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Filed on behalf of Giesecke+Devrient GmbH

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

Case No. IPR-2024-00836

**Petition for *Inter Partes* Review of
U.S. Patent No. 10,189,294**

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Ex. 1008	US10639925 (“Fuhse925”)
Ex. 1009	US20140367957 (“Jordan”)
Ex. 1010-1021	RESERVED
Ex. 1022	WO2012048847A1_English (“Fuhse 847”)
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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	Hecht. Optics (4th edn_ 2002)

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Ex. 1028	Saleh and Teich. Fundamentals of Photonics (1st Edition 1991), Ch. 1
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Ex. 1030	Franssila, S. Introduction to Microfabrication (1st ed. 2004)
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Ex. 1049	US Patent Application Publication No. US 2010/0208036

I. INTRODUCTION

Giesecke+Devrient GmbH, Giesecke+Devrient Currency Technology GmbH, and Papierfabrik Louisenthal GmbH (collectively, “Petitioners”) requests review under 35 U.S.C. § 311 and cancellation of claims 1, 6-14, 28 and 32-39 of U.S. Patent No. 10,189,294 (EX1001, “the ’294 Patent”) as unpatentable.

Optically variable devices (“OVDs”) for document anti-counterfeiting were introduced in the 1980s. OVDs are applicable to currency (e.g., banknotes), passports, ID cards, and product labels, as these solutions use optical features to verify authenticity.

OVD technology has advanced rapidly “stay ahead” of rapidly advancing counterfeiting technology. The first commercial OVDs were diffraction-based solutions first implemented on the Australian ten-dollar banknote in January, 1988. By the early 2000s, micromirrors replaced diffraction patterns on currency.

Petitioners already pioneered this micromirror solution well before the ’294 Patent’s earliest possible priority date. Petitioners invented and publicly disclosed the subject matter of the challenged claims years before Patent Owner (“PO”). In particular, Christian Fuhse, the first named inventor of Fuhse262, is the head of the Optical Effects and Data Processing team at Papierfabrik Louisenthal (one of Petitioners). Wittich Kaule, the second named inventor, is a prolific and pioneering inventor with over 100 issued patents worldwide.

Because the claims cover known techniques published years before the earliest priority date, the Board should claim 1, 6-14, 28 and 32-39 as unpatentable.

II. BACKGROUND

By December 2015 (earliest priority date), micromirror arrays for document security already had been known for decades, including the approach pioneered by Petitioners and described herein. EX1003, ¶32.

A. OVDs for Document Anti-Counterfeiting

During the 1990's, diffraction-based OVDs became widespread, adopted on national currencies and other documents. These OVDs generally used 30 x 30 µm or 60 x 60 µm pixel elements with picture information encoded by varying the individual groove angles and/or spacing continuously along the diffraction grooves. EX1003, ¶26.

In the early 2000s, micromirror OVDs replaced diffraction gratings. Micromirror OVD technology advanced rapidly in the period from the early 2000s, with significant efforts from industry, most prominently Petitioners – a preeminent innovator in the field for over 170 years, and governmental organizations, most prominently the Commonwealth Scientific and Industrial Research Organisation (“CSIRO”), an Australian Government agency. EX1003, ¶¶24-29.

B. Micromirror Arrays

Each micromirror in an array is around 25-50 microns and reflects incident light in a certain direction determined by the orientation of the micromirror. The reflected incident light creates an image floating in space from the observer's perspective. EX1003, ¶30.

Banknotes use micromirror OVDs because they are low cost. Through work of Petitioners, micromirror OVD technology advanced rapidly in the period from the early 2000s. EX1003, ¶¶31-32.

III. THE '294 PATENT

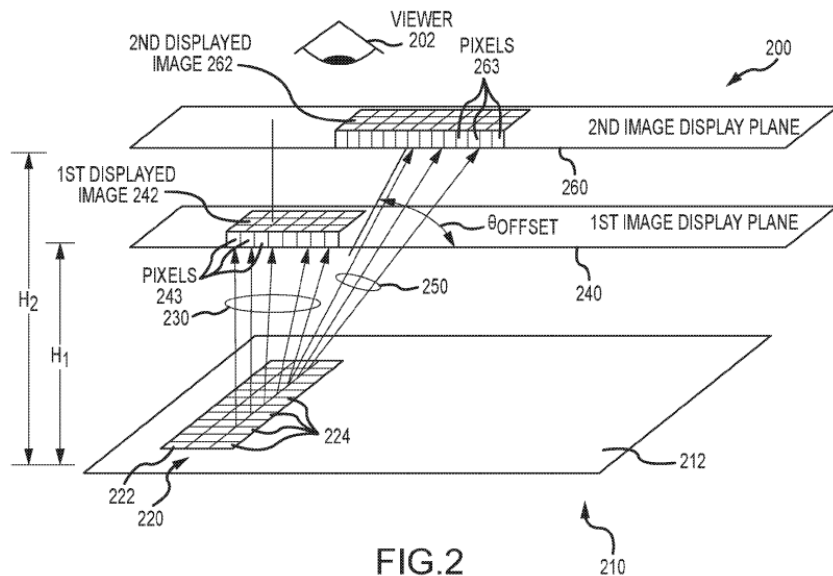
A. Specification

The '294 Patent frames its purported invention as an advancement of currency anti-counterfeiting devices. EX1001, 1:25-2:29. Instead of “merely laterally reflecting back light...or using reproducible holograms,” the purported invention of the '294 Patent displays “images that float above and/or below a focal plane.” EX1001, 2:23-29; EX1003, ¶¶50-55.

The '294 Patent describes a security element for banknotes, which generates images with light in “spatial planes above and below the surface of an array of micro mirrors.” EX1001, 2:33-36, 3:9-14; EX1003, ¶56.

The '294 Patent groups the micromirrors, with the micromirrors of each set oriented to reflect ambient light towards a point corresponding to a “pixel.” EX1001,

2:33-47. Numerous pixels together form an image in an “image display plane,” and multiple images may be produced in different image display planes. *Id.* Figure 2 depicts “floating image(s)” at “a height or distance above...the array of micro mirrors.” EX1001, 5:10-6:9 EX1003, ¶53-55.



The angle at which one image (such as image 242) is viewed may be offset from the angle at which another image (such as image 262) is viewed by a viewing angle offset, such the viewer 202 typically only views one of the floating images 242, 262 at a time. EX1001, 8:2-6; EX1003, ¶55.

B. Prosecution History

The '294 Patent was filed on May 23, 2016, as U.S. Patent Application No. 15/162,113, claiming priority to 62/262,767, (EX1004) filed on Dec. 3, 2015.

The Examiner rejected the claims twice as indefinite and anticipated by

US2005/0057812 (“Raber”) (Ex. 1038). EX1002, pp. 353-75, 430-55¹. Both times in response, the applicant amended and argued that Raber disclosed “very different technologies” because it was variable focus for use in electronics requiring rapidly changing the image over time. EX1002, pp. 400-26, 505-30. The Examiner additionally rejected the claims in view of Pub. No. 2010/0208036 (“Kaule”) (EX1049), and the applicant amended some claims and argued that instead of micromirrors, Kaule provides lenses that focus light on layers on ink to make them more visible to the user (*id.*, pp. 540, 548-55). EX1003, ¶¶60-64.

In allowing the claims, the Examiner stated, “the prior art fails to teach or reasonably suggest” the claim language corresponding to the portion of element [1.b3] starting with “a body,” and all of elements [1.b4], [1.b5], and [1.b6] (and corresponding limitations of claim 28), and elements [35.b3] (beginning with “surface”), [35.b4], [35.b7], and [35.b8]. *Id.*, 713-16; EX1003, ¶66.

However, the Examiner apparently overlooked the importance of Fuhse262 including a combination of its embodiments, as it was not applied during prosecution, and which discloses the purported distinguishing features during

¹ Petitioner cites to the stamped number on the exhibit for the file history only. Other cites herein are to the document number.

prosecution. Further, the Examiner did not have the benefit of Fuhse925, Jordan, and Fuhse172.

IV. STATEMENT OF RELIEF REQUESTED

A. Grounds

No.	Claims Challenged	Grounds
1	1, 6-13, 28, 32, 33, and 35-38	Fuhse262 (embodiment of Fig. 2) in view of Fuhse262 (embodiment of Figs. 8-10)
2	1, 6-13, 28, 32, 33, and 35-38	Fuhse262 (Ground 1) in view of Fuhse925
3	1, 6-13, 28, 32-33, and 35-38	Fuhse262 (Ground 1) in view of Jordan
4	1, 6-13, 28, 32-33, and 35-38	Fuhse262 and Fuhse925 (Ground 2) in view of Jordan
5 - 8	14, 34, 39	Grounds 1, 2, 3, or 4 in view of Fuhse172

B. Priority Date

The earliest application to which the '294 Patent claims priority is US 62/262,767, filed December 3, 2015, which is the earliest possible priority date. Petitioners do not concede that the claims are entitled to that priority date. EX1003, ¶49.

C. The References Are Prior Art

All references relied on in the Grounds are prior art under 35 U.S.C. §102(a)(1) or §102(a)(2):

- (1) German Patent Application Publication No. 102010048262A1² (Fuhse262), published April 12, 2012 (EX1006³);
- (2) U.S. Patent 10,639,925 (“Fuhse925”) with priority to an application filed on May 8, 2015 (EX1008);
- (3) U.S. Pub. 2014/0367957 (“Jordan”) filed June 13, 2014, published December 18, 2014 (EX1009); and
- (4) U.S. Pub. 2013/0093172 (“Fuhse172”) filed June 19, 2012 with priority to December 4, 2009, and published on April 18, 2013 (EX1035).

D. Prior Art

1. Fuhse262 (EX1006)

Fuhse262 discloses a security element created from an reflective micromirrors array that reflect light to “light spots” or “pixels,” which together form two- or three-dimensional images (“light-spot images”) that appear to “float” at “floating heights

² PCT Publication No. WO 2012/048847 (Fuhse847), published on April 19, 2012 with priority to October 12, 2010, claims priority to Fuhse262. EX1041 is a verified, official translation of the native language Fuhse847 Native at EX1040. See EX1043 (certificate of translation).

³ EX1006 is a verified, official translation of the native language Fuhse262 at EX1005. See EX1007 (certificate of translation).

above or below” the substrate surface. EX1006, ¶¶0013-15. The images can be “visible from the same or different viewing angles.” EX1006, ¶0118; EX1003, ¶¶78-79.

In one embodiment, Figure 2 shows concave mirrors 24 that reflect light from distant light source 34 to “produce the specified image points as light spots 32.” EX1006, ¶¶0056-57; EX1003, ¶¶82-83.

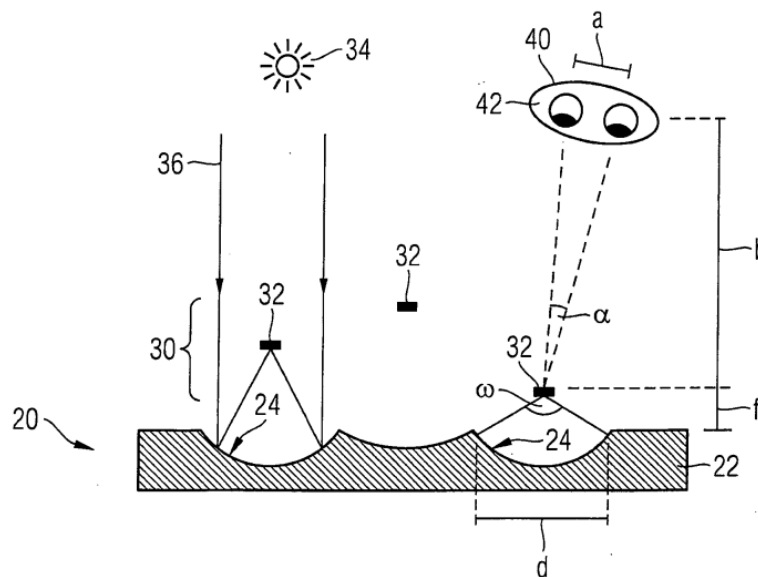
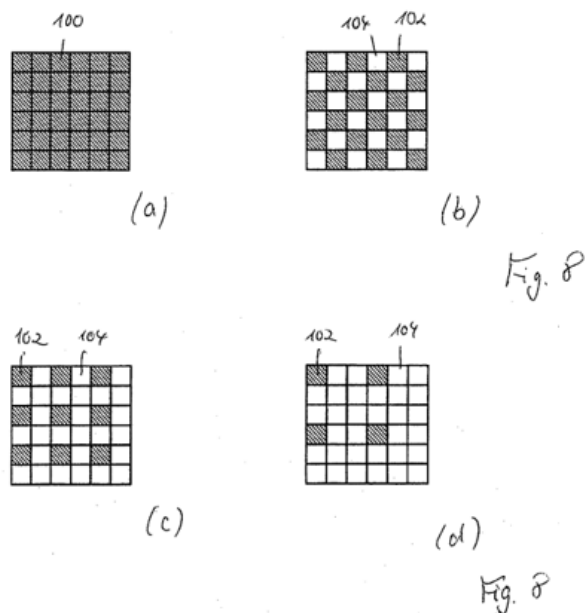


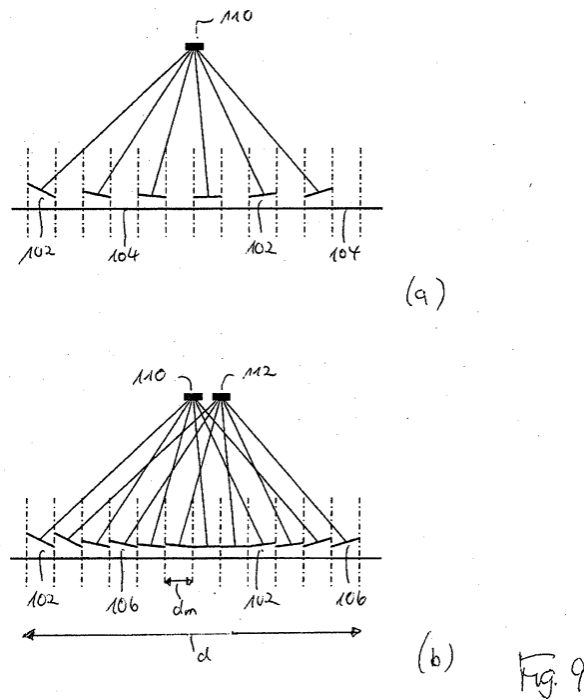
Fig. 2

In another embodiment with respect to Figures 8-10, Fuhse262 replaces the “curved concave mirror” of Figure 2 with a flat micromirrors array in order to obtain “higher resolution” images, and because “flat surfaces are easier to calculate and produce.” EX1006, ¶¶, 0048, 0083, 0086. Figures 8(a)-8(d) show micromirror array examples.



EX1006, ¶¶0087-90; EX1003, ¶¶84-85.

The micromirrors array are “n x n micromirrors” that each have “a flat mirror surface” with a “dimension of 50 μm x 50 μm .” EX1006, ¶0087. Further, the micromirrors may be “assigned to every light spot of the light-spot image,” as shown in Figure 9:



EX1006, ¶¶0019; EX1003, ¶86.

The images may be 3D, including any 2D image “that floats at a certain height above or below the substrate surface.” EX1006, ¶¶0068, 0054-56; EX1003, ¶91.

Fuhse262 discloses how to produce its images, by defining the image points for the image, and defining a cone for each image point such that a “sphere of influence” is defined on the substrate plane for assigning micromirrors to that image point. EX1006, ¶¶0036, 0125-31. Fuhse262’s Figure 10 and associated descriptions further teach how to orient each micromirror in the array such that it reflects light to its assigned light spot. EX1006, ¶0096-99; EX1003, ¶¶90-91.

Fuhse262 discloses different images viewed at different angles (*see* ¶¶0111-15) and describes a “preferred procedure” to produce the structures of these combined teachings. EX1006, ¶¶0125-28, 0036; EX1003, ¶93.

In the combined teachings of FIG. 2 and FIGs. 8-10, Fuhse262 teaches a substrate and ambient light source (as described in FIG. 2), as well as arrays of micro-mirrors that include assignments of sets of micromirrors to light spots that form light spot images. EX1003, ¶94.

2. Fuhse925 (EX1008)

Fuhse925 relates to an optical security element that shows different images (such as characters, numbers or shapes, referred to as curves in the patent) at different viewing/tilt angles, that “float alternatingly a few millimeters above or below the plane of the security thread.” EX1008, Abstract, 6:67-7:1; EX1003, ¶95.

These images are created using an array of micro mirrors orientated at different inclination angles on a substrate. EX1008, Abstract, 6:67-7:1; EX1003, ¶96..

3. Jordan (EX1009)

Jordan teaches methods of using arrays of reflective microstructures that produce images “as a security and anti-counterfeiting feature to identify and distinguish authentic products from counterfeit products,” such as “banknotes” or “coinage,” as well as “product marking and labeling” and “packaging.” EX1009, Abstract, ¶¶0013, 0002-04, 0113-14, 0124-25, 0154, 0159, 0174-77; EX1003, ¶97.

4. Fuhse172 (EX1035)

Fuhse172 discloses that in order “to apply a color-shifting coating, in particular a thin-film system, to the facets,” the thin-film system can use dielectric layers. EX1035, ¶¶0118, 0027-29; EX1003, ¶¶98-99.

E. The Prior Art is Analogous Art

Prior art is analogous if it is from the same field of endeavor, regardless of the problem addressed, or it is reasonably pertinent to the particular problem with which the inventor is involved. *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1000 (Fed. Cir. 2016). Petitioners’ references are analogous because they are from the same field as the ’294 Patent, *e.g.*, optical devices for document security. EX1001, Abstract, 1:15-23. They are also pertinent to a problem the inventor was focused on, *e.g.*, displaying images with document security devices. EX1001, 2:15-29; EX1003, ¶¶50-58, 228, 247, 298.

V. LEVEL OF ORDINARY SKILL

Based on the relevant factors, *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995), a person of ordinary skill in the art (“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. EX1003, ¶¶68-74.

VI. CLAIM CONSTRUCTION

PO has sued Petitioners for infringement of the '294 Patent. *See, supra*, 0. Although the parties may propose constructions for certain terms, no claim terms require express construction to resolve the challenges here.⁴

VII. GROUNDS OF UNPATENTABILITY

A. Ground 1: Claims 1, 6-13, 28, 32, 33, and 35-38 are rendered obvious under 35 U.S.C. §103 by Fuhse262.

1. Motivation to Combine

Fuhse262 discloses “a depiction” element invention. EX1006, ¶¶0001, 0010-11, Abstract. Particularly, the Petition relies on a combination of Fuhse262 Figures 1-2, 8(a)-(d), and 9-10 and accompanying disclosures. EX1003, ¶¶101-102.

It would have been obvious to a POSITA to combine the multiple embodiments. EX1003, ¶102. It is well-established that “[c]ombining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness.” *Boston Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009).

⁴ In district court, the parties may dispute whether some claims are invalid under 35 U.S.C. § 112. For this proceeding only, Petitioners assumes the claims are not invalid under § 112.

Fuhse262 provides express motivation to combine the features of its embodiments, and a POSITA would have been motivated to use micromirrors in lieu of concave mirrors, for benefits such as higher resolution and easier production. EX1003, ¶¶103-104.

Figure 2 shows various aspects and elements “[t]o explain the principle of the invention.” EX1006, ¶¶0056-60. Figures 8(a)-(d) build on Figure 2 by replacing the “curved concave mirror” of Figure 2 “with micro-mirrors.” EX1006, ¶0048. Fuhse262 explicitly refers back to the “previous exemplary embodiments” in building on those teachings. EX1006, ¶0083, 0087. Also, Figures 8(a)-8(d) show different variations of the same teachings. EX1003, ¶¶103-104.

Fuhse262 provides explicit motivation to replace the curved mirrors of Figure 2 with micromirrors, including that “higher resolution” is obtained and that “flat surfaces are easier to calculate and produce.” EX1006, ¶¶0083, 0086; EX1003, ¶104.

Likewise, Figure 9 builds on the teachings of Figures 8(a)-8(d) by illustrating them “in a sectional view” and providing further explanation. EX1006, ¶¶0091-94, 0049. Finally, Figure 10 builds on the teachings of Figures 8(a)-8(d) and 9 by describing how to calculate and orient the surfaces of the micromirrors. EX1006, ¶¶0095-101, 0050 (“Fig. 10 illustrates the calculation of the flat mirror surfaces of

the micro-mirrors of Figs. 8 and 9”). Fuhse262 also describes a “further development of the invention” regarding providing different images to the viewer when viewed at different angles (*see* ¶¶0111-15), and describes a “preferred procedure” to produce the structures of these combined teachings. EX1006, ¶¶0125-28, 0036; EX1003, ¶105.

2. Reasonable Expectation of Success

A POSITA would have had a reasonable expectation of success combining the embodiments of Fuhse262.

As a POSITA would have recognized, the teachings of Fuhse262 relied on in this Ground represent different aspects of the invention that all operate on the same principle, and work to disclose different aspects that rely on the same principles. The aspects of the Figure 2 descriptions relied on – such as the substrate and ambient light (*see* I.A.3.b ([1a]) and I.A.3.c ([1b.1])) – would operate on the same principles, serve the same purpose, and maintain the same relevant characteristics when applied to the micromirrors of Figure 8-10. Fuhse262 teaches to “replace[]” the curved mirrors of Figure 2 with the micromirrors 100 (*see* EX1006, ¶¶0083-86), and a POSITA would have reasonably been able to adapt those teachings regarding Figure 2 to micromirrors. EX1003, ¶107.

Likewise, the different specific implementations, such as possible arrays sizes of 100 micromirrors (*see* ¶0087) or 288 micromirrors (*see* ¶¶0090-92), would have been routinely and predictably implemented by a POSITA. EX1003, ¶108.

The predictable nature of the combination is confirmed by evidence showing that the operation of micromirror arrays—and their application to security elements—was well-understood at the time of the alleged priority date. Given that micromirror arrays of the type contemplated in the '294 Patent were textbook knowledge at the time of the alleged invention, a POSITA would have no difficulty combining embodiments of Fuhse262. EX1003, ¶¶109.

Thus, a POSITA would have been able to implement the obviousness modifications in this ground without difficulty. EX1003, ¶¶110.

3. Claim 1

a. [1Pre] “A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:”

The preamble is not limiting. The preamble merely states what the invention is “useful as” (*see* EX1003, ¶113), and preambles that “only to state a purpose or intended use for the invention” are not limiting. *Catalina Mktg. Int’l, Inc. v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (quoting *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997)) (“where a patentee...uses the preamble only to state a purpose or intended use for the invention” is not limiting).

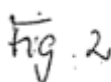
Further, no preamble term provides antecedent basis to terms in the claim body, so the preamble does not contribute to the structural completeness of the claim body. EX1003, ¶114.

To the extent it is limiting, Fuhse262 teaches the preamble. Fuhse262’s invention relates to “a depiction element” (**[a] visual display assembly**) “[f]or security applications” and with “an attractive visual appearance.” EX1006, ¶¶0008-12. The depiction element is **useful as a security element** for a “data carrier” and “[t]he data carrier can in particular be a value document,” such as a “paper banknote” (**paper... currency**). EX1006, ¶0037, FIG. 1. A POSITA would understand that “data carriers” includes **coin currency** and **product labels**. EX1003, ¶¶116-120.

Accordingly, Fuhse262 renders obvious [1Pre]. EX1003, ¶¶113-120

b. [1a] “a substrate; and”

Fuhse262 teaches [1a]. EX1006, Abstract, ¶¶0001, 0010, 0035, 0056-65, 0110; EX1003, ¶101. Fuhse262 discloses “**a substrate 22**” shown below annotated in blue. *Id.*

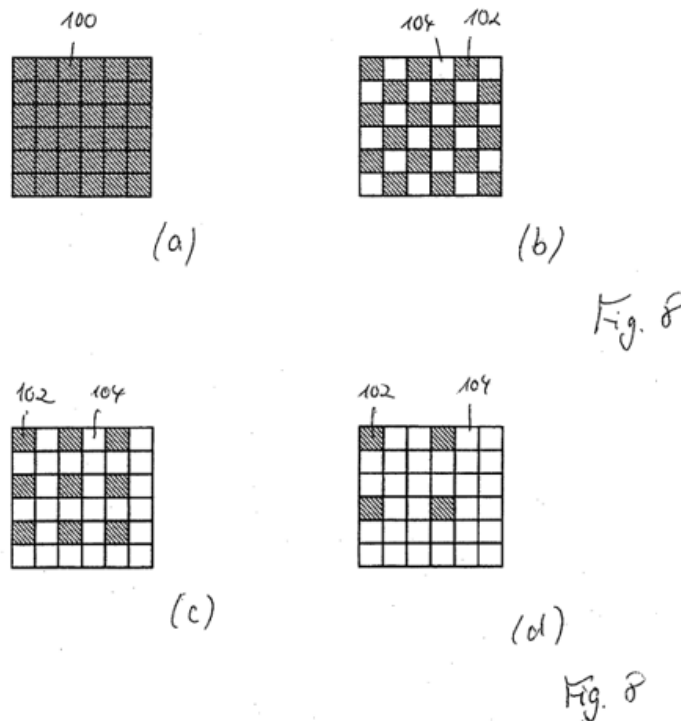


Accordingly, Fuhse262 renders obvious [1.a]. EX1003, ¶¶121-124.

c. [1b.1] “on a surface of the substrate, an array of micro mirrors receiving ambient light and,”

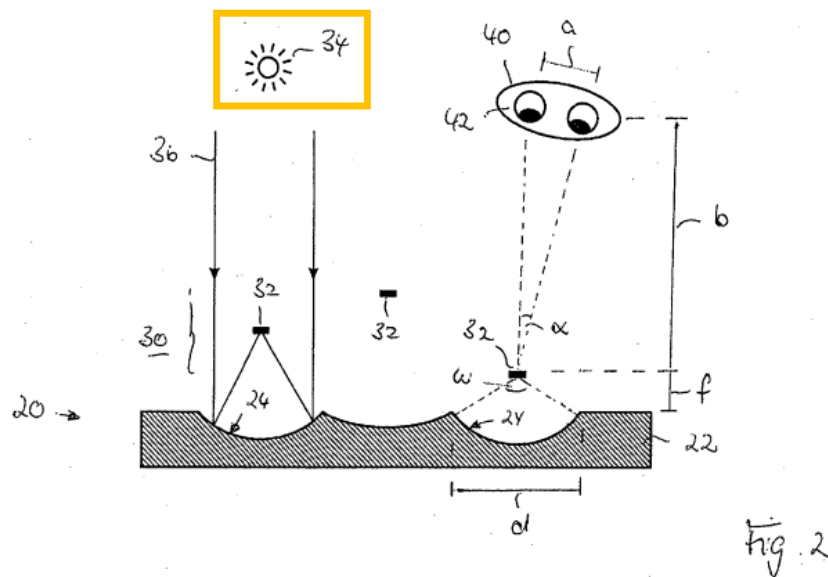
Fuhse262 teaches [1b.1]. Fuhse262's substrate has "a surface region" (**on a surface of the substrate**) "in which a plurality of optical elements are arranged." See EX1006, Abstract, ¶¶0010, 0001, 0035, 0056-65, 0110. The optical elements may be "plurality of micromirrors" (**an array of micro mirrors**) "distributed over a certain surface region of substrate 22" (**on a surface of the substrate**). EX1006, ¶¶0060, 0013, 0022, 0030, 0083, 0087-95. The surface of the substrate defines a "xy plane" or "substrate plane." EX1006, ¶¶0126-27, 0110; EX1003, ¶¶125-127.

Figure 8, including Figures 8(a)-8(d), and supporting disclosure provides further detail of the **array of micro mirrors** as “an arrangement of $n \times n$ micromirrors 100, arranged next to one another without any distance between them.” EX1006, ¶¶0060, 0013, 0022, 0030, 0083, 0087-95. Specifically, the curved mirrors of Figure 2 are “replaced by” the plurality of micromirrors 100 because they are “easier to calculate and produce.” EX1006, ¶¶0083-86; EX1003, ¶128.



A POSITA would have understood that this ordered arrangement of micromirrors 100 is **an array**. The micromirrors shown in Figure 8 **receiv[e] ambient light** because they are “illuminated” in the same manner as the lenses and mirrors

disclosed in Fuhse262. EX1006, ¶¶0082-83, 0091. Fuhse262 discloses that the illumination is with **ambient light** such as “sunlight or a ceiling lamp.” EX1006, ¶0054. For example, Fuhse262 discloses illumination by “distant light source 34,” depicted in Figure 2 as sunlight:



EX1006, ¶¶0057-58, 0061, *see also* 0029 (distinguishing “normal illumination” “visible to the naked eye” with “directed illumination with laser light”). A POSITA would have understood that sunlight and light from a ceiling lamp are **ambient light** because they are understood to generally illuminate space. EX1003, ¶¶129-130.

Accordingly, Fuhse262 renders obvious [1b.1]. EX1003, ¶¶125-131.

- d. [1b.2] “in response, displaying an image in a plane spaced a distance apart from the surface of the

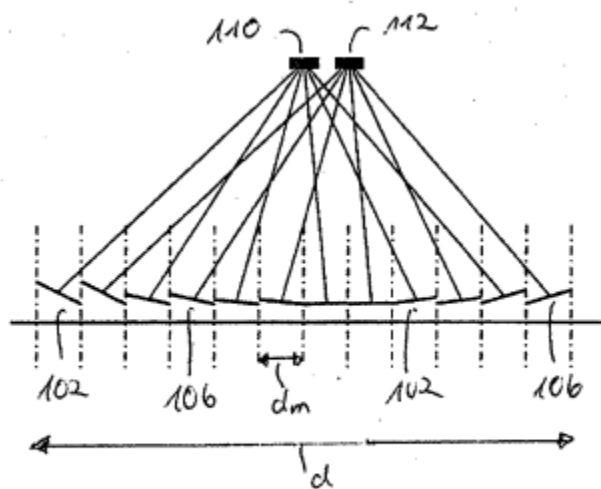
substrate, wherein the image comprises a plurality of pixels and”

Fuhse262 teaches [1b.2]. Fuhse262 teaches that “upon illumination” (**in response**) “to produce...a light-spot image composed of a plurality of light spots,” (**displaying an image...wherein the image comprises a plurality of pixels**) “that for a viewer appear floating above or below the surface region” (**in a plane spaced a distance apart from the surface of the substrate**). EX1006, ¶¶0010-12, 0015, 0035-36, 0054-56, 0083-84, 0126-28. The production of light-spot image composed of a plurality of light spots is **in response** to the illumination because the illumination causes the micromirrors to reflect light, which produces the light spots. EX1006, ¶0010; EX1003, ¶¶132-135.

Fuhse262 teaches that while “a truly three-dimensional” **image** can be formed by using light spots (**pixels**) of “different floating heights above and/or below the substrate surface,” alternatively, “all light spots [**a plurality of pixels**] in the light-spot **image** [may] have the same floating height,” (forming **a plane spaced a distance apart from the surface of the substrate**) which provides a two-dimensional image “that floats at a certain height above or below the substrate surface.” EX1006, ¶¶0068. Just as the pixels 243 in the ’294 Patent produce image 242 (*see* EX1001, 7:37-43, FIG. 2), the light spots produce the light spot image. EX1003, ¶136-137.

Fuhse262 teaches that any arbitrary “desired three-dimensional motif having image points P_j and height values Z_j above an xy plane” may be “specified,” meaning that providing image points P_j of all the same height values Z_j above the surface of the substrate results in **displaying an image in a plane spaced a distance apart from the surface of the substrate**. EX1006, ¶¶0036, 0125-28. Fuhse262 interchangeably refers to image point P_j (**pixel**) and its corresponding light spot as “pixel P_j .” EX1006, ¶¶0126, 0128. The “xy plane” is understood to be **the surface of the substrate** because it is the plane that is divided into fields that are “covered with” the optical elements (micromirrors) which are **on a surface of the substrate**, as required by element [1.b1]. EX1006, ¶¶0036, 0125-28; EX1003, ¶¶138-140.

For example, Figure 9(b) shows “two closely adjacent light spots” 110 and 112 (two **pixels**) formed at the same height:



(b) Fig. 9

EX1006, ¶¶0049, 0091-92; EX1003, ¶¶141-142.

By teaching any arbitrary three-dimensional image in space (*i.e.*, x, y, z space) can be constructed of light points, a POSITA would understand that a two-dimensional image can be constructed by fixing the height (z) values of the pixels. However, Fuhse262 goes further and explicitly teaches that a two dimensional image may be formed by fixing the height (z) values of the pixels: “*all light spots in the light-spot image have the same floating height.*” EX1006, ¶¶0068, 0015 (emphasis added). In fact, Fuhse262 refers to the resulting image as “a two-dimensional motif,” such as “a font or a logo.” EX1006, ¶¶ 0015, 0027, 0117. For the given fixed height of the two-dimensional motif (for example, $z = z_1$), the image is **in a plane** defined by (x, y, z_1). EX1003, ¶¶138-141.

Accordingly, Fuhse262 renders obvious [1b.2]. EX1003, ¶¶132-143.

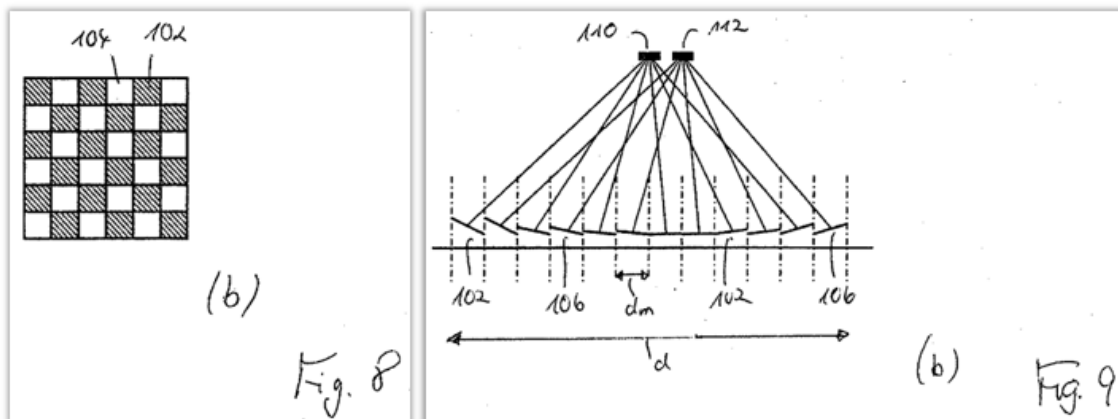
- e. **[1b.3] “wherein the array of micro mirrors includes for each of the pixels a different set of the micro mirrors each having a reflective surface oriented, in a fixed manner with a body of each of the micro mirrors rotated about at least one of first and second rotation axes extending through the body, to reflect the ambient light toward a point on the plane corresponding to one of the pixels”**

Fuhse262 teaches element [1b.3].

Fuhse262 discloses that **the array of micro mirrors includes for each of the pixels a different set of the micro mirrors.** EX1006, ¶¶0019-20, 0036, 0084, 0088,

0091-92. Fuhse262 explains that “a plurality of optical elements is assigned to *every* light spot” (**for each of the pixels a different set of the micro mirrors**), such that “groups of optical elements” “are each assigned to *different* light spots.” EX1006, ¶¶0019-20 (emphasis added). Fuhse262 does so by defining “a number of fine fields” “for every image point P_j ,” (**each of the pixels**), and providing that the optical elements in those fine fields (**a different set of the micro mirrors**) “contribute to producing the light spot that corresponds to image point P_j .” EX1006, ¶¶0036, 0126-28; EX1003, ¶¶144-145.

In the example of FIG. 8b, (shaded) micromirrors 102 form **a set of micro mirrors**, and (white) “fields 104 [] covered with micromirrors 106” form a second **set of micro mirrors**, and the sets are different because they comprise different micromirrors. EX1006, ¶¶0091-92. As shown in Figure 9(b), “[m]icromirrors 102 form a group of micromirrors, which are all assigned to the same light spot 110 and produce it together when illuminated,” while micromirrors 106 “serve to produce a light spot 112,” meaning **a different set of the micro mirrors** is assigned **for each of the pixels**. *Id.* Fuhse262 states that in the “The number $n \times n$ of micromirrors is, for example, 10×10 ,” (totaling 100) meaning that in FIG. 8(b), each **set of micro mirrors** would have 50 micromirrors. EX1006, ¶0087; EX1003, ¶¶146-147.



Fuhse262 discloses that **the micro mirrors each having a reflective surface oriented... to reflect the ambient light toward a point on the plane corresponding to one of the pixels.** Fuhse262 discloses that its micromirrors may be “purely reflective.” Fuhse262, ¶¶0013, 0010-11, 0036, 0060. In particular, Fuhse262 discloses that “the flat mirror surfaces of the micromirrors” “reflect[]” incident light **(the micro mirrors each having a reflective surface).** EX1006, ¶¶0095-97. For each of the pixels, the micromirror surfaces reflect incident light **(reflect the ambient light)**, such as light source 120, **towards** the point (x_0, y_0, z_0) , which “denotes the position of light spot 110” **(a point on the plane corresponding to one of the pixels).** EX1006, ¶¶0095-97; EX1003, ¶148.

Fuhse262 discloses that such orientation is **in a fixed manner with a body of each of the micro mirrors rotated about at least one of first and second rotation axes extending through the body.** EX1006, ¶¶0095-0101. As an initial matter, Fuhse262’s orientation of all its mirrors is **in a fixed manner** because they have one

permanent orientation (normal vector n , as discussed below).⁵ Micromirrors for security elements on, for example, currency, are generally manufactured with a particular orientation to produce a particular image, and generally are not variably-controlled. EX1003, ¶¶149-152.

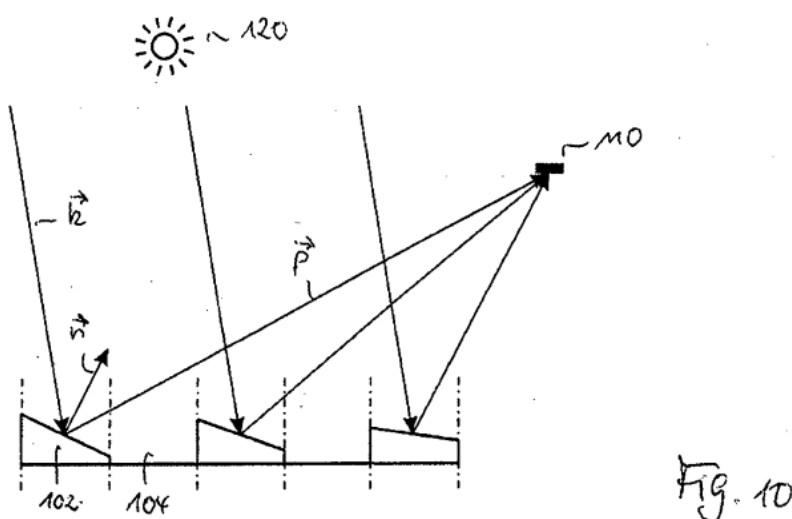
Fuhse262 discloses how to calculate orientations of its flat micromirror surfaces with respect to Figure 10 and corresponding disclosures. *Id.* In particular, Fuhse262 explains that “[t]he position of the mirror surfaces, i.e. the normal vector n , is to be determined in such a way that the light incident from a specified direction $k \rightarrow$ is reflected onto the focal point (x_0, y_0, z_0) for all micromirrors 102 assigned to

⁵ The term “fixed manner” was added to the claim during prosecution to distinguish Raber, which is in the electronic arts and discloses using variable focal length to “sequentially display a slice of an image on differing image planes.” EX1002, pp. 464/765, 479-80. The ’294 Patent teaches mirror fabrication to form such fixed orientations includes embossing the surface of the substrate and then metalizing the surface. EX1001, 16:55-60. Fuhse262 likewise teaches that its micro-mirrors are produced by embossing a lacquer layer and providing a metallized coating on top. Fuhse262, ¶¶32-33; EX1003, ¶150.

light spot 110,” the following equations are used to define the normal vector $\vec{n}$, incident light $\vec{k}$, and reflected light ray $\vec{p}$:

$$\vec{n} = \frac{\frac{\vec{p}}{|\vec{p}|} - \frac{\vec{k}}{|\vec{k}|}}{\left| \frac{\vec{p}}{|\vec{p}|} - \frac{\vec{k}}{|\vec{k}|} \right|}, \quad \vec{p} = \begin{pmatrix} x_0 - x \\ y_0 - y \\ z_0 \end{pmatrix}, \quad |\vec{p}| = \sqrt{(x_0 - x)^2 + (y_0 - y)^2 + z_0^2}$$

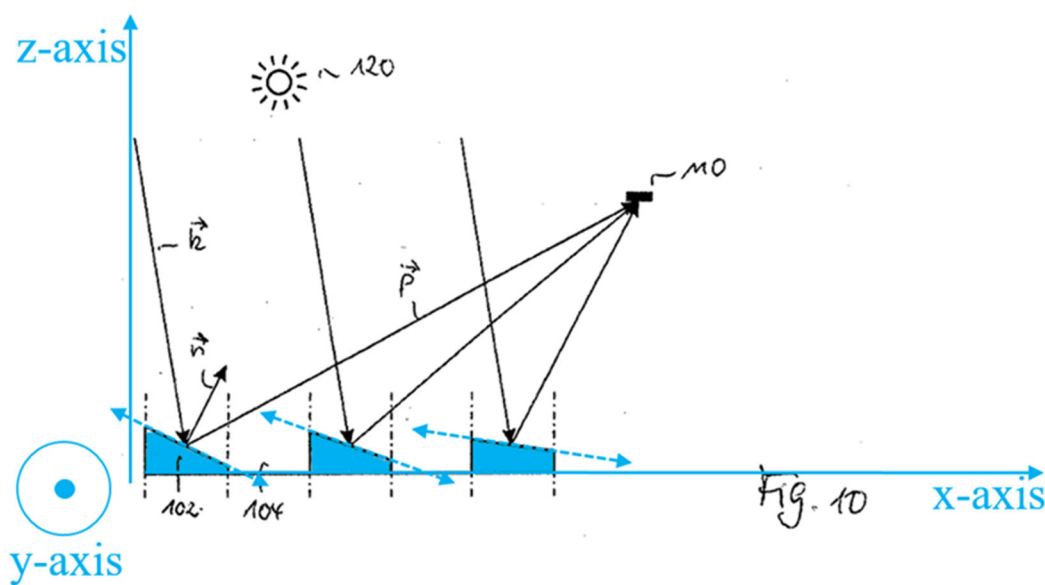
EX1006, ¶¶0095-97. These vectors are shown in Figure 10 below. EX1003, ¶153.



The x and y axes are **first and second rotation axes**, such that **a body of each of the micro mirrors rotated about at least one of first and second rotation axes extending through the body** in order to align the normal vector $\vec{n}$ of the micro-mirrors such that reflected light ray $\vec{p}$ is directed towards the point (x_0, y_0, z_0) corresponding to one of the pixels. In the '294 Patent, the **first and second rotation axes**

are likewise the x and y axes. See '294 Patent, FIG. 1 (“1ST ROTATION AXIS (Y-AXIS)” and “2ND ROTATION AXIS (X-AXIS).”); EX1003, ¶154.

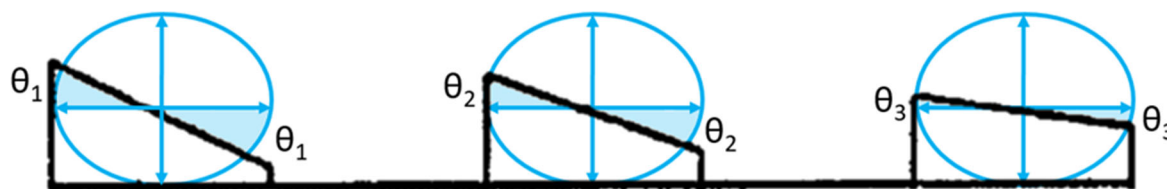
As shown in annotated Figure 10 below, **a body of each of the micro mirrors** has been **rotated about at least one of first and second rotation axes extending through the body**. Assuming the axes shown in annotated Figure 10 below, with the x axis extending along the horizontal, the z axis extending along the vertical, and the y axis extending perpendicular to the page, the below micromirrors have been rotated about the **y rotation axis**, which **extend[s]** through the y - length of the micromirror **body**.



EX1003, ¶155.

The below annotated Figure 10 of Fuhse262 shows the angle of rotation (*i.e.*, θ_1 , θ_2 , θ_3) about the y-axis for each of the three micromirrors. This angle represents

the particular angle of rotation required in order for the micromirror to reflect light to the coordinates of light spot 110. The angles θ_1 , θ_2 , and θ_3 are different because of the different positions of the mirrors require different angles of rotation to reflect light to the same point. EX1003, ¶156.



Accordingly, Fuhse262 renders obvious element [1b.3]. EX1003, ¶¶144-157.

- f. [1b.4] “wherein each of the different sets concurrently reflect the ambient light to concurrently generate the plurality of pixels,”

Fuhse262 teaches [1b.4]. Fuhse262’s **array of micro mirrors receiving ambient light** is an array of micromirrors arranged on, e.g., a banknote that receive the same **ambient light** that is the same for all micromirrors (e.g., sunlight in FIGs. 2, 10). *See, supra*, Section VII.A.3.c. Fuhse262 relies on **ambient light** that is **concurrently** incident on all micromirrors, not focused light that is only incident on particular micromirrors at a given time. Fuhse262’s micromirrors are passive reflectors, and when illuminated with such concurrently incident ambient light, concurrently reflect the light, such that the micromirrors of **each of the different sets**

concurrently reflect the ambient light in the manner discussed in element [1.b3].

See, supra, Section VII.A.3.e ([1.b3]); EX1003, ¶¶159-161.

Further, each of the different sets **concurrently generate the plurality of pixels** in the manner discussed for [1.b3]. *See, supra*, Section VII.A.3.e ([1.b3]). As long as the micromirrors are properly oriented or aimed to generate their respective pixels, the concurrent reflections of ambient light will **concurrently generate the plurality of pixels**. EX1003, ¶¶162.

The '294 Patent does not use the term “concurrent” (or “simultaneous” or similar terms) and does not even discuss the concept of concurrent operation of sets of micromirrors.⁶ During prosecution, Applicant added this claim limitation to distinguish over Raber’s “very different technologies” for 3D television. *See, supra*, Section III.B. This limitation is trivially met by any array of passive micromirrors that operate based on reflecting ambient light. EX1003, ¶¶163-164.

⁶ Any argument that “angular offset viewing” (*see* '294 Patent, 5:24-34) doesn’t satisfy this limitation should be rejected because that involves whether an image is visible to a viewer from a certain angle, not whether the micromirrors are reflecting ambient light. Even in that case, ambient light would still be reflected by the micromirrors to create all the images, regardless if there is a viewer to view them.

Accordingly, Fuhse262 renders obvious [1b.4]. EX1003, ¶¶158-165.

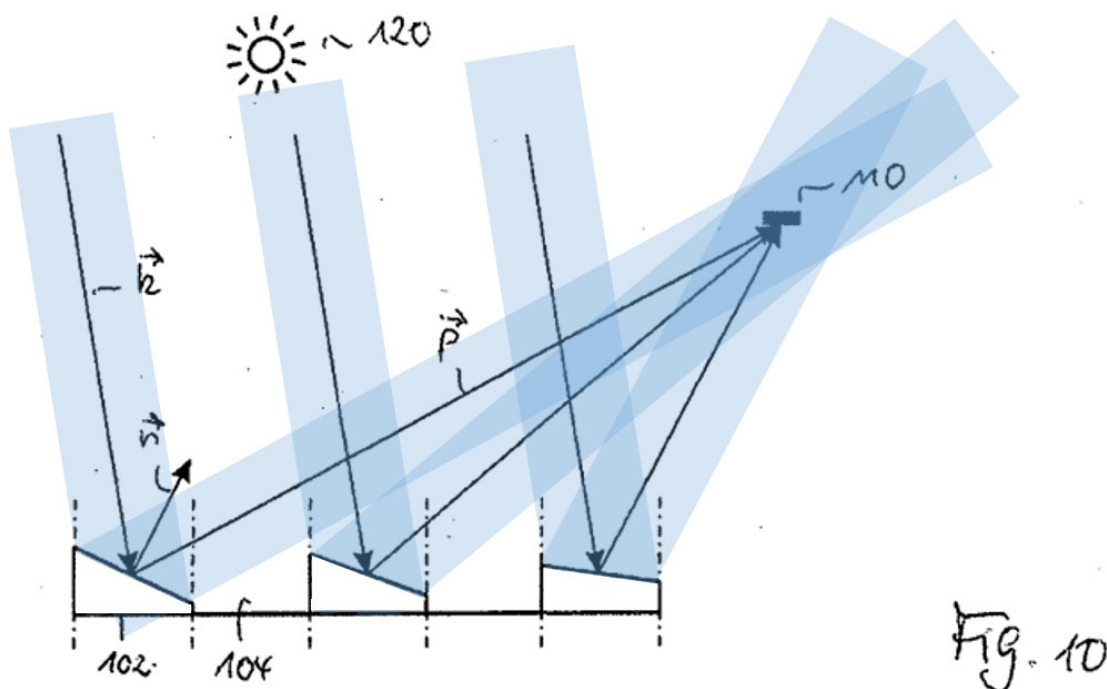
- g. [1b.5] “and wherein a voxel is created at each of the points on the plane via intersection of two or more beams of the reflected ambient light and”**

Fuhse262 teaches [1b.5].

The '294 Patent does not use the term “voxel.” Like element [1.b4], PO added element [1.b5] during prosecution in response to the Examiner’s rejection based on Raber. FH p. 411. A POSITA would understand the “voxels” have a volume. EX1003, ¶¶167-168.

As discussed above, for each of the pixels, a light spot at point (x_0, y_0, z_0) is **a point on the plane corresponding to one of the pixels**. EX2006, ¶¶0095-97. In other words, each light spot is defined in three-dimensional space (i.e., x, y, z coordinates), which is the center-point of **a voxel is created at each of the points on the plane**. EX1003, ¶169.

Figure 10 shows chief light rays for each optical element and converging on light spot 110. Ambient and reflected light form beams of light that reflect off the entire surface of the mirror, not just the center point, shown below. EX1003, ¶170.



The volume of the voxel corresponds to the intersection of beams from micromirror set, with the center of the voxel being the coordinates of the point (x_0, y_0, z_0) where all the beams intersect. As more micromirrors are added for a given pixel, the pixel or voxel becomes brighter and more defined. EX1003, ¶¶171-172.

As shown in Figure 10, Fuhse262 creates a voxel via intersection of two or **more beams of the reflected ambient light**. As 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. EX1003, ¶173; EX1006, ¶¶0095-97.

Each “reflected light ray” (i.e., the chief ray in each image) represents the center of each **beam[] of the reflected ambient light**. Because each pixel is required to be formed with a “set of micro mirrors” (as required by [1.b3]), the voxel would include **two or more beams**. As shown in Figure 10, each point (x_0, y_0, z_0) (**a point on the plane corresponding to one of the pixels**) is the center-point of each voxel. EX1003, ¶¶173-174.

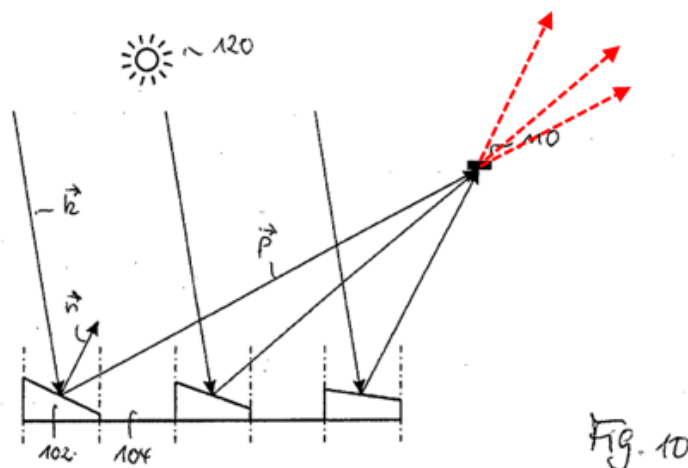
Accordingly, Fuhse262 renders obvious [1b.5]. EX1003, ¶¶166-175.

- h. [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 teaches element [1b.6].

Fuhse262 teaches that its “light-spot image composed of a plurality of light spots” (**each of the created voxels**) “for a viewer appear floating above... the surface region” in the form of a specified motif (**produces an effect of a point source of light floating above the surface of the substrate in the plane**). EX1006, ¶¶0010-11, 0015, 0035, 0058-59, 0063-69, 0083, 0089. The image in the plane “floats at a certain height above... the substrate surface” because “all light spots in the light-spot image have the same floating height.” EX1006, ¶¶0068; EX1003, ¶177.

The voxel’s **effect of a point source** is evident from Fuhse262’s Figures 9-10, as illustrated in the annotated Figure 10:



In other words, **voxels produce[] 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. Fuhse262 teaches a “cone” can be described “originating from the image point” and including all the micromirrors within the base of the cone (i.e., “sphere of influence E_j ”). EX1006, ¶¶0036, 0126; EX1003, ¶¶178-180.

Accordingly, Fuhse262 renders obvious element [1b.6]. EX1003, ¶¶176-181.

4. Claim 28

Claim 28 is similar to independent claim 1, with a few exceptions which are mapped below. *See* analysis for claim 1 in Section VII.A.3, which is incorporated herein.

- a. **[28Pre] “A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:”**

Fuhse262 renders obvious the limitation. *See, supra*, Section VII.A.3.a ([1Pre]); EX1003, ¶183.

- b. **[28a] “a substrate; and”**

Fuhse262 renders obvious [28a]. *See, supra*, Section VII.A.3.b ([1a]); EX1003, ¶184.

- c. **[28b.1] “on a surface of the substrate, an array of micro mirrors receiving ambient light and”**

Fuhse262 renders obvious the limitation. *See, supra*, Section VII.A.3.c ([1b.1]); EX1003, ¶185.

- d. **[28b.2] “in response, displaying a first image and a second image in a plane spaced a distance apart from the surface of the substrate at first and second viewing angles, respectively, wherein the first and second images each comprises a plurality of pixels,”**

Fuhse262 teaches **in response, displaying a first image... in a plane spaced a distance apart from the surface of the substrate... wherein the first... image[] [] comprises a plurality of pixels.** *See, supra*, Section VII.A.3.d ([1b.2]); EX1003, ¶187.

Fuhse262 also teaches **a second image that comprises a plurality of pixels, and is also in a plane spaced a distance apart from the surface of the substrate**

(i.e., the same plane as the first image). Fuhse262 generates multiple images, including “a light-spot image A” (the **image**) and “a light-spot image B” (**a second image**). EX1006, ¶¶0111-20. Both images are produced in the same manner as previously discussed. *See, supra*, Section VII.A.3.d; EX1003, ¶¶188-189.

Fuhse262 further teaches that two images may “lie next to each other and/or appear alternately in the same place when the viewing direction changes.” EX1006, ¶¶0027, 0118. Whether image A and B “lie next to each other” or are “in the same place,” they are in the same **plane spaced a distance apart from the surface of the substrate**. For example, when the two images are in the same place, their pixels have the same heights, and therefore are in the same plane. This is accomplished in the same way as discussed above. *See, supra*, Section VII.A.3.d; EX1006, ¶¶0036, 0125-28; EX1003, ¶¶190-192.

To the extent it could be argued that Fuhse262 only explicitly discloses a three-dimensional image in the same place or next to a two-dimensional image (*see* ¶¶0027, 0118), it would have been obvious to provide two two-dimensional images. As discussed above (*see, supra*, Section VII.A.3.d), 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 same place or next to each other, and that images may be two-dimensional, it would have been obvious to a POSITA to provide two two-dimensional images at the same height (*i.e.*, in the same plane). EX1003, ¶192.

Fuhse262 also teaches **first and second viewing angles** for the first and second images, respectively. Fuhse262 teaches that “different images become visible to the viewer from different directions.” EX1006, ¶¶0111, 0024; EX1003, ¶193.

In other words, light-spot image A (the **image**) is viewable from a certain angle (**a first viewing angle**), and an “image change” to light-spot image B (**the second image**) occurs when “tilted to the side” (**a second viewing**). These teachings are specifically taught to apply to the case where the two images “lie next to each other” or are “in the same place,” such that the images “appear alternately” “when the viewing direction changes.” EX1006, ¶¶0027, 0118; EX1003, ¶194.

Accordingly, Fuhse262 renders obvious [28b.2]. EX1003, ¶186-195.

- e. [28b.3] “wherein the array of micro mirrors includes for each of the pixels a unique set of the micro mirrors each having a reflective surface rigidly oriented, by rotating a body of each of the micro mirrors about at least one of two rotations axes extending through the body, to reflect the ambient light away from the substrate toward a point on the plane corresponding to one of the pixels,”

Fuhse262 teaches [28b.3].

The sets of micro mirrors for each pixel are **unique** for the same reasons the sets are **different**. *See, supra*, Section VII.A.3.e; EX1003, ¶197.

The micro mirrors are oriented **rigidly** for the same reasons the micro mirrors are oriented **in a fixed manner**. *See, supra*, Section VII.A.3.e; EX1003, ¶¶198.

Further, the reflected light **is away from the substrate** for the same reasons it is directed **toward a point on the plane corresponding to one of the pixels**. *See, supra*, Section VII.A.1.e. Because the array of micromirrors is on the substrate (*see, supra*, Section VII.A.1.c), reflections from the micromirrors are always **away from the substrate**. EX1003, ¶199.

Accordingly, Fuhse262 renders obvious [28b.3]. EX1003, ¶¶196-199.

f. [28b.4] “wherein each of the unique sets of the micro mirrors includes a number of the micro mirrors in the range of 2 to 40, and”

Fuhse262 teaches [28b.4]. The total number of micromirrors may be “for example a few tens, a few hundred or even several thousand.” EX1006, ¶0087. “The number $n \times n$ of micromirrors is, for example, 10×10 ,” (totaling 100) (see ¶0087) or 288 ($12 \times 12 = 144$ plus $12 \times 12 = 144$) (see ¶¶0090-92). EX1006, ¶0087. In Figure 8(c), Fuhse262 teaches that “every fourth field can be covered with micromirrors 102 that are assigned to a specific light spot,” while the other fields “are assigned to up to three other light spots.” EX1006, ¶0094. For the 100 micromirror example, if “three

other light spots” are utilized, that means the 100 micromirrors would serve four light spots, meaning **each of the unique sets of the micro mirrors includes** twenty five micromirrors (**a number of the micro mirrors in the range of 2 to 40**). EX1003, ¶201.

[28b.4] is also satisfied by Figure 8(d), where the “every ninth field is covered by micromirrors 102 assigned to a specific light spot,” and the remaining “micro-mirrors [] are assigned to *up to eight other light spots*.” EX1006, ¶0094 (emphasis added). If all “eight other light spots” are utilized, the 100 micromirrors would serve nine light spots, meaning **each of the unique sets of the micro mirrors includes** eleven micromirrors (**a number of the micro mirrors in the range of 2 to 40**). Similarly, for the 288 micromirror example, **each of the unique sets** would have 32 (i.e., 288 divided by nine) micromirrors (**a number of the micro mirrors in the range of 2 to 40**). EX1003, ¶202.

Accordingly, Fuhse262 renders obvious [28b.4]. EX1003, ¶200-202.

- g. [28b.5] “wherein the reflected ambient light from the **number of the micro mirrors intersects at the point corresponding to the one of the pixels to create a voxel**,”

Fuhse262 renders obvious [28b.5]. *See, supra*, Section VII.A.3.g ([1b.5]); EX1003, ¶203.

- h. [28b.6] “whereby the voxel acts like a point light source positioned in the plane at the point corresponding to the one of the pixels.”**

Fuhse262 renders obvious [28b.6]. *See, supra*, Section VII.A.3.h ([1b.6]) ; EX1003, ¶204.

The voxel is created **at the point corresponding to the one of the pixels**. *See supra*, Sections VII.A.3.g ([1b.5]), VII.A.3.e ([1b.3]). EX1003, ¶205.

Further, [28.6] is a “whereby” clause that only states the result of [28.5]. Thus, it is non-limiting. *Texas Instruments Inc. v. U.S. Int’l Trade Comm’n*, 988 F.2d 1165, 1172 (Fed. Cir. 1993) (“A ‘whereby’ clause that merely states the result of the limitations in the claim adds nothing to the patentability or substance of the claim.”).

5. Claim 35

Claim 35 is similar to independent claim 1, with a few exceptions which are mapped below. *See* analysis for cl. 1 in Section I.A.3, which is incorporated herein.

- a. [35Pre] “A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:”**

Fuhse262 renders obvious [35Pre]. *See, supra*, Section VII.A.3.a ([1Pre]) ; EX1003, ¶207.

b. [35a] “a substrate; and”

Fuhse262 renders obvious [35a]. *See, supra*, Section VII.A.3.b ([1a]); EX1003, ¶208.

c. [35b.1] “on a surface of the substrate, an array of micro mirrors receiving ambient light and,”

Fuhse262 renders obvious [35b.1]. *See, supra*, Section VII.A.3.c [1b.1]; EX1003, ¶209.

d. [35b.2] “in response, displaying an image in a plane spaced a distance apart from the surface of the substrate, wherein the image comprises a plurality of pixels,”

Fuhse262 renders obvious [35b.2]. *See, supra*, Section VII.A.3.d ([1b.2]); EX1003, ¶210.

e. [35b.3] “wherein the array of micro mirrors includes for each of the pixels a different set of the micro mirrors each having a reflective surface oriented, differently from others of the micro mirrors in the different set, to reflect the ambient light away from the substrate and toward a point on the plane corresponding to one of the pixels,”

Fuhse262 renders obvious [35b.3]. *See, supra*, Section VII.A.3.e ([1b.3]).

Fuhse262 teaches that the reflective surfaces of the micromirrors in each different set are oriented **differently from others of the micro mirrors in the different set**. For a given set of micromirrors, each micromirror is oriented to the same pixel. *See, supra*, Section VII.A.3.e ([1b.3]). Each micromirror is not physically in

the same place, but is in a different location in the array. *See, supra*, Section VII.A.3.c ([1b.1]); EX1003, ¶¶212-213.

Fuhse262 teaches that the micromirrors reflect light meaning the ambient light is reflected **away from the substrate**. *See, supra*, Section VII.A.4.e; EX1003, ¶213.

Accordingly, Fuhse262 renders obvious [35b.3]. EX1003, ¶¶211-214.

- f. [35b.4] “a first set of voxels concurrently being created at the points on the plane via intersection of two or more beams of the reflected ambient light at each of the points on the plane to concurrently display the pixels of the image, wherein,”

Fuhse262 teaches this [35b.4]. *See, supra*, Sections VII.A.3.f ([1b.4]), VII.A.3.g ([1b.5]), and VII.A.3.e ([1b.3]).

When **a voxel is created at each of the points, a first set of voxels [is] concurrently [] created** just as pixels are created concurrently. *See, supra*, Section VII.A.3.f; EX1003, ¶¶216-217.

Accordingly, Fuhse262 renders obvious element [35b.4]. EX1003, ¶¶215-218.

- g. [35b.5] “further in response to the receiving of the ambient light, the array of micro mirrors displays a second image in a second plane spaced a distance apart from the plane displaying the image,”

Fuhse262 teaches this limitation.

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. Fuhse262 discloses displaying two images in the same plane. *See, supra*, Section VII.A.4.d ([28.b2]); EX1003, ¶220.

The two images are in the “foreground” and “background” of each other (EX1006, ¶0117), meaning that they are **spaced a distance apart** from each other. EX1003, ¶221.

To the extent it could be argued that Fuhse262 only explicitly discloses a three-dimensional image in the foreground of a two-dimensional image (*see* ¶0117), it would have been obvious to provide two two-dimensional images. 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 understood to a POSITA to provide two two-dimensional images at different heights (*i.e.*, in different planes). EX1003, ¶222.

Accordingly, Fuhse262 renders obvious this limitation. EX1003, ¶¶219-223.

h. [35b.6] “wherein the second image comprises a plurality of pixels, and”

Fuhse262 renders obvious [35b.6]. *See, supra*, Section VII.A.4.d ([28.b2]); EX1003, ¶224.

- i. **[35b.7] “wherein the array of micro mirrors includes, for each of the pixels of the second image, a different set of the micro mirrors each having a reflective surface oriented, differently from others of the micro mirrors in the different set, to reflect the ambient light away from the substrate and toward a point on the second plane corresponding to one of the pixels of the second image,”**

Fuhse262 renders obvious [35b.7]. *See, supra*, Section VII.A.5.e ([35.b3]) and VII.A.5.g ([35.b5]); EX1003, ¶225.

- j. **[35b.8] “a second set of voxels concurrently being created at the points on the second plane via intersection of two or more beams of the reflected ambient light at each of the points to concurrently display the pixels of the second image.”**

Fuhse262 renders obvious [35b.8]. *See, supra*, Section VII.A.5.f ([35.b4]) and VII.A.5.g ([35.b5]).

These claim limitations are satisfied for the second set of voxels in the same way they are satisfied for the first set of voxels. EX1003, ¶226.

Accordingly, Fuhse262 renders obvious [35b.8]. EX1003, ¶¶226-227.

B. Ground 2: Claims 1, 6-13, 28, 32, 33, and 35-38 are rendered obvious under §103 by Fuhse262 in view of Fuhse925

This ground is the same as Ground 1, but additionally relies on Fuhse925’s teachings regarding orientation of its micromirrors, as teaching limitation [1b.3]/[28.b3].

1. Motivation and Combine

Fuhse262 and Fuhse925 share the same inventor and assignee, which weighs strongly in favor of finding a motivation to combine the two references. *See, e.g., Abbot Vascular, Inc. v. Flexstent*, IPR2019-00882, Paper 48, 28-29 (Oct. 2, 2020); ; *Black v. CE Soir Lingerie Co.*, No. 2:06-CV-544, 2008 WL 3852722, at *14 (E.D. Tex. Aug. 15, 2008) (“strong motivation to combine” prior art “patented by the same inventor”).

A POSITA would have found it obvious to apply the Fuhse925’s teachings to Fuhse262. Both relate to security elements for data carriers (e.g., banknotes) with optical elements arrays that are arranged to produce, upon illumination, three-dimensional motifs, and thus are in the same field. EX1006, Abstract; EX1008, Abstract; EX1003, ¶228.

A POSITA would have looked to Fuhse925. Fuhse262 describes the proper orientation of its micromirrors in the surface plane (x-y axes) by a normal vector n of its reflective surface. EX1006, ¶¶95-99. While a POSITA would understand how much to rotate the mirror surface in the x and y axes to achieve the normal vector n (as is shown in Fuhse262 (FIGs. 9-10)), it is not expressed in explicit detail. Fuhse925, however, *does* provide that explicit detail. Fuhse925 teaches that the normal surface N can be broken down into two “inclination components” that represent the inclination angle of the mirror in each respective axis. EX1008, 7:33-63. It

would therefore have been obvious for a POSITA to examine how mirror surface orientations are achieved with Fuhse262. EX1003, ¶229.

Fuhse925 explicitly explains to how implement Fuhse262’s micromirrors with a surface normal n . $N_{\parallel}$ and $N_{\perp}$ are the “mirror slope” in each of the x and y axes, such that the body of each micromirror is rotated about the x-axis extending through the body by an amount of $N_{\parallel}$, and the body of each micromirror is rotated about the y-axis extending through the body by an amount of $N_{\perp}$ to achieve the proper orientation. EX1008, 7:33-63. Whereas Fuhse262 discloses a desired surface normal for each micromirror and shows the properly angled mirrors (see FIGs. 9-10), Fuhse925 provides further explicit detail for how to properly oriented mirrors using “inclination components,” thus, it would have been obvious for a POSITA to combine. EX1003, ¶230.

Additionally, using Fuhse925’s teachings regarding inclination components in Fuhse262’s system would have involved using a known technique to improve Fuhse262 in a known way, without unpredictable results, and would thus also have been obvious under *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-18 (2007). EX1003, ¶231.

2. Reasonable Expectations

A POSITA would have had a reasonable expectation of success in implementing the combination. As a POSITA would have recognized, the structures of Fuhse262 and Fuhse925 are similar and compatible. EX1003, ¶232.

Fuhse262 teaches that its micromirrors may “have a dimension of $50\text{ }\mu\text{m} \times 50\text{ }\mu\text{m}$ and can be formed with a flat mirror surface.” EX1006, ¶¶95-99. Fuhse925’s facets are “micromirrors” with “the dimensions...preferably between $50\text{ }\mu\text{m}$ and $200\text{ }\mu\text{m}$.” EX1006, 5:36-38, 7:43-48. Fuhse262 and Fuhse925 provide almost identical teachings how the micromirrors should be made. *Compare* EX1006, ¶0032 with EX1008, 5:4-8. Thus, the Fuhse925’s teachings regarding proper orientation of micromirrors would have been applied to Fuhse262 with no difficulty. EX1003, ¶233-234.

As discussed in Ground 1 (see VII.A), the art was relatively predictable in the relevant timeframe (2015). *Id.* Thus, a POSITA would have been able to implement the obviousness modifications in this ground without difficulty. *Id.*

3. [1Pre]/[28Pre]/[35Pre]

To the extent not taught by Fuhse262, Fuhse262 in view of Fuhse925 renders this element obvious.

Fuhse925 additionally teaches that its invention is **useful as a security element on** not only banknotes, but also on “labels on goods and packaging” (**product labels**). EX1008, 6:55-60; EX1003, ¶238.

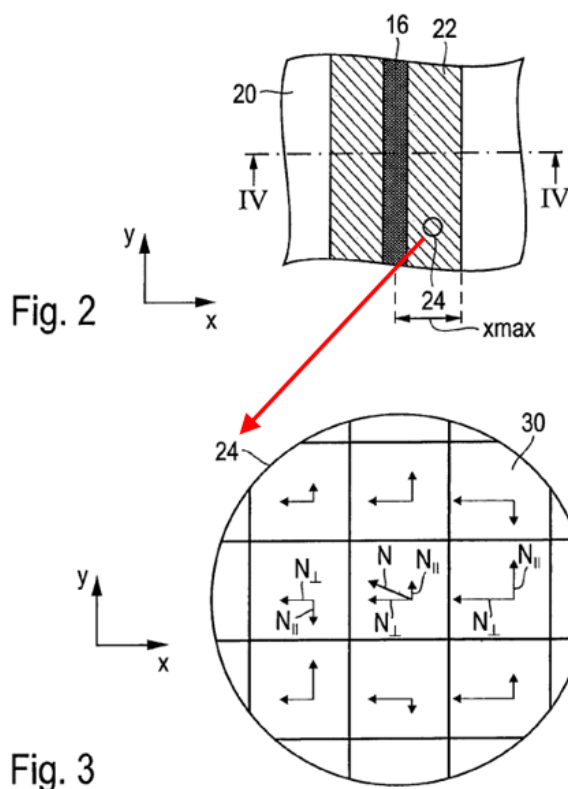
A POSITA would have been motivated to combine Fushe262 with Fuhse925 in order to maximize the utility and applications of the invention. While Fuhse262 describes its invention may be applicable to any “data carrier,” it does not explicitly list all of its application. A POSITA would have been motivated to look at other references, including Fuhse925, to find additional data carriers for additional applications. EX1003, ¶239.

Accordingly, Fuhse262 in view of Fuhse925 renders obvious the preambles. EX1003, ¶¶237-239.

4. [1b.3]/[28.b3]/[35b.3]

Fuhse262 in view of Fuhse925 renders obvious element [1b.3]/[28b.3] with respect to the phrase **micro mirrors each having a reflective surface oriented, in a fixed manner with a body of each of the micro mirrors rotated about at least one of first and second rotation axes extending through the body** and for element [35b.3] with respect to the phrase **micro mirrors each having a reflective surface oriented**. Fuhse262 discloses that the micromirrors each have a normal vector n of its reflective surface defined in the x and y axes, and a POSITA would understand rotating the surface in the x and y axis to achieve that normal vector n . However, to the extent it would not, Fuhse925’s additional teachings would. EX1003, ¶¶240-241.

Like Fuhse262, Fuhse925 teaches a security element (for currency, for example) using arrays of reflective micromirrors to create three-dimensional images appearing to float above the security element. EX1008, 6:63-7:18, 7:33-48. Also like Fuhse262, each micromirror is taught to have a normal vector – “slope N” – that defines the overall surface orientation of the micromirror. EX1008, 7:55-58. Fuhse925 further teaches that the normal surface N can be broken down into two “inclination components” that represent the inclination angle of the mirror in each respective axis. EX1008, 7:33-63. Fuhse925 Figures 2 and 3, referenced in the passage above, are reproduced below:



EX1008, 7:33-58; EX1003, ¶¶242-244.

As Fuhse925 explains, $N_{\parallel}$ and $N_{\perp}$ are the “mirror slope” in each of the x and y axes (**first and second rotation axes**), such that the **body of each of the micro mirrors [is] rotated about** the x-axis **extending through the body** by an amount of $N_{\parallel}$, and the **body of each of the micro mirrors [is] rotated about** the y-axis **extending through the body** by an amount of $N_{\perp}$ to achieve the proper orientation of the micro mirrors. EX1008, 7:33-58; EX1003, ¶245.

Fuhse925 clarifies that the micro-mirrors are oriented **in a fixed manner** by explaining that its reflective planar facets 30 are “characterized by an inclination angle.” EX1008, 7:37-42, claim 1. The planar facets 30 are “characterized” by this single “inclination angle” because they are manufactured to provide that angle to achieve a desired reflection. EX1003, ¶246.

Accordingly, Fuhse262 in view of Fuhse925 renders obvious [1b.3] and [28b.3]. EX1003, ¶¶240-246.

C. Grounds 3/4: Claims 1, 6-13, 28, 32, 33, and 35-38 are rendered obvious under §103 by Fuhse262 (Ground 1) or Fuhse262 in view of Fuhse925 (Ground 2), and further in view of Jordan

This ground is the same as Ground 1, but additionally relies on Jordan’s teachings regarding the useful applications of optical security elements, as relevant to the preamble. This ground is also the same as Ground 2, as the inclusion of Fuhse925 does not affect the combination.

1. Motivation and Combine

A POSITA would have been motivated to combine Fuhse262 with Jordan, and Fuhse262 and Fuhse925 in further view of Jordan, in order to maximize the utility and applications of the invention. While Fuhse262 describes its invention may be applicable to any “data carrier,” it does not explicitly list all of its application. A POSITA would have been motivated to look at other references, including Jordan, to find additional data carriers. EX1003, ¶247.

2. Reasonable Expectations

A POSITA would have had a reasonable expectation of success in implementing the combination of Fuhse262 and Jordan, with or without Fuhse925. As Petitioner’s expert explains, the art was relatively predictable in the relevant timeframe (2015). (*Id.*). A POSITA would have been able to implement the obviousness modifications in this ground without difficulty. (*Id.*). EX1003, ¶248.

Because coin currency and product labels were known in the art as useful applications of OVD technology, a POSITA would have routinely recognized that Fuhse262 would be “useful as a security element” for those applications. EX1003, ¶249.

1. [1Pre]/[28Pre]/[35Pre]

To the extent not taught by Fuhse262, Fuhse262, alone or in combination with Fuhse925, and further in view of Jordan teach this element.

Jordan teaches methods of using arrays of reflective microstructures that produce images “as a security and anti-counterfeiting feature to identify and distinguish authentic products from counterfeit products,” such as “banknotes” or “coinage,” as well as “product marking and labeling” and “packaging.” EX1009, Abstract, ¶¶0013, 0002-04, 0113-14, 0124-25, 0154, 0159, 0174-77; EX1003, ¶253.

Accordingly, Fuhse262, alone or in combination with Fuhse925, in view of Jordan renders obvious the preambles of claims 1, 28, and 35. EX1003, ¶¶252-253.

D. Dependent Claims, Grounds 1-4: Ground 1 (Obviousness in view of Fuhse262) or Ground 2 (Fuhse262 in view of Fuhse925) in view of Jordan

The dependent claims for Grounds 1-4 are mapped below. The positions in the dependent claims are the same for Grounds 1-4, because all positions are based on Fuhse262 which is common to Grounds 1-4. However, for claims 11 and 35, Petitioners include an additional position that pertains to Grounds 2 and 4 only as it relies on Fuhse925. EX1003, ¶254.

1. Claim 6 / Element [6a]

- a. [6a] “The assembly of claim 1, wherein each of the sets of the micro mirrors includes a number of the micro mirrors in the range of 2 to 40 and”**

Fuhse262 renders obvious [6a]. *See, supra*, Sections VII.A.4.f ([28b.4]), VI I.A.3.b ([1a]), VII.A.3.c ([1b]). EX1003, ¶255.

- b. [6b] “wherein the reflected ambient light from at least twenty of the micro mirrors intersects at the point corresponding to the one of the pixels.”

Fuhse262 teaches element [6b]. *See, supra*, Sections VII.A.3.e ([1.b3]), VII.A.3.g ([1.b5]), and VII.A.1.a ([6a]). EX1003, ¶256.

As discussed in element [6a], amounts such as 25 or 32 micromirrors (**at least twenty of the micro mirrors**) may be used. As discussed in elements [1.b3] and [1.b5], all of the micromirrors in each of the sets provide **reflected ambient light** that **intersects at the point corresponding to the one of the pixels**, including all of the 25 or 32 micromirrors. EX1003, ¶257.

Accordingly, Fuhse262 renders obvious [6b]. EX1003, ¶256-258.

2. **Claim 7: The assembly of claim 6, wherein each of the sets of the micro minors includes at least thirty of the micro mirrors.**

Fuhse262 teaches claim 7. *See, supra*, Section VII.D.1.a ([6a]).

For the 288 micromirror example, **each of the sets** would have 32 (*i.e.*, 288 divided by nine) micromirrors (**at least thirty of the micro mirrors**). *See, supra*, Section VII.A.4.f; EX1003, ¶260.

Accordingly, Fuhse262 renders obvious claim 7. EX1003, ¶¶259-260.

3. **Claim 8: “The assembly of claim 6, wherein the point on the plane corresponds to an apex of a cone and the at least twenty of the micro mirrors are located within a base of the cone coplanar with the surface of the substrate.”**

Fuhse262 teaches claim 8.

Fuhse262 teaches that “every image point P_j ,” **(the point on the plane) corresponds to** a “cone originating from” or “emanating from” the image point **(an apex of a cone)**. EX1006, ¶¶0036, 0126. Further, “a sphere of influence E_j [**a base of the cone**] is determined by an intersection of the aperture cone originating from the image point with the xy plane” **(coplanar with the surface of the substrate)**. *Id.* As discussed in element [1b.2], the “xy plane” is understood to be **the surface of the substrate** because it is the plane that is divided into fields that are “covered with” the optical elements (micromirrors) which are **on a surface of the substrate**, as required by element [1.b1] (see element [1.b1]). EX1006, ¶¶0036, 0125-28; EX1003, ¶262.

In Fuhse262, all of the micromirrors (in this case, **the at least twenty of the micro mirrors**) that “contribute to producing the light spot that corresponds to image point P_j ” are selected from fields in the xy plane that are “in the sphere of influence E_j of the image point P_j ” **(within a base of the cone)**. Fuhse262, ¶¶0036, 0125-28; EX1003, ¶263.

Accordingly, Fuhse262 renders obvious claim 8. EX1003, ¶261-263.

4. **Claim 9: “The assembly of claim 8, wherein the micro mirrors within the base of the cone and excluded from the set of the micro mirrors displaying the pixel are oriented to reflect the ambient light away from point**

on the plane corresponding to the pixel to provide a dark background for the image.”

Fuhse262 teaches claim 9.

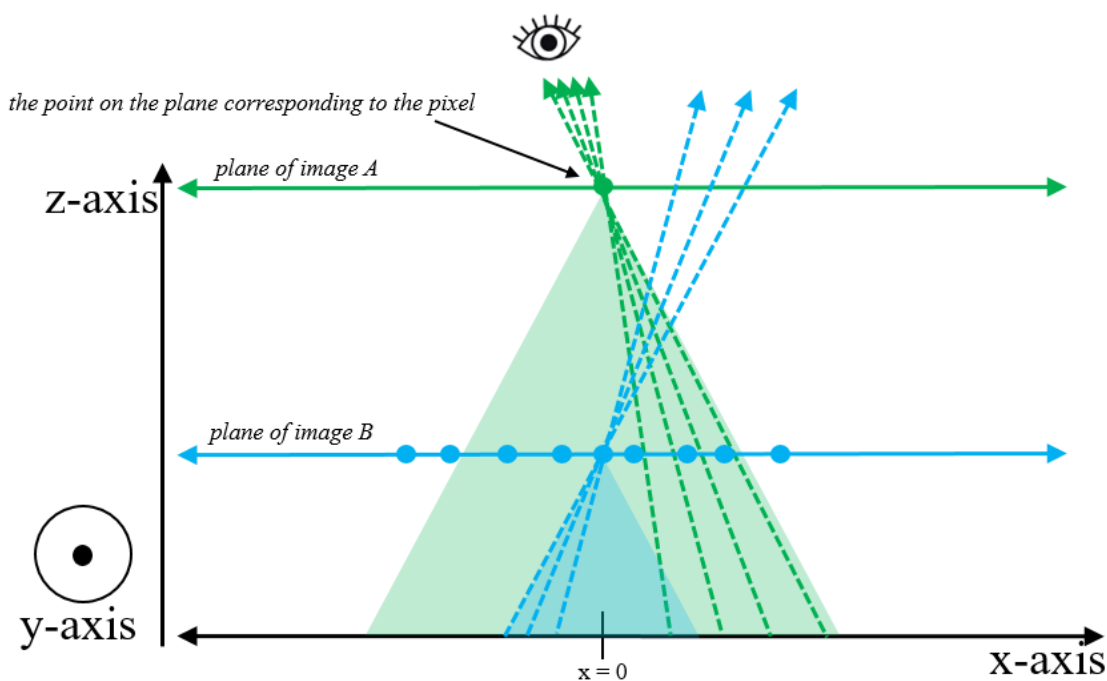
The '294 Patent describes viewing two images at different angles (*see* claims 10 and 11), as discussed with respect to Figure 5. *See* '294 Patent, 9:19-28; EX1003, ¶265.

Fuhse262 teaches producing two light spots that are visible at different viewing angles, explaining that “different images become visible to the viewer from different directions” by omitting the “micromirrors in which the x component n_x of the normal vector is greater than zero” for image A” and omitting the micromirrors “where the x component n_x of the normal vector is less than zero” for the light-spot image B. EX1006, ¶¶0111-13; EX1003, ¶266.

Fuhse262 has “foreground” and “background” images (*see* ¶¶0117), which are distinct two images that “lie next to each other.” EX1006, ¶¶26-27. Fuhse262 further recognizes that there are areas that “must be kept **dark**” in order to create “a visually appealing three-dimensional light-spot image.” EX1006, ¶¶106-07. One of those dark areas would be a **background**. EX1003, ¶¶267-271.

Thus, Fuhse262 teaches that two images may be in the background and foreground of each other, and that they may be viewable at different viewing angles, as illustrated below. As taught by Fuhse262, one image (including **the point**) is in the

foreground of another image, which is in the background of the first image. As further taught by Fuhse262, for image A (the image in the foreground in green including the point), micromirrors in which the x component n_x of the normal vector is greater than zero have been omitted, while for image B (the image in the background in blue), the micromirrors are omitted where the x component n_x of the normal vector is less than zero. The micromirror reflections for one light spot for each image is shown below, but it is understood that each light spot of each image includes a set of micromirrors providing reflections:



See EX1003, ¶¶266, 271.

Because the two images are in the foreground and background of each other, and not next to each other, **the micro mirrors within the base of the cone and**

excluded from the set of the micro mirrors displaying the pixel (which is of image A) are allocated for image B. Because the image plane of **the pixel** is above image plane of image B, **the base of the cone** would overlap with the small cones for image points of image B (the background image). See EX1003, ¶272

As seen above, the micromirrors for light points of image B (in blue) **are oriented to reflect the ambient light away from point on the plane corresponding to the pixel**. When the viewer is in the position of the eye in the image above, this will **provide a dark background for the image** (image A in green). See EX1003, ¶273.

Fuhse262 teaches how micromirrors **are oriented to reflect the ambient light away from point on the plane corresponding to the pixel** in order to provide such dark areas, both of which alternatively satisfy this claim language. Fuhse262 teaches “mirrors that are oriented in such a way that spatial regions that do not contain any light sources are reflected,” for example, “mirrors can be directed... at the viewer’s body.” EX1006, ¶¶108. As such, the micromirrors **are oriented to reflect the ambient light towards the viewer’s, which is away from point on the plane corresponding to the pixel**. See EX1003, ¶¶274-275.

In such case, the micromirrors performing this darkening are both (1) **the micro mirrors within the base of the cone**, and (2) **excluded from the set of the**

micro mirrors displaying the pixel. The micromirrors that are oriented to provide dark areas are **the micro mirrors within the base of the cone** because they are micromirrors that are assigned to a darkened light spot. As discussed in claim 8, micromirrors are only assigned to a light spot if they are “in the sphere of influence E_j of the image point P_j ” (**within a base of the cone**) corresponding to the light spot. EX1006, ¶¶0036, 0125-28. As Fuhse262 explains, micromirrors “*that are assigned to a light spot* can be darkened depending on the desired fraction of maximum brightness.” EX1006, ¶¶106-07 (“it is currently preferred to adjust the brightness of a light spot after breaking it down into micro-optical elements”). Because these assigned micromirrors are oriented to reflect light away from the light spot (i.e., and towards the viewer’s body or inward) *corresponding to the pixel* (see [1b.2]), they are **excluded from the set of the micro mirrors displaying the pixel**. See EX1003, ¶276.

Accordingly, Fuhse262 renders obvious claim 9. EX1003, ¶¶264-276.

5. **Claim 10: “The assembly of claim 1, wherein, further in response to the receiving of the ambient light, the array of micro mirrors displays a second image in a second plane spaced a distance apart from the plane displaying the image, wherein the second image comprises a plurality of pixels and wherein the array of micro mirrors includes, for each of the pixels of the second image, a set of the micro mirrors each having a reflective surface oriented to reflect the ambient light toward a point on the second plane corresponding to one of the pixels of the second image.”**

Fuhse262 renders obvious this claim. *See, supra*, Sections VII.A.5.g ([35.b5); VII.A.5.h ([35.b6). EX1003, ¶277.

6. Claim 11: “The assembly of claim 10, wherein the image has a first viewing angle and the second image has a second viewing angle offset from the first viewing angle by at least 10 degrees.”

Fuhse262 teaches claim 11.

Fuhse262 teaches that “different images become visible to the viewer from different directions.” EX1006, ¶0111, 0024. In other words, light-spot image A (the **image**) is viewable from a certain angle (**a first viewing angle**), and an “image change” to light-spot image B (**the second image**) occurs when “tilted to the side” (**a second viewing**). See EX1003, ¶¶279-280.

Fuhse262 further teaches an **offset** in the two viewing angles by providing the ability “to separate the light-spot images of a changing image.” EX1006, ¶0115. Fuhse262 teaches “the size of the visibility range can be set as desired,” including between “three light-spot images A, B, C to change when tilted vertically.” EX1006, ¶0115. When chosen such that light-spot image A (the **image**) is viewable from a certain angle (**a first viewing angle**), and light-spot image B (**the second image**) is viewable from another certain angle, with a third image viewable at an angle between those images, the **offset** would be understood to be **least 10 degrees**. A

POSITA would understand that at least 10 degrees would be needed to be provided to the third image. EX1003, ¶281.

Accordingly, Fuhse262 renders obvious claim 11. EX1003, ¶¶278-281.

a. Grounds 2 and 4 Alternative

To the extent it is argued that Fushe262 does not satisfy the claim, Fushe925 does, and a POSITA would have been motivated to combine them with reasonable expectation of success. *See, supra*, Sections VII.A.1 and VII.A.2; EX1003, ¶282.

To the extent that Fushe262 does not provide express detail of the first and second viewing angles, and the offset between them to be 10 degrees, Fushe925 does such as seen in Figs. 6(a)-(b) below. EX1008, Figs. 6(a)-(b); 6:26-27 (“FIGS. 6(a) and 6(b) illustrations of the effect achieved by reducing the spreading range for two viewing directions”). EX1003, ¶283.

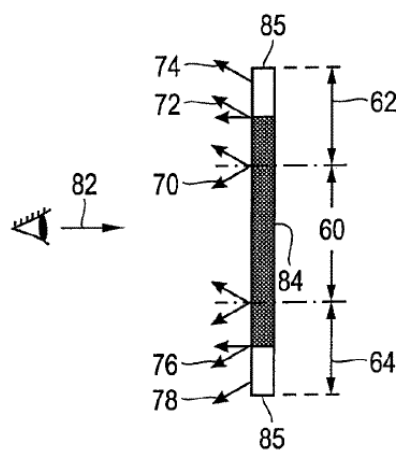


Fig. 6(a)

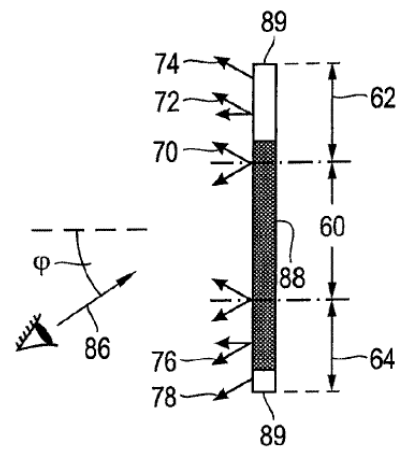


Fig. 6(b)

“In the perpendicular view 82 shown in FIG. 6(a) (corresponding to a viewing angle $\phi=0^\circ$) [(a **first viewing angle**)], the viewer sees that portion 84 of the line 16 in which the spreading range includes the angle $\phi=0^\circ$.” EX1008, 9:66-10:2. “In the view 86, shown in FIG. 6(b), obliquely from below at an angle $\phi=-10^\circ$ [(a **second viewing angle offset from the first viewing angle by at least 10 degrees**)], the viewer sees that portion 88 of the line 16 in which the spreading range includes the angle $\phi=-10^\circ$.” EX1008, 10:9-12. Accordingly, a POSITA would understand that the image and the second image have viewing angles and an offset between them. EX1003, ¶¶ EX1003, ¶284.

7. **Claim 12: “The assembly of claim 1, wherein the plane is above, below, or coinciding with the focal plane for the array of the micro mirrors.”**

Fuhse262 teaches claim 12.

In Fuhse262, **the plane is... coinciding with the focal plane for the array of the micro mirrors.**” As discussed in [1b.3] and [1b.5], the plane is for each of the pixels, the micromirror surfaces reflect incident light towards the point (x_0, y_0, z_0) , which “denotes the position of light spot 110,” which is **a point on the plane corresponding to one of the pixels.** EX1006, ¶¶0095-97. Fuhse262 further teaches “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.**” EX1006, ¶¶0097,

0100, 0057. Because all the pixels are in the plane (see [1.b2]), the all the focal points for the plurality of pixels form a **focal plane**. Thus, the plane **coincid[es]** with **the focal plane for the array of the micro mirrors**. See EX1003, ¶286.

Accordingly, Fuhse262 renders obvious claim 12. EX1003, ¶285-286.

8. Claim 13: “The assembly of claim 12, wherein the micro mirrors are configured to display the image with colors.”

Fuhse262 teaches claim 13. As an initial matter, **the micro mirrors are configured to** reflect visible light to **display the image**, which is visible and therefore is **with colors**. A POSITA would understand that all visible light has **colors**. See EX1003, ¶288.

To the extent it could be argued that this claim requires the image be displayed with particular colors, Fuhse262 satisfies this interpretation in two ways. EX1003, ¶289.

First, Fuhse262 teaches that its invention can be “combined with other security features,” such as “layer systems that show a color change when tilted.” EX1006, ¶0034. As discussed, one of these tilting angles corresponds to **the image** (see claims 10-11), so in this case, the image would be shown with the “color change.” EX1003, ¶290.

Second, Fuhse262 teaches that its mirco-mirrors may be “designed as embossed structures in an embossing lacquer layer,” such as “a thin-film element with

a color-shifting effect.” EX1006, ¶0032. Because the thin film provides “color-shifting” of the reflected light of **the micro mirrors, the image is display[ed] with the colors** that the film shifted to. EX1003, ¶291.

Accordingly, Fuhse262 renders obvious claim 13. EX1003, ¶287-291.

9. **Claim 32: “The assembly of claim 28, wherein the point on the plane corresponds to an apex of a cone and the number of the micro mirrors are located within a base of the cone coplanar with the surface of the substrate.”**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.A.3 (claim 8); *see also* Sections VII.A.1 and VII.A.2 (claims 6-7). EX1003, ¶292.

10. **Claim 33: “The assembly of claim 32, wherein the micro mirrors within the base of the cone and excluded from the set of the micro mirrors displaying the pixel are oriented to reflect the ambient light away from point on the plane corresponding to the pixel to provide a dark background for the image.”**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.A.4 (claim 9).
EX1003, ¶293.

11. **Claim 36: “The assembly of claim 35, wherein the image has a first viewing angle and the second image has a second viewing angle offset from the first viewing angle by at least 10 degrees.”**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.A.6 (claim 11).
EX1003, ¶294.

a. Grounds 2 and 4 Alternative

Alternatively, Fuhse262 in view of Fuhse925 renders obvious this claim. *See, supra*, Section VII.A.6.a (claim 11). EX1003, ¶295.

- 12. Claim 37: “The assembly of claim 35, wherein each of the sets of the micro mirrors includes a number of the micro mirrors in the range of 2 to 40, wherein the reflected ambient light from the number of the micro mirrors intersects at the point corresponding to the one of the pixels.”**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.A.1 (claim 6); see also Sections VII.A.4.g, VII.A.4.h ([28.b5-b6]) and VII.A.3.f, VII.A.3.g ([1b.4-b5]). EX1003, ¶296.

- 13. Claim 38: “The assembly of claim 35, wherein the plane is above, below, or coinciding with the focal plane for the array of the micro mirrors.”**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.A.6.a (claim 12). EX1003, ¶297.

E. Grounds 5 - 8: Grounds 1, 2, 3, or 4 in view of Fuhse172

Claims 14, 34, and 39 are obvious from Grounds 1, 2, 3, or 4 in view of Fuhse172. The positions for these claims are the same in view of Grounds 1, 2, 3, or 4, as the inclusion of Fuhse925 and/or Jordan do not affect the positions. EX1003, ¶¶305-306.

1. Fuhse262 and Fuhse925

a) Motivation to Combine

It is obvious to apply the teachings of Fuhse172 to Fuhse262. Fuhse262 and Fuhse172 are in the same field. EX1006, Abstract; EX1008, Abstract; EX1003, ¶298.

One reviewing Fuhse262 would have looked to Fuhse172. Fuhse262 teaches that its micromirrors may be provided with “a thin-film element with a color-shifting effect” (EX1006, ¶0032), or are included with “layer systems that show a color change when tilted.” EX1006, ¶0034. However, Fuhse262 does not provide explicit detail how to implement those thin-films in order to provide color-shifting. Fuhse172, however, *does* provide that explicit detail. EX1003, ¶299.

Fuhse172 further teaches that dielectric materials may be used to provide color-shifting. *See* EX1035, ¶¶0118, 0027-29. It would therefore have been obvious to examine how thin-films are implemented to achieve color-shifting when reviewing Fuhse262. Fuhse925 provides explicit detail for implementing what Fuhse262 teaches, namely that dielectric materials may be used to provide a thin-film color-shifting effect. EX1003, ¶¶300-301.

Using Fuhse172’s teachings regarding thin-film dielectrics in Fuhse262’s system would have involved using a known technique to improve Fuhse262 in a known

way, without unpredictable results, and would thus also have been obvious under *KSR Int’l Co. v. Teleflex, Inc.*, 550 U.S. 398, 416-18 (2007). EX1003, ¶302.

b) Reasonable Expectation of Success

A POSITA would have had a reasonable expectation of success in implementing the combination of Fuhse262 and Fuhse172. As a POSITA would have recognized, the structures of Fuhse262 and Fuhse172 are similar and compatible. Like the Fuhse262, Fuhse172 provides reflective facets for security elements that reflect light to produce images. EX1035, ¶¶97-98, Abstract. Like Fuhse262’s teaching to use “50µm x 50µm” size for the mirrors (Ex. 1006 (Fuhse262), ¶0087), Fuhse172 teaches to use edge lengths of its facets “in the range between 20 and 100 µm.” EX1035, ¶98; EX1003, ¶303.

As discussed in Ground 1 (see VII.A **Error! Reference source not found.**), the art was relatively predictable in the relevant timeframe (2015). *Id.* Thus, a POSITA would have been able to implement the obviousness modifications in this ground without difficulty. EX1003, ¶304.

2. Application to the Challenged Claims

a) Claim 14: The assembly of claim 13, wherein at least one of ink, plasmonic resonance, and dielectric

material is used to configure the micro mirrors to display the image with the colors.

Fuhse262 in view of Fuhse172 renders claim 14 obvious. *See* Fuhse172, ¶¶0118, 0027-29; EX1003, ¶307.

Fuhse172 discloses that in order “to apply a color-shifting coating, in particular a thin-film system, to the facets,” the thin-film system can have multiples “**dielectric layer[s]**” formed one on the other. EX1035, ¶¶0118, 0027-29. This “dielectric layer” is a **dielectric material** that is **used to configure the micro mirrors to display the image with the colors**. EX1003, ¶308.

Fuhse172 further discloses that instead of multiple dielectric layers, a combination of dielectric layers and metal layers may also be used, which also means a **dielectric material** is used. EX1035, ¶¶0027-29; EX1003, ¶¶309-311.

- b) **Claim 34: The assembly of claim 28, wherein the plane is above, below, or coinciding with the focal plane for the array of the micro mirrors, wherein the micro mirrors are configured to display the image with colors, and wherein at least one of ink, plasmonic resonance, and dielectric material is used to configure the micro mirrors to display the image with the colors.**

Fuhse262 renders obvious this claim. *See, supra*, Sections VII.D..7 (claim 12); Section I.A.8 VII.D.8 (claim 13); and Section VII.E.2.A (claim 14); EX1003, ¶312.

- c) **Claim 39: The assembly of claim 35, wherein the micro mirrors are configured to display the image with colors and wherein at least one of ink, plasmonic resonance, and dielectric material is used to configure the micro mirrors to display the image with the colors.**

Fuhse262 renders obvious this claim. *See, supra*, Section VII.D.8 (claim 13) and VII.E.2.A (claim 14) EX1003, ¶313.

VIII. SECONDARY CONSIDERATIONS OF NONOBVIOUSNESS

Secondary considerations should be considered but do not control the obviousness conclusion. *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 768 (Fed. Cir. 1988). Where, as here, a strong *prima facie* obviousness showing exists, even relevant secondary considerations supported by substantial evidence may not dislodge the obviousness conclusion. *Leapfrog Enters. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007). Petitioners is aware of no evidence supporting a claim for secondary considerations. EX1003, ¶314.

IX. INSTITUTION IS APPROPRIATE UNDER §314(A)

Efficiency, fairness, and merits support institution despite the existence of co-pending litigation. *Apple v. Fintiv*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential).

Factor 1 (stay) is favors institution, because Petitioners moved for a stay under seal (see Factor 2) based on issues unrelated to this proceeding. *See Hulu LLC*

v. SITO Mobile R&D IP, LLC, IPR2021-00298, Paper 11 at 10-11 (PTAB May 19, 2021).

Factor 2 (proximity to trial) favors institution. With this Petition filing, Final Written Decision is expected by November 2025. While the trial is scheduled for November 18, 2024 (EX1048, p. 1), the case may be transferred to the Court of Federal Claims (CoFC). In a separate litigation before the CoFC concerning the same patents-at-issue and involving the US Government, PO expressly represented that 28 U.S.C. § 1498 covers the nucleus of operative facts concerning alleged infringing products and identifies Petitioners as product contractors to the defendant in that case. Separately, in the EDTX case, Petitioners filed a Motion for Protective Order (including a request for stay) under seal concerning technical information sought by PO in light of the sensitivity of the information and Petitioners' defense under §1498. Petitioners expect to have more information prior to institution and can share relevant information with the Board as applicable and with any appropriate protections in place.

Factor 3 (investment in parallel litigation) is neutral. Fact discovery has not closed and the parties have not engaged in expert discovery. EX1048, p. 3. And the *Markman* hearing has been scheduled for June 14, 2024, after the filing of this Petition.

Factor 4 (overlapping issues) is neutral. If the litigation is not transferred to the CoFC prior to institution, Petitioners will consider not pursuing the Petition’s grounds before the district court by stipulation. *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020); *Sand Revolution II, LLC v. Cont’l Intermodal Grp.-Trucking LLC*, IPR2019-01393, Paper 24, 11-12 (PTAB Jun. 16, 2020); *Google LLC v. Jawbone Innovations, LLC*, IPR2022-00630, Paper 10, 16-17 (PTAB Sept. 13, 2022). However, pending resolution of Factor 2, it is premature to submit a *Sotera* stipulation at this time.

Factor 5 (same parties) may weigh slightly in favor of denial, because Petitioners and PO are the same parties as in the district court. However, based on a “holistic view,” the factors favor institution. *Samsung Elecs. Co. Ltd. v. Dynamics Inc.*, IPR2020-00505, Paper 11 at 15 (PTAB Aug. 12, 2020).

Factor 6 (other considerations) favors institution. Because the challenged claims cover known techniques published years before the earliest priority date, as discussed above, the features of the challenged claims are disclosed/suggested in the prior art presented here. *See, supra*, Section VII. This Petition’s merits are compelling.

Accordingly, *Fintiv* favors institution.

X. INSTITUTION IS APPROPRIATE UNDER §325(D)

The Board should not exercise discretion to deny institution of trial under 35 U.S.C. § 325(d). In performing an analysis, the Board uses the two-part *Advanced Bionics* framework. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential).

Part One: The grounds/arguments presented hererein are not the same or substantially the same as the prior art combinations and arguments raised during prosecution. Fuhse925, Jordan, and Fuhse172 were not cited during the '294 Patent prosecution and therefore were not considered. *See, supra*, Section III.B. While Applicant cited Fuhse262 near the end of prosecution, the Examiner neither cited nor applied it. Specifically, the Examiner did not substantively discuss or rely at all on Fuhse262 in any rejection of the claims. *Id.*

For Ground 1, Petitioner relies on a combination of different embodiments of Fuhse262 (Fig. 2 embodiment in view of embodiment(s) for Figs. 8-10). *See, supra*, Section VII.A. Such a combination was not considered by the Examiner. For Grounds 2-5, Petitioner relies on Fuhse262 (Ground 1) in view of Fuhse925, Jordan, and/or Fuhse172. *See, supra*, Sections VII.B-VII.E. Such combinations were not considered by the Examiner. *Sony Grp. Corp. v. MZ Audio Scis., LLC*, IPR2022-01544, Paper 12 at 7-8 (PTAB Apr. 21, 2023); *see also, supra*, Section III.B.

The prior art disclosures and combinations relied on in this Petition are not cumulative over prior art applied/relied on by the Examiner. For example, as Applicant argued during prosecution, Raber (relied on by the Examiner) in the electronic arts is “useful in providing a 3D television” and uses optical elements that display images “in succession with one another.” EX1002, pp. 420-22; *see also, supra*, Section III.B. As Applicant stated, that electronic device is “very different technologies” with a currency security device. *Id.* Applicant also argued that Raber reorients optical elements to vary focal length in order to “sequentially display a slice of an image on differing image planes,” and does not disclose orienting sets of micro mirrors in a fixed manner. *Id.*, p. 480. Fuhse262’s teachings are different from those of Raber’s and disclose a currency security device and orienting sets of micro mirrors in a fixed manner. *See, supra*, Section VII.A.7. Thus, Fuhse262 is not cumulative. *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 15-16 (PTAB Oct. 16, 2019) (precedential) (finding that a newly raised reference is not cumulative over previously considered art, where it taught “different structures that serve different purposes” and “solv[ed] a problem that is closer to that of the [challenged] patent”). Moreover, with such fundamental differences, combining Raber with Fuhse262 would not have been feasible and/or would not have remedied the deficiencies of Raber.

As another example, Applicant argued that instead of micromirrors, Kaule (relied on by the Examiner) provides lenses that focus light on layers on ink to make them more visible to the user. EX1002, p. 540. Fuhse262's teachings are different from those of Kaule's and disclose the use of micro mirrors in the claimed manner. *See, supra*, Section VII.A.7. Because of such differences, combining Kaule with Fuhse262 would not have remedied the deficiencies of Kaule.

Part Two: Even if the prior art or the arguments herein are substantially the same as those raised during prosecution (they are not), the Examiner/Office erred in a manner material to the patentability of the claims. For this part, “if the record of the Office’s previous consideration of the art is not well developed or silent, then a petitioner may show the Office erred by overlooking something.” *Advanced Bionics*, Paper 6 at 10.

As discussed above (for Part One), the Examiner did not substantively discuss or rely on the prior art and the combinations that the Petition relies on. For example, the Examiner did not substantively discuss or rely on Fuhse262 or consider the combination based on different embodiments of Fuhse262 (Ground 1) or such a combination in further view of Fuhse925, Jordan, and/or Fuhse172 (for Grounds 2-5). Thus, the record is not well developed and is silent.

The Examiner overlooked relevant disclosures of prior art. For example, the Examiner identified certain claim features that were believed to be missing in the prior art of record. *See, supra*, Section III.B. However, as discussed above in the analysis of the prior art and grounds (Section VII), Petitioner has sufficiently shown a reasonable likelihood that such claim features identified by the Examiner and the challenged claims are obvious in view of the combination of different embodiments of Fuhse262 and/or such a combination in further view of other prior art references. *See, supra*, Section VII. The Examiner clearly overlooked the relevant disclosures of Fuhse262 (*e.g.*, those pertaining to embodiments of Figs. 2, 8-10 and the combination of such embodiments) and those of other prior art references and the combinations relied on in the Petition. Thus, the Examiner/Office erred in a manner material to the patentability of the claims. *Cellco P'ship d/b/a Verizon Wireless v. Huawei Device Co., Ltd.*, IPR2020-01117, Paper 10 at 13-15 (PTAB Feb. 3, 2021) (declining to exercise discretion when an IDS and international search report identified prior art references, but the examiner did not address/apply them with respect to the challenged claims); *LG Elecs. Inc. v. Pantech Corp.*, IPR2023-01273, Paper 26 at 15-18 (PTAB Apr. 9, 2024).

Accordingly, the Board should not exercise its §325(d) discretion to deny institution.

XI. MANDATORY NOTICES

A. Real Parties-in-Interest Under 37 C.F.R. § 42.8(b)(1)

Petitioners are the real parties-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

To the best knowledge of Petitioners, the '294 Patent is involved in the following district court litigation: *Lumenco, LLC v. Giesecke+Devrient GmbH*, No. 2:23-cv-00100 (E.D. Tex. 2023) and *Lumenco, LLC v. United States*, No. 24-139-T (Fed Cl. 2024)

C. Lead and Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioners provides the following designation of counsel:

Lead Counsel	Backup Counsel
David M. Tennant (Reg. No. 48,362) davidtennant@paulhastings.com <u>Postal & Hand-Delivery Address:</u> Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1997	Jacob Rothenberg (Reg. No. 77,891) jacobrothenberg@paulhastings.com <u>Postal & Hand-Delivery Address:</u> Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1976
	Jeremy Rashid (Reg. No. 76,229) jeremyrashid@paulhastings.com <u>Postal & Hand-Delivery Address:</u> Paul Hastings LLP 2050 M Street, NW Washington, DC 20036 Telephone: (202) 551-1776

	Eric E. Lancaster (<i>pro hac vice</i> to be filed) ericlancaster@paulhastings.com <u>Postal & Hand-Delivery Address:</u> Paul Hastings LLP 1117 S. California Avenue, Palo Alto, Palo Alto, CA 94304 Telephone: (650) 320-860
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Pursuant to 37 C.F.R. § 42.10(b), a Power of Attorney accompanies this petition.

D. Service Information Under 37 C.F.R. § 42.8(b)(4)

A Power of Attorney is being filed concurrently with this Petition in accordance with 37 C.F.R. § 42.10(b). Petitioner consents to electronic service by e-mail, using the email addresses identified above.

XII. GROUNDS FOR STANDING

Petitioners certifies that the '294 Patent is available for IPR; Petitioners is not barred or estopped from requesting IPR; and this petition is being filed within one year of service of the complaint in the co-pending district court litigation.

XIII. CONCLUSION

Petitioners requests institution of this IPR and cancellation of the claims.

Dated: May 1, 2024

Respectfully submitted,

/David M. Tennant/
David M. Tennant (Reg. No. 48,362)
davidtennant@paulhastings.com
Postal & Hand-Delivery Address:

Giesecke+Devrient v. Lumenco, GmbH, et al., IPR2024-00836
IPR Petition – U.S. Patent No. 10,189,294

Paul Hastings LLP
2050 M Street, NW
Washington, DC 20036
Telephone: (202) 551-1997

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), the undersigned certifies that foregoing
**PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO.
10,189,294**, exclusive of the parts exempted as provided in 37 C.F.R. §42.24(a),
contains 13,920 words and therefore complies with the type-volume limitations of
37 C.F.R. §42.24(a).

Dated: May 1, 2024

Respectfully submitted,

/David M. Tennant/

David M. Tennant (Reg. No. 48,362)

davidtennant@paulhastings.com

Postal & Hand-Delivery Address:

Paul Hastings LLP

2050 M Street, NW

Washington, DC 20036

Telephone: (202) 551-1997

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing **PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 10,189,294 AND EXHIBITS 1001-1023** are being served on May 1, 2024, via Federal Express overnight mail on counsel of record for U.S. Patent No. 10,189,294 as addressed below:

McCarthy, Randall
72766 - Hall Estill Hardwick Gable Golden & Nelson, P.C.
100 North Broadway
Suite 2900
Oklahoma City, OK 73102

A courtesy copy is also being served on counsel for the patent holder in the pending litigation via electronic mail.

Jonathan L. Hardt (TX 24039906)* ROZIER HARDT MCDONOUGH PLLC 712 W. 14th Street, Suite C Austin, Texas 78701 Telephone: (210) 289-7541 Email: hardt@rhmttrial.com	C. Matthew Rozier (CO 46854)* ROZIER HARDT MCDONOUGH PLLC 2590 Walnut Street, Suite 10 Denver, Colorado 80205 Telephone: (720) 820-3006 Email: matt@rhmttrial.com
James F. McDonough, III (GA 117088)* Jonathan R. Miller (GA 507179)* Travis E. Lynch (GA 162373)* ROZIER HARDT MCDONOUGH PLLC 3621 Vinings Slope, Suite 4300 Atlanta, Georgia 30339 Telephone: (470) 840-9505, -9517, -9514	

Email: jim@rhmttrial.com Email: miller@rhmttrial.com Email: lynch@rhmttrial.com	
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Dated: May 1, 2024

Respectfully submitted,

/David M. Tennant/

David M. Tennant (Reg. No. 48,362)

davidtennant@paulhastings.com

Postal & Hand-Delivery Address:

Paul Hastings LLP

2050 M Street, NW

Washington, DC 20036

Telephone: (202) 551-1997