

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00836

IPR2024-00838

IPR2024-00839

Lumenco, LLC

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

Patent Owner's Demonstratives

IPR2024-00836: U.S. Pat. No. 10,189,294

IPR2024-00838: U.S. Pat. No. 10,901,191

IPR2024-00839: U.S. Pat. No. 11,448,863

(the three challenged patents are referred to collectively herein as the “Lumenco Patents”)

August 26, 2025

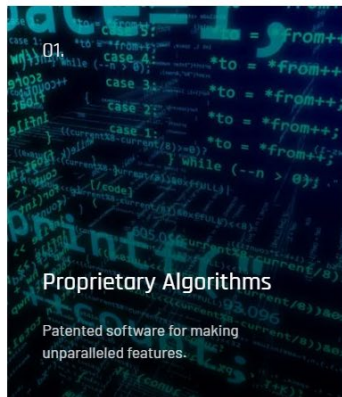
Lumenco, LLC



The Global Leader in Micro-Optics

Patent Owner Lumenco is a Colorado-based research and development company founded in 2012.

Lumenco's business focuses on micro-optic, micro mirror, lighting, and screen technologies.

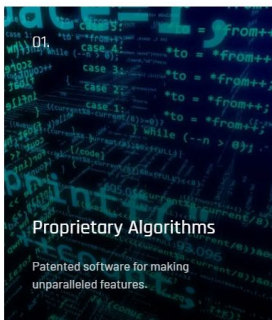


IPR2024-00836, POR at p. 3
IPR2024-00838, -00839, POR at pp. 2-3

Lumenco, LLC



The Global Leader in Micro-Optics



- Over the past decade, Lumenco has provided a broad array of optical security products to governments and private companies around the world.
- In 2015 Lumenco entered into a development agreement with the United States Bureau of Engraving and Printing (“BEP”).
- The collaboration lasted five years and involved micro-optical technologies for use on banknotes.

IPR2024-00836, POR at pp. 3-5

IPR2024-00838, -00839, POR at pp. 2-5

Timeline of Major Events

(See, e.g., IPR2024-00839, Petition, pp. 205)

2015 - Lumenco designed and developed a new micro mirror-based optical security feature with code name Dycyfer™.

2016 - Lumenco presented its Dycyfer™ technology to the United States Bureau of Engraving and Printing (BEP) as a potential technology for use in United States banknotes.

2017 - Lumenco introduced its Dycyfer™ technology and its micro mirror patent application to Petitioner.

2017 - Mark Raymond and Hector Porra invited by Petitioner to Germany to present Lumenco's Dycyfer™ technology and the applications that eventually issued as the '294 patent, the '191 patent, and the '863 patent.

2018 - Petitioner released its Galaxy® product line using certain features described in Lumenco's patent applications

Timeline of Major Events (cont.)

(*See, e.g.*, IPR2024-00839, Petition, pp. 205)

January 29, 2019 - U.S. Patent No. 10,189,294 issued.

January 21, 2021 - Patent Owner sent Petitioner a letter notifying Petitioner of its infringement of several of Lumenco's patents. G+D continued to infringe.

January 26, 2021 - U.S. Patent No. 10,901,191 issued.

September 20, 2022 - U.S. Patent No. 11,448,863 issued.

March 2023 - Patent Owner initiated patent infringement litigation against Petitioner in Eastern District of Texas.

May 2024 - Petitioner filed these IPR petitions.

Evidentiary Standard: A Preponderance of the Evidence

“the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.” 35 U.S.C. § 316(e).

“In an inter partes review, the burden of persuasion is on the petitioner to prove 'unpatentability by a preponderance of the evidence,' 35 U.S.C. § 316(e), and that burden never shifts to the patentee.” *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016) (citing *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015)).

IPR2024-00836, -00838, POR at pp. 4-5

IPR2024-00839, POR at pp. 1, 4, 5, 6

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00836

IPR2024-00838

IPR2024-00839

Challenged Claims

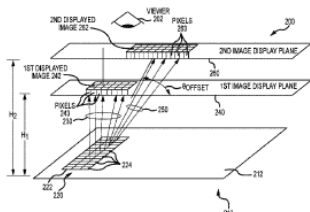
Challenged Claims

U.S. Patent No. 10,189,294

[1b.5], [35b.4], [35b.5], and claim 24

 US010189294B2	
(12) United States Patent Raymond et al.	(10) Patent No.: US 10,189,294 B2 (45) Date of Patent: Jan. 29, 2019
(54) ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES FOR CURRENCY AND BRAND AUTHENTICATION	(56) References Cited U.S. PATENT DOCUMENTS 5,105,306 A 4/1992 Ohala 6,288,842 B1 9/2001 Florczak (Continued)
(71) Applicant: LUMENCO, LLC , Englewood, CO (US)	FOREIGN PATENT DOCUMENTS DE 102010048262 A1 4/2012 WO 2011012460 A2 2/2011 (Continued)
(72) Inventors: Mark A. Raymond , Littleton, CO (US); Hector Andres Porras Soto , Littleton, CO (US); Howard G. Lange , San Diego, CA (US)	OTHER PUBLICATIONS International Search Report for International Application No. PCT/US2016/061845 dated Mar. 16, 2017. (Continued)
(73) Assignee: LUMENCO, LLC , Englewood, CO (US)	
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 35 days.	
(21) Appl. No.: 15/162,113	Primary Examiner — Jade R Chwaz (74) Attorney, Agent, or Firm — Marsh Fischmann & Breyfogle LLP; Kent A. Lembke
(22) Filed: May 23, 2016	
(65) Prior Publication Data US 2017/0157973 A1 Jun. 8, 2017	(57) ABSTRACT A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light so as to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light each set of micro mirrors intersects to illuminate or write a pixel of an image.
Related U.S. Application Data (60) Provisional application No. 62/262,767, filed on Dec. 3, 2015.	
(51) Int. Cl. B42D 25/29 (2014.01) G02B 17/00 (2006.01) (Continued)	
(52) U.S. CL. CPC B42D 25/373 (2014.10); B42D 25/29 (2014.10); B42D 25/324 (2014.10); (Continued)	
(58) Field of Classification Search CPC ... B42D 25/373; B42D 25/378; B42D 25/29; B42D 25/21; B42D 25/351; B42D 25/23; (Continued)	

39 Claims, 20 Drawing Sheets



IPR2024-00836, Ex. 1001

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

a substrate; and

on a surface of the substrate, an array of micro mirrors receiving ambient light and, 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 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, wherein each of the different sets concurrently reflect the ambient light to concurrently generate the plurality of pixels, 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 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.

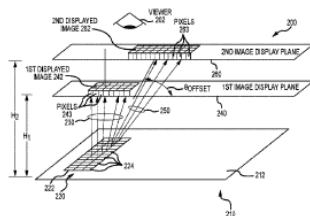
[1b.5]

Challenged Claims

U.S. Patent No. 10,189,294

[1b.5], [35b.4], [35b.5], and claim 24

 US010189294B2	
(12) United States Patent Raymond et al.	(10) Patent No.: US 10,189,294 B2 (45) Date of Patent: Jan. 29, 2019
(54) ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES FOR CURRENCY AND BRAND AUTHENTICATION	(56) References Cited
(71) Applicant: LUMENCO, LLC , Englewood, CO (US)	U.S. PATENT DOCUMENTS
(72) Inventors: Mark A. Raymond , Littleton, CO (US); Hector Andres Porras Soto , Littleton, CO (US); Howard G. Lange , San Diego, CA (US)	5,105,306 A 4/1992 Ohala 6,288,842 B1 9/2001 Floreczak (Continued)
(73) Assignee: LUMENCO, LLC , Englewood, CO (US)	FOREIGN PATENT DOCUMENTS
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 35 days.	DE 102010048262 A1 4/2012 WO 2011012460 A2 2/2011 (Continued)
(21) Appl. No.: 15/162,113	OTHER PUBLICATIONS
(22) Filed: May 23, 2016	International Search Report for International Application No. PCT/US2016/061845 dated Mar. 16, 2017. (Continued)
(65) Prior Publication Data US 2017/0157973 A1 Jun. 8, 2017	<i>Primary Examiner</i> — Jade R Chwisz (74) <i>Attorney, Agent, or Firm</i> — Marsh Fischmann & Breyfogle LLP; Kent A. Lembke
Related U.S. Application Data	(57) ABSTRACT
(60) Provisional application No. 62/262,767, filed on Dec. 3, 2015.	A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light so as to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light each set of micro mirrors intersects to illuminate or write a pixel of an image.
(51) Int. Cl. B42D 25/29 (2014.01) G02B 17/00 (2006.01) (Continued)	
(52) U.S. CL. CPC B42D 25/373 (2014.10); B42D 25/29 (2014.10); B42D 25/324 (2014.10); (Continued)	
(58) Field of Classification Search CPC ... B42D 25/373; B42D 25/378; B42D 25/29; B42D 25/21; B42D 25/351; B42D 25/23; (Continued)	
39 Claims, 20 Drawing Sheets	



IPR2024-00836, Ex. 1001

35. A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:

a substrate; and

on a surface of the substrate, an array of micro mirrors receiving ambient light and, 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,

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, **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,

[35b.4]

[35b.5]

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 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, 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.

Challenged Claims

U.S. Patent No. 10,189,294

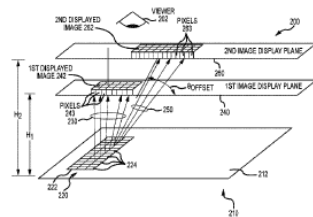
[1b.5], [35b.4], [35b.5], and claim 24



(12) United States Patent Raymond et al.		(10) Patent No.: US 10,189,294 B2
		(45) Date of Patent: Jan. 29, 2019
(54) ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES FOR CURRENCY AND BRAND AUTHENTICATION	(56) References Cited	
		U.S. PATENT DOCUMENTS
		5,105,306 A 4/1992 Ohala 6,288,842 B1 9/2001 Floczak (Continued)
(71) Applicant: LUMENCO, LLC , Englewood, CO (US)	FOREIGN PATENT DOCUMENTS	
		DE 102010048262 A1 4/2012 WO 2011012460 A2 2/2011 (Continued)
(73) Assignee: LUMENCO, LLC , Englewood, CO (US)	OTHER PUBLICATIONS	
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 35 days.		International Search Report for International Application No. PCT/US2016/061845 dated Mar. 16, 2017. (Continued)
(21) Appl. No.: 15/162,113	<i>Primary Examiner</i> — Jade R Chwysz (74) <i>Attorney, Agent, or Firm</i> — Marsh Fischmann & Breyfogle LLP; Kent A. Lembke	
(22) Filed: May 23, 2016		
(65) Prior Publication Data	(57) ABSTRACT	
US 2017/0157973 A1 Jun. 8, 2017		A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light so as to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light each set of micro mirrors intersects to illuminate or write a pixel of an image.
Related U.S. Application Data		
(60) Provisional application No. 62/262,767, filed on Dec. 3, 2015.		
(51) Int. Cl. B42D 25/29 (2014.01) G02B 17/00 (2006.01) (Continued)		
(52) U.S. CL. CPC B42D 25/373 (2014.10); B42D 25/29 (2014.10); B42D 25/324 (2014.10); (Continued)		
(58) Field of Classification Search CPC ... B42D 25/373; B42D 25/378; B42D 25/29; B42D 25/21; B42D 25/351; B42D 25/23; (Continued)		

39 Claims, 20 Drawing Sheets

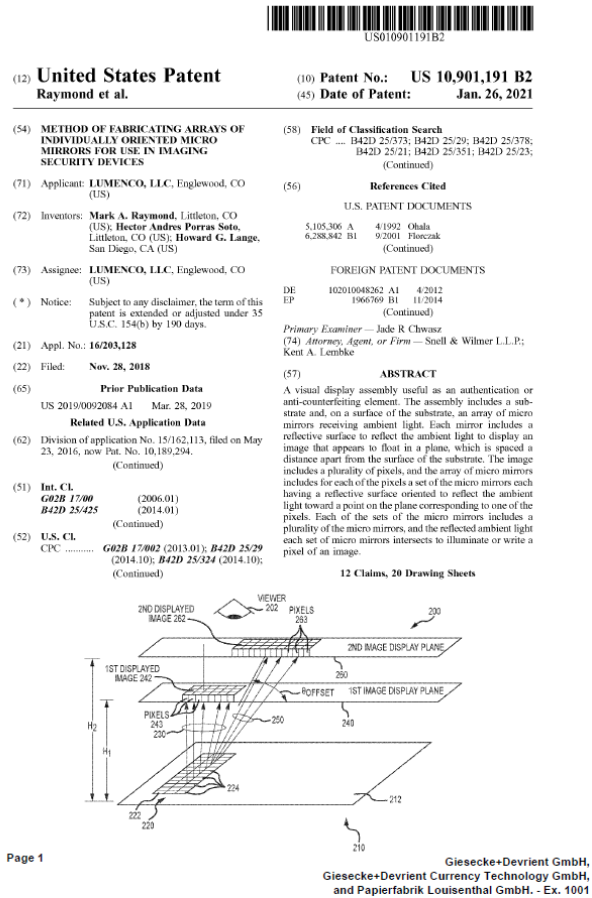
39 Claims, 20 Drawing Sheets



IPR2024-00836, Ex. 1001

24. The assembly of claim 15, 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.

Challenged Claims
U.S. Patent No. 10,901,191
[1d]



1. A method of fabricating a security element useful on paper and coin currency and product labels, comprising:

providing a substrate; and

forming an array of micro mirrors on a surface of the substrate,

wherein the array of micro mirrors is configured for receiving ambient light and, 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,

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,

wherein each of the different sets concurrently reflect the ambient light to concurrently generate the plurality of pixels,

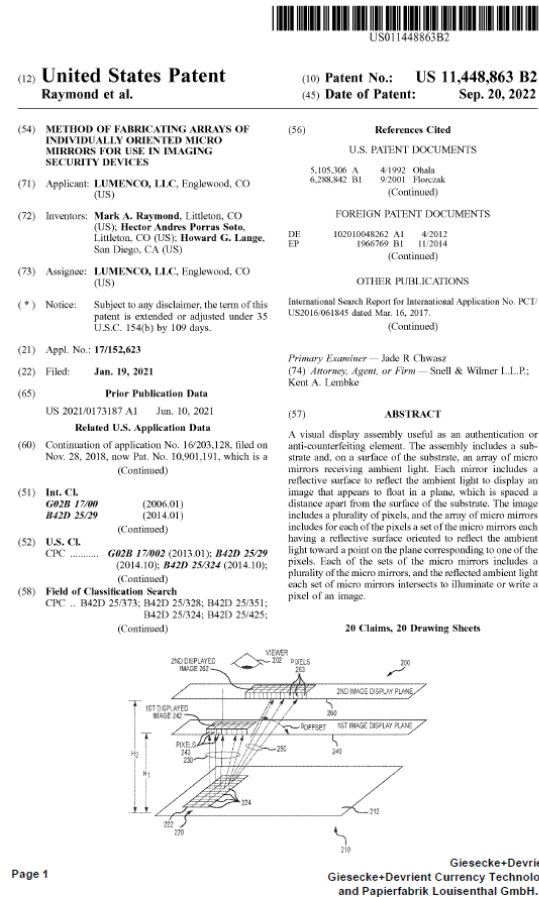
[1d] wherein a voxel is created at each of the point on the plane via intersection of two or more beams of the reflected ambient light, and

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

Challenged Claims

U.S. Patent No. 11,448,863

[1a], [7d], [12b], and Claim 3



1. A method of fabricating a security element, comprising:

[1a]

assigning a first object in a starting digital image to a first image display plane and a second object in the starting digital image to a second image display plane;

with a processor of a computing device, executing code to provide an array design module that operates to select a set of micro mirrors in an array of the micro mirrors to display each of the pixels of the first object in the first image display plane and to display each of the pixels of the second object in the second image display plane;

for each of the pixels, determining with the array design module an angular orientation of each of the micro mirrors in the selected sets of the micro mirrors;

generating a design output file including the angular orientation and location coordinates in the array for each of the micro mirrors in the selected sets of the micro mirrors; and

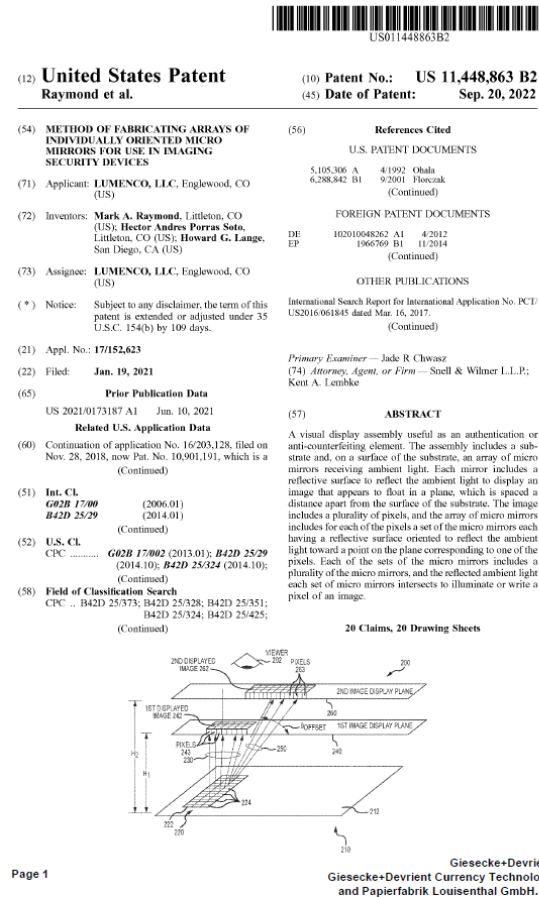
forming the array of the micro mirrors according to the design output file.

'863 patent, p. 1

Challenged Claims

U.S. Patent No. 11,448,863

[1a], [7d], [12b], and Dependent Claim 3



7. A method of fabricating a security element, comprising:

with a processor of a computing device, executing code to provide an array design module configured to select a set of micro mirrors in an array of the micro mirrors to display pixels of a first object in a first image display plane and to display pixels of a second object in a second image display plane spaced apart from the first image display plane;

for each of the pixels, determining, with the array design module, an angular orientation of each of the micro mirrors in the selected sets of the micro mirrors;

generating a design output file including the angular orientation and location coordinates in the array for each of the micro mirrors in the selected sets of the micro mirrors, wherein each of the sets of micro mirrors are selected randomly from a plurality of the micro mirrors located in a base of a cone on a surface containing the array of the micro mirrors; and

forming the array of the micro mirrors according to the design output file.

'863 patent, p. 1

Challenged Claims

U.S. Patent No. 11,448,863

7d], [12b], and Dependent C



(12) **United States Patent**
Raymond et al.

(10) **Patent No.:** US 11,448,863 B2
(45) **Date of Patent:** Sep. 20, 2022

(54) METHOD OF FABRICATING ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES (56) References Cited U.S. PATENT DOCUMENTS

(71) Applicant: **LUMENCO, LLC**, Englewood, CO
(US)

(72) Inventors: **Mark A. Raymond**, Littleton, CO (US); **Hector Andres Porras Soto**, Littleton, CO (US); **Howard G. Lange**, San Diego, CA (US)

(73) Assignee: **LUMENCO, LLC**, Englewood, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 109 days.

(21) Appl. No.: 17/152,623

(22) Filed: **Jan. 19, 2021**

(65) **Prior Publication Data**
 US 2021/0173187 A1 Jun. 10, 2021 (57) **ABSTRACT**

Related U.S. Application Data

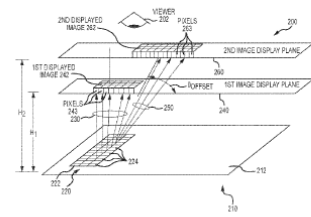
(60) Continuation of application No. 16/203,128, filed on Nov. 28, 2018, now Pat. No. 10,901,191, which is a (Continued)

(51) **Int. Cl.**
G02B 17/00 (2006.01)
B42D 25/29 (2014.01)
(Continued)

(52) U.S. Cl. CPC **G02B 17/002** (2013.01); **B42D 25/29** (2014.10); **B42D 25/324** (2014.10);
(Continued)

(38) Field of Classification Search
CPC .. B42D 25/373; B42D 25/328; B42D 25/351;
B42D 25/324; B42D 25/425;
(Continued)

20 Claims, 20 Drawing Sheets



Giesecke+Devrient GmbH,
Giesecke+Devrient Currency Technology GmbH,
and Papierfabrik Louisenthal GmbH. - Ex. 1001

12. A method of fabricating a security element useful on paper and coin currency and on product labels, comprising:

with a processor of a computing device, executing code to provide an array design module configured to define an array of micro mirrors to be formed on a surface of a substrate;

[12b] generating a design output file including an angular orientation and location coordinates in the array for each of the micro mirrors; and

forming the array of micro mirrors according to the design output file,

wherein the array of micro mirrors is configured, when formed on the surface of the substrate, for receiving ambient light and, 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

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.

'863 patent, p. 1

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00836

IPR2024-00838

IPR2024-00839

Person of Ordinary Skill In the Art (“POSITA”)

Petitioner's Definition

A POSITA would have had an:

- “undergraduate degree in mechanical or electrical engineering or physics and
- at least 2 years of experience in **micro-optics design.**”

IPR2024-00836, Ex. 1003 at ¶ 68

IPR2024-00838, Ex. 1003 at ¶ 87

IPR2024-00839, Ex. 1003 at ¶ 94

Patent Owner's Definition



Dr. Mikael Lindstrand
Patent Owner's Expert

A POSITA would have had an:

- “undergraduate degree in electrical engineering, mechanical engineering, physics, or a similar field and
- at least 2 years of experience with diffusive light micro-optic security features.”

IPR2024-00836, -00838, Ex. 2004 at ¶23;
IPR2024-00839, Ex. 2001 at ¶23

Ambient Light is Diffusive Light

- The Lumenco Patents are directed to micromirror arrays for use in ambient light environments. Ex. 1001, 2:33-47, 5:10-6:9, 7:30-36
- Petitioner and its expert admit this. *See, e.g.*, Petition, pp. 3-4 and Ex. 1003, ¶94 (citing Ex. 1001, 2:33-47, 5:10-6:9, 7:30-36).
- All challenged claims of the '294 and '191 patents recite micromirrors “receiving ambient light.”

Petitioner's Expert Misunderstands Ambient Light Systems

- Dr. Hesselink's opinions are premised on his understanding that:
 - “ambient light refers to parallel light, i.e., all the rays coming from the source are parallel to each other,” (Ex. 1003, ¶46); and
 - “When using parallel light (i.e. as used in the patent) all incident rays that are parallel to each other experience the same direction in which they are reflected.” *Id.*, ¶45.
- Dr. Hesselink does not explain the basis for his understanding.

See, e.g., IPR2024-00836, Ex. 1003 at ¶¶45-46

But In Ambient/Diffusive Light Systems, All Light Rays Are Not Parallel



Dr. Mikael Lindstrand
Patent Owner's Expert

37. Ambient light environments often involve light rays from multiple sources and light from those sources is often intentionally diffused. Ambient light refers to, for example, the lighting conditions in an indoor office environment with multiple overhead light sources, natural light entering through windows, etc. In ambient light systems, light rays engage security features from a variety of directions—the rays are not all parallel to each other.

IPR2024-00836, -00838, Ex. 2004 at ¶137;
IPR2024-00839, Ex. 2001 at ¶137

Parallel Light Rays Occur In Collimated Light Systems



Dr. Mikael Lindstrand
Patent Owner's Expert

- Systems in which all rays are parallel to each other are collimated light systems, not ambient systems. IPR2024-00836 Ex. 2004 at ¶27.
- In collimated systems, the angle of rays are highly controlled and predictable, e.g., lasers. *Id.* at ¶27.
- All of Dr. Hesselink's listed experience is with collimated light sources – there is no evidence that he has any experience with ambient/diffusive light systems. *Id.* at ¶¶ 30-33.

Dr. Hesselink's Experience



Dr. Mikael Lindstrand
Patent Owner's Expert

33. Dr. Hesselink provides several more specific examples of his experience with optical systems. He states that he has experience with “3-D displays, including autostereoscopic holographic displays, 3-D up conversion display, 3-D displays for security applications, grating-based displays, as well as data analysis of complex 3-D flow visualizations using scanning laser systems, tomography, and mathematical topology,” as well as “3-D display and storage devices” and the use of “interferometry to determine the 3-shape of objects using optical and X-ray scanners.” None of the specific technologies detailed by Dr. Hesselink are diffusive light systems. For example, autostereoscopic holographic, 3-D up conversion, and grating-based display systems all use collimated light or other focused light sources, not ambient or diffusive light sources.

IPR2024-00836 Ex. 2004 at ¶33.

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00836

Arguments of Patent Owner, Lumenco, LLC
U.S. Pat. No. 10,189,294

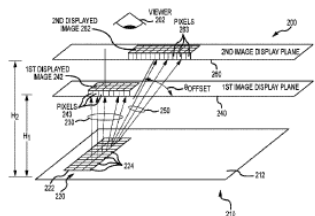
U.S. Patent No. 10,189,294

[1b.5], [28b.5], and [35b.4]

No “Creation of Voxels”

 US010189294B2	
(12) United States Patent Raymond et al.	(10) Patent No.: US 10,189,294 B2 (45) Date of Patent: Jan. 29, 2019
(54) ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES FOR CURRENCY AND BRAND AUTHENTICATION	(56) References Cited U.S. PATENT DOCUMENTS 5,105,306 A 4/1992 Ohala 6,288,842 B1 9/2001 Florenczak (Continued)
(71) Applicant: LUMENCO, LLC , Englewood, CO (US)	FOREIGN PATENT DOCUMENTS DE 102010048262 A1 4/2012 WO 2011012460 A2 2/2011 (Continued)
(72) Inventors: Mark A. Raymond , Littleton, CO (US); Hector Andres Porras Soto , Littleton, CO (US); Howard G. Lange , San Diego, CA (US)	OTHER PUBLICATIONS International Search Report for International Application No. PCT/US2016/061845 dated Mar. 16, 2017. (Continued)
(73) Assignee: LUMENCO, LLC , Englewood, CO (US)	
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 35 days.	
(21) Appl. No.: 15/162,113	Primary Examiner — Jade R Chwysz (74) Attorney, Agent, or Firm — Marsh Fischmann & Breyfogle LLP ; Kent A. Lembke
(22) Filed: May 23, 2016	
(65) Prior Publication Data US 2017/0157973 A1 Jun. 8, 2017 Related U.S. Application Data (60) Provisional application No. 62/262,767, filed on Dec. 3, 2015.	(57) ABSTRACT A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light so as to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light each set of micro mirrors intersects to illuminate or write a pixel of an image.
(51) Int. Cl. B42D 25/29 (2014.01) G02B 17/00 (2006.01) (Continued)	
(52) U.S. CL. CPC B42D 25/373 (2014.10); B42D 25/29 (2014.10); B42D 25/324 (2014.10); (Continued)	
(58) Field of Classification Search CPC B42D 25/373; B42D 25/378; B42D 25/29; B42D 25/21; B42D 25/351; B42D 25/23; (Continued)	

39 Claims, 20 Drawing Sheets



IPR2024-00836, Ex. 1001

1. A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:
a substrate;

[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 [.]

[28b.5] 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

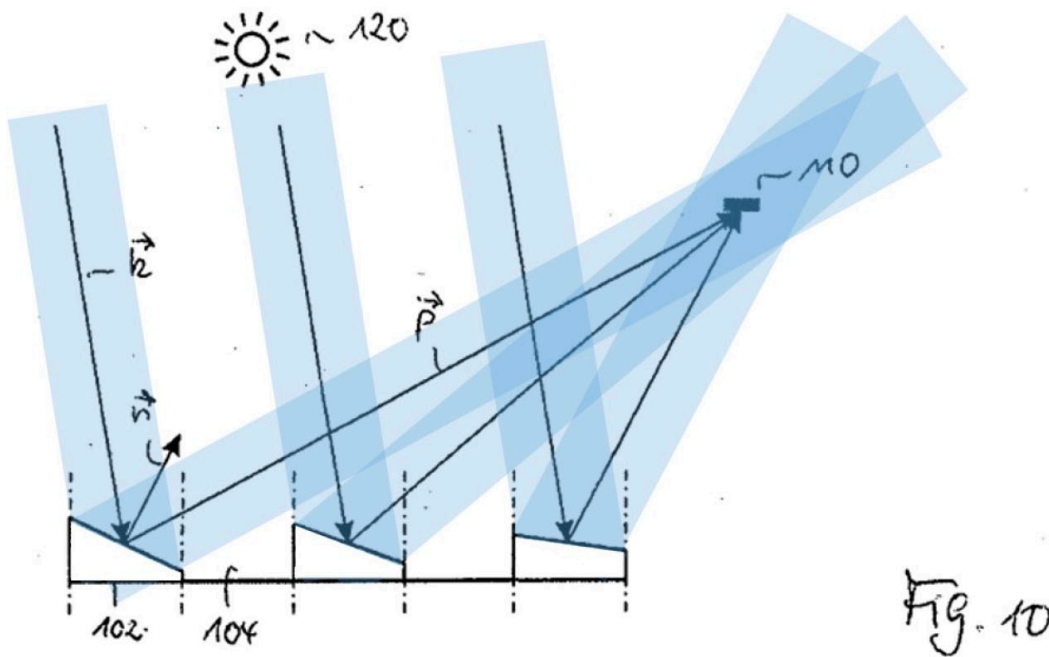
[35b.4] wherein the reflected ambient light from the number of the micro mirrors intersects at the point corresponding to the one of the pixels to create a voxel

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

- All Grounds argue that Fuhse262 discloses “creation of voxels.”
- Petition admits that “[t]he ’294 Patent does not use the term “voxel.”
Petition, p. 31.
- Petitioner does not argue that the figures of the ’294 patent show voxels.
See, generally, Petition.
- No prior art in this IPR discloses or discusses voxels or 3D pixels.

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

The “Evidence” From Fuhse262



“for each of the pixels, a light **spot** at point (x0, y0, z0) is a **point** on the plane corresponding to one of the **pixels**.” EX2006, ¶¶0095-97

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

- Preponderance of the evidence standard
- Inherency - “necessarily must be present, or the natural result of the combination of elements explicitly disclosed by the prior art.” *PAR Pharm., Inc. v. TWI Pharm., Inc.*, 773 F.3d 1186, 1196 (Fed. Cir. 2014).
- “High standard” that is “carefully circumscribed.” *Id.* at 1195.
- “May not be established by probabilities or possibilities” *Id.* at 1196.

IPR2024-00836, Sur-Reply at p. 3

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

- No matter the standard, creation of a pixel does not teach or suggest creation of a voxel. IPR2024-00836, Paper at p. 13; Ex. 2004, ¶¶ 45-46.
- Creating voxels involves significant additional technical challenges:
 - Pixels require less information;
 - Interference from diffused light rays;
 - Pixels can be displayed even when there has been substantial degradation from interference;
 - Compensating for interference requires extra computation and storage.

IPR2024-00836, Paper at p. 18; Ex. 2004, ¶¶ 46-51

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”



Dr. Mikael Lindstrand
Patent Owner's Expert

“A POSITA would not expend the time and money to achieve the higher-level design required to produce a voxel if only pixels were necessary to achieve a desired image goal.” Ex. 2004, ¶¶45-46.

“Dr. Hesselink does not acknowledge or address any of these concerns. This may stem from Dr. Hesselink’s misunderstanding about the nature of ambient light environments.” Ex. 2004, ¶52.

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

Petitioner’s Reply Does Not Cure Deficiencies

- “PO provided no explanation of why a pixel formed from Fuhse262’s reflected light beams all aimed at a common point **would not** have a volume.” Reply, p. 6 (emphasis added).
- False and “burden never shifts.” *FanDuel, Inc. v. Interactive Games LLC*, 966 F.3d 1334, 1341 (Fed. Cir. 2020)
- *In re: Epstein* is not applicable:
 - Addressed enablement of element expressly disclosed by the prior art. No dispute here that Fuhse262 does not expressly disclose voxels.
 - ‘294 patent expressly discloses voxels and the claims use the term. Reply, p. 8.

U.S. Patent No. 10,189,294
[1b.5], [28b.5], and [35b.4]
No “Creation of Voxels”

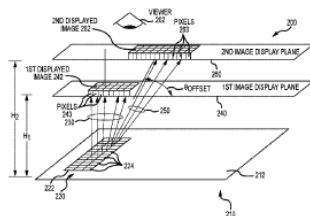
- Mischaracterizes deposition testimony:
 - “upon cross-examination, Dr. Lindstrand admitted that for someone on earth, sunlight is ‘best approximated as a parallel light source.’” Reply, p. 23 (citing Ex. 1052, 96:1-7, 98:10-20)
- Actual testimony: **“in the void of space outside, far from earth . . . it's best approximated as a parallel light source.”** Sur-Reply, p. 7.
- “entering again closer to the earth, you have disturbances in our atmosphere that cause the light rays to become[] messy . . . bouncing around, and then you have light rays from different directions . . . you have bouncing around from the whole environment, the cars and the mirrors and everything, ***then you have an ambient light condition.***” Sur-Reply, p. 8.

U.S. Patent No. 10,189,294 [35b.5] and claim 24

No “Second Image In Second Plan Spaced a Distance Apart”

 US010189294B2	
(12) United States Patent Raymond et al.	(10) Patent No.: US 10,189,294 B2 (45) Date of Patent: Jan. 29, 2019
(54) ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES FOR CURRENCY AND BRAND AUTHENTICATION	(56) References Cited
(71) Applicant: LUMENCO, LLC , Englewood, CO (US)	U.S. PATENT DOCUMENTS 5,105,306 A 4/1992 Ohala 6,288,842 B1 9/2001 Florczak (Continued)
(72) Inventors: Mark A. Raymond , Littleton, CO (US); Hector Andres Porras Soto , Littleton, CO (US); Howard G. Lange , San Diego, CA (US)	FOREIGN PATENT DOCUMENTS DE 102010048262 A1 4/2012 WO 2011012460 A2 2/2011 (Continued)
(73) Assignee: LUMENCO, LLC , Englewood, CO (US)	OTHER PUBLICATIONS International Search Report for International Application No. PCT/US2016/061845 dated Mar. 16, 2017. (Continued)
(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 35 days.	
(21) Appl. No.: 15/162,113	<i>Primary Examiner</i> — Jade R Chwisz (74) <i>Attorney, Agent, or Firm</i> — Marsh Fischmann & Breyfogle LLP; Kent A. Lembke
(22) Filed: May 23, 2016	
(65) Prior Publication Data US 2017/0157973 A1 Jun. 8, 2017	(57) ABSTRACT A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light so as to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light each set of micro mirrors intersects to illuminate or write a pixel of an image.
Related U.S. Application Data (60) Provisional application No. 62/262,767, filed on Dec. 3, 2015.	
(51) Int. Cl. B42D 25/29 (2014.01) G02B 17/00 (2006.01) (Continued)	
(52) U.S. CL. CPC B42D 25/373 (2014.10); B42D 25/29 (2014.10); B42D 25/324 (2014.10); (Continued)	
(58) Field of Classification Search CPC B42D 25/373; B42D 25/378; B42D 25/29; B42D 25/21; B42D 25/351; B42D 25/23; (Continued)	

39 Claims, 20 Drawing Sheets



IPR2024-00836, Ex. 1001

35. A visual display assembly useful as a security element on paper and coin currency, and product labels, comprising:

[35b.5]

...

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[.]

24. The assembly of claim **15**, 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.

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In A Second Plane Spaced a Distance Apart”

- All Grounds rely exclusively on Fuhse262.
- The Evidence Cited in the Petition:
 - “The two images are in the ‘foreground’ and ‘background’ of each other, meaning they are spaced a distance apart.” Petition (citing EX1006 (Fuhse252), ¶0117).

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In A Second Plane Spaced a Distance Apart”

- Dr. Hesselink: “A POSITA would have understood that for two images to be in the foreground and background of each other, they are spaced a distance apart from each other.” Ex. 1003, ¶221.
- 37 C.F.R. § 42.65(a) (“[e]xpert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight”).
- No motivation to modify: “This is accomplished by selecting all of the image points P_j of the second image to have a height values Z_j that is different from height values Z_j of the first image.” *Id.*; *SIBIA Neurosciences, Inc. v. Cadus Pharm. Corp.*, 225 F.3d 1349, 1356 (Fed. Cir. 2000).

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In Second Plan Spaced a Distance Apart”

- The Petition and Dr. Hesselink admit the two images are in the same plane

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.

Pet. p. 43 (citing Hesselink Declaration)

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In Second Plan Spaced a Distance Apart”

Relevant Text From ¶0117 of Fuhse262

- “It may also be advisable to **combine** a three-dimensional motif with a two-dimensional motif **in the light-spot image**”
- “For example, if a two-dimensional foreground motif is combined with a three dimensional background motif, the light-spot image does not disappear completely, even in poor illumination conditions, but is **simply reduced** to the more robust two-dimensional foreground motif.”

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In A Second Plane Spaced a Distance Apart”

The Petition’s alternative argument:

- If “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.” Petition, p. 43.
- “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). Petition, p. 43 (citing EX1003, ¶222).

U.S. Patent No. 10,189,294
[35b.5] and claim 24

No “Second Image In A Second Plane Spaced a Distance Apart”

Using the invention of the challenged patent as a roadmap or motivation to modify a prior art reference is “hindsight bias of the worst kind, ‘wherein that which only the invention taught is used against its teacher.’”

Sci. Plastic Prods. v. Biotage AB, 766 F.3d 1355, 1362 (Fed. Cir. 2014)

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00838

Arguments of Patent Owner, Lumenco, LLC
U.S. Pat. No. 10,901,191

Challenged Claims

U.S. Patent No. 10,901,191

[1d]



(12) **United States Patent**
Raymond et al.

(10) **Patent No.:** US 10,901,191 B2
(45) **Date of Patent:** Jan. 26, 2021

(54) METHOD OF FABRICATING ARRAYS OF INDIVIDUALLY ORIENTED MICRO MIRRORS FOR USE IN IMAGING SECURITY DEVICES

(71) Applicant: **LUMENCO, LLC**, Englewood, CO
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(72) Inventors: **Mark A. Raymond**, Littleton, CO (US); **Hector Andres Porras Soto**, Littleton, CO (US); **Howard G. Lange**, San Diego, CA (US)

(73) Assignee: **LUMENCO, LLC**, Englewood, CO
(US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 190 days.

(21) Appl. No.: 16/203,128

(22) Filed: Nov. 28, 2018

(65) **Prior Publication Data**
US 2019/0092084 A1 Mar. 28, 2019

Related U.S. Application Data

(62) Division of application No. 15/162,113, filed on May 23, 2016, now Pat. No. 10,189,294.
(Continued)

(51) Int. Cl.
G02B 17/00 (2006.01)
B42D 25/425 (2014.01)

(52) **U.S. Cl.**
CPC *G02B 17/002* (2013.01); *B42D 25/29*
(2014.10); *B42D 25/324* (2014.10);
(Continued)

(58) **Field of Classification Search**
CPC — B42D 25/373; B42D 25/29; B42D 25/378;
B42D 25/21; B42D 25/351; B42D 25/23;
(Continued)

(56) **References Cited**
U.S. PATENT DOCUM

5,105,306 A 4/1992 Ohala
6,288,842 B1 9/2001 Florczak
(Continued)

FOREIGN PATENT DOCUMENTS

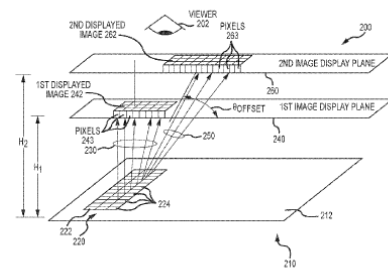
(Continued)

Primary Examiner — Jade R Chwasz
(74) Attorney, Agent, or Firm — Snell & Wilmer L.L.P.;
Kent A. Lembke

(57) **ABSTRACT**

A visual display assembly useful as an authentication or anti-counterfeiting element. The assembly includes a substrate and, on a surface of the substrate, an array of micro mirrors receiving ambient light. Each mirror includes a reflective surface to reflect the ambient light to display an image that appears to float in a plane, which is spaced a distance apart from the surface of the substrate. The image includes a plurality of pixels, and the array of micro mirrors includes for each of the pixels a set of 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. Each of the sets of the micro mirrors includes a plurality of the micro mirrors, and the reflected ambient light from each set of micro mirrors intersects to illuminate or write a pixel of an image.

12 Claims, 20 Drawing Sheets



Page 1

Giesecke+Devrient GmbH,
Giesecke+Devrient Currency Technology GmbH,
and Papierfabrik Louisenenthal GmbH. - Ex. 1001

IPR2024-00838, Ex. 1001

1. A method of fabricating a security element useful on paper and coin currency and product labels, comprising:

• • •

[1d] wherein a voxel is created at each of the point on the plane via intersection of two or more beams of the reflected ambient light[.]

GIESECKE+DEVRIENT GMBH, *et al.* v. LUMENCO, LLC

IPR2024-00839

Arguments of Patent Owner, Lumenco, LLC
U.S. Pat. No. 11,448,863

U.S. Patent No. 11,448,863

[1a]

- Petition relies exclusively on Fuhse847
- Fuhse847 does not teach or suggest identifying first and second objects from a single starting digital image to two different planes, as required by element [1.a].

[1a] No “identifying first and second objects from a single starting digital image to two different planes”

- The Petition argues that: The “**body**” disclosed by Fuhse847 **is both** “the first object” (“Fuhse847 teaches ‘a body’ (a **first object**)”) **and** “the starting digital image ” (“[t]his body satisfies a **starting digital image**”). Petition, p. 18.
- Different claim terms have different meanings. *See Anderson Corp. v. Fiber Composites, LLC*, 474 F.3d 1361, 1370 (Fed. Cir. 2007); *Rembrandt Techs, LP v. Cablevision Sys. Corp. (In re: Rembrandt Techs, LP, Patent Litig.)*, 496 F. App’x 36, 45-46 (Fed. Cir. 2012). IPR2024-00839, POR at p.15.

[1a] No “identifying first and second objects from a single starting digital image to two different planes”

Argument No. 1

- The Petition argues that Fuhse84 “teaches **assigning** the body in the starting digital image **to a first image display plane** by defining ‘light spots’ **for every point in the digital image.**” Petition, p. 19.
 - Admits that Fuhse847 discloses selecting a starting digital image and assigning **that entire digital image** (“for every point in the digital image”) to a display plane, not assigning different images from the starting digital image to different planes, as required by element [1.a].

[1a] No “identifying first and second objects from a single starting digital image to two different planes”

Argument No. 2

- Petition: Fuhse84 “teaches **assigning** the body in the starting digital image **to a first image display plane** by defining ‘light spots’ **for every point in the digital image.**” Petition, p. 19.
 - Entire starting digital image - not assigning different images from the starting digital image to different planes, as required by element [1.a].
- “Other than being in a second image display plane, a second object in the starting digital image has **only the same requirements of the first object in a starting digital image, and is therefore satisfied by the same teachings discussed above.** EX1003, ¶173.” Petition, p. 21.

[1a] No “identifying first and second objects from a single starting digital image to two different planes”

Argument No. 3

- “A POSITA would have understood that the second image is from a second object in the starting digital image.”
- “For example, in the case that the two images are two different “two-dimensional” images such as ‘a font or a logo’ (see EX1022, 5, 7, 26), they represent two different objects.”
- “A POSITA would have further understood that they were both provided in the same starting digital image. For example, it was well-known that formats like 3D-CAD, ‘computer aided technical drawing,’ and ‘3D laser scanning of real three-dimensional bodies’ could provide multiple objects in their images.” EX1003, ¶176.

U.S. Patent No. 11,448,863

[12b]: No “generating a design output file including an angular orientation and location coordinates in the array for each of the micro mirrors”

- Petition relies on Fuhse847 in view of Rich.
- Petition argues that:
 - Rich teaches a design output file that includes “the orientation of the features.” *Id.*, pp. 30-31.
- Rich uses the word “orientation,” but that use is in the context of determining the orientation of a surface of a 3d object, not of individual micro mirrors in a set of micro mirrors, as required by element [12.b].

U.S. Patent No. 11,448,863

[12b]: No “generating a design output file including an angular orientation and location coordinates in the array for each of the micro mirrors”

- In relevant part, Rich recites “an orientation of the features can correlate to an orientation of the surface S of the 3D object 50 at the one or more corresponding points.” Petition, p. 31; Exhibit 1039, 17:1-4.
- The “features” in this passage are “features of intensity corresponding to non-holographic elements on the optical product 10.” Petition, p. 31; Exhibit 1039, 16:64-66.
- No disclosure of “angular orientation.” Instead, the cited passage discloses only determining an orientation of the intensity of the features of a 3d object 50.
Petition, p. 31; Exhibit 1039, 16:64-66.

U.S. Patent No. 11,448,863

[12b]: No “generating a design output file including an angular orientation and location coordinates in the array for each of the micro mirrors”

- Rich also fails to disclose location coordinates
- Rich discloses only that the data file is a “map to generate the ***pattern*** of features F1, F2, . . . Fn on the surface 12 of the master 10.” Petition, p. 31.
- Rich does not disclose that the data file includes specific information on the location **coordinates** of each individual feature on the array, only the “pattern” of those features is defined and no coordinates are disclosed.

U.S. Patent No. 11,448,863

Claim 3 and [7d]: “wherein each of the sets of micro mirrors are selected randomly from a plurality of the micro mirrors located in a base of a cone on a surface containing the array of the micro mirror”

- Petition argues obviousness over Fuhse847 and Fuhse925
- The Board found Petitioner’s arguments related to claim 3/element [7d] unpersuasive. Decision on Institution, pp. 22-24.
- No change in Petitioner’s arguments.
- Dr. Hesselink’s declaration merely repeats, **verbatim**, the conclusory and unsupported argument in the Petition. *See* 37 C.F.R. § 42.65(a).

Claim 3 and [7d]: “wherein each of the sets of micro mirrors are selected randomly from a plurality of the micro mirrors located in a base of a cone on a surface containing the array of the micro mirror”

- **Decision on Institution** (p. 23):
 - Fuhse847 teaches selecting a set of mirrors located in the base of a cone, but does not teach or suggest that the selection is random.
 - Fuhse925 teaches that facets can have a parallel component that can vary randomly.
 - The references do not teach or suggest random selection of mirrors within the base of a cone, as required by claim 3 and [7d].

U.S. Patent No. 11,448,863

Claim 3 and [7d]: “wherein each of the sets of micro mirrors are selected randomly from a plurality of the micro mirrors located in a base of a cone on a surface containing the array of the micro mirror”

Petitioner contends that a POSITA would look to Fuhse925 for explicit detail as to how to implement Fuhse847’s desired normal vector to direct the light to a focal point for the assigned light spot. Pet. 54–56. This, however, does not sufficiently explain why a POSITA would have combined Fuhse847’s teaching of assigning a group of micro mirrors within a sphere of influence to every light spot in an image, with Fuhse925’s teaching of a normal vector of the reflective micro mirrors having a randomly varying parallel component $N_{\parallel}$, to arrive at a random selection of a set of micro mirrors from a plurality of the micro mirrors located in a base of a cone.

Decision on Institution, p. 24.

U.S. Patent No. 11,448,863

Claim 3 and [7d]: “wherein each of the sets of micro mirrors are selected randomly from a plurality of the micro mirrors located in a base of a cone on a surface containing the array of the micro mirror”

- Petitioner has presented no evidence that can cure the fundamental deficiencies in the Petition’s proposed combination.
- The Reply argues that “such randomness of the non-vanishing component $N_{||}$ would result in the randomly selected pattern of the micro-mirrors.” *Id.*, pp. 12-13 (citing Ex. 1003, ¶¶340-42).
- “[w]hile a POSITA would have understood that Fuhse847 discloses orienting the mirror surface in the x and y axes to achieve the normal vector n , a POSITA would have looked to Fuhse925 for how the vector “is chosen independently” and “varies randomly or pseudorandomly.” Reply, p. 13 (citations omitted).

Thank you!