

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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**APPLE INC.**

**Petitioner**

**v.**

**IMMERVISION, INC.**

**Patent Owner**

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**Case IPR2023-00472**

**Patent No. 10,795,120**

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**PATENT OWNER'S RESPONSE UNDER 37 C.F.R. § 42.120**

**TABLE OF CONTENTS**

|                                                                                                                                     | <b>page</b> |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------|
| I. INTRODUCTION .....                                                                                                               | 1           |
| II. THE RELEVANT INVENTION OF THE ‘120 PATENT.....                                                                                  | 2           |
| A. The Non-Linear Targeted Resolution.....                                                                                          | 4           |
| B. Zones of Different Magnification.....                                                                                            | 6           |
| C. Compensating for Relative Illumination or MTF Drops.....                                                                         | 8           |
| D. The Complementary Concept of Fig. 7 .....                                                                                        | 10          |
| III. THE ASSERTED PRIOR ART .....                                                                                                   | 10          |
| A. Thibault.....                                                                                                                    | 10          |
| B. Matsusaka .....                                                                                                                  | 12          |
| C. Kim .....                                                                                                                        | 13          |
| IV. PERSON OF ORDINARY SKILL IN THE ART .....                                                                                       | 14          |
| V. CLAIM CONSTRUCTION .....                                                                                                         | 14          |
| VI. PETITIONER FAILED TO DEMONSTRATE BY A<br>PREPONDERANCE OF EVIDENCE THAT THE CLAIMS OF<br>THE ‘120 PATENT ARE UNPATENTABLE ..... | 18          |
| A. Legal Standards .....                                                                                                            | 18          |
| B. Petitioner’s “Downward Slope” Analysis is Irrelevant to the<br>Claim Language.....                                               | 19          |
| C. Petitioner Has Not Shown Claims 1-7 are Anticipated By, or<br>Obvious Over, Thibault .....                                       | 24          |
| 1. Petitioner Cannot Rely on the “Being Used to Compensate”<br>Clause Being Read Out of Claim 1 .....                               | 24          |
| 2. Petitioner Fails to Identify Any Magnification Zone in<br>Thibault .....                                                         | 25          |

|      |                                                                                                                                                  |    |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------|----|
| D.   | Petitioner Has Not Shown Claims 1 or 3-6 are Anticipated By,<br>or Obvious Over, Matsusaka .....                                                 | 27 |
| 1.   | Petitioner Cannot Rely on the “Being Used to Compensate”<br>Clause Being Read Out of Claim 1 .....                                               | 28 |
| 2.   | Petitioner Fails to Provide Any MTF or Relative<br>Illumination Curve for Correlating the Magnification Zone<br>Positions .....                  | 28 |
| E.   | Petitioner Has Not Shown Claims 1, 4, 5, or 7 are Anticipated<br>By, or Obvious Over, Kim .....                                                  | 31 |
| 1.   | Petitioner Cannot Rely on the “Being Used to Compensate”<br>Clause Being Read Out of Claim 1 .....                                               | 32 |
| 2.   | Petitioner’s Relative Illumination Curve for Kim from the<br>Parallel Litigation Shows Why No Such Data was<br>Submitted with the Petition ..... | 32 |
| VII. | CONCLUSION.....                                                                                                                                  | 36 |

**TABLE OF AUTHORITIES**

|                                                                                                     | <b>Page(s)</b> |
|-----------------------------------------------------------------------------------------------------|----------------|
| <b>Cases</b>                                                                                        |                |
| <i>Baldwin Graphic Sys., Inc. v. Siebert, Inc.</i> ,<br>512 F.3d 1338 (Fed. Cir. 2008) .....        | 16             |
| <i>In re Danly</i> ,<br>263 F.2d 844 (C.C.P.A. 1959) .....                                          | 17             |
| <i>Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.</i> ,<br>800 F.3d 1375 (Fed. Cir. 2015) .....     | 18             |
| <i>In re Hack</i> ,<br>245 F.2d 246 (C.C.P.A. 1957) .....                                           | 17             |
| <i>Harmonic Inc. v. Avid Tech., Inc.</i> ,<br>815 F.3d 1356 (Fed. Cir. 2016) .....                  | 18             |
| <i>Hewlett-Packard Co. v. Bausch &amp; Lomb, Inc.</i> ,<br>909 F.2d 1464 (Fed. Cir. 1990) .....     | 17             |
| <i>K-2 Corp. v. Salomon S.A.</i> ,<br>191 F.3d 1356 (Fed. Cir. 1999) .....                          | 16, 25         |
| <i>Kinetic Concepts, Inc. v. Smith &amp; Nephew, Inc.</i> ,<br>688 F.3d 1342 (Fed. Cir. 2012) ..... | 19             |
| <i>KSR Int’l Co. v. Teleflex Inc.</i> ,<br>550 U.S. 398 (2007).....                                 | 19             |
| <i>In re Michlin</i> ,<br>256 F.2d 317 (C.C.P.A. 1958) .....                                        | 17             |
| <i>Net MoneyIN, Inc. v. Verisign, Inc.</i> ,<br>545 F.3d 1359 (Fed. Cir. 2008) .....                | 18             |
| <i>In re Stencel</i> ,<br>828 F.2d 751 (Fed. Cir. 1987) .....                                       | 17             |
| <i>Verdegaal Bros. v. Union Oil Co. of Cal.</i> ,<br>814 F.2d 628 (Fed. Cir. 1987) .....            | 18             |

**Statutes**

|                            |    |
|----------------------------|----|
| 35 U.S.C. § 312(a)(3)..... | 18 |
| 35 U.S.C. § 316(e) .....   | 18 |

**EXHIBIT LIST**

| <b>Exhibit No.</b> | <b>Description</b>                                                                                                                                    |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2001               | Declaration of Michael Lebby, Ph.D.                                                                                                                   |
| 2002               | October 12, 2023 Deposition Transcript of David Kessler, Ph.D.                                                                                        |
| 2003               | Defendant Apple Inc.'s Invalidity Contentions and Exhibit B-1 thereto from <i>ImmerVision, Inc. v. Apple, Inc.</i> , Case No. 1:21-cv-01570 (D. Del.) |
| 2004               | U.S. Pat. App. Pub. No. 2012/0314296 ("Shabtay")                                                                                                      |
| 2005               | U.S. Pat. No. 6,844,990 ("the '990 Patent")                                                                                                           |
| 2006               | Chapter 1 of "Smart Mini-Cameras," (Tigran V. Galstian, ed., 2014)                                                                                    |
| 2007               | Chapters 6, 9, and 17 of José Sasián, "Introduction to Lens Design" (2019)                                                                            |
| 2008               | "Imaging Optics A Technical Resource for Imaging Solutions" published by Edmund Optics, V173A                                                         |
| 2009               | Chapter 8 of Rudolf Kingslake & R. Barry Johnson, "Lens Design Fundamentals," (2 <sup>nd</sup> ed., 2010)                                             |
| 2010               | Chapter 11 of Warren J. Smith, "Warren J. Smith's Modern Optical Engineering," (3 <sup>rd</sup> ed., 2000)                                            |
| 2011               | <i>Curriculum vitae</i> of Michael Lebby, Ph.D.                                                                                                       |

## **I. INTRODUCTION**

Petitioner fails to meet its burden to show unpatentability of the claims in the ‘120 Patent at least because Petitioner ignores express claim language, performs incomplete analyses of the references, and relies on irrelevant embodiments within the patent.

Claim 1 of the ‘120 Patent requires a correlation between image magnification zones and drops in relative illumination or modulation transfer function (MTF). Petitioner first attempts to read this element out of the claims completely using an unsupported claim construction argument. But even when reluctantly allowing the clause patentable weight, Petitioner still ignores select terms to arrive at its conclusions. Petitioner: (1) never identifies any magnification zones in the Thibault reference asserted in Ground 1; and (2) fails to provide any relative illumination or MTF data for the Matsusaka or Kim references in Grounds 2 and 3. Petitioner’s expert, Dr. David Kessler, even admitted he didn’t think the relative illumination or MTF data was necessary for these references despite their usage in claim 1. This disregard is betrayed at least by Petitioner’s relative illumination data for Kim produced in the parallel litigation, which completely contradicts its unpatentability position on Kim.

Instead of addressing the express claim language, Petitioner manufactures an argument for anticipation and obviousness using the ‘120 Patent’s Fig. 7 and its

accompanying description. Specifically, Petitioner contends that each of the three asserted references includes a downward trending slope at some point in their respective resolution curves. Petitioner reasons that since Fig. 7 in the ‘120 Patent also includes a downward curve, the three references must read on the claims. But as Patent Owner’s expert, Dr. Michael Lebby, explains, Fig. 7 relates to a different and previously known technique than the one claimed – the “downward slope” is not being used to “compensate for” drops in MTF or relative illumination, contrary to Petitioner’s assertions. Petitioner’s misguided and incomplete arguments are insufficient for Petitioner to meet its burden in this proceeding and the PTAB should find the challenged claims not unpatentable as a result.

## **II. THE RELEVANT INVENTION OF THE ‘120 PATENT**

In general, the ‘120 Patent is directed to miniaturized lenses with wide-angle fields of view, particularly for applications such as cameras in mobile devices, which require low profile lenses. Ex. 1001 at 1:20-30; Ex. 2001 at ¶ 46. The claims specifically address challenges faced by conventional miniature wide-angle lenses that can degrade image quality, especially at an edge of the field of view (FOV). Ex. 1001 at 1:53-2:3; Ex. 2001 at ¶ 52.

Lens design is complicated by the numerous tradeoffs that must be balanced to achieve various design objectives. Ex. 2001 at ¶ 49; Ex. 2006 at 9-10. Key drivers of the design can include costs, tolerances, and optical performance. Ex.

2001 at ¶ 48; Ex. 2006 at 13-17. Optical performance factors to be balanced include sharpness, relative illumination, MTF, and distortion, among others. Ex. 2001 at ¶ 49; Ex. 2006 at 9-10, 18-26. These considerations have taken greater importance recently in mobile device camera applications, where image quality demands continue increasing although the size of the phone remains small. Ex. 2001 at ¶¶ 46-47; Ex. 2007 at 187; Ex. 2006 at 3.

Relative illumination is a lens characteristic that can be influenced by several factors. Ex. 2001 at ¶ 50; Ex. 2006 at 23-25; Ex. 2007 at 59-60; Ex. 2008 at 20, 23. Relative illumination is a ratio of illumination or intensity at any point in an image as compared to a maximum illumination (which is typically on-axis). Ex. 2001 at ¶ 50; Ex. 2008 at 20. This may be represented by a curve plotting the ratio as a percentage against field angle. Ex. 2001 at ¶ 50; Ex. 1001 at Fig. 4; Ex. 2008 at 13. Drops in relative illumination can affect image quality due to increased diffraction effects and sensor noise. Ex. 2001 at ¶ 50; Ex. 1001 at 1:60-62. One prior method of compensating for low relative illumination includes post-capture digital processing of the image. Ex. 2006 at 28.

MTF is a characterization of two major elements of image performance: contrast and resolution. Ex. 2001 at ¶ 51; Ex. 2009 at 250-252; Ex. 2010 at 366-372. Contrast describes the lens's ability to differentiate between maximum and minimum intensity values. Ex. 2001 at ¶ 51; Ex. 2007 at 105; Ex. 2008 at 9.

Object resolution refers to a system's ability to recognize object detail and is typically calculated using the resolution of the camera and imaging magnification. Ex. 2001 at ¶ 51; Ex. 2008 at 8-9; Ex. 2010 at 366. MTF is the ability of the lens to transfer contrast at a particular resolution from the object to the image. Ex. 2001 at ¶ 51; Ex. 2008 at 12-13. As line spacing decreases, optical systems have more difficulty efficiently transferring the decrease in contrast, which lowers MTF. Ex. 2001 at ¶ 51; Ex. 2007 at 106. As with relative illumination, declines in MTF can similarly reduce image quality. Ex. 2001 at ¶ 51; Ex. 1001 at 2:1-3.

The inventors of the '120 Patent determined that the negative image quality effects from decreased relative illumination and MTF could be compensated for by adjusting the image resolution. *See e.g.*, Ex. 2001 at ¶ 52; Ex. 1001 at 2:45-55. In other words, in some instances, a lens designer can tolerate low relative illumination or MTF in a region of an image if increased resolution allows more details from the region to be obtained. Ex. 2001 at ¶¶ 52, 60, 62. This allows high quality to be maintained in low profile, wide angle lenses. *Id.* at ¶ 52.

#### **A. The Non-Linear Targeted Resolution**

The solution starts with the lens being designed to exhibit a non-linear targeted resolution. Ex. 1001 at 2:45-55, 6:9-13; Ex. 2001 at ¶¶ 52-53. In a lens with a linear targeted resolution, the number of pixels per degree will essentially be constant across the entire FOV of the lens. Ex. 2001 at ¶ 53. That is, each degree

interval between the center and the edge of the FOV will be projected onto an equal number of pixels. *Id.* The image below shows an example where two randomly selected one degree-wide regions from the FOV both project onto separate regions of an image sensor, each being ten pixels wide. *Id.* This would be expected to be consistent over the entire FOV for the lens. *Id.* A resolution plot for such a lens against the field angle would appear as a horizontal line at a height of 10 pixels per degree. *Id.* at ¶¶ 53-54; Ex. 1003 at ¶ 164; Ex. 2002 at 78:19-79:15.

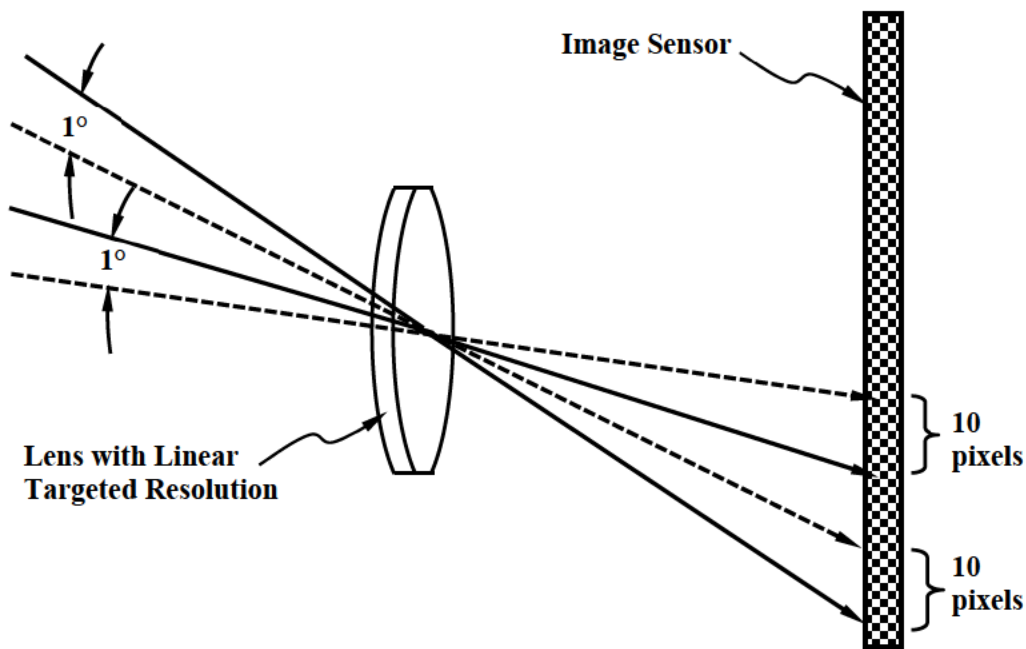


Fig. 6 (reproduced below) represents an example of a non-linear targeted resolution curve for a lens, where the number of pixels per degree varies across the FOV. Ex. 2001 at ¶ 55. The Fig. 6 lens exhibits a resolution of between 12-13 pixels per degree at the center, but the resolution continually rises as the FOV

increases until peaking around 20 pixels per degree at the edge. *Id.*; Ex. 1001 at Fig. 6.

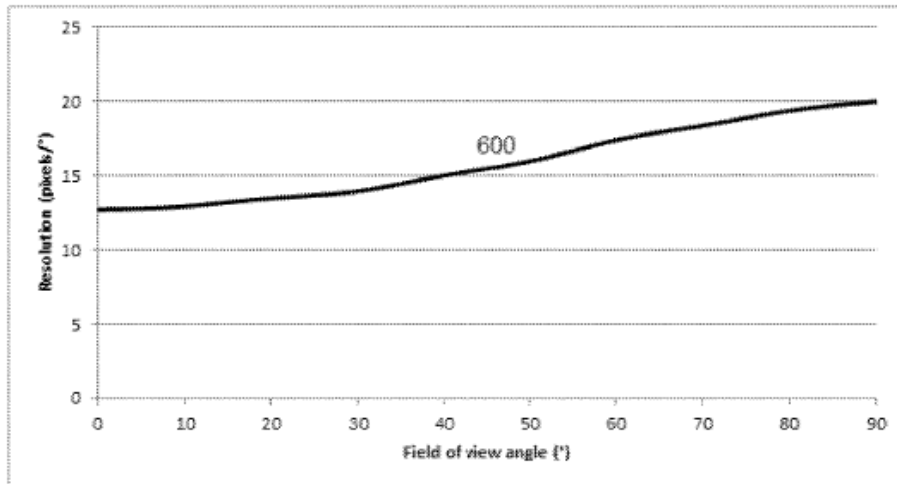


Figure 6

## B. Zones of Different Magnification

The practical effect of a non-linear targeted resolution is that the resultant image will have zones where object to image magnification is higher or lower when compared to a linear resolution. Ex. 1001 at 2:45-55, 6:9-27; Ex. 2001 at ¶¶ 56; Ex. 1003 at ¶¶ 165, 196. A higher magnification equates to a higher number of pixels per degree and a lower magnification means the opposite. Ex. 1001 at 2:45-55, 6:9-27; Ex. 2001 at ¶¶ 56, 58. For purposes of comparison, a horizontal line representing a linear resolution for a lens “equivalent” to a non-linear resolution lens may be placed in the plot at a height where the area under both curves would be identical. Ex. 2001 at ¶ 57. Another way to calculate the equivalent linear value would be to divide the image height (in units like microns or pixels) by the total FOV. Ex. 2001 at ¶¶ 56; Ex. 1003 at ¶¶ 164, 195.

Using Fig. 6 again, an example estimated equivalent linear resolution is added in the plot below for illustration. Ex. 2001 at ¶¶ 57-58. The linear resolution (red line) and the non-linear resolution (black curve) intersect, in this example, at a field angle of approximately  $52^\circ$ . *Id.* at ¶ 58. Where the non-linear curve lies below the red line, a zone of lower magnification is created, meaning the image projected by the Fig. 6 lens would look compressed at the center as compared to the image from the linear resolution equivalent lens. *Id.* Similarly, where the non-linear curve lies above the red line, a zone of higher magnification is created. *Id.* The image projected by the Fig. 6 lens would appear expanded at the edge when compared to a linear resolution equivalent. *Id.*

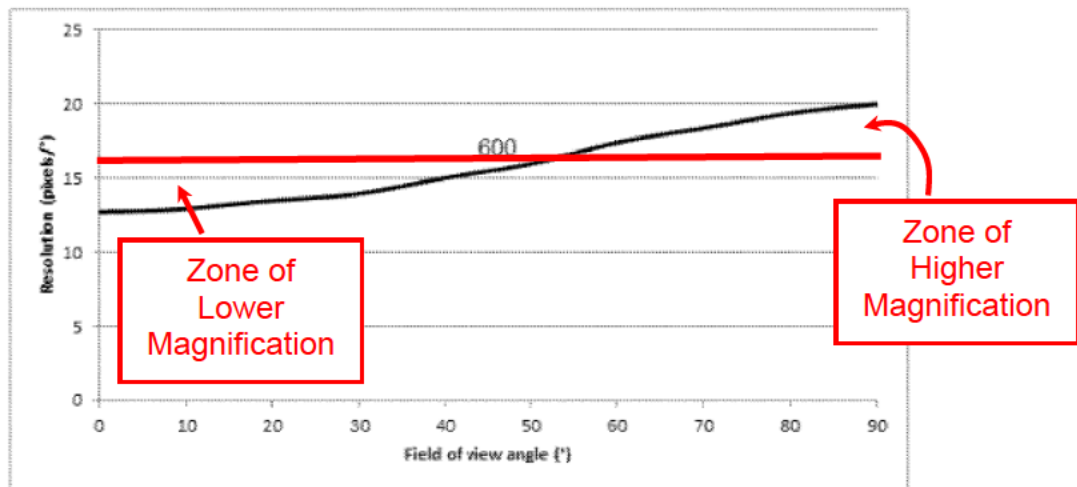


Figure 6

### C. Compensating for Relative Illumination or MTF Drops

Fig. 4 (reproduced below) is an example relative illumination plot for a lens that can be aided by the resolution configuration shown in Fig. 6. Ex. 1001 at 6:13-16; Ex. 2001 at ¶ 59. The relative illumination in the lens center is at or near

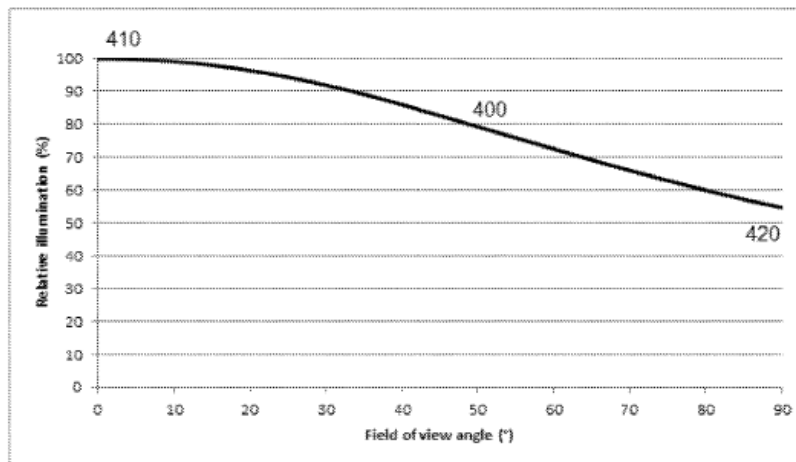


Figure 4

100%, but exhibits only a shallow drop until taking a more precipitous decline starting around 25° or 30°.

Ex. 2001 at ¶ 59. The relative illumination is at

80% by 50° and is well below 60% at the edge. *Id.* The curves in Figs. 4 and 6 show a general relative inverse correlation – at the center where the relative illumination is highest, the magnification is lowest, and the higher resolution zone in Fig. 6 from about 52° to the edge corresponds to the lowest relative illumination areas. *Id.* at ¶ 60. The slopes also correlate well, with the resolution curve showing a slow initial ascent generally matching the slow initial decline of the relative illumination at the center, with subsequent corresponding steeper slopes. *Id.* As the relative illumination drops, the magnification tends to increase to compensate for the effect on image quality – a higher number of pixels per degree is present as the relative illumination degrades, which gives more image space to

this zone to enhance the image despite the illumination problem. *Id.*; Ex. 1001 at 6:9-27.

Fig. 5 (reproduced below) similarly gives an example MTF plot that can be compensated for by the magnification scheme of Fig. 6. Ex. 1001 at 6:16-19; Ex. 2001 at ¶ 61. The sagittal and tangential MTF curves are roughly 85% at the lens center but drop to 70% or below at the edge. Ex. 2001 at ¶ 61. Starting at around 30°, both curves start to trend

toward a more precipitous decline. *Id.* Once again, the resolution curve in Fig. 6 exhibits a somewhat inverse relationship, with the minimum resolution at the

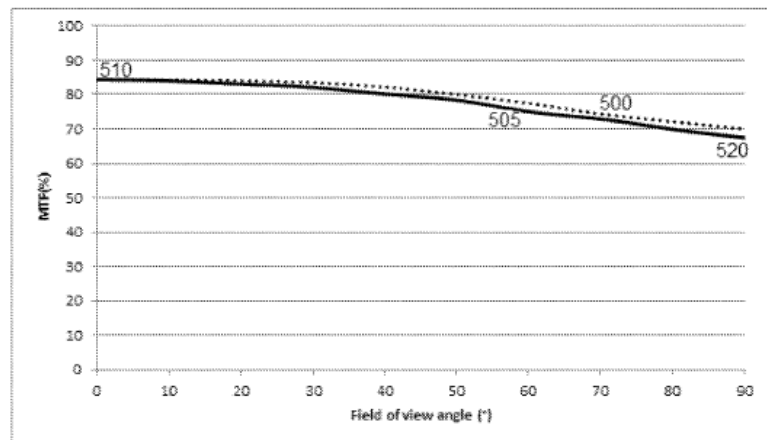


Figure 5

center but the highest magnification at the edge, where the MTF is also at its lowest. *Id.* at ¶ 62. As with the relative illumination, the placement of a zone of higher magnification between about 52° and the edge in this example provides more sensor space to that portion of the image to offset image quality problems caused by the lowest MTF values. *Id.*; Ex. 1001 at 6:19-27.

#### **D. The Complementary Concept of Fig. 7**

Fig. 7 shows a different example resolution curve having multiple changes of direction resulting in a maximum resolution value at point 712. Ex. 1001 at 6:28-50, Fig. 7; Ex. 2001 at ¶¶ 88-89. This example plot shape is designed to optimize image quality for that particular lens by creating more balanced relative illumination and MTF. Ex. 1001 at 6:51-61; Ex. 2001 at ¶ 89. As will be explained in greater detail below, Fig. 7 partially embodies a different, complementary concept to the compensation scheme described above. Ex. 2001 at ¶¶ 89-91. In short, the Fig. 7 embodiment attempts to actively increase relative illumination in certain areas of the image, rather than merely compensating for poor image quality caused by a lower relative illumination. *Id.*

### **III. THE ASSERTED PRIOR ART**

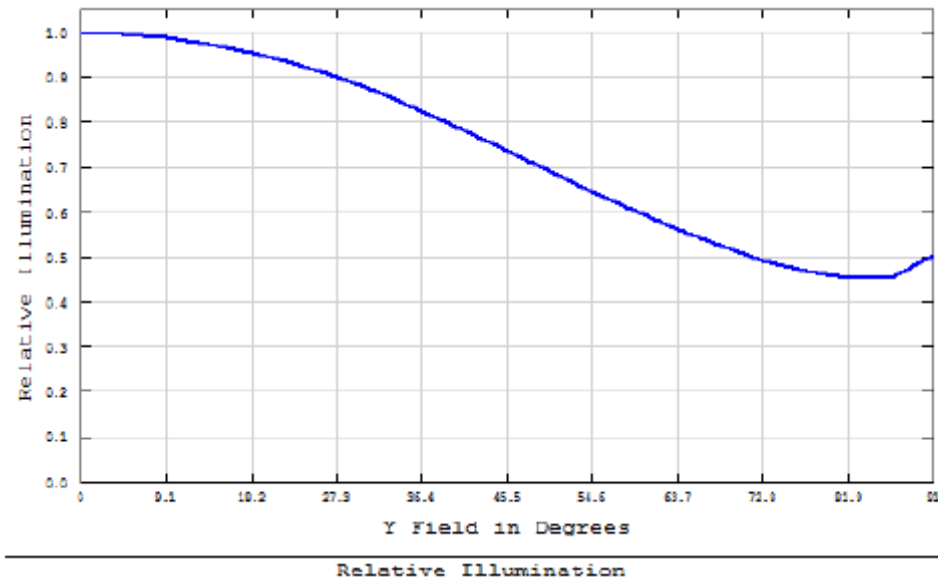
#### **A. Thibault**

Thibault provides two designs for miniature 180° FOV lenses for use in consumer electronics. Ex. 1004 at 2; Ex. 2001 at ¶ 68. The designs address specific challenges in reducing a total track length of the lens, including, *inter alia*, constraints imposed by minimum thicknesses needed for the 5-6 lens elements required to give a 180° FOV, chromatic aberration balancing, and molding constraints. Ex. 1004 at 2-3; Ex. 2001 at ¶ 68.

One of the lenses is intended for mobile device applications and has a total track length of 3.80 mm despite using six plastic lens elements. Ex. 1004 at 6.

The lens uses “targeted distortion to increase the number of pixels in the *zone of interest* for mobile video chat applications.” *Id.* at 6-7 (emphasis added); Ex. 2001 at ¶¶ 68-69. This is shown in Figure 6, where a maximum resolution is achieved around 60° in the FOV. Ex. 1004 at 7; Ex. 2001 at ¶ 69. When compared with Figure 9 in the article, the maximum resolution corresponds generally to the locations of individuals in a mobile video chat, as opposed to the center (viewing the ceiling), which is of little interest in such an application. Ex. 1004 at 8; Ex. 2001 at ¶ 69. Thibault’s primary concern for non-linear resolution application is areas of an image likely to contain features of interest to the viewer (*e.g.*, faces, primary objects, etc.), just like in ImmerVision’s own previous ‘990 Patent. Ex. 1004 at 8; Ex. 2001 at ¶¶ 68-69, Ex. 2005 at 3:43-4:10.

Thibault also provides a relative illumination curve for the 3.80 mm lens in Figure 7 (reproduced below). The relative illumination is approximately 100% at center but drops markedly after about 20°, dropping below 50% around 70°, and only recovering slightly back to 50% at the edge of the FOV (~91°). Ex. 1004 at 7; Ex. 2001 at ¶ 70. Thibault does not explicitly correlate the resolution distribution in Figure 6 with the relative illumination curve of Figure 7. Ex. 2001 at ¶ 70. Thibault also does not describe any impact of its resolution distribution as related to any MTF of the lens. *Id.*

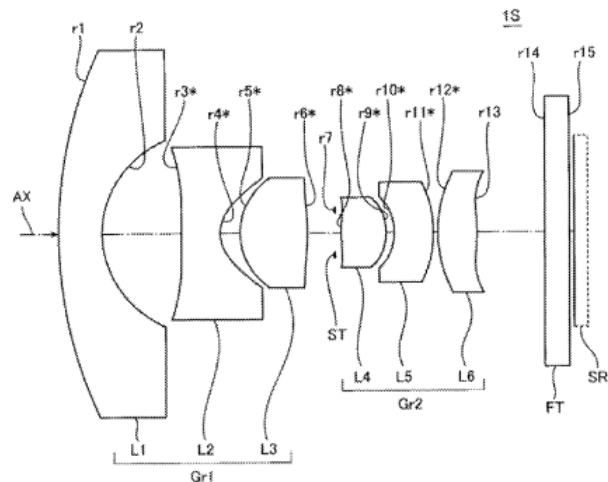


## B. Matsusaka

Matsusaka is directed to a wide-angle optical system, primarily for use in a vehicle onboard rearview camera, with improved contrast due to the sufficient correction of chromatic aberrations in a compacted system. *See e.g.*, Ex. 1005 at [0002]-[0009]; Ex. 2001 at ¶ 71. Petitioner focuses on the lens system of Example 19, a sectional of which is

FIG. 23

shown in Fig. 23 (reproduced at right). Petition at 46; Ex. 2001 at ¶ 72. The Example 19 system includes a negative power front lens group Gr1 of three lenses



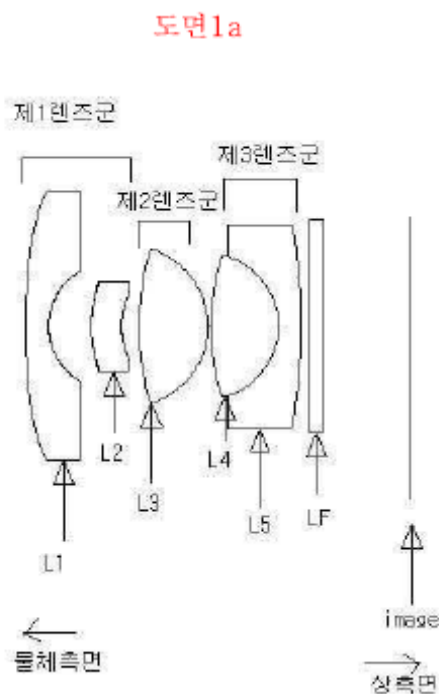
L1-L3, an aperture stop ST, and a second lens group Gr2 of three lenses L4-L6.

Ex. 1005 at [0405]-[0408]. A parallel flat plate FT, which can include a filter and

cover glass, is positioned between the second lens group Gr2 and an image pickup element SR. *Id.* at [0409]. Various characteristics of the Example 19 system are displayed in Figs. 43A-43B, including aberrations, astigmatism, and distortion. *Id.* at [0412]; Ex. 2001 at ¶ 72. Matsusaka does not show a resolution curve, nor does it describe or plot the relative illumination or the MTF of the Example 19 system (or any of its other wide-angle optical systems, for that matter). Ex. 2001 at ¶¶ 73-74.

### C. Kim

Kim discloses a compact superwide angle optical system for mounting on a vehicle for surveillance. Ex. 1007 at 3-4; Ex. 2001 at ¶ 75. Petitioner focuses on the first system embodiment shown in Diagram 1a (reproduced below). Petition at



68; Ex. 2001 at ¶ 76. The system includes a first lens group of a first lens L1 and a second lens L2, a second lens group with a third lens L3, and a third lens group having a fourth lens L4 and a fifth lens L5. Ex. 1007 at 4. The first lens group has a strong negative power in order to obtain a superwide angle of incoming light. *Id.* To increase lens brightness and resolution, a drawback of

earlier systems, Kim constructs the object and image surfaces of the first and second lenses L1, L2 to be aspherical. *Id.* Various characteristics of the first embodiment are displayed in Diagram 1b, including aberrations and astigmatism. *Id.* at 7; Ex. 2001 at ¶¶ 75-76. Kim does not provide resolution information, nor does it describe or plot the relative illumination or the MTF of the first embodiment (or any of its other embodiments, for that matter). Ex. 2001 at ¶¶ 77-78.

#### **IV. PERSON OF ORDINARY SKILL IN THE ART**

*Solely* for purposes of this Response, Patent Owner does not object to Petitioner's definition of a POSA. Ex. 2001 at ¶ 45. Patent Owner reserves the right to assert an alternative definition for a POSA in this or another proceeding involving the '120 Patent, where appropriate.

#### **V. CLAIM CONSTRUCTION**

Petitioner contends no formal constructions are necessary, but advocates removing the phrase: "the lower or higher object to image magnification being used to compensate, at least in part, for a lower image quality due to at least one of a drop of relative illumination or a drop of MTF in a zone of the image" as not having patentable weight. Petition at 9-12. Petitioner characterizes the overall phrase as an intended use limitation by emphasizing the "being used to

compensate” language as implying an intent. *Id.* Petitioner’s position ignores the surrounding claim language and the supporting specification.

Prior to the clause in question, claim 1 recites the apparatus includes “a non-linear targeted resolution to intentionally create a zone in an image captured by the miniature wide-angle optical apparatus with a lower or higher object to image magnification compared to linear targeted resolution.” Ex. 1001 at cl. 1. This merely indicates the existence of a magnification zone, which was previously known. Ex. 2001 at ¶ 65; Ex. 2005 at 3:43-4:10. The subsequent “being used to compensate” language explains, *inter alia*, **where** the created zones are placed in the apparatus – *i.e.*, in locations within the FOV corresponding to the relative illumination or MTF drop. Ex. 2001 at ¶ 66.

The example from Figs. 4-6 demonstrates this concept. As explained above in section II, Fig. 6 shows a resolution plot where a zone of higher magnification is provided in a location corresponding to drops in relative illumination and MTF exhibited in Figs. 4 and 5, respectively. Ex. 2001 at ¶¶ 60, 62, 66; *see also* Ex. 1001 at 6:9-27 (*e.g.*, “By **having more imaging pixels in this zone, this compensates** for the lower image quality in this zone either due to the lower relative illumination or the lower MTF” (emphasis added)). Other portions of the specification also tie this “being used to compensate” language to zone location as well. For example:

In some embodiments of the current invention, the targeted resolution curve of the miniature wide-angle lens is configured to offset, at least in part, the drop of relative illumination from the miniature wide-angle lens ***by increasing the number of pixels imaged in the zone where the relative illumination is lower.***

In some other embodiments of the current invention, the targeted resolution curve of the miniature wide-angle lens is configured to offset, at least in part, the drop of MTF from the miniature wide-angle lens ***by increasing the number of pixels imaged in the zone where the MTF is lower.***

*Id.* at 2:45-55 (emphasis added); Ex. 2001 at ¶ 52. The language at issue results in a structural difference – it at least indicates where the targeted zone is located in the apparatus. Ex. 2001 at ¶¶ 66-67. By Petitioner’s own argument, it must therefore be assigned patentable weight. *See* Petition at 10 (“to limit an apparatus claim, functional language must result in a structural difference in the claimed apparatus”) (*citing K-2 Corp. v. Salomon S.A.*, 191 F.3d 1356, 1363-64 (Fed. Cir. 1999) (reading functional language as separate, structural limitation)).

The other cases cited by Petitioner for the proposition of reading out “descriptions of use” from apparatus claims either afford patentable weight to the element at issue or present far different claim drafting circumstances. *See e.g., Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1344 (Fed. Cir. 2008) (refusing to limit apparatus claim to process by which a certain element is

manufactured); *Hewlett-Packard Co. v. Bausch & Lomb, Inc.*, 909 F.2d 1464, 1468 (Fed. Cir. 1990) (patentee's structural differences were enough to distinguish prior art – no need to rely on operational differences); *In re Stencel*, 828 F.2d 751, 754 (Fed. Cir. 1987) (applicant permitted to limit device claim with statement of purpose in preamble); *In re Danly*, 263 F.2d 844, 847-48 (C.C.P.A. 1959) (novelty was not in device capable of having alternating current passed through the tie rods, but in a method of actually passing that current in the rods); *In re Michlin*, 256 F.2d 317, 320 (C.C.P.A. 1958) (apparatus claim concluded with step of how apparatus may be operated); *In re Hack*, 245 F.2d 246, 248-49 (C.C.P.A. 1957) (composition claims invalid because the composition was old and invention was merely a new use).

The “being used to compensate” clause in claim 1 is not reciting a new use for an old product, does not relate to a process of making the optical apparatus, nor does it provide a step for operation. Rather, it at least explains to the POSA how the created zone is arranged within the FOV of the optical apparatus. Ex. 2001 at ¶ 66. For at least these reasons, all elements in claim 1 should be considered to have patentable weight for purposes of evaluating the asserted prior art.

**VI. PETITIONER FAILED TO DEMONSTRATE BY A PREPONDERANCE OF EVIDENCE THAT THE CLAIMS OF THE ‘120 PATENT ARE UNPATENTABLE**

**A. Legal Standards**

A claim in an *inter partes* review is not unpatentable unless the Petitioner can demonstrate to the contrary by a preponderance of the evidence. 35 U.S.C. § 316(e). “[T]he petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (petitions must identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); 35 U.S.C. § 316(e). This burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378–79 (Fed. Cir. 2015).

To demonstrate anticipation, Petitioner must show that each and every element in the challenged claim is found, either expressly or inherently, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). The reference must also disclose those elements “arranged as in the claim.” *Net MoneyIN, Inc. v. Verisign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008).

Where obviousness is alleged under 35 U.S.C. § 103, Petitioner must demonstrate that the references, when combined, teach or suggest *each* of the

elements of the challenged claim. *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1366-67 (Fed. Cir. 2012). However, even if all of the elements are present in the prior art, Petitioner must still provide an apparent reason why one of ordinary skill in the art would have combined the elements in the fashion claimed. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007) (“A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art,” but ““there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness””).

**B. Petitioner’s “Downward Slope” Analysis is Irrelevant to the Claim Language**

Throughout their analysis, Petitioner and Dr. Kessler rely exclusively on the presence of a “downward slope” in the resolution curves of Thibault, Matsusaka, and Kim as evidence the references teach the “being used to compensate for...” term of the ‘120 Patent’s claim 1. Petition at 30-32, 60, 80; Ex. 1003 at ¶¶ 123, 167, 198; Ex. 2001 at ¶¶ 80, 94, 101. This error is based on comparisons with the Fig. 7 curve and the mistaken notion that the ‘120 Patent “conflated a negative or downward sloped resolution curve as having lower object to image magnification ratio,” which leads a POSA to also understand “a positive or upward sloped resolution curve as having higher object to image magnification ratio.” Petition at 26; Ex. 1003 at ¶ 123 (each *citing* Ex. 1001 at 6:28-41); Ex. 2001 at ¶ 83.

First, the alleged correlation is factually incorrect, which Petitioner and Dr. Kessler both recognized in their own analyses. Ex. 2001 at ¶ 84. Take, for example, the resolution curve for Matsusaka's Example 19 lens and how Petitioner and Dr. Kessler identified the magnification zones:

Areas where the blue curve are *above the red curve are areas of increased magnification* with respect to the linear targeted resolution, and areas where the blue curve are *below the red curve are areas of decreased magnification* with respect to the linear targeted resolution.

Ex. 1003 at ¶ 165 (emphasis added); Petition at 58-59; Ex. 2001 at ¶¶ 84-85. As seen from the plot at page 58 of the Petition (reproduced at right), the blue curve is below the red line from the center until approximately 40° in the FOV, meaning it has



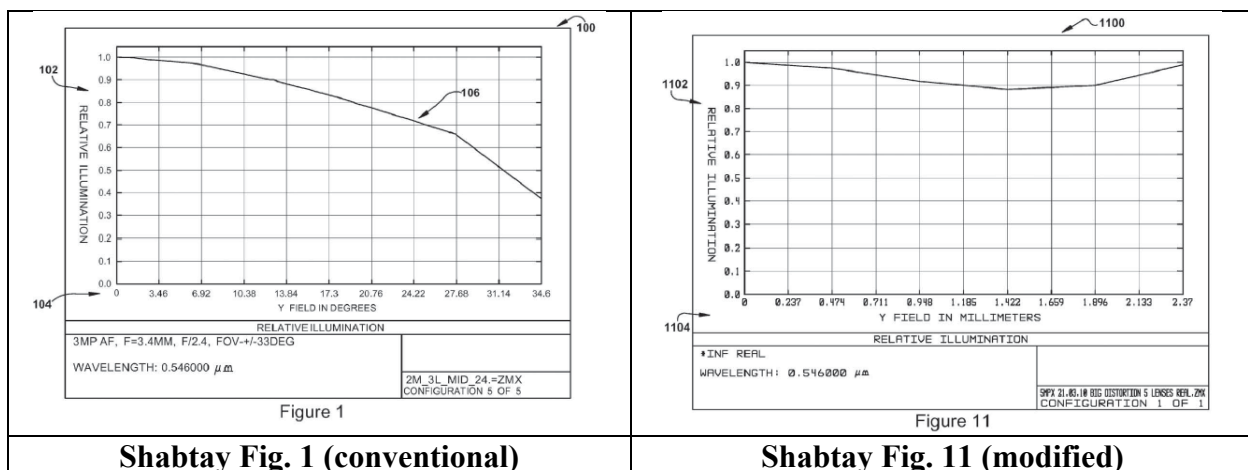
*decreased magnification in that area despite exhibiting an entirely upward trending slope.* Ex. 2001 at ¶ 85; Ex. 2002 at 81:7-14. Similarly, from approximately 75° until around 92-93°, the blue curve is above the red line with a *downward slope*, but Petitioner's analysis confirms this area will have an *increased magnification*. Ex. 2001 at ¶ 85; Ex. 2002 at 81:15-22. As another

example, the slope of Kim's resolution curve is downward for the entire FOV, but the region from center to about 40° is an increased magnification zone because the blue curve is above the red line. Petition at 79; Ex. 2001 at ¶ 86, Ex. 2002 at 79:16-80:7.

Second, nothing in the '120 Patent states to the contrary. For example, the Fig. 6 resolution curve is described as having only one part ("zone") with "a higher number of pixels per degree" or "higher resolution" that "compensates" for the MTF or relative illumination drops shown in Figs. 4 and 5. Ex. 1001 at 6:9-27; Ex. 2001 at ¶¶ 58, 87. Since Fig. 6 exhibits a generally upward slope over the entire plot, the '120 Patent has not equated slope to the claimed magnification zones in this example. Ex. 2001 at ¶ 87.

Petitioner and Dr. Kessler instead rely on Fig. 7 to support their improper conclusion. Fig. 7 shows a downward curve portion located between a maximum resolution value 712 and a position 714 appearing near the edge of the FOV. Ex. 1001 at 6:30-41; Ex. 2001 at ¶ 88. Unlike Fig. 6, which is tied to Figs. 4-5, the '120 Patent does not align Fig. 7 with any illustrated relative illumination or MTF plot. Ex. 1001 at 6:9-61; Ex. 2001 at ¶ 91. Dr. Kessler further admits that the '120 Patent only uses the claim term "compensate" in conjunction with Figs. 4-6 and *not* Fig. 7. Ex. 1001 at 3:18-25, 6:9-61; Ex. 2001 at ¶ 91; Ex. 2002 at 83:3-86:1.

Fig. 7 is described as illustrating a different, but related, principle, which is that a decrease in resolution can be utilized to *actually raise relative illumination*. Ex. 1001 at 6:35-41; Ex. 2001 at ¶¶ 89-90. That is, *instead of compensating* for poor image quality from low relative illumination by magnifying that area to capture more detail, as is done in Fig. 6, the illumination itself can be increased by dropping resolution. Ex. 2001 at ¶¶ 89-90. This particular concept is not new. For example, Shabtay (cited during prosecution of the ‘120 Patent) utilizes an exaggerated negative distortion at the edge to keep relative illumination high throughout the FOV. Ex. 2004 at ¶¶ [0001], [0042], [0044], [0076]-[0077], Figs. 10-11; Ex. 2001 at ¶ 89. This changes the relative illumination curve from something similar to that shown in Fig. 1 (which drops severely to 40% at the edge) to that of Fig. 11, where the relative illumination stays above ~88%. Ex. 2004 at ¶¶ [0037], [0077]; Figs. 1, 11; Ex. 2001 at ¶ 89.



This is precisely the concept behind the resolution curve presented in Fig. 7 and its accompanying description in the '120 Patent:

The targeted resolution curve is chosen to have an upward curve between the center resolution value 710 and a maximum 712 (number of pixels/degree), followed by a downward curve between the maximum 712 and a region near the edge of the field of view around position 714. This *downward curve between maximum value 712 and position 714 allows the lens system to have a higher relative illumination value toward the edge of the field of view by having a lower object to image magnification ratio in that region* and hence redirecting the same quantity of light from an object to a smaller region in the image with more illumination.

Ex. 1001 at 6:30-41 (emphasis added); Ex. 2001 at ¶ 90.

It is quite apparent to a POSA, based on the '120 Patent's description and the background context provided above, that the concept of actively increasing relative illumination by dropping resolution is a separate and different approach to improving image quality than using resolution magnification to compensate for low MTF or relative illumination. Ex. 2001 at ¶ 91.

**C. Petitioner Has Not Shown Claims 1-7 are Anticipated By, or Obvious Over, Thibault**

Petitioner fails to demonstrate any of claims 1-7 are anticipated by,<sup>1</sup> or obvious over, Thibault because, when considering all elements of claim 1, Petitioner has not identified any magnification zones in Thibault's resolution curve. Absent this information, one cannot determine whether those zones are properly located to compensate for the drop in relative illumination experienced by Thibault's lens. Petitioner's only evidence depends on the existence of a downward slope in Thibault's resolution curve, which is irrelevant to the claim.

**1. Petitioner Cannot Rely on the "Being Used to Compensate" Clause Being Read Out of Claim 1**

Petitioner initially contends that Thibault need not meet claim 1's "being used to compensate" clause because the phrase is allegedly not entitled to patentable weight. Petition at 30-31. As previously explained, this clause provides structural limitations to the optical apparatus. *See* § V, above. Specifically, this

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<sup>1</sup> Dr. Kessler opines that Thibault (and the other references) anticipate or render obvious claims of the '120 Patent. *See e.g.*, Ex. 1003 at pp. 58, 84, 106. However, Dr. Kessler fails to set out any legal standard for anticipation in his declaration and could not cogently explain the doctrine at his deposition. *Id.* at § 5; Ex. 2002 at 23:7-24:22. His opinions as to anticipation should be given little to no weight.

language at least informs the POSA of the created magnification zone's location within the FOV. *Id.* The zone is positioned in relation to a drop in the relative illumination or MTF of the apparatus. *Id.* The “being used to compensate” clause must be given patentable weight because it limits the structure of the optical apparatus. *See e.g., K-2*, 191 F.3d at 1363 (analyzing functional language as an additional limitation to an apparatus claim). Petitioner cannot demonstrate anticipation or obviousness with Thibault by reading the “being used to compensate” language out of the claim. Ex. 2001 at ¶¶ 80-81.

## **2. Petitioner Fails to Identify Any Magnification Zone in Thibault**

Claim 1 of the '120 Patent recites that the magnification ratio of the created *zone* is made *relative to a linear targeted resolution*, and *this zone* is “being used to compensate” for the lower image quality due to a drop in relative illumination or MTF. Ex. 1001 at cl. 1; Ex. 2001 at ¶¶ 65-66. Petitioner clearly recognizes in Grounds 2 and 3 how to identify such zones in a lens – areas of a resolution curve above a linear resolution represent increased magnification and areas below represent decreased magnification. Petition at 58, 79; Ex. 2001 at ¶ 82. Curiously, Petitioner managed to label these zones for Matsusaka and Kim by using arbitrary pixel counts (Petitioner at 58-59, 78-80; Ex. 1003 at ¶¶ 164, 195), but does not similarly examine Thibault. Ex. 2001 at ¶ 82. Calculating the linear resolution for Thibault would have been a straightforward exercise since the article provides the

exact image height and pixel size. Ex. 1004 at 6; Ex. 2001 at ¶¶ 56, 82. Dr. Kessler would have only needed to place the line at the appropriate height on Thibault's Fig. 6 to identify the low and high resolution zones. Ex. 2001 at ¶ 82. But Dr. Kessler omitted this analysis and provides *no* evidence regarding a location of any particular magnification zone in Thibault with respect to Thibault's relative illumination curve. *Id.*

Instead, Petitioner's sole argument relies on Fig. 6 in Thibault exhibiting a "similar downward slope to Figure 7 of the '120 Patent," which "would therefore have the same impact on relative illumination as described in the '120 Patent." Petition at 31-32; Ex. 2001 at ¶ 83. As explained above in section VI.B, not only is the existence of a downward slope insufficient to demonstrate the location of a magnification zone or its relationship to the lens' relative illumination or MTF, but the concept Petitioner considers is *not* relevant to the "being used to compensate..." language in claim 1. Ex. 2001 at ¶¶ 83-91. Even if the brief, minor upturn in relative illumination in Thibault's Fig. 7 is somehow attributable to the decline in resolution shown over a span of 30° in the article's Fig. 6, this phenomenon is attributable to the principle described in Shabtay and the '120 Patent for its Fig. 7 – it does *not* demonstrate using magnification zones to compensate for low relative illumination or MTF. *Id.* at ¶ 89-91; Ex. 1001 at 6:35-41; Ex. 2004 at ¶¶ [0076]-[0077]. Since Petitioner does not even bother to identify

the magnification zones, it has not demonstrated how such zones correlate to any portion of the relative illumination curve illustrated in Thibault's Fig. 7. Ex. 2001 at ¶¶ 79, 92. Petitioner and Dr. Kessler simply offer no evidence in this regard. Petitioner has therefore failed to meet its burden to show Thibault anticipates or renders obvious any of the claims of the '120 Patent.

**D. Petitioner Has Not Shown Claims 1 or 3-6 are Anticipated By, or Obvious Over, Matsusaka**

Petitioner fails to demonstrate any of claims 1 or 3-6 are anticipated by, or obvious over, Matsusaka because, when considering all elements of claim 1, Petitioner has not provided any information about the MTF or relative illumination characteristics of Matsusaka's Example 19<sup>2</sup> lens. Without this data, one cannot determine whether the magnification zones identified by Petitioner are located to compensate for any drop in relative illumination or MTF, as called for by claim 1.

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<sup>2</sup> Both Petitioner and Dr. Kessler contend Matsusaka's "Examples 6, 8, 18, 19, 20, 22, and 23" allegedly "prove that claims 1 and 3-6 of the '120 Patent are anticipated and/or obvious," and focus their analysis on Example 19 "for simplicity." Petition at 45-46; Ex. 1003 at ¶ 93. However, Dr. Kessler could not recall whether he modeled any of Matsusaka's other examples and admits that analysis does not appear anywhere in his declaration. Ex. 2002 at 30:5-33:17.

Petitioner depends again exclusively on the existence of a downward slope in Matsusaka's resolution curve, which is irrelevant to the claim.

**1. Petitioner Cannot Rely on the “Being Used to Compensate” Clause Being Read Out of Claim 1**

Similar to Ground 1, Petitioner first contends in Ground 2 that Matsusaka need not meet claim 1's “being used to compensate” clause. Petition at 59. As explained above, this clause provides structural limitations (involving the location of the created zone in relation to drops in relative illumination or MTF) to the claim that must be considered in comparison to the prior art. *See* § V, above. To the extent Petitioner is relying on a claim feature not having patentable weight to prove invalidity, Ground 2 is deficient. Ex. 2001 at ¶¶ 94-95.

**2. Petitioner Fails to Provide Any MTF or Relative Illumination Curve for Correlating the Magnification Zone Positions**

Petitioner's backup position asserts the claim element is met “based on the fact that Matsusaka's lens includes the claimed ‘zones.’” Petition at 59. But as explained above, the mere presence of the created zone is not enough – claim 1 also calls for the zone's location to correlate with a drop in relative illumination or MTF. *See* § V, above.

Petitioner and its expert identify a high magnification zone between two low magnification zones in Matsusaka, as shown by their resolution curve<sup>3</sup> reproduced from the Petition, below. Petition at 58-59; Ex. 1003 at ¶¶ 164-165. A first low magnification zone is located between 0° and approximately 40°. Ex. 2001 at ¶¶ 85, 96; Ex. 2002 at 81:7-14. The resolution peaks around 75° in the FOV and begins decreasing to form another low magnification zone starting at about 92°-93° and continuing to the edge, where the resolution drops below the resolution at the center. Ex. 2001 at ¶ 96; Ex. 2002 at 81:15-22.



<sup>3</sup> While adopted for purposes of this proceeding, the data Dr. Kessler used to create Matsusaka's resolution plot exhibits inconsistencies with the data provided in Matsusaka. See e.g., Ex. 2001 at ¶ 73; Ex. 1005 at ¶ [0411]; Ex. 1018 at p. 1.

Despite quantifying the zones in Matsusaka's Example 19 lens, Petitioner did not include in its Petition (nor did Dr. Kessler include in his declaration) any data relating to the MTF or relative illumination characteristics. Ex. 2001 at ¶¶ 74, 96; Petition at 43-46, 59-60; Ex. 1003 at ¶¶ 89-99, 146-168. In fact, Dr. Kessler "didn't think it's necessary basically. And the reason is all I tried to do is to show magnification changes" even though the claim is specifically concerned with the relationship of the resolution with respect to these two characteristics. Ex. 2002 at 61:14-64:12. Without such information, Petitioner cannot show whether any particular zone identified in Matsusaka's purported resolution curve is located as required by claim 1. Ex. 2001 at ¶ 96.

Petitioner's sole argument relies on its calculated resolution plot for Matsusaka and the '120 Patent's Fig. 7 both exhibiting "a similar downward slope." Petition at 60; Ex. 1003 at ¶ 167; Ex. 2001 at ¶ 97. As explained above in section VI.B, not only is the existence of a downward slope insufficient to demonstrate the location of a magnification zone or its relationship to the lens' relative illumination or MTF, but the concept Petitioner considers is *not* relevant to the "being used to compensate..." language in claim 1. Ex. 2001 at ¶¶ 83-91, 97. Increasing relative illumination through a downward slope is different from using magnification zones to compensate for low relative illumination or MTF. *Id.* at ¶¶ 89-91, 97. Petitioner and Dr. Kessler simply offer no evidence from Matsusaka

to correlate any portion of their calculated resolution plot to the lens' undisclosed relative illumination or MTF. *Id.* at ¶¶ 93, 98. Petitioner has therefore failed to meet its burden to show that Matsusaka anticipates or renders obvious any of the claims of the '120 Patent.

**E. Petitioner Has Not Shown Claims 1, 4, 5, or 7 are Anticipated By, or Obvious Over, Kim**

Petitioner fails to demonstrate any of claims 1, 4, 5, or 7 are anticipated by, or obvious over, Kim because, when considering all elements of claim 1, Petitioner's own evidence from the parallel litigation shows that the identified magnification zones in Kim's first embodiment<sup>4</sup> lens is clearly *not* positioned to compensate for any drop in relative illumination or MTF. Petitioner depends again exclusively on the existence of a downward slope in Kim's resolution curve, which is irrelevant to the claim.

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<sup>4</sup> Petitioner and Dr. Kessler contend each of Kim's three lenses allegedly "prove that claims 1, 4, 5, and 7 of the '120 Patent are anticipated and/or obvious," and focus their analysis on the first embodiment "for simplicity." Petition at 68; Ex. 1003 at ¶ 104. As before, Dr. Kessler could not recall modeling Kim's other two lenses and admits that analysis does not appear anywhere in his declaration. Ex. 2002 at 65:21-66:18.

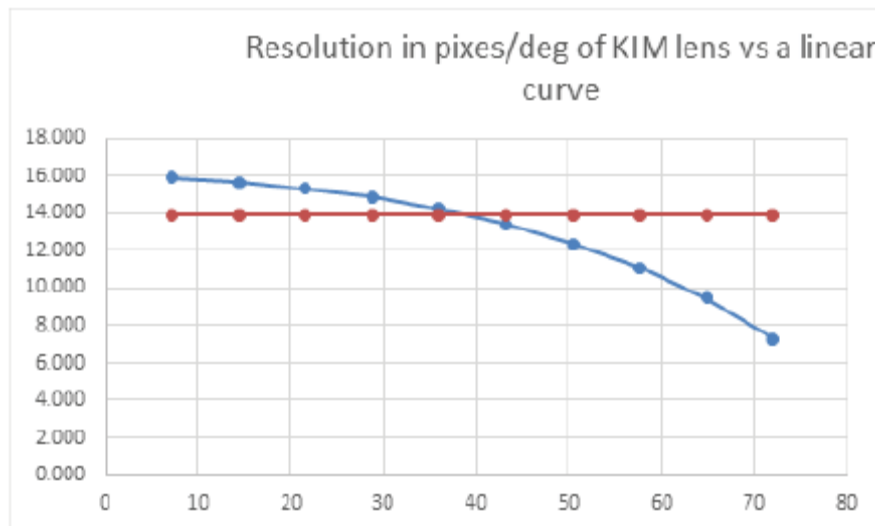
**1. Petitioner Cannot Rely on the “Being Used to Compensate” Clause Being Read Out of Claim 1**

Similar to Grounds 1 and 2, Petitioner first contends in Ground 3 that Kim need not meet claim 1’s “being used to compensate” clause. Petition at 80. As explained above, this clause provides structural limitations (involving the location of the created zone in relation to drops in relative illumination or MTF) to the claim that must be considered in comparison to the prior art. *See* § V, above. To the extent Petitioner is relying on a claim feature not having patentable weight to prove invalidity, Ground 3 is deficient. Ex. 2001 at ¶¶ 100-101.

**2. Petitioner’s Relative Illumination Curve for Kim from the Parallel Litigation Shows Why No Such Data was Submitted with the Petition**

Petitioner’s backup position asserts the claim element is met “based on the fact that Kim’s lens includes the claimed ‘zones.’” Petition at 80. But as explained above, the mere presence of the created zone is not enough – claim 1 also calls for the zone’s location to correlate with a drop in relative illumination or MTF. *See* § V, above.

Petitioner and its expert identify a high magnification zone and a low magnification zone in Kim, as shown by the resolution curve<sup>5</sup> reproduced from the Petition, below. Petition at 78-79; Ex. 1003 at ¶¶ 195-196. The resolution starts high ( $\sim 16$  pixels/ $^\circ$ ) near the center of the lens and drops continuously thereafter to a minimum point ( $\sim 7$  pixels/ $^\circ$ ) at the edge. Ex. 2001 at ¶¶ 86, 103; Ex. 2002 at 79:16-80:7.



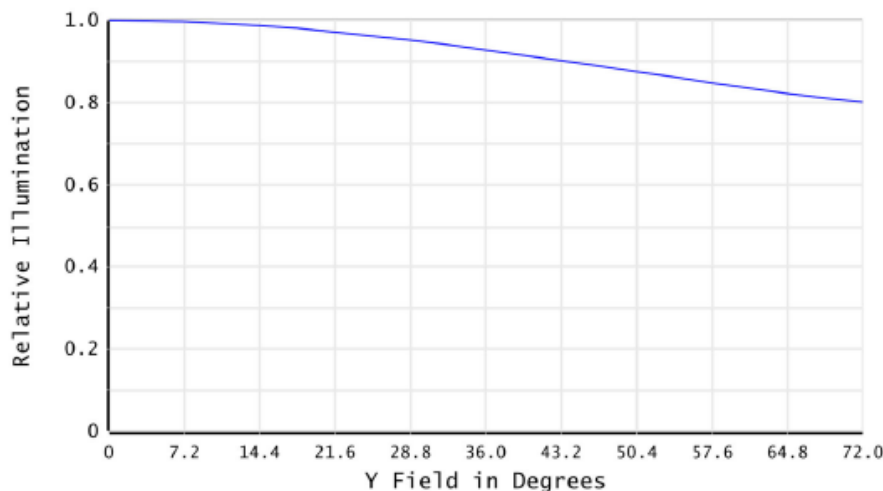
Despite quantifying the zones in Kim's Embodiment 1 lens, Petitioner did not include in its Petition (nor did Dr. Kessler include in his declaration) any data relating to the MTF or relative illumination characteristics. Ex. 2001 at ¶¶ 78, 102, 104; Petition at 65-68, 76-80; Ex. 1003 at ¶¶ 100-105, 180-199. As before, Dr.

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<sup>5</sup> While adopted for purposes of this proceeding, the data Dr. Kessler used to create Kim's resolution plot contains at least one typographical error. *See e.g.*, Ex. 2001 at ¶ 77; Ex. 1007 at p. 6; Ex. 1019 at p. 2.

Kessler disregarded the claim's recitation of these curves because he "didn't think it's necessary basically. And the reason is all I tried to do is to show magnification changes." Ex. 2002 at 61:14-64:12. While Dr. Kessler may not have timely reviewed such information, Petitioner served invalidity contentions in the co-pending litigation that provided a relative illumination curve for Kim (reproduced below) behaving *exactly opposite* to what is claimed. Ex. 2003 at p. 32; Ex. 2001 at ¶¶ 78, 102-103. The curve below is very similar to Fig. 4 of the '120 Patent – the relative illumination is 100% at the center and drops toward the edge.

*Compare* Ex. 2003 at p. 32 *with* Ex. 1001 at Fig. 4; Ex. 2001 at ¶¶ 102-103.



To fall within the claimed invention, one of ordinary skill in the art would have expected a higher magnification zone to appear at the edge of the FOV in Kim to compensate for the drop off in relative illumination in that area, akin to Fig. 6 of the '120 Patent. Ex. 2001 at ¶ 103. Instead, as shown above, Kim's resolution is maximum at the center and decreases with the FOV, with the lowest resolution

appearing in the same location as the worst relative illumination. *Id.* The only data of record therefore demonstrates that the magnification zones in Kim are **not** being used to compensate for a drop in relative illumination, leaving Kim deficient on this claim element. *Id.* at ¶¶ 103-104.

As with the prior grounds, Petitioner's sole argument relies on its calculated resolution plot for Kim and the '120 Patent's Fig. 7 both exhibiting "a similar downward slope." Petition at 80; Ex. 1003 at ¶ 198; Ex. 2001 at ¶ 105. As explained above in section VI.B, not only is the existence of a downward slope insufficient to demonstrate the location of a magnification zone or its relationship to the lens' relative illumination or MTF, but the concept Petitioner considers is **not** relevant to the "being used to compensate..." language in claim 1. Ex. 2001 at ¶¶ 83-91, 105. Increasing relative illumination through a downward slope is different from using magnification zones to compensate for low relative illumination or MTF. *Id.* at ¶¶ 89-91, 105. Petitioner and Dr. Kessler simply offer no evidence from Kim (nor can they in view of Exhibit 2003) to correlate any portion of their calculated resolution plot to the lens' relative illumination or MTF. *Id.* at ¶¶ 99, 106. Petitioner has therefore failed to meet its burden to demonstrate that Kim anticipates or renders obvious any of the claims of the '120 Patent.

## VII. CONCLUSION

For at least the reasons recited above, Patent Owner requests that the PTAB find the challenged claims not unpatentable.

Date: October 27, 2023

Respectfully submitted,

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**CERTIFICATE OF WORD COUNT**

Pursuant to 37 C.F.R. §§ 42.24(a)(1)(i), 42.24(b)(2), and 42.24(d), the undersigned certifies that, according to the “Word Count” tool in Microsoft Word, which was used to prepare this paper, the number of words in this Patent Owner’s Response Under 37 C.F.R. § 42.120 is 7,532.

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**CERTIFICATE OF SERVICE UNDER 37 CFR § 42.6(e)**

I hereby certify that true copies of the foregoing PATENT OWNER'S RESPONSE UNDER 37 CFR § 42.120 and accompanying exhibits have been served in their entireties this 27<sup>th</sup> day of October 2023, by electronic mail on Petitioner's lead and back-up counsel, as follows:

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