challenged claim and, therefore, the Board should deny institution of the Petition.

A. THE ’191 PATENT

The ’191 patent is directed towards sophisticated and robust optical security features using micro mirrors that generate multiplanar images (*i.e.*, the images appear to have optical depth) that are visible without specialized glasses or lighting and without the use of holographic imagery. **Exhibit 1001** [’191 patent], 1:19-26;

2:6-34; 2:64-3:13. This results in security features for banknotes and brand authentication that are practically, if not literally, impossible to replicate and that are substantially better than any prior existing technologies. *Id.*

The '191 patent describes a special technique that enables images to be “written” into one or more spatial planes using a micro mirror array. *Id.*, 2:38-63. The images appear above and below the plane of the security element on which the micro mirrors are located. *Id.* The generated images consist of several pixels. *Id.* A pixel is created by several micro mirrors directing the light to a specific point. *Id.*, 3:14-4:7. The micro mirrors that generate a pixel are referred to as a “set.” *Id.*, 5:14-6:15.

A method of generating pixels by means of multiple micro mirrors is graphically illustrated in Figure 4 of the '191 patent. *Id.*, 8:61-9:23. In the example of Figure 4, the micro mirrors are located at the bottom of the security element. *Id.* As shown below, the light reflected by the mirrors is represented approximately by the arrows (423). *Id.* At their intersections, the reflected light creates the pixels (422) above the plane (420) of the security element. *Id.* Figure 4 also shows another plane (430) on which reflected light represented by the arrows (433) generates pixels (432). *Id.*

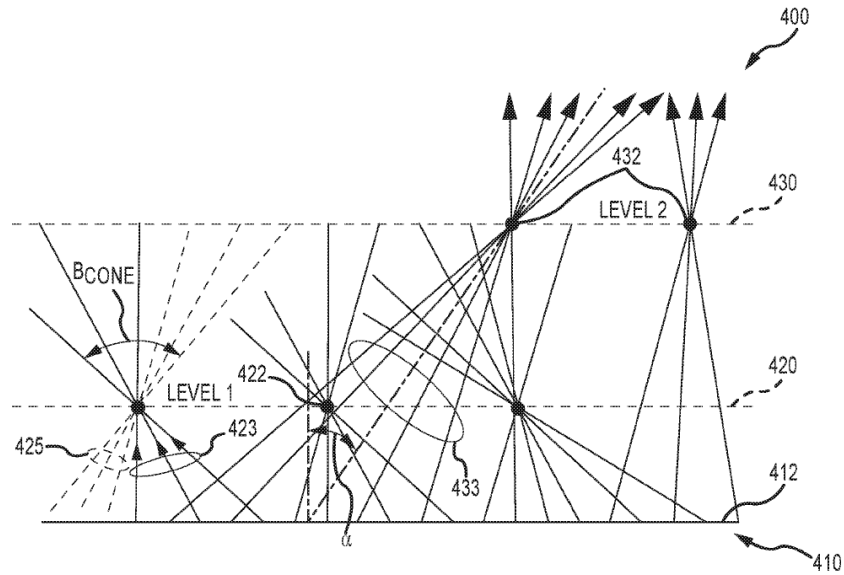


FIG. 4

Figure 2 of the '191 patent (reproduced below) shows an example of images generated by means of these pixels from a different perspective:

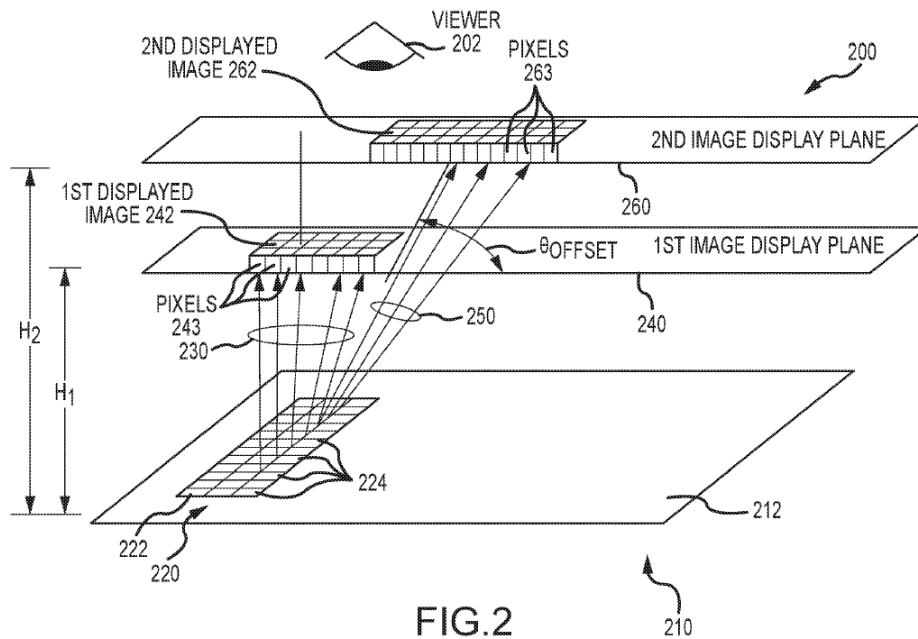


FIG. 2

See also Exhibit 1001, 7:28-8:24. Figure 2 of the '191 patent also shows an example of multiple micro mirrors (224) and two images, first displayed image 242 on plane

(240) and second displayed image 262 on plane (260) above the plane of the substrate (212) on which the micro mirrors are mounted. *Id.* The images consist of several pixels (243 and 263). *Id.*

B. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (a “POSITA”) in the relevant field, as of the date of alleged invention of the ’191 patent, would have had an undergraduate degree in electrical engineering, mechanical engineering, physics, or a similar field and at least 2 years of experience in micro-optic based security features..

C. CLAIM CONSTRUCTION

Patent Owner agrees that the terms do not require construction for purposes of evaluating the Petition.

D. GROUND 1 – FUHSE262 DOES NOT RENDER OBVIOUS CLAIMS 1 AND 6

Fuhse262 does not render obvious claims 1 and 6 at least because Fuhse262 does not teach or suggest every limitation of those claims.

1. Independent Claim 1

Fuhse262 does not render obvious claim 1, at least because it does not teach or suggest claim elements [1b.5] and [1b.6].

- i. [1b.5] “wherein a voxel is created at each of the point on the plane via intersection of two or more beams of the reflected ambient light, and”*

Fuhse262 fails to teach or suggest limitation [1b.5] at least because Fuhse262

fails to teach or suggest creating a “voxel . . . via the intersection of two or more beams of the reflected ambient light,” as required by element [1b.5].

A POSITA would have understood that a voxel is a type, or subspecies, of a pixel. Specifically, a voxel is a 3-dimensional pixel. Generally, “voxel” means “volume pixel” and “represents a quantity of 3-D data just as a pixel represents a point or a cluster of points in 2-D data.” **Exhibit 2002**, p. 1 (“Voxel is short for volume pixel, the smallest distinguishable box-shaped part of a 3D image. It is the 3D equivalent of the 2D pixel”); **Exhibit 2003**, p. 575 (description of “voxel”). Thus, Patent Owner agrees with the assertion of Petitioner and Dr. Hesselink that “[a] POSITA would understand[that] ‘voxels’ have a volume.” Petition, p. 33.

Fuhse262 does not disclose voxels and does not teach or suggest the creation of pixels with volume. As an initial matter, the Petition does not argue that Fuhse262 expressly discloses voxels. *See generally*, Petition, pp. 32-34. Fuhse262 does not use the term “voxel” and does not mention “pixels with volume” or “3d pixels” or any similar term. *See generally*, Petition, pp. 31-33. Instead, Fuhse262 consistently and unambiguously refers to the creation of “pixels P_j,” which it also refers to as “image *points* P_j.” EX1006, ¶¶ [0036], [0126]-[0128] (emphasis added). Fuhse262 discloses that each pixel or image point P_j is formed at a specific *point* in space, i.e., a specific point defined by its x, y, and x coordinates. *Id.*, ¶¶ [0095]-[0097]; Petition, p. 32.

As best as it can be understood, the Petition appears to argue that Fuhse262 inherently discloses the creation of voxels. Petitioner must “meet a high standard in order to rely on inherency to establish the existence of a claim limitation in the prior art in an obviousness analysis—the limitation at issue necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art.” *Par Pharm., Inc. v. TWi Pharms., Inc.*, 773 F.3d 1186, 1195-1196 (Fed. Cir. 2014). Petitioner fails to meet its burden here because Petitioner has not established that creation of a three-dimensional voxel is the “natural result” of the system of Fuhse262. *Id.* at 1195.

In place of a well-reasoned inherency argument, the Petition and supporting declaration merely present a marked-up version of FIG. 10 of Fuhse262 and then argue that the figure, as modified by Petitioner, allegedly shows voxels. Petition, p. 33; EX1003, ¶ [0178].¹ This falls far short of the substantial evidence that would be needed to show that Fuhse262 would *necessarily* produce voxels of any sort, much less voxels that “produce[] an effect of a point source of light floating above the surface of the substrate,” as required by the remainder of claim 1. *See* ’191 patent, limitation [1b.6]. At best, Petitioner has shown that the micro mirror array of

¹ Dr. Hesselink’s declaration also cites to EX1029, p. 359 in support of Petitioner’s inherency argument. But that page is completely unrelated to the subject matter of the ’191 patent and does not mention mirrors, voxels, or resolution. Instead, the cited page discusses plastic deformation and elastic-stress relations.

Fuhse262 *might*, when implemented in the real world, result in overlapping light beams. Even then, Petitioner does not explain how or why light beams overlapping in an irregular shape would *necessarily* form a voxel for use in displaying an image. A haphazard and unintentional overlapping of random light beams does not magically create an image pixel or voxel, and Petitioner has not presented any evidence to the contrary.

Moreover, if three-dimensional voxels were *necessarily* the result of the Fuhse262 system, then that system would not be able to create the two-dimensional images disclosed by Fuhse262. EX1006, ¶¶ [0026]-[0027], [0117] (discussing creation of two-dimensional images, *i.e.*, images without a volume). If the Fuhse262 system created three-dimensional voxels instead of the two-dimensional pixels or image points expressly disclosed by Fuhse262, all of the images produced by Fuhse262 would also necessarily be three-dimensional because they would have all have a volume. Thus, the teachings of Fuhse262 illustrate that creation of voxels is not the natural result of the Fuhse262 system.

For at least these reasons, Fuhse262 does not teach or suggest the creation of “voxels” “via the intersection of two or more beam of the reflected ambient light,” as required by element [1b.5]. The Petition should therefore be denied.

ii. [1b.6] “wherein each of the created voxels produces an effect of a point source of light floating above the surface of the substrate in the plane.”

Fuhse262 also fails to teach or suggest limitation [1b.6] at least because Fuhse262 does not teach or suggest voxels that “produce an effect of a point source of light,” as required by element [1b.6].

First, as noted above, Fuhse262 does not teach or suggest creating voxels and the Petition does not assert, much less establish, that two-dimensional pixels such as those disclosed by Fuhse262 can function as point sources of light. For that reason alone, Fuhse262 does not teach or suggest element [1b.6].

Second, even if Fuhse262 did teach voxels, it would not teach or suggest voxels that produce the effect of a “point source of light.” As with the previous limitation, Petitioner appears to admit that Fuhse262 does not expressly disclose point sources of light. *See, generally*, Petition, pp. 34-35. The Petition instead argues that it “is evident” that the “voxels” allegedly formed by the system of Fuhse262 would produce an effect of a point source of light. *Id.*, p. 34. In other words, the Petition relies on inherency for element [1b.6] just as it did for element [1b.5]. But this argument fails.

For example, the Petition notes in support of its argument that Fuhse262 discloses a “light-spot image composed of a plurality of light spots.” Petition, p. 34. These light spots, however, are nothing more than the pixels 110 discussed with

respect to the previous limitation. EX1006, ¶¶0068; EX1003, ¶185. The Petition does not explain why a POSITA would understand that the “light spots” of Fuhse262 would necessarily “produce[] an effect of a point source of light,” as required by element [1b.6]. In fact, the only other “evidence” cited in the Petition is a modified version of FIG. 10 of Fuhse262. Petition, pp. 34-35. Petitioner’s manipulated figure conveniently draws in red arrows emanating outward from pixel 110 in FIG. 10 of Fuhse262. *Id.* The Petition then asserts, again without citation, that ***any time*** a pixel is formed at the apex of a cone by mirrors within the base of that cone, that pixel would produce an effect of a point source of light, and then notes that Fuhse262 discloses a cone. *Id.*, p. 35. None of this is explained—it is presented in conclusory fashion—and none of it is supported by Fuhse262.

It is Petitioner’s burden to “specify where each element of the claim is found in the prior art patents or printed publications relied upon.” 37 C.F.R. § 42.104(b)(4)–(5) (2012); *see also Intelligent Bio-Systems, Inc. v. Illumnia Cambridge*, 821 F.3d 1359, 1367 (Fed. Cir. 2016) (“It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify ‘with particularity’ the ‘evidence that supports the grounds for the challenge to each claim.’”) (quoting 35 U.S.C. § 312(a)(3) (2012)). Petitioner has not met that burden here, and the Petition should be denied for that reason alone.

Moreover, a close inspection of the arguments in the Petition reveals that they

rely on improper hindsight bias. They should be rejected for this additional reason. For example, the Petition cites to ¶ [0188] of Dr. Hesselink's declaration in support of its arguments for element [1b.6]. Petition, p. 34. In that paragraph, Dr. Hesselink explains that he is relying on the teachings of the '191 patent to inform his conclusion that Fuhse262 discloses element [1b.6]. EX1003, ¶ [0188]. Dr. Hesselink specifically notes that *the '191 patent* describes an embodiment in which micro mirrors are selected and aimed or targeted in a specific manner so as to create a point source of light. *Id.* From that, Dr. Hesselink concludes that a voxel will always “produce[s] an effect of a point source of light at least when a cone can be described in which the voxel is the cone's apex and the micro mirrors are within the base of the cone.” No explanation is provided and no other supporting evidence is cited. This is a textbook example of improper hindsight bias and should be rejected because Petitioner is improperly attempting to use the invention as a template for its own reconstruction. *W.L. Gore & Assoc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983). The Petition does not assert, much less attempt to demonstrate, that a POSITA without the benefit of the disclosure of the '191 patent would believe that pixel 110 of Fuhse262 would create the effect of a point source of light. The Petition should be rejected for this additional reason.

Even if it were proper to rely on the teachings on the '191 patent to illustrate the knowledge of a POSITA, the Petition does not make a showing that the system

of Fuhse262 discloses the same structure as that disclosed by the specification of the '191 patent. The '191 patent discloses specific methods and structures that are used in particular arrangements in order to create the desired point of light effects. The cited passage of the '191 patent does not, as Petitioner implies, stand for the proposition that *every voxel* formed by mirrors in the base of a cone will produce an effect of a point source of light. '191 patent, 6:7-14. Instead, the cited passage states that the micro mirror-based visual assemblies disclosed and described *in the '191 patent's specification* would achieve that result. *Id.*, 5:14-6:14. Neither the Petition nor Dr. Hesselink's declaration demonstrate that the micro mirror assembly of Fuhse262 shares the same structural configuration or functionality of the embodiments described in the '191 patent's specification. The Petition should also be rejected for this reason.

For at least these reasons, Fuhse925 does not teach or suggest element [1b.6].

2. Independent Claim 6

As noted by the Petition, independent claim 6 is similar to independent claim 1. Petition, p. 35. As relevant to this response, element [6b.5] contains all the limitations recited in element [1b.5]. *Id.*, p. 40 (relying on arguments for element [1b.5]). And element [6b.6] recites limitations similar to those recited in element [1b.6]. *Id.*, p. 41 (relying on arguments for element [1b.6]). As discussed above in

Section IV(D)(1), Fuhse262 does not teach or suggest limitations [1b.5] or [1b.6]. For the same reasons, Fuhse262 does not teach or suggest limitations [6b.5] or [6b.6].

E. GROUND 2 – THE COMBINATION OF FUHSE262 AND FUHSE925 DOES NOT RENDER OBVIOUS CLAIMS 1 AND 6

The combination of Fuhse262 and Fuhse925 (the “Ground 2 References”) does not render obvious claims 1 and 6. The only difference between Ground 1 and Ground 2 is the addition of Fuhse925. Fuhse925 is applied in Ground 2 only to limitations [1Pre], [6Pre], [1b.3], and [6b.3]. Petition, pp. 41-48. Fuhse925 does not remedy the deficiencies of Fuhse262 as to limitations [1b.5], [1b.6], [6b.5], and [6b.6], and the Petition does not so assert. Claims 1 and 6 are therefore valid for at least the same reasons as those detailed with respect to Ground 1.

F. GROUND 3: CLAIMS 2-4, 7-11 ARE NOT RENDERED OBVIOUS UNDER 35 U.S.C. §103 BY FUHSE262 (GROUND 1) IN VIEW OF FUHSE395

Claims 2-4 depend from and add limitations to claim 1. Claims 7-11 depend from and add limitations to claim 6. As noted above, Fuhse262 does not teach or suggest the limitations of claims 1 and 6, and therefore do not render obvious claims 1 and 6. Fuhse395 does not remedy the deficiencies of Fuhse262, and the Petition does not so assert. *See* Petition, pp. 48-47.

For at least that reason, the combination of Fuhse262 and Fuhse395 does not render obvious claims 2-4 and 7-11.

G. GROUND 4: CLAIMS 2-4 AND 7-11 ARE NOT RENDERED OBVIOUS BY FUHSE262 IN VIEW OF SAUVAGE-VINCENT

Claims 2-4 depend from and add limitations to claim 1. Claims 7-11 depend from and add limitations to claim 6. As noted above, Fuhse262 does not teach or suggest the limitations of claims 1 and 6, and therefore do not render obvious claims 1 and 6. Sauvage-Vincent does not remedy the deficiencies of Fuhse262, and the Petition does not so assert. *See* Petition, pp. 57-65. For at least that reason, the combination of Fuhse262 and Sauvage-Vincent does not render obvious claims 2-4 and 7-11.

H. GROUND 5: CLAIMS 5 AND 12 ARE NOT RENDERED OBVIOUS BY FUHSE262 IN VIEW OF MORFORD

Claim 5 depends from and add limitations to claim 1. Claim 12 depends from and add limitations to claim 6. As noted above, Fuhse262 does not teach or suggest the limitations of claims 1 and 6, and therefore does not render obvious claims 1 and 6. Morford does not remedy the deficiencies of Fuhse262, and the Petition does not so assert. *See* Petition, pp. 65-68. For at least that reason, the combination of Fuhse262 and Morford does not render obvious claims 5 and 12.

I. GROUND 6: CLAIMS 2-4, 7-11 ARE NOT RENDERED OBVIOUS UNDER 35 U.S.C. §103 BY FUHSE262 IN VIEW OF FUHSE925 (GROUND 2) AND FURTHER IN VIEW OF FUHSE395 (GROUND 3)

Claims 2-4 depend from and add limitations to claim 1. Claims 7-11 depend from and add limitations to claim 6. As noted above, Fuhse262 and Fuhse925, taken alone or in combination, do not teach or suggest the limitations of claims 1 and 6,

and therefore do not render obvious claims 1 and 6. Fuhse395 does not remedy the deficiencies of Fuhse262 and Fuhse295, and the Petition does not so assert. *See* Petition, pp. 68-69. For at least that reason, the combination of Fuhse262, Fuhse925, and Fuhse395 does not render obvious claims 2-4 and 7-11.

J. GROUND 7: CLAIMS 2-4, 7-11 ARE NOT RENDERED OBVIOUS UNDER 35 U.S.C. §103 BY FUHSE262 IN VIEW OF FUHSE925 (GROUND 2) AND FURTHER IN VIEW OF SAUVAGE-VINCENT (GROUND 4)

Claims 2-4 depend from and add limitations to claim 1. Claims 7-11 depend from and add limitations to claim 6. As noted above, Fuhse262 and Fuhse925, taken alone or in combination, do not teach or suggest the limitations of claims 1 and 6, and therefore do not render obvious claims 1 and 6. Sauvage-Vincent does not remedy the deficiencies of Fuhse262 and Fuhse295, and the Petition does not so assert. *See* Petition, p. 69. For at least that reason, the combination of Fuhse262, Fuhse925, and Sauvage-Vincent does not render obvious claims 2-4 and 7-11.

K. GROUND 8: CLAIMS 5 AND 12 ARE NOT RENDERED OBVIOUS UNDER 35 U.S.C. §103 BY FUHSE262 IN VIEW OF FUHSE925 (GROUND 2) AND FURTHER IN VIEW OF MORFORD (GROUND 5)

Claim 5 depends from and add limitations to claim 1. Claim 12 depends from and add limitations to claim 6. As noted above, Fuhse262 and Fuhse925, whether taken alone or in combination, do not teach or suggest the limitations of claims 1 and 6, and therefore do not render obvious claims 1 and 6. Morford does not remedy the deficiencies of Fuhse262 and Fuhse925, and the Petition does not so assert. *See*

Petition, p. 70. For at least that reason, the combination of Fuhse262, Fuhse925 and Morford does not render obvious claims 5 and 12.

V. CONCLUSION

For the reasons set forth above, Patent Owner requests that the Board deny institution of the Petition.

DATED: August 29, 2024

Respectfully submitted,

By: /C. Matthew Rozier/
C. Matthew Rozier
Registration No. 63,429
Counsel for Patent Owner

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I hereby certify that the foregoing Patent Owner's Preliminary Response contains 3685 words as measured by the word processing software used to prepare the document, excluding the cover page, signature block, and portions exempted under 37 C.F.R. § 42.24(a) or (b).

DATED: August 29, 2024

Respectfully submitted,

By: /C. Matthew Rozier/
C. Matthew Rozier
Registration No. 63,429
Counsel for Patent Owner

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, the undersigned certifies that August 29, 2024, the foregoing document was served on counsel of record for Petitioners by filing this document through the End-to-End System, as well as *via* electronic mail to counsel of record for Petitioners at the following address:

David M. Tennant (Reg. No. 48,362) davidtennant@paulhastings.com Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1997	Jeremy Rashid (Reg. No. 76,229) jeremyrashid@paulhastings.com Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1776
Jacob Rothenberg (Reg. No. 77,891) jacobrothenberg@paulhastings.com Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1976	Eric E. Lancaster (<i>pro hac vice</i> to be filed) ericlancaster@paulhastings.com Paul Hastings LLP 1117 S. California Avenue, Palo Alto, Palo Alto, CA 94304 Telephone: (650) 320-860

DATED: August 29, 2024

Respectfully submitted,

By: /C. Matthew Rozier/
C. Matthew Rozier
Registration No. 63,429
Counsel for Patent Owner