

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3D SYSTEMS CORPORATION AND 3D SYSTEMS, INC.,

Petitioner

v.

INTREPID AUTOMATION, INC.,

Patent Owner

IPR2025-01242

U.S. Patent No. 11,338,511

PATENT OWNER'S SUR-REPLY TO PETITIONER'S REPLY

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I. Introduction

Petitioner's grounds rely on partial clauses or half statements in the prior art to teach complicated stereolithography concepts. For the irradiance mask, Petitioner relies on two words from Shkolnik and three words from Sekine to teach a filter found by the examiner to be the very reason for allowance. EX1002, 74. For the gamma correction mask, Petitioner relies on a basic statement about resin properties without any teaching of the technique to adjust parameters that fully account for such resin properties. These vague statements fail to teach the specific filters claimed.

II. Ground 1 Fails

a. Shkolnik does not disclose “an irradiance mask that normalizes irradiance”

i. Petitioner ignores critical claim language

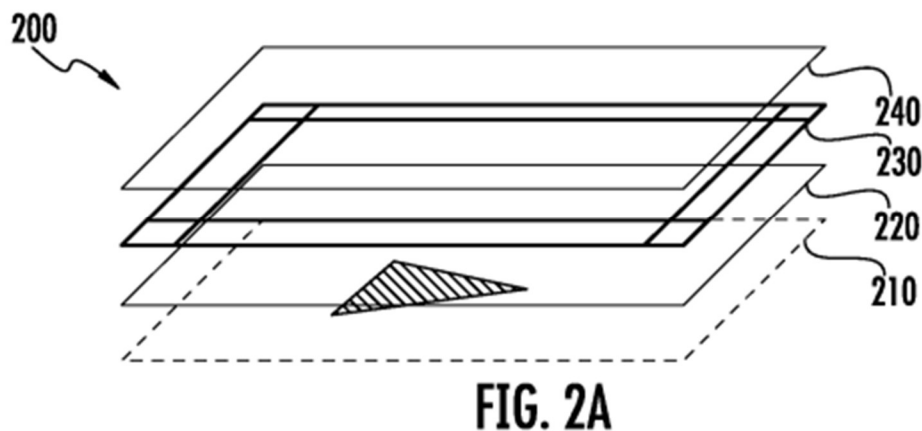
Petitioner argues that “[t]he claim language does not include limitations on what the ‘irradiance mask’ is or how the mask ‘normalizes irradiance.’” Reply, 23. This is incorrect. Petitioner treats the phrase “irradiance mask that normalizes irradiance” as if the only operative language is the function (“normalizes irradiance”) while the word “mask” is mere surplusage. This approach improperly strips the term “irradiance mask” of all meaning. *See Becton, Dickinson & Co. v. Tyco Healthcare Grp., LP*, 616 F.3d 1249, 1257 (Fed. Cir. 2010) (claims must be construed to give meaning to all terms and avoid rendering any language

superfluous); *Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006) (“Claims are interpreted with an eye toward giving effect to all terms in the claim.”).

Patent Owner (“PO”), meanwhile, gives the term actual meaning by properly consulting the specification. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (en banc) (“Properly viewed, the ‘ordinary meaning’ of a claim term is its meaning to the ordinary artisan after reading the entire patent”). Here, the specification describes the irradiance mask as a digital filter in a stack of digital filters that applies defined correction parameters to a projected image or sub-image by considering lowest and/or highest energy regions. EX1001, 11:24-60. The mask “enable[s] control over the energy across the build area to compensate for non-uniformities in the projector optics and/or optical path.” EX1001, 11:49-52. Hence, an “irradiance mask” is a digital filter with defined correction parameters that is applied to a projected image to produce uniform irradiance at the build surface. EX2015, ¶¶ 54-59. This is not importing a limitation; it is giving patentable weight to the term “irradiance mask.” So, while the parties may agree that the plain and ordinary meaning applies, the parties disagree regarding the scope of the term “irradiance mask”.¹ *O2 Micro Int’l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d

¹ Initially, PO believed that Petitioner was not applying the correct meaning of the term “normalize irradiance”. POR at 5. However, through the Reply it has become

1351, 1361 (Fed. Cir. 2008). Patent Owner’s reliance on the specification to give content to this term is legally required.²



'511 Patent, FIG. 2A

ii. Shkolnik fails to teach an irradiance mask

In the Reply, Petitioner cites Shkolnik only once when arguing that Shkolnik teaches an irradiance mask: a passage stating that a pattern correction map “may also provide for intensity compensation.” Reply, 11; EX1004, 5:47-49. This single phrase cannot carry the weight Petitioner places on it. “Intensity compensation” is

clear that Petitioner simply fails to give the term “irradiance mask” any weight at all.

² Petitioner misconstrued the record and PO’s position. To be clear, the parties have never agreed that the irradiance mask claim limitation means: “all pixels (once ‘normalized’) have uniform brightness.” Reply, 8. Instead, Dr. Rosen’s declaration clearly states that, “[a] POSITA at the time of the invention would understand that the irradiance mask recited in the independent claims of the ’511 Patent normalizes radiance power per unit area (i.e., irradiance) across a sub-image or composite image,” and “normalizing the irradiance of an image causes the image to have a uniform irradiance range across the entire image.” EX2015, ¶¶ 55, 57.

a broad, generic term that could encompass many different techniques for adjusting light intensity. EX1034, 64:13-65:11, 77:10-13. Indeed, the irradiance mask, the gamma correction mask, and the edge blending bar all require some form of intensity compensation, yet the '511 Patent claims and describes them differently and solving different purposes. *Id.*; EX2015, ¶ 63. A mere statement that intensity may be compensated does not teach the specific structure and function of an irradiance mask.

An irradiance mask, as described in the '511 patent, performs specific functions: it identifies which pixels in the projected image are dimmer than others, determines correction amounts, and maps those corrections to a filter that normalizes irradiance at the build surface. EX1001, 11:36-52; EX2015, ¶¶ 54-59. The irradiance mask learns which pixels are dimmer and can, for example, decrease the value of the brighter pixels so that all pixels have the same maximum exposure value. EX2015, ¶ 59.

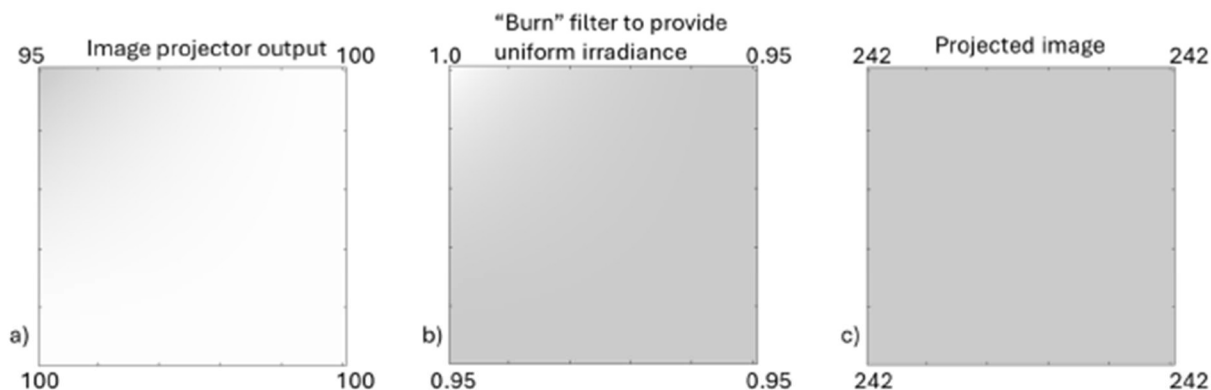
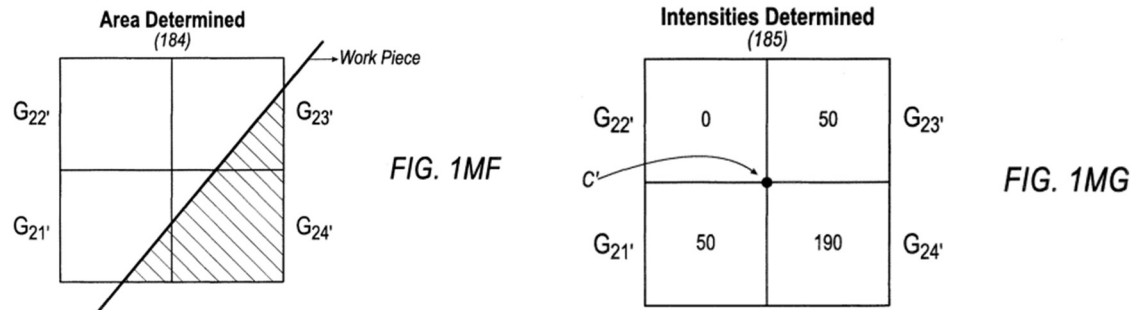


Illustration 2. Example 1 visualization showing a) image projector output with the upper left corner dimmer than the rest of the image, b) an irradiance normalization filter that provides c) uniform irradiance.

Shkolnik’s generic reference to “intensity compensation” does not describe this technique.

In fact, when Shkolnik is read in its entirety, it becomes clear that the “intensity compensation” Petitioner relies upon is specifically grayscale for antialiasing purposes, not an irradiance mask. Shkolnik explains that grayscale values are used “to control the pattern generator’s output to provide full intensity, no output, or variation in between.” EX1004, 6:23-27. Shkolnik describes grayscale as an “intensity value.” EX1004, 9:35-46. And critically, Shkolnik uses the term “intensity compensation” to describe correcting “linear and non-linear distortions”—the exact same goals stated in Petitioner’s cited passage—in the context of grayscale adjustment/antialiasing. EX1004, 18:1-10, 18:26-49, 24:14-34. Indeed, Shkolnik specifically defines voxel intensity as the depth of cure of a voxel, where the intensity value corresponds to the volume that the component will

occupy within a voxel. *Id.* This process is standard grayscaling to correct voxel intensity values based on a part's geometric shape. EX1004, 25:15-32; EX2015, ¶ 75.



Grayscaling and irradiance normalization are not the same thing.

Grayscaling adjusts pixel intensity values to control how much light is projected at each location for purposes of forming a build region or correcting geometric distortions in the build region shape. *Id.* An irradiance mask, by contrast, identifies and corrects non-uniformities in the projector's output itself—hardware-level variations in the light source, optics, or optical path that cause some pixels to be brighter or dimmer than others regardless of the commanded intensity. EX1001, 11:37-52; EX2015, ¶¶ 54-59. An irradiance mask is agnostic to the geometric shape formed. EX1001, 11:37-52, 23:16-26; EX2015, ¶ 75. Shkolnik's grayscaling does not identify or correct such projector non-uniformities.

Dr. Rosen provided a detailed technical analysis explaining why Shkolnik's teaching of grayscaling does not disclose an irradiance mask. EX2015, ¶¶ 61-76.

Petitioner did not submit a rebuttal declaration from Dr. Chen, despite PTAB rules permitting it. 37 C.F.R. § 42.23(b). Dr. Rosen's conclusions stand un rebutted.

iii. Dr. Allen's declaration is irrelevant

Petitioner's reliance on the Allen Declaration is misplaced. Dr. Allen's statements are irrelevant under FRE 401-403 and should be disregarded entirely. Dr. Allen's report refuted 3DS's trade secret positions, considering whether 3DS had identified its trade secrets with sufficient particularity to distinguish themselves from publicly available information. This is a far different standard than patent anticipation or obviousness. Moreover, Dr. Allen's statements about an irradiance mask do not interpret Shkolnik (or Sekine). In fact, they solely discuss prior art from a field different from stereolithography. It is Petitioner's burden to show anticipation in view of Shkolnik, and the words of Dr. Allen's declaration do not change what Shkolnik discloses.

Petitioner's citation of the Allen Declaration also violates PTAB procedure. A petitioner may not change its grounds post-institution. 37 C.F.R. § 42.23(b); *Juniper Networks, Inc. v. Swarm Technology LLC*, IPR2021-01445, Paper 62, p.28-29 (PTAB Feb. 7, 2023). Petitioner's Ground 1 was that Shkolnik *anticipates* certain claims of the challenged patent. Now, in relying on EX1035, Petitioner seeks to morph Ground 1 into an obviousness ground based on Shkolnik and

supposed common knowledge in the art. The Allen Declaration must be disregarded as an attempt to change invalidity theories post-institution.

Even if the Allen Declaration were considered, it does not change the teachings of Shkolnik. Allen does not state that Shkolnik discloses an irradiance mask, let alone point to any specific disclosure evidencing the same. Shkolnik fails to teach an irradiance mask, which means Ground 1 fails. Any statements about whether an irradiance mask could be a trade secret have no bearing on the merits of Ground 1.

b. Shkolnik does not disclose “a gamma correction mask that adjusts sub-image energy based on a reactivity of resin in the resin pool”

Petitioner’s argument confuses *recognizing a problem* with *providing a solution*. Shkolnik acknowledges that curing behavior is material-dependent. EX1004, 10:22-24. But acknowledging a problem is not the same as disclosing a digital filter that solves it. The claims require “a gamma adjustment mask that adjusts sub-image energy based on a reactivity of resin in the resin pool.” This specific mask defines resin-specific parameters that map pixel intensity values to the reactivity characteristics of a particular resin across the full dynamic range of 8-bit intensity levels. EX1001, 12:8-12; EX2015, ¶¶ 78-83. Shkolnik does not disclose such a mask.

Petitioner points to Shkolnik’s teaching that “the time and intensity to achieve a particular depth of cure is material dependent” and that intensity values

determined for one resin “may not be usable for a second reactive material.” Reply, 14; EX1004, 10:22-26. PO does not dispute that Shkolnik recognizes resin-dependence. But identifying that a variable exists is not the same as disclosing a filter that fully accounts for it. Shkolnik identifies that “there may not be a linear relation” between intensity values and depth of cure, EX1004, 18:33-37, yet provides no model, equation, transfer function, or mapping to address this non-linearity. The problem is stated; the solution is absent.

Regardless, even if Shkolnik did teach gamma correction, the gamma correction is not taught as a filter. Instead, Shkolnik teaches that the gamma correction is programmed into the source file (bitmap) itself, which contains part-specific geometry. EX1004, 18:33-42, 10:7-8. A gamma correction filter does not contain part-specific geometry. Specifically, Shkolnik again notes material dependence of intensity but unequivocally specifies that intensities are assigned for each pixel *in the bitmap*. *Id.* This is not a gamma correction *mask* that is part of a set of filters. EX1001, 11:61-13:47.

The specification describes the gamma adjustment mask as a filter in the filter stack, which “provides resin reactivity leveling... by mapping the pixel intensity range (e.g., 0-255) to the minimum and maximum reactivity characteristics of the pixel.” EX1001, 12:8-12. The ’511 patent provides a detailed, multi-step method for constructing the gamma adjustment mask, which

importantly includes both deriving minimum and maximum exposure values E' , and $E'_{\max}$ from those constants; and creating a transfer function that maps the *full pixel intensity range* (e.g., 0-255) to the addressable energy range for that specific resin. EX1001, 23:30-25:6; EX2015, ¶¶ 79-83. The result is a resin-specific digital filter that can be applied to any projected image independent of part geometry.

Petitioner cobbles together Shkolnik passages to manufacture a disclosure. Reply, 13-14. Petitioner assembles fragments from at least four passages: (1) a general description of intensity value assignment (EX1004, 9:47-51); (2) a statement that 0-255 intensity ranges are “convenient” for an 8-bit system (EX1004, 9:59-62); (3) a minimum polymerization threshold (EX1004, 9:51-55); and (4) a general observation that cure depth is “material dependent” (EX1004, 10:22-26). None of these passages describe a filter or mask. None propose a method for mapping intensity values to a resin’s reactivity *range*. Indeed, Shkolnik does not disclose: (1) any method for characterizing a resin’s curing behavior (no working curve, no experimental procedure to determine resin constants); or (2) any transfer function or mapping that relates pixel intensity values to a particular resin’s reactivity range. Petitioner treats each passage as a puzzle piece, but the completed picture is one Petitioner drew—not one Shkolnik disclosed. A prior art reference must be considered for what it teaches, not as a warehouse of isolated

sentences to be rearranged into a desired disclosure. *See Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008).

Petitioner argues that Shkolnik teaches gamma adjustment because it discloses that “where reactive material 118 has a minimum intensity threshold for polymerization or partial-polymerization, the ‘off’ or zero (0) value intensity (e.g., brightness and/or ‘on’ time) may be determined based on the reactive material threshold.” Reply, 14; EX1004, 9:51-55. But setting a minimum threshold below which the resin will not polymerize is not a gamma adjustment mask. It is a single threshold value — not a filter that maps the entire pixel intensity range (0-255) to the full addressable range of a resin’s reactivity. The ’511 patent’s gamma adjustment mask takes the full dynamic range of pixel intensities and maps them to the resin’s energy range from E'_{min} to E'_{max} , enabling the full fidelity of grayscale values to be used for curing. EX1001, 13:7-20; 24:48-25:6. A single polymerization threshold does not accomplish this mapping. It addresses one endpoint (the minimum), not the continuous relationship across the entire range, particularly when the relationship is non-linear. EX2015, ¶ 80-83.

Finally, Petitioner argues that the antialiasing illustrated in Shkolnik’s FIGs. 1MA-1MG constitutes gamma correction. Reply, 15. It does not. The voxelized correction method in Shkolnik determines intensity values based on the volumetric intersection of a voxel with the part geometry — that is, how much of a voxel is

occupied by the part. EX1004, 18:26-30. This is a *geometric* determination: if the work piece occupies 50% of the voxel, the intensity is set to 50%. *Id.* As Dr. Rosen explained, “this is purely a geometric correction applied to voxels, but does not take into account resin characteristics. Gamma adjustment or correction relies on consideration of resin characteristics. Hence, this example does not describe gamma adjustment.” EX2015, ¶ 94. This geometric correction is, again, grayscale for antialiasing purposes, not gamma correction.

Petitioner’s argument that antialiasing is “an inherent result of successful gamma correction” (Reply, 15) inverts the causation. Gamma correction *enables* proper antialiasing by ensuring the full pixel intensity range maps to the resin’s reactivity characteristics, but that does not mean every instance of antialiasing constitutes gamma correction. EX1001, 12:8-12. Shkolnik’s antialiasing is based on geometric overlap of part boundaries with voxels, but it lacks the resin-specific mapping that defines a gamma adjustment mask. Like the irradiance mask, gamma correction is part geometry agnostic. EX1001, 23:30-41. Dr. Rosen confirmed this distinction: “gamma adjustment doesn’t perform smoothing or antialiasing, but it can be used for smoothing and antialiasing” — “that’s a separate step.” EX1034, 81:19-82:13.

Dr. Rosen’s technical analysis on this point (EX2015, ¶¶ 77-95) stands un rebutted. Petitioner did not submit a declaration from Dr. Chen addressing why

Shkolnik’s acknowledgment of resin-dependence, without any transfer function or mapping, constitutes a gamma adjustment mask.

c. Shkolnik does not disclose dependent claims 3, 4, 8, 15, and 16

For the reasons discussed above, Shkolnik fails to teach claims 3, 4, 15, and 16. Finally, regarding claim 8, Shkolnik’s teachings that the projectors can calibrate “at the same time” does not teach synchronization of *exposure* control; it merely teaches concurrent calibration. EX2015, ¶96-100.

III. Ground 3 Fails

a. Sekine does not teach “adjusting properties and aligning a position of each sub-image in the array using a set of filters”

Petitioner’s arguments regarding Sekine’s alleged disclosure of a “set of filters” fail for at least three independent reasons. The core deficiency is that Sekine never discloses a filter at all—it discloses only direct modifications to source data and hardware settings.

Petitioner argues that the specification’s teaching about the base source file remaining unchanged “is not in the claims.” Reply, 19. Petitioner is wrong. The claims recite “adjusting properties and aligning a position of each sub-image in the array *using a set of filters*.” The claim does not merely require adjusting properties and alignment—it requires doing so *using a set of filters*. A filter, by definition, is something applied on top of or in addition to the underlying data. EX2015, ¶50-52. If properties were adjusted and alignment achieved by altering the source bitmap

directly, there would be no need for a filter at all—one would simply modify the source file. By specifying that adjustments are made “using a set of filters,” the claims require that the adjustments are made through filters applied to the source data, not through modification of the source data itself. This is not importing a limitation from the specification; it is giving the claim term “filter” meaning.

Sekine’s adjustments — whether mechanical (Embodiment 1) or through modification of the exposure images themselves (Embodiments 2, 3, and 6) — are not applied as filters overlaid on source data. As Dr. Rosen explained, the ’511 patent’s “filters are applied on top of part cross-section geometry images and are designed to work together in a stack configuration (see FIG. 2A).” EX2015, ¶ 109. In contrast, Sekine only discloses changes to the source file. EX1005, [0038]-[0041], [0081]-[0092] (using mechanical actuators to move or tilt the image forming element 23), [0093]-[0098] (tilting a transmissive member 12); [0063], [0078], [0100] (modifying the exposure image, *i.e.* source file).

Petitioner argues that “[e]very filter ultimately causes a ‘mechanical’ change somewhere in the system” because mirrors flip. Reply, 19-20. This argument betrays a fundamental misunderstanding of pattern generator technology. Not every pattern generator is a DMD using mirrors. EX1001, 6:28-33, 8:13-18, 15:43-52, 19:15-20. As Dr. Rosen explained, a pattern generator “may be a digital micromirror device (DMD), an LCD screen, or other type of device that can

project a patterned image.” EX2015, ¶ 44. An LCD-based pattern generator, for example, does not use mirrors at all—it uses liquid crystals to modulate light. In other words, an LCD generator is a *purely electronic* pattern generator without any mechanical elements at all. Petitioner’s theory that all pattern generators flip mirrors or use mechanical movements is simply wrong.

Finally, Petitioner points to Sekine’s “Other Embodiments” section for the proposition that embodiments can be combined. Reply, 20-21; EX1005, [0138]-[0139], [0151]. But this argument is beside the point. The deficiency in Sekine is not merely that its embodiments are described separately — it is that *none* of them, individually or collectively, disclose a digital filter as that term is understood in the art and as used in the claims. None of these is a filter applied on top of source data in a stack configuration. Sekine never uses the terms “filter,” “digital filter,” “mask,” or “filter mask.” EX2015, ¶ 110-111. Combining them does not create a filter — it creates a collection of direct modifications to source images and hardware settings. Combining zero filters still yields zero filters.

Dr. Rosen’s analysis on this point (EX2015, ¶¶ 108-111) stands unrebutted. Petitioner did not submit a declaration from Dr. Chen explaining how Sekine’s direct modifications to source images and hardware settings constitute a “set of filters”.

b. Sekine does not disclose “an irradiance mask that normalizes irradiance”

i. Uniform duty ratio is different than irradiance mask

Petitioner asserts that a single clause (“make the illumination distribution uniform”) in Sekine [0071] teaches this claim limitation. Petitioner misreads [0071]. Sekine’s statement about making an illumination distribution uniform describes setting a uniform input signal to all pixels—the opposite of the individualized per-pixel corrections that define an irradiance mask.

The sentence in dispute reads, “Thus, in embodiment 3, measurements of the illumination distribution on the projection plane TM of the projection image TG are performed, and the brightness gradation (duty ratio) of each pixel in the plane of the image forming element 23 is controlled to make the illumination distribution uniform.” EX1005, [0071]. To begin, it must be understood that the “duty ratio” described by Sekine is not an irradiance range or intensity projected on the resin; the duty ratio is not a measurement of the projected light. The duty ratio is the **signal** applied to the image forming element 23, which is a DMD. EX1005, [0021], [0019]. Sekine specifically states that the duty ratio extends from 0% to 100%, which *causes* grayscale. EX1005, [0021]. A POSITA would understand that a duty ratio that causes grayscale is the electrical signal provided to the DMD micromirrors instructing each micromirror *how long* to reflect light. *Id.*; EX2016, 41:13-42:4.

Importantly, Sekine fails to teach independent pixel-by-pixel duty cycle control, which is required for an irradiance mask. Instead, Sekine specifically states “the brightness gradation (duty ratio) of each pixel in the plane of the image forming element 23 *is controlled to be the same.*” EX1005, [0071] (emphasis added). Sekine sets the duty ratio **uniformly**, not differentiated pixel-by-pixel.

Theoretically, providing the same duty ratio to every micromirror would result in the same irradiance at every pixel in the projected image. However, in reality, errors could exist in one or more micromirrors (as well as many other sources), resulting in non-uniformities. EX2016, 101:18-102:10; EX1003, ¶ 171, 173. Sekine recognizes that errors may occur, but the error sources contemplated by Embodiment 3 are inter-projector differences (light source errors or lens errors) not intra-projector, per-pixel non-uniformities caused by individual mirror defects, optical path variations, or spatial energy non-uniformities within a single projector’s image. EX1005, [0071]. Sekine does not contemplate, much less solve, the problem that the ’511 patent’s irradiance mask addresses. EX1001, 11:30-33, 49-52, 23:16-26; EX2015, ¶¶ 58-59.

Unlike Sekine’s illuminance correction control, an irradiance mask also accounts for performance differences in the pattern generator itself. EX1001, 11:24-60; EX2015, ¶¶ 48, 59. Also, the irradiance mask described by the ’511 patent would not send the same duty ratio to all pixels in a pattern generator, which

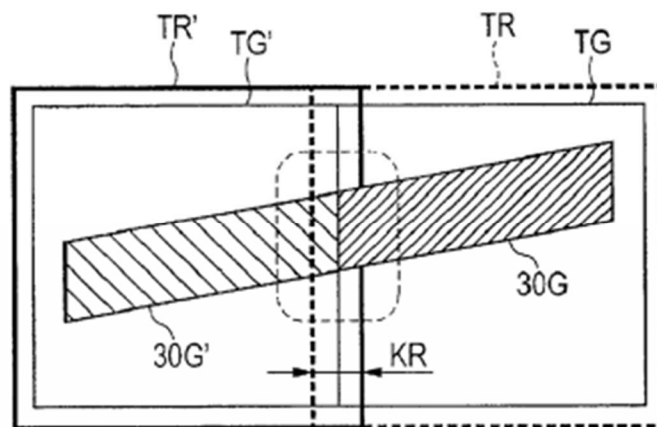
is the opposite of the teachings of Sekine. EX1001, 23:16-26; EX1005, [0071]; EX2015, ¶ 59. Instead, like in the specification's example, some pixels would receive a lower "duty ratio" than other pixels. *Id.* So, controlling the duty ratio of each pixel in the image forming element 23 to be the same would not normalize irradiance across the whole image because some pixels would be brighter than other pixels due to, e.g., DMD errors even though the same duty ratio was applied to all pixels. EX2015, ¶¶ 113-116. Essentially, the uniform duty ratio taught by Sekine would not normalize irradiance.

ii. Sekine cannot detect non-uniformities outside the boundary region KR

Sekine uses the uniform duty ratio signal sent to all image forming elements 23 to find an "illuminance difference between images at the boundary of adjacent projection images TG." EX1005, [0071]. As with many other locations within Sekine, Sekine uses a singular noun to describe multiple identical components. *See, e.g.*, EX1005, [0045] (using the singular "camera 130" to describe four cameras illustrated in FIG. 6), [0043] (using singular projection image TG after describing TG as four images), [0057] (using singular projection image TG to describe two projection images TG in FIG. 8A and 8B). Sekine commonly describes all the image forming elements 23 together, despite each individual projector 20 having a respective image forming element 23. EX1005, FIG. 1, [0014]. Sekine continues to use the singular when describing multiple image

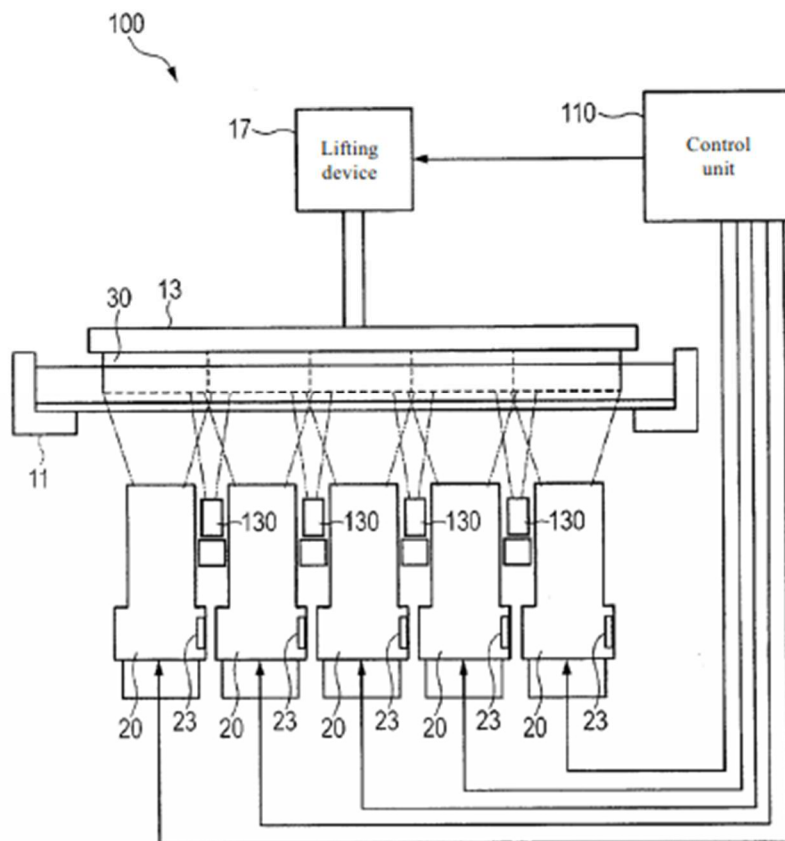
forming elements 23 in paragraph [0071]. Specifically, Sekine says “to ensure that the illuminance difference between adjacent projection images TG across the boundary is eliminated, the brightness gradation (duty ratio) of each pixel in the plane of the image forming element 23 [singular describing multiple] is controlled to be the same.” EX1005, [0071]. Sekine must be describing multiple image forming elements 23 using a singular noun because this sentence describes multiple projection images TG, and each image forming element 23 projects its own projection image TG. EX1005, FIG. 5, 12A-C. Hence, Sekine states that all pixels of multiple DMDs receive the same electronic signal (duty ratio). This baseline duty ratio signal sets the table for detecting differences in projection image illumination *in the boundary region KR*. EX1005, [0070]-[0080]; EX2015, ¶¶ 119-125.

[FIG. 12A]



Indeed, Sekine is not configured to detect intra-projector errors. First, Sekine teaches that a camera detects illuminance difference only in the boundary region KR. EX1005, [0075]. Sekine teaches that the cameras are placed between adjacent optical systems 25 so that it can capture an image of the boundary region. EX1005, [0037].

[FIG. 1]



Sekine consistently describes the camera as capturing images only of the boundary region. EX1005, [0013], [0034], [0042], [0045], [0050], [0059], [0074]. Sekine never teaches that the camera can capture images of anything other than the boundary region KR. So, Sekine's camera cannot detect irradiance non-

uniformities in regions other than the boundary region KR because the camera does not even have all projected pixels in its field of view. This camera set-up and description belies Petitioner’s reading of paragraph 71 as an irradiance mask because the camera cannot detect non-uniformities outside the boundary region.

Finally, Sekine’s solution would not fix any intra-projector errors, as the remainder of Embodiment 3 ([0070]-[0080]) makes clear:

First, the stated objective of Embodiment 3 is to “eliminate the brightness difference between adjacent projection images.” EX1005, [0070]. This is an inter-projector problem—not an intra-projector uniformity problem.

Second, the only measurement tool in Embodiment 3 is a camera pointed at the boundary region KR. EX1005, [0074].

Third, the only correction computed is based on comparing “the average illuminance” in the boundary region of one projector’s image against another’s. EX1005, [0077]. This single scalar correction amount derived from averaging is not a per-pixel irradiance map. Moreover, this average illuminance correction would not result in a normalized irradiance. EX2015, ¶¶ 117-136.

Fourth, the correction is applied as a bulk shift to one image’s brightness to match the other’s. EX1005, [0076], [0078]. And Sekine also proposes adjusting “the illuminance of the entire projection image TG by changing the output of the

light source 21.” EX1005, [0080]. This is a hardware-level, whole-projector adjustment, which is the opposite of a per-pixel digital filter.

Given these structural facts, setting the duty ratio “to make the illumination distribution uniform” would be understood as an initialization step: setting all pixel duty ratios to the same value (a uniform input signal) so that the subsequent camera-based detection at the boundary region can isolate hardware-related illuminance differences between projectors (e.g., differences in light source output or lens characteristics). This reading is confirmed by paragraph [0071], which states the duty ratio is “controlled to be the same.” The phrase “controlled to be the same” is the language of a uniform baseline signal—not individualized per-pixel correction.

Even if one were to read paragraph [0071] as aspirationally describing uniform irradiance (which PO disputes), Embodiment 3 provides no mechanism to achieve it. The camera captures only the boundary region KR. EX1005, [0074]-[0075]. A defective or underperforming mirror located anywhere in the interior of the DMD—away from the boundary region—would produce a localized irradiance non-uniformity that the camera could never detect.

An irradiance mask, by contrast, is a correction applied to compensate for non-uniformities across the whole image, not just average differences across a boundary region. EX2015, ¶ 57. This distinction matters because sending the same

signal to all mirrors does not produce uniform irradiance at the resin surface. Non-uniformities in the light source, optical path, lens characteristics, and individual mirror performance will cause the actual irradiance to vary across the projected image even when identical duty ratio signals are sent to all mirrors. The '511 patent's irradiance mask exists precisely to correct for these hardware-induced non-uniformities that persist despite uniform input signals. Dr. Chen's own testimony confirms this. He explained that the purpose of irradiance normalization is to address "the projection DMD devices defects or optical lens defects"—hardware-level non-uniformities that exist regardless of the input signal. EX2016, 55:3-8.

Dr. Rosen demonstrated Sekine's limitation with detailed numerical examples showing that Sekine's averaging-based correction method produces non-uniform results even in simple cases. EX2015, ¶¶ 120-136. Dr. Rosen concluded: "neither the proposed solution in paragraphs [0073-0079] nor the proposed solution in paragraph [0080] achieves the objective of irradiance normalization; that is, neither solution produces a uniform irradiance distribution." EX2015, ¶ 132.

The question before the Board is not whether Sekine uses words that sound like irradiance normalization when taken in isolation. The question is whether Sekine actually discloses the structure and process of "an irradiance mask that

normalizes irradiance” as those words are understood in the context of the ’511 patent’s claims. That requires more than aspirational language; it requires a disclosure of how per-pixel non-uniformities are identified, measured, and corrected through individualized pixel-level adjustments derived from the measured irradiance distribution at the build surface.

iii. Petitioner’s other arguments fail

Petitioner also relies on paragraph [0021] of Sekine, which describes the DMD’s capability to individually set duty ratios for each pixel. But describing the hardware capability of a DMD to individually control pixels does not teach or disclose using that capability to create a normalizing irradiance mask.

Every DMD inherently has per-pixel control—that is simply how DMDs function. The innovation of the ’511 patent’s irradiance mask is not the per-pixel control of the DMD itself, but the measurement-and-correction process that (1) characterizes the actual irradiance output at the build surface, (2) identifies per-pixel non-uniformities, (3) determines what specific, individualized correction values each pixel requires to produce uniform irradiance at the build surface, and (4) building a filter that implements those correction values. Sekine nowhere discloses measuring per-pixel irradiance output at the build surface and creating an individualized correction mask based on those measurements.

Petitioner’s logic would render every DMD-based projection system an “irradiance mask” by definition—since every DMD has per-pixel control. This cannot be correct. As Dr. Chen himself confirmed, grayscale (adjusting pixel values for image formation) and irradiance masking are “solving different problems; they’re two different things.” EX2016, 112:9-14. The mere ability to control individual pixel duty ratios does not constitute an irradiance mask.

Dr. Rosen’s technical analysis on Sekine (EX2015, ¶¶ 112-136) stands un rebutted. Petitioner did not submit a declaration from Dr. Chen rebutting any of these conclusions.

iv. Dr. Rosen’s testimony does not support Petitioner’s position

Petitioner makes much of Dr. Rosen’s deposition testimony regarding paragraph [0071]. Reply, 22 (citing EX1034, 89:14-92:9; 92:5-9; 93:20-95:8). But Dr. Rosen’s acknowledgment that a “fair reading” of paragraph [0071] includes language about controlling pixels to make illumination uniform does not concede that Sekine teaches an irradiance mask that normalizes irradiance.

Sekine paragraph [0071] describes setting a duty ratio signal—an input to the DMD. The ’511 patent’s irradiance mask is a correction applied to compensate for the difference between what the input signal commands and what the output irradiance actually produces at the resin surface. These are fundamentally different

concepts, and Dr. Rosen’s acknowledgment of Sekine’s text does not bridge that gap.

Moreover, Petitioner’s characterization of Dr. Rosen’s testimony as an “admission” that Sekine teaches irradiance normalization overstates what occurred. Dr. Rosen acknowledged the language of paragraph [0071]—not that it constitutes a disclosure of an irradiance mask as claimed. Indeed, Dr. Rosen’s detailed numerical illustrations (EX2015, ¶¶ 117-136) demonstrate precisely why Sekine’s approach does not achieve and cannot achieve irradiance normalization. Those illustrations remain unrebutted.

c. Petitioner has not shown a POSITA would be motivated to combine the disparate embodiments of Sekine

Petitioner attempts to dismiss PO’s argument that Sekine’s embodiments cannot be freely combined by characterizing *In re Stepan Co.*, 868 F.3d 1342, 1345-46 n.1 (Fed. Cir. 2017), as non-binding dicta. Reply, 26. However, the underlying legal principle requiring a motivation to combine distinct embodiments is well-established. *Bos. Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009); *Abiomed, Inc. v. Maquet Cardiovascular, LLC*, IPR2017-01204, - 01205, Paper 9 at 8-12 (PTAB Oct. 23, 2017).

Petitioner seeks to cure this oversight by citing to Chen’s use of the word “techniques”. Reply, 27-28, *citing* EX1003, ¶¶ 298-300. However, these passages

do not address combining *Sekine's* embodiments. When one reads those paragraphs in context, they are discussing the motivation to combine *Sekine with Greene* — an entirely different reference — not the motivation to combine Sekine's own internal embodiments with each other. Paragraph 298 states that “the references” (plural — Sekine and Greene) “are directed towards the same field of endeavor.” EX1003, ¶ 298. Paragraph 299 states that “both references are directed towards overall similar purposes, and the specific techniques of the references are complementary.” EX1003, ¶ 299 (emphasis added). Paragraph 300 explains that “the POSITA would be motivated to combine and modify *Sekine and Greene*” — not Sekine's Embodiments 1, 2, 3, and 6 with each other. EX1003, ¶ 300.

Nowhere in these passages — or anywhere else in the Chen Declaration — does Dr. Chen opine that a POSITA would be motivated to combine Embodiment 1 (mechanical actuator adjustment), Embodiment 2 (exposure image data modification), Embodiment 3 (illuminance correction at boundaries), and Embodiment 6 (overlap region adjustment) of Sekine into a single unified system that constitutes a “set of filters.” Petitioner's attempt to repurpose inter-reference motivation-to-combine analysis as intra-reference embodiment-combination analysis is a transparent effort to paper over a gap in its case. The Petition and the Chen Declaration simply did not perform this analysis, and Petitioner cannot manufacture it now by pulling quotes out of context.

d. Sekine does not disclose dependent claims 3, 8, 14, and 15

For the reasons discussed above, Sekine fails to teach claims 3, 14, and 15. Finally, regarding claim 8, Sekine's teachings that the projectors divide an overall image into four does not teach synchronization of *exposure* control. EX2015, ¶137-143.

IV. Grounds 2, 4-5 Fail

Grounds 2, 4-5 all rely on failed teachings from Shkolnik or Sekine and fail for the reasons discussed above.

V. CONCLUSION

For the foregoing reasons, Petitioner's Reply fails to demonstrate that any Ground invalidates the '511 patent.

Dated: July 15, 2026

Respectfully submitted,
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CERTIFICATION

Pursuant to 37 C.F.R. § 42.24(d), the Sur-Reply excluding the caption, Table of Contents, signature blocks, and this Certification contains 5567 words.

Respectfully submitted,

Dated: July 15, 2026

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CERTIFICATE OF SERVICE

I hereby certify that, pursuant to 37 C.F.R. § 42.6(e), a true and correct copy of **PATENT OWNER'S SUR-REPLY TO PETITIONER'S REPLY** is being served electronically on July 15, 2026, to the e-mail addresses shown below:

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