

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CANON INC.

Petitioner

v.

OPTIMUM IMAGING TECHNOLOGY, LLC

Patent Owner

IPR2020-01322

Patent No. 8,451,339

Issue Date: May 28, 2013

Title: Digital Imaging System for Correcting Image Aberrations

**PETITION FOR *INTER PARTES* REVIEW UNDER 35 U.S.C. §§ 311-319
AND 37 C.F.R. §§ 42.100 *et seq.***

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EXHIBIT LIST

Exhibit	Title
1001	U.S. Patent No. 8,451,339
1002	Declaration of Leonard Laub
1003	Complaint, <i>Optimum Imaging Technologies, LLC v. Canon Inc.</i> , No. 2:19-cv-246-JRG (E.D. Tex. July 8, 2019), D.I. 1
1004	Claim Construction Memorandum Opinion and Order, No. 2:19-cv-00246-JRG (E.D. Tex. June 11, 2020), D.I. No. 88.
1005	<Reserved>
1006	U.S. Pat. App. No. 2002/0135688 (“Niikawa”)
1007	U.S. Pat. App. No. 2005/0280877 (“Watanabe”)
1008	JOHN C. RUSS, THE IMAGE PROCESSING HANDBOOK (CRC Press, 4th ed. 2002) (“Russ”).
1009	A certified translation of JP2004-343358 (“Kishida”)
1010	<Reserved>
1011	A certified translation of JP2004-328506 (“Kita”)
1012	U.S. Patent No. 7,245,319 (“Enomoto”)
1013	A certified translation of JPH11-313250 (“Yamagata”)
1014	U.S. Pat. No. 5,905,530 (“Yokota”)
1015	A certified translation of JP2002-190979 (“Kuniba”)
1016	<Reserved>
1017	U.S. Pat. App. No. 2004/0150732 (“Yamanaka II”)

Exhibit	Title
1018	GUAN et al., <i>Digital Image Correcting Method for Digital Camera</i> (December 2005) (“Ricoh”)
1019	Declaration of Kiyoto Nagai, (July 15, 2020)
1020	<i>Ricoh Technical Report No. 31</i> , RICOH (Apr. 20, 2006), https://web.archive.org/web/20060420051054/http://www.ricoh.co.jp/about/business_overview/report/31/
1021	U.S. Pat. No. 7,738,015 (“Steinberg I”)
1022	U.S. Pat. No. 7,590,305 (“Steinberg II”)
1023	A certified translation of JP2000-184247 (“Imai”)
1024	GONZALEZ & WOODS, <i>DIGITAL IMAGE PROCESSING</i> , (Prentice Hall, 2d ed. 2002) (“Gonzalez”)
1025	U.S. Pat. No. 5,414,782 (“Carasso”)
1026	U.S. Pat. No. 4,903,204 (“Dobbins”)
1027	A certified translation of JP2006-72660 (“Yamazaki”)
1028	U.S. Pat. No. 7,609,297 (“Master”)
1029	U.S. Pat. App. No. 2007/0080280 (“Havens”)
1030	The U.S. National Stage Version of WO2005/093653 (US2007/0171288) (“Inoue”)
1031	U.S. Pat. No. 7,936,392 (“Ng”)
1032	U.S. Pat. App. No. 2003/0095197 (“Wheeler”)
1033	A Japanese Patent Office Machine Translation of JP,05-323444A (“Masabumi”)

Exhibit	Title
1034	A Japanese Patent Office Machine Translation of JP,2000-224611A (“Takeuchi”)
1035	<Reserved>
1036	The image processing handbook, Library of Congress Catalog, <i>available at</i> https://lccn.loc.gov/2002073595
1037	USPTO File History for the ’805 Patent
1038	USPTO File History for the ’339 Patent
1039	A certified translation of JP2002-199410 (“Fukumoto”)
1040	<Reserved>
1041	<Reserved>
1042	<Reserved>
1043	<Reserved>
1044	Taylor & Francis Grp. Customer Serv., Publication Confirmation

I. MANDATORY NOTICES

A. REAL PARTY-IN-INTEREST UNDER 37 C.F.R. § 42.8(B)(1)

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner certifies that Canon Inc. is the real party-in-interest.

B. RELATED MATTERS UNDER 37 C.F.R. § 42.8(B)(2)

Pursuant to 37 C.F.R. § 42.8(b)(2), U.S. Patent No. 8,451,339 is currently involved in the following proceeding: *Optimum Imaging Technologies, LLC v. Canon Inc.*, No. 2:19-cv-246-JRG (E.D. Tex. July 8, 2019).

C. LEAD AND BACKUP COUNSEL AND SERVICE INFORMATION UNDER 37 C.F.R. §§ 42.8(B)(3)-(4)

Petitioner hereby designates lead and backup counsel as follows:

Lead Counsel	Backup Counsel
Justin J. Oliver (Reg. No. 44,986) JOliver@venable.com VENABLE LLP 600 Massachusetts Ave., NW Washington, DC 20001 T: 202-721-5423 F: 202-344-8300	Michael P. Sandonato (Reg. No. 35,345) MSandonato@venable.com VENABLE LLP 1270 Avenue of the Americas New York, NY 10020 T: 212-218-2217 F: 212-218-2200
	Nicholas Marcello (Reg. No. 77,182) NDMarcello@venable.com VENABLE LLP 1270 Avenue of the Americas New York, NY 10020 T: 212-218-2365 F: 212-218-2200

Service information for lead and backup counsel is provided in the designation of lead and backup counsel, above. Petitioner consents to electronic service by email at the email addresses provided above.

D. PAYMENT OF FEES UNDER 37 C.F.R. §§ 42.15(A) & 42.103

The required fees are submitted herewith in accordance with 37 C.F.R. §§ 42.103(a) and 42.15(a). If any additional fees are due during the proceeding, the Office is authorized to charge such fees to Deposit Account No. 22-0261. Any overpayment or refund of fees may also be deposited in this Deposit Account.

II. INTRODUCTION

Canon Inc. (“Petitioner”) requests *inter partes* review (“IPR”) pursuant to 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.100 *et seq.* of claims 1-5 and 14-18 (the “Challenged Claims”) of U.S. Patent No. 8,451,339 (Ex. 1001), which issued on May 28, 2013, to Neal Solomon. On June 25, 2019, the patent was assigned to Optimum Imaging Technologies (“Patent Owner”).

The ’339 patent relates to a digital imaging system that corrects for optical lens aberrations. The system corrects for aberrations by storing aberration correction data in a database and applying the same to image data. The claims primarily describe the correction system in functional terms, describing processes and elements that are well-known by persons of ordinary skill in the art (“POSA”).

The correction of optical aberrations in lens systems through the use of stored algorithms represents a simple implementation of common filtration techniques on common hardware to achieve an expected result. Indeed, using digital filtration methods to correct for lens aberrations was well known at the time. As established below, each of the claimed elements can be readily found in the art.

Petitioner has demonstrated by a preponderance of the evidence that each of the challenged claims is unpatentable over the asserted grounds. Petitioner respectfully requests the Board institute trial.

III. GROUNDS FOR STANDING

The '339 patent is available for IPR and Petitioner is not barred or estopped from requesting IPR of the '339 patent. This Petition is being filed within one year of the Petitioner being served with a complaint alleging infringement of the '339 patent. Exs. 1001, 1003.

IV. DISCRETIONARY DENIAL IS NOT APPROPRIATE

The Board has discretion to deny institution where a counterpart litigation will be resolved prior to resolution of the IPR and “the petitioner has raised the same invalidity challenges.” *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 2 (PTAB Mar. 20, 2020) (precedential); *see also NHK Spring Co. Ltd. v. Intri-Plex Technologies, Inc.*, IPR2018-00752, Paper 8, (PTAB Sep. 12, 2018) (precedential) (noting inefficiencies where the petitioner “relies on the same prior art ... and arguments in its district court invalidity contentions”). Such discretionary denial, however, would not be appropriate here.

First, while jury selection in the district court trial currently is scheduled for November 2020, that trial will not resolve the issues before the Board here inasmuch as neither the same nor similar invalidity challenges are at issue. The primary references applied in this Petition are not at issue in the litigation. In fact, the primary references were only uncovered by Petitioner in the last 2 months (which is why the Petition was not filed earlier). While the secondary references

(Kita and Kishida) are of record in the litigation, they are only applied against dependent claims here. Therefore, the primary driver behind *Fintiv* and *NHK Spring*—avoiding the inefficiency of considering issues that will be resolved by the parallel proceeding—is not a concern here. *See Fintiv*, IPR2020-00019, Paper 11 at 6-9 (tying even the option of a stay to the question of timing of a decision on “the same or substantially similar issues to those presented in the petition”), 12-13 (addressing the overlap of issues). For this reason alone, discretionary denial is not warranted.

Second, other *Fintiv* factors weigh against denial. In particular, there has been no investment in the parallel proceeding with respect to the prior art issues for the independent claims involved here. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12. Also, the merits weigh in favor of institution given the strength of the grounds presented and developed below. *See Fintiv*, IPR2020-00019, Paper 11 at 14-16. Indeed, a single reference is applied in each ground involving the independent claims.

Third, policy considerations support institution. In this case, even if Petitioner had filed its petition on *the very day* it was sued (in July 2019), it would have been unable to complete an IPR prior to the currently scheduled start of trial (in November 2020). Using such a circumstance as a bar to institution undermines

the Congressional intent of the IPR proceeding and would bar the use of IPRs for defendants sued in jurisdictions that set early trial dates.

V. OVERVIEW

A. STATE OF THE PRIOR ART

Optimizing images has been a longtime pursuit in photography across various lens types. Ex. 1001 at 1:36-48. While expensive lenses can be designed to minimize aberrations, imperfections in less expensive lenses can cause problems in the captured images. As photography has advanced, automated mechanisms were invented to correct issues such as blurring. These automated processing means advanced further as microprocessors and sensors improved. Ex. 1001 at 2:30-33. The '339 patent acknowledges that prior to the filing date it was known to “use[] software that automatically corrects” image issues, particularly for issues caused by imperfect imaging systems. Ex. 1001 at 2:57-62; *see also* 6:32-42 (discussing post-production software programs that can emulate filters).

The '339 patent simply claims systems and methods that store information for correcting optical aberrations associated with a particular lens type in a database. These features were well-known in the prior art.

B. CORRECTION OF ABERRATIONS

i. Known types of Aberrations and Manners of correction

Aberration correction has been around as long as photography itself. The specification of the '339 patent identifies the various aberration such as barrel, pin

cushion and so on. Ex. 1001 at 3:40-45. These aberrations arise from the physical design of the lens and their solutions have long been known. *See* Ex. 1013 at [0003] (Seidel aberrations); *see also* Ex. 1014 at col. 1:32-38 (barrel and pincushion); Ex. 1015 at [0044] (vignetting); Ex. 1017 at [0012] (chromatic); Ex. 1002 at ¶¶ 32-56. For example, vignetting was a well-known aberration in which the periphery of the captured image is darker than the center thereof. Ex. 1001 at 3:45-46 (“[O]ptical vignetting affects peripheral illumination.”). As explained in Fukumoto, low-cost lens systems used with digital cameras can cause “vignetting, and the like . . . reducing the image quality.” Ex. 1039 at [0005]-[0006]; Ex. 1023 at (0008).

In digital systems, lens imperfections have been corrected using digital filters—essentially algorithms that adjust image data to remedy the aberration arising from the physical lens. Ex. 1017 at [0066] (“[F]ilter computation is performed by using a filter[,] . . . by convolution computation or the like in order to simultaneously perform the color interpolating process and the chromatic aberration correcting process”), [0058] (“[D]etermines an image filter . . . applied when the color interpolating process and chromatic aberration correcting process are performed in the image processing unit”); Ex. 1012 at 4:51-5:13, Ex. 1002 at ¶¶ 32-58. Thusly, an imperfect physical lens can be corrected by digital means, after image capture.

A study conducted by Ricoh confirmed methods “wherein image processing is used to correct image distortion, peripheral shading, and the like” through software processing in a digital camera. Ex. 1018 at p. 103 (“Ricoh”). Ex. 1019; Ex. 1020. Those methods, like others discussed herein, rely upon “shooting conditions that are required to make such corrections.” Ex. 1018 at p. 105. The corrections are determined based on the details of the specific lens being used and the conditions under which the image is captured (e.g., focal length), which correction information is determined in advance for the lens and stored in a memory for later use. Ex. 1018 at pp. 105-10 (identifying and correcting peripheral shading, i.e., vignetting and chromatic aberration). The references relied upon herein (Niikawa and Watanabe) use similar methods of correction.

With respect to lens specifics, “[l]enses are broadly classified into two types, [] single-focus lenses and zoom lenses.” Ex. 1030 at [0071]. The only difference between the two types is that zoom lenses change focal lengths and fixed focal length lenses do not. Ex. 1030 at [0071]. In addition to corrections being different depending on the specific lens at issue, the corrections (e.g., specific digital filter) may differ depending on the focal length. Ex. 1014 at 7:27-32; *see also* Ex. 1011 at Claim 10; Ex. 1015 at [0007], [0024] (“[C]alculates a brightness distribution . . . based on lens aperture data” (including focal length data stored in a table)); Ex. 1013 at [0014]-[0015] (detecting a zoom position and obtaining correction data

stored in memory to apply). Thus, zoom lenses may have different correction values for each different zoom setting.

ii. Storage of Correction Values for Different Lenses

The claims recite “us[ing] a database to identify at least one correction algorithm” and that “the multiple optical aberrations of each lens is listed in the database” (i.e., picking a specific correction for a particular lens). Specifically, a camera may be capable of receiving interchangeable lenses. Each new lens may have its own aberration issues. Ex. 1002 at ¶¶ 45, 52-54. It has been known to store correction values for different lenses. For example, Watanabe discloses storing aberration correction data corresponding to the type of lens and the focal length settings. Ex. 1007 at [0049]; Ex. 1015 at [0032]; Ex. 1017 at [0164] (obtaining information “indicative of optical characteristics of an image capturing optical system as the image capturing apparatus . . . registered in a storing unit”); Ex. 1022 at 4:50-5:4. Similarly, Niikawa stores correction tables for different lenses and parameters such as focal length. Ex. 1006 at [0084], [0130] [0168]; *see also* [0108], [0123].

The prior art taught various ways of storing aberration correction information, including in the lens itself, in the memory of the camera body, and in storage devices connected to the camera. *See* Ex. 1023 at (0005), Ex. 1006 at [0083]-[0085], Ex. 1007 at [0046]-[0047]. Regardless of the storage location, it

was “necessary to . . . hold correction values corresponding to all interchangeable lenses in advance.” Ex. 1023 at (0008); *see also* Ex. 1007 at [0047]; Ex. 1006 at [0083]-[0085].

C. APPLICATION OF THE FAST FOURIER TRANSFORM

In digital imaging systems, the correction of optical aberrations occurs through the use of algorithms that manipulate the image data to remove the unwanted image issue in the digital space.

As discussed above, digital systems may manipulate image data through digitally implemented algorithms. A popular manner of making such changes uses Fourier transforms (which have been known since 1822) with “fast” Fourier transforms gaining in popularity in the 1950s. Ex. 1024 at p. 148. Implementing a Fourier transform has long been a simple task. *See* Ex. 1024 at p. 158 (“Filtering in the frequency domain is straightforward.”); *see also id.* at 213 (“Virtually all comprehensive signal and image processing software packages have generalized implementations of the FFT.”); Ex. 1002 at ¶¶ 57-65.

Fourier transforms have been used to sharpen images in digital image processing. Ex. 1008 at p. 318-19; Ex. 1036 (indicating in the Library of Congress Classification a 2002 publication); Ex. 1044 (publisher confirmation of a publication date of July 26, 2002); *see also* Ex. 1025 at Abstract, 9:4-16; Ex. 1026 at 5:37-42. Fast Fourier transforms are also used to soften images. Ex. 1008 at p.

301, 304-08; Ex. 1024 at pp. 167-80, 179 (describing the use of low-pass filters for cosmetic processing images of the human face); Ex. 1027 at [0034]-[0035], [0055].

Fast Fourier transforms also have been used to convert color data into its frequency domain to filter the color components individually to improve images. Ex. 1008 at p. 308-09, Ex. 1002 at ¶¶ 64. Additionally, Kita uses a Fourier transform to analyze images from various optical conditions to correct an image aberration. Ex. 1011 at [0026].

Thus, fast Fourier transforms have long been known to be useful in correcting image data in an efficient manner.

D. THE MANNER OF PROCESSING

The claims also recite that the digital adjustments are carried out using a microprocessor, digital signal processor (“DSP”), and software. These conventional elements have long been used in digital image processing. Ex. 1028 at 1:67-2:4 (“Conventional digital image processing, however, utilizes conventional processing technology, such as digital signal processors (“DSPs), microprocessors”); *see also* Ex. 1013 at [0005] (disclosing a DSP); Ex. 1029 at [0045] (disclosing a microprocessor); Ex. 1031 at 23:59-24:2 (disclosing a microprocessor, and DSP), Ex. 1021 at col. 4:8-14 (disclosing a microprocessor and DSP).

Similarly, it has long been known that software is used to execute processing operations, including in cameras. Ex. 1021 at 4:8–14; Ex. 1032 at [0047] (“ordinarily be implemented as a software program”), Ex. 1002 at ¶¶ 66-71.

In addition to being ubiquitous, these components and software operations were also known to be interchangeable, as the ’339 patent admits. Ex. 1001 at 17:37-39. Further, Havens, cited by the Examiner in the prosecution history, confirmed that it was well known to adjust the division of processing labor between, e.g., microprocessors and DSPs. Ex. 1029 at [0047]; Ex. 1038 at OITCAN-00000491-95; Ex. 1028 at 14:21-39. Thus, whether the particular function was performed by, e.g., a DSP or microprocessor was a matter of design choice. Ex. 1002 at ¶¶ 66-71.

The prior art relied upon herein shows the use of these types of processing structures to perform the exact same functions claimed.

VI. THE ’339 PATENT

A. THE CHALLENGED CLAIMS

Claims 1-5 and 14-18 are at issue in this petition. Claim 1 is independent and is primarily focused on correcting aberrations for a fixed focal length lens. It reads as follows:

1. A digital imaging system for correcting optical image aberrations comprising:

a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a fixed focal length lens;

wherein a microprocessor uses system software to identify at least one optical aberration by accessing the database;

wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration;

wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;

wherein the image file with the at least one optical aberration is corrected by applying digital filtration by using at least one algorithm in the digital signal processor; and

wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory.

Claims 2-5 depend from Claim 1. Claim 2 recites specific types of aberrations, such as spherical, curvature of field, and barrel distortion, among others. Claim 3 recites the vignetting aberration wherein the digital imaging system

applies an algorithm to lighten the corners of the image and exposure is optimized.

Claim 4 recites applying a fast Fourier transform to correct an aberration. Claim 5 recites, in part, that each lens type and corrections therefor are stored in a camera database.

Claim 14 is directed to a system with a zoom lens, and reads as follows:

14. A digital imaging system for correcting image aberrations comprising:
a digital camera mechanism, an optical lens mechanism, a digital sensor, a microprocessor, a digital signal processor, system software, a database management system and a memory storage sub-system;

wherein the optical lens mechanism is a zoom lens;

wherein the zoom lens changes focal length positions;

wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor and to memory;

wherein the microprocessor uses system software to access the database to identify at least one optical aberration in the image file at any focal length of a zoom lens configuration;

wherein the microprocessor accesses the database to obtain at least one filtration correction algorithm to the optical aberrations and forwards the at least one filtration algorithms to the digital signal processor;

wherein the image file is forwarded to the digital signal processor which applies at least one filtration algorithm to optimize the image and corrects the at least one optical aberration at the specific focal length in the zoom lens configuration; and

wherein the modified image file consisting of the digital data optimized from the at least one optical aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory.

Claims 15-18 depend from claim 14. Claim 15 recites the correction of certain aberrations such as spherical, curvature of field, and barrel distortion, among others. Claim 16 recites applying a fast Fourier transform to correct an aberration. Claim 17 recites each focal length of a lens being analyzed for an optical aberration. Claim 18 recites the vignetting aberration wherein the digital imaging system applies an algorithm to lighten the corners of the image and exposure is optimized.

B. PROSECUTION HISTORY

During prosecution, the Examiner applied only one prior art reference against the claims—namely, Alon (U.S. Pat. Appl. Publ. No. 2007/0236574). Ex. 1038 at OITCAN-00000480-97, OITCAN-00000510-28. The applicant argued that the cited reference was not directed to a camera capable of correcting aberrations,

but to a system for designing camera optics so as to not have aberrations in the first place. Ex. 1038 at OITCAN-00000510-28.

The prior art applied herein describes aberrations performed by digital cameras to correct aberrations from lens designs. For this reason, the prior art and arguments applied herein is not substantially the same as the prior art addressed during prosecution.

C. CONSTRUCTION OF THE CHALLENGED CLAIMS

The PTO applies the *Philips* standard to construe claims. Under the *Philips* standard, the “words of a claim are generally given their ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005).

While Petitioner believes many of the claims are indefinite, Petitioner acknowledges that indefiniteness cannot be raised in *inter partes* review and relies on the Markman Order issued in the district court litigation. The Markman Order from the litigation is submitted herewith. Ex. 1004. Provided below is a claim term of note as construed in the Markman Order.

i. “vignetting”

The district court confirmed that “vignetting” means “an effect in which the edges of an image are darker than the image’s center.” Ex. 1004 at pp. 9-10.

D. PERSON OF ORDINARY SKILL IN THE ART

Petitioner submits that a POSA would have (i) a Bachelor of Science degree in electrical engineering, or a related field (which includes physics in the case of digital cameras), with approximately two-three years of experience or research related to digital image and/or video processing, or (ii) equivalent training and work experience in electrical engineering and digital camera system design. Ex. 1002 at ¶¶ 20-22.

E. IDENTIFICATION OF THE CHALLENGE (37 C.F.R. § 42.104(B))

Petitioner requests an Order cancelling the Challenged Claims as unpatentable under 35 U.S.C § 103.

i. Claims for Which Inter Partes Review is Requested

Inter partes review is requested for claims 1-5 and 14-18 of the ’339 patent.

ii. The Prior Art and Specific Grounds on Which the Challenge is Based

Ground	Claims	Basis for Unpatentability
1	1, 5, 14, and 17	Obvious (§ 103) over U.S. Pat. Appl. Publ. No. 2002/0135688 (“Niikawa”) (Ex. 1006)
2	2, 4, 15 and 16	Obvious (§ 103) over Niikawa in view of JP2004-328506 (“Kita”) (Ex. 1011)

3	3 and 18	Obviousness over Niikawa in view of JP2004-343358 (“Kishida”) (Ex. 1009)
4	1-3, 5, 14-15, 17-18	Obvious (§ 103) over U.S. Pat. Appl. Publ. No. 2005/0280877 (“Watanabe”) (Ex. 1007)
5	4 and 16	Obvious (§ 103) over Watanabe in view of Kita

The claims are unpatentable for the reasons detailed below.

F. NIIKAWA GROUNDS

i. Ground 1: Obviousness of Claims 1, 5, 14, and 17 over U.S. Patent Application Publication No. 2002/0135688 (“Niikawa”)

Niikawa is a published U.S. patent application (published on September 26, 2002). It is prior art under 35 U.S.C. § 102(b) (pre-AIA).¹

Niikawa describes a digital camera and correction methods for the same. Ex. 1006 at Abstract. Like the ’339 patent, Niikawa stores aberration correction information for various lenses.

As Niikawa describes, there were known methods for correcting blurring and shading problems. Ex. 1006 at [0005]-[0012]. It is an object of Niikawa to improve solutions to shading aberrations due to lens design. Ex. 1006 at [0023]. To correct images, Niikawa describes storing aberration information specific to, e.g., the lens, different focal lengths, etc., such that, when a lens is used with the

¹ While the ’339 patent claims a priority date of July 11, 2006, Petitioner does not believe it is entitled to a priority date earlier than July 6, 2007. Nevertheless, the prior art asserted herein applies under either date.

camera, the camera can use its processing power and stored correction options to digitally correct image data to account for lens aberrations. Ex. 1006 at [0083]-[0084]; [0101], [0205]-[0206]; Ex. 1002 at ¶¶ 55-56, 72-74. This allows the camera system to improve image quality across various lenses. *Id.* at [0058], [0101], [0066] (stating that the lens is detachably attached).

The primary aberration correction handled in Niikawa is that of shading in an image. Specifically, shading correction circuit 123 uses correction data stored in tables for various optics systems to “correct[] a shading due to optical system.” *Id.* at [0082]; Ex. 1002 at ¶¶ 72-74, 106-11.

Of note, the claims recite a microprocessor, a DSP, and software to perform various functions. The ’339 patent is imprecise in its use of, at least, the term DSP. In one instance, it identifies the same as being element 195, which is later referred to as an ASIC. Ex. 1001 at 30:33-35. Elsewhere, the DSP is referred to as element 220 of Fig. 2, despite that portion of Fig. 2 referring to functional steps. Ex. 1001 at 31:10-14, Fig. 2 (“Digital Signal Processing”). Elsewhere the DSP is referred to as the general chipset of the camera. Ex. 1001 at 31:49-54, Fig. 7 (“DSP Chip”).

In addition, the ’339 patent states that functions performed by a microprocessor may be interchanged without effect. Ex. 1001 at 17:34-36. A POSA would have understood that a camera may have processors with various

functional components for performing image processing, and that the same can be addressed using dedicated hardware as well as a combination of hardware and software, as needed. Ex. 1002 at ¶¶ 66-71. The Examiner noted during prosecution of the parent application (U.S. Patent Application No. 11/825,521) that any recited division of labor in this regard was not a patentable feature. Ex. 1037 at OITCAN-00000186-89.

Thus, while Niikawa may not expressly use the terms digital signal processor and microprocessor, it describes the same in different terms and, in any event, it would have been obvious that any one of a number of image processing functions could have been implemented using a digital signal processor or microprocessor. Ex. 1002 at ¶¶ 66-71, 81, 91-98. For these reasons, the Petition relies on performance of the recited functions by Niikawa's processors and circuitry, with the understanding that a POSA would have understood that the division of labor among those different components, and structure thereof, could be altered as a matter of simple design preference. Ex. 1002 at ¶¶ 66-71, 81.

With that understanding, Niikawa describes a microprocessor, at least, in that it describes a general controller 150. Ex. 1006 at [0081], [0095]. Niikawa also describes a digital signal processor in the form of, at least, shading correction circuit 123 for performing corrections in combination with the special imaging controller 158 and image synthesizer 159 for performing special effect functions.

Ex. 1006 at [0082], [0103]-[0104], [0237]. These elements perform the correction and enhancement of the digital image data. A POSA readily would appreciate that certain claim functions can be performed by different ones of these elements (e.g., the DSP may be considered a combination of portions of elements 123, 158 and 159) and that it would be obvious to provide the hardware as needed, without substantively changing Niikawa's operation. Ex. 1002 at ¶¶ 66-71, 81, 93-96.

Niikawa describes a mathematical correction of digital image data using correction coefficients that modify that digital image data, which a POSA would understand as "digital filtration." Ex. 1002 at ¶¶ 41-43, 59-65, 82; *see* Ex. 1001 at 8:30-33 (explaining that digital filtration is used to correct aberrations); Ex. 1006 at [0082], FIG. 6, [0107]-[0110]. Similarly, the process of modifying image data in using a correction coefficient would be understood as an algorithmic process. Ex. 1002 at ¶¶ 41, 109-11, 114-15.

Also, while Niikawa does not use the exact term "vignetting," a POSA would understand that Niikawa provides a correction for vignetting, or that the same would be obvious. Ex. 1006 at [0012]. Specifically, Niikawa refers to the "shading" problem as one in which the "level of image data decreases with distance from the center of the image to the periphery." *Id.* This suggests an issue known in the filed as vignetting, as defined in the prior art and in the counterpart litigation. Ex. 1001 at 3:45-46 ("[O]ptical vignetting affects peripheral

illumination.”); Ex. 1004 at p. 9-10 (construing the term “vignetting” to mean “an effect in which the edges of an image are darker than the image’s center”); Ex. 1002 at ¶¶ 23-24, 44, 169-76.

While Niikawa describes a camera that uses interchangeable lens, it does not explicitly describe a fixed focal length lens. Ex. 1006 at [0066] (“[A]n imaging lens 3 which is detachably attached to the camera main body”). A POSA would have understood that there are two classes of lenses, zoom and fixed focal length. Ex. 1002 at ¶¶ 50-56. A POSA would have understood that a digital camera, such as the one described in Niikawa, would have been expected to receive either type of lens. The POSA also would have understood that the correction process would not have materially differed for either type. Indeed, the only difference is that correction information is provided per focal length. Thus, a fixed focal length lens would typically have a single focal length-related correction option, while a zoom lens would have a correction operation for each possible zoom setting (i.e., each different focal length). Ex. 1002 at ¶¶ 50-56.

The application of Niikawa to claims 1, 5, 14, and 17, is detailed in the claim chart below.

Claim Clause	Niikawa Grounds
1. A digital imaging system for correcting	Niikawa discloses a digital imaging system for image correction. Ex. 1006 at [0065] (“[C]onfigurations of an

Claim Clause	Niikawa Grounds
optical image aberrations comprising:	appearance of a digital camera 1 which is an image processing apparatus according to the first preferred embodiment of the present invention.”), [0075] (describing a digital camera), [0082] (describing shading correction). Ex. 1002 at ¶¶ 80-82.
a digital camera mechanism,	Niikawa discloses a digital camera. Ex. 1006 at [0065] (“[A] digital camera 1”), [0075] (describing a digital camera). Ex. 1002 at ¶ 83.
an optical lens mechanism,	Niikawa teaches an optical lens mechanism. Ex. 1006 at [0066] (“[A]n imaging lens 3”), [0076]. Ex. 1002 at ¶¶ 84-86.
a digital sensor,	Niikawa discloses a digital sensor in the form of a CCD. Ex. 1006 at [0067] (“Also, behind the image pickup device . . . is provided a color image pickup device 303. . . . The color image pickup device (hereinafter referred to as ‘CCD.’”), [0077]. Ex. 1002 at ¶¶ 87-90.
a microprocessor,	A microprocessor is disclosed as a general controller, i.e., microcomputer, in Niikawa. Ex. 1006 at [0082], [0095] (“The general controller 150 is implemented by a microcomputer and performs centralized control of the exposure function and playback function.”). Ex. 1002 at ¶¶ 91-92.

Claim Clause	Niikawa Grounds
a digital signal processor,	The digital signal processor is Niikawa's shading correction circuit 123 for performing corrections in combination with, at least, the special imaging controller 158 and image synthesizer 159. Ex. 1006 at [0082] ("The shading correction circuit 123 corrects a shading due to optical system with respect to the image data that has been subjected to A/D conversion."), [0103] (the special image controller performs gradation control), [0104], (the image synthesizer performs image synthesis). Ex. 1002 at ¶¶ 93-96.
system software,	Niikawa discloses software. Ex. 1006 at [0096] (disclosing "processing programs for executing a variety of concrete processing[]"); <i>see also</i> [0127] ("[S]hading correction is executed by software."). Ex. 1002 at ¶¶ 97-98.
a database management system and	Niikawa discloses a database management system as a correction table and associated image memory 126. Ex. 1006 at [0082]-[0086], [0108], [0130], [0138] (teaching that the correction table stores correction coefficients). Ex. 1002 at ¶¶ 99-103.
a memory storage sub-system;	After correction, the images are stored in memory card 8. Ex. 1006 at [0100]-[0101], [0121]; <i>see also</i> [0087], FIG. 1. Ex. 1002 at ¶¶ 104.

Claim Clause	Niikawa Grounds
wherein the optical lens mechanism is a fixed focal length lens;	Niikawa discloses a detachable imaging lens. Ex. 1006 at [0066]. This indicates that the imaging lens is interchangeable and may be a zoom lens or a fixed focal length lens. Ex. 1002 at ¶¶ 105.
wherein a microprocessor uses system software to identify at least one optical aberration by accessing the database;	The general controller 150 (microprocessor) has RAM which serves as a work area for executing the various processing programs. Ex. 1006 at [0096]. The general controller (microprocessor) in Niikawa identifies an aberration, and therefore a corresponding correction, based on capture conditions such as focal length. Ex. 1006 at [0084] (“The general controller 150 performs selection of correction table from the shading ROM 153 in accordance with the optical condition such as lens type, focal length and f-number at the time of imaging. Therefore, the shading correction circuit 123 can perform a shading correction in accordance with the optical condition.”) [0205] (“focal length and f-number were used as correction table selection conditions.”), [0130], [0168]; [0108], [0123]. Ex. 1002 at ¶¶ 106-08.
wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration;	The general controller (microprocessor) selects one of a plurality of correction tables stored in ROM so shading correction can be performed. Ex. 1006 at [0084]. The solutions to the shading aberrations in Niikawa are stored in the correction tables. Ex. 1006 at [0084], [0085] (Furthermore, it is also possible to set a correction data of each block unit as a reference value of the block, and determine a correction coefficient of each pixel by weights of reference values of the block to which the object pixel belongs and the peripheral

Claim Clause	Niikawa Grounds
	blocks with the position (distance) of the pixel.) Shading correction is then performed by executing multiplication processes of image data in the shading correction circuit (DSP). Ex. 1006 at [0108]. Niikawa describes that its processes can be carried out using software. Ex. 1006 at [0096], [0127] Ex. 1002 at ¶¶ 109-11.
wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;	Data is provided from the CCD to the signal processor which contains the shading correction circuit 123. Ex. 1006 at [0077] (“The CCD 303 receives the light of the subject light source . . . and outputs the image signal to a signal processor 120 by using a readout control signal inputted from the timing generator.”), [0079]; <i>see also</i> [0107]-[0108]. Ex. 1002 at ¶¶ 112-13.
wherein the image file with the at least one optical aberration is corrected by applying digital filtration by using at least one algorithm in the digital signal processor;	The shading correction circuit 123 (DSP) applies an algorithm to correct shading. Ex. 1006 at [0108] (“The shading correction circuit 123 performs shading correction by executing multiplication process of image data outputted from the A/D conversion circuit 122 and the inputted correction table.”), [0082] (“The shading correction circuit 123 corrects a shading due to optical system with respect to the image data that has been subjected to A/D conversion. The shading correction circuit has a multiplier 123a as shown in FIG. 6, and receives a timing control signal inputted from the timing control circuit 112 and performs multiplication of image data converted in the A/D conversion circuit 122 and a correction table inputted from the general controller 150.”); <i>see also</i> [0107]-[0110].

Claim Clause	Niikawa Grounds
	Ex. 1002 at ¶¶ 114-15.
and wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory.	The corrected image is stored in memory card 9. Ex. 1006 at [0121]; <i>see also</i> [0109] (“image memory 126”). Ex. 1002 at ¶¶ 116-17.
5. The system of claim 1:	
wherein each lens type is registered in the camera database;	In Niikawa, “[a] plurality of correction tables for different parameters which are the optical conditions such as focal length” are prepared and stored. Ex. 1006 at [0084]. The lens in Niikawa is detachable from the main camera body. Ex. 1006 at [0066]. Data such as the lens name is included in the tag information. Ex. 1006 at [0101]. Also, Niikawa states that, among other factors, “also the type of imaging lens used at the time of exposure may be” used “as correction table selection conditions.” Ex. at 1006 at [0205]. Thus, the lens type would be one of the optical conditions for which to prepare and store a correction table. Ex. 1006 at [0084]. Ex. 1002 at ¶¶ 118-120.
wherein the multiple optical aberrations of	The shading correction table is selected using the tag information for the captured image. Ex. 1006 at [0121], [0148], [0205] (“[T]he camera type, focal length and f-

Claim Clause	Niikawa Grounds
each lens is listed in the database;	number were used as correction table selection conditions.”). The tag information includes information such as camera name, a lens name, an f-number at the time of exposure, an exposure mode, a subject brightness, and a white balance adjustment value. Ex. 1006 at [0101]; <i>see also</i> [0205] (stating that “the type of imaging lens used at the time of exposure may be” relied upon for “correction table selection.”). This information is used in the determination of an aberration correction value to be used, indicating multiple options for a lens aberration correction. Ex. 1006 at [0158]. Ex. 1002 at ¶¶ 121-22.
wherein the filtration solutions to the lens optical aberrations are listed in the database;	The solutions to the aberrations in Niikawa are stored in the correction tables. Ex. 1006 at [0084]. Ex. 1002 at ¶¶ 123-24.
wherein the filtration of each lens optical aberration is applied by the digital signal processor;	The shading correction circuit (DSP) applies an algorithm to correct shading. Ex. 1006 at [0108] (“The shading correction circuit 123 performs shading correction by executing multiplication process of image data outputted from the A/D conversion circuit 122 and the inputted correction table.”). Ex. 1002 at ¶ 125.
and wherein after the digital signal processor applies the filtration to correct the optical	The corrected image is stored in memory. Ex. 1006 at [0109], [0121]. Ex. 1002 at ¶¶ 126-27.

Claim Clause	Niikawa Grounds
aberrations the corrected digital file is forwarded to storage in memory.	
14. A digital imaging system for correcting image aberrations comprising:	See claim 1. Ex. 1002 at ¶¶ 128-29.
a digital camera mechanism,	See claim 1. Ex. 1002 at ¶ 130.
an optical lens mechanism,	See claim 1. Ex. 1002 at ¶ 131.
a digital sensor,	See claim 1. Ex. 1002 at ¶ 132.
a microprocessor,	See claim 1. Ex. 1002 at ¶ 133.
a digital signal processor,	See claim 1. Ex. 1002 at ¶ 134.
system software,	See claim 1. Ex. 1002 at ¶ 135.
a database management system and	See claim 1. Ex. 1002 at ¶ 136.
a memory storage sub-system;	See claim 1. Ex. 1002 at ¶ 137.
wherein the optical lens mechanism is a zoom lens;	Niikawa discloses a zoom lens. Ex. 1006 at [0067] (“[T]he imaging lens which is a zoom lens.”), [0076].

Claim Clause	Niikawa Grounds
	Ex. 1002 at ¶ 138.
wherein the zoom lens changes focal length positions;	Niikawa system is capable of changing (and detecting the amount of) zoom, which corresponds to changes in focal length. Ex. 1006 at [0067], [0089]-[0090]. Ex. 1002 at ¶ 139.
wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal processor and to memory;	See claim 1 Ex. 1002 at ¶ 140.
wherein the microprocessor uses system software to access the database to identify at least one optical aberration in the image file at any focal length of a zoom lens configuration;	See claim 1. The general controller (microprocessor) in Niikawa identifies an aberration, and therefore a corresponding correction, based on capture conditions such as focal length. Ex. 1006 at [0084] (“The general controller 150 performs selection of correction table from the shading ROM 153 in accordance with the optical condition such as lens type, focal length and f-number at the time of imaging. Therefore, the shading correction circuit 123 can perform a shading correction in accordance with the optical condition.”) [0205] (“focal length and f-number were used as correction table selection conditions.”), [0130], [0168]; <i>see also</i> [0108], [0123]. Thus, the correction is specific to the focal length of the zoom lens used at capture. Ex. 1006 at [0084], [0130] [0168]; <i>see also</i> [0108], [0123]. Ex. 1002 at ¶¶ 141-44.

Claim Clause	Niikawa Grounds
wherein the microprocessor accesses the database to obtain at least one filtration correction algorithm to the optical aberrations and forwards the at least one filtration algorithms to the digital signal processor;	See claim 1 The general controller (microprocessor) selects one of a plurality of correction tables stored in ROM so shading correction can be performed. Ex. 1006 at [0084]. The solutions to the shading aberrations in Niikawa are stored in the correction tables. Ex. 1006 at [0084], [0085] (“Furthermore, it is also possible to set a correction data of each block unit as a reference value of the block, and determine a correction coefficient of each pixel by weights of reference values of the block to which the object pixel belongs and the peripheral blocks with the position (distance) of the pixel”). Shading correction is then performed by executing multiplication processes of image data in the shading correction circuit (DSP). Ex. 1006 at [0108]. Ex. 1002 at ¶¶ 145-46.
wherein the image file is forwarded to the digital signal processor which applies at least one filtration algorithm to optimize the image and corrects the at least one optical aberration at the specific focal length in the zoom lens configuration;	The image captured by the CCD is provided to the signal processor which contains the shading correction circuit 123. Ex. 1006 at [0077], [0079]; <i>see also</i> [0107]-[0108]. The shading correction circuit 123 corrects shading by finding a solution which corresponds to the optical conditions at capture (e.g., focal length). Ex. 1006 at [0108]. Ex. 1002 at ¶¶ 147-151.
and wherein the modified image file consisting of the digital data optimized from the at least one optical	See claim 1. Ex. 1002 at ¶¶ 152-53.

Claim Clause	Niikawa Grounds
aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory.	
17. The system of claim 14:	
wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.	Niikawa shows that correction values, and therefore aberrations, may differ at one focal length based on the f-number used. Ex. 1006 at [0084] (“The general controller 150 performs selection of correction table from the shading ROM 153 in accordance with the optical condition such as focal length and f-number at the time of imaging.”). Thus, there may be different corrections at each focal length. Ex. 1002 at ¶¶ 154-56.

ii. Ground 2: Obviousness of Claims 2, 4, 15 and 16 over U.S. Patent Application Publication No. 2002/0135688 (“Niikawa”) in view of JP2004-328506 (“Kita”)

The claims challenged under Ground 2 depend from claims addressed in Ground 1, and further recite correcting for aberrations using a fast Fourier transform. In view of this feature, Niikawa is combined with Kita in this ground.

Kita is a Japanese Patent Application that published November 18, 2004. Kita qualifies as prior art under 35 U.S.C. § 102(b) (pre-AIA). Kita provides an imaging device and an image restoring device suitable for application in a digital

camera. Ex. 1011 at [0001]. As Kita explains, spatial frequency processing has been used conventionally in imaging devices. Ex. 1011 at [0002]. Kita purported to solve a problem in which corrections were only available for single focal lengths. Ex. 1011 at [0006]-[0007]. Kita uses a fast Fourier transform to correct aberrations in images captured with various optical conditions. Ex. 1011 at [0026].

Kita captures an image on a charge coupled device which is then converted and subjected to aberration correction through the use of various processors and circuits. Ex. 1011 at [0046], [0054]. In Kita, aberrations characteristic of lens systems can be processed. Ex. 1011 at [0046], [0052]-[0053], [0060]. The aberration is corrected using stored correction values corresponding to characteristics such as focal lengths. Ex. 1011 at [0057], [0060]. The relevant correction data for the aberrations are stored ahead of time in a correction table. Ex. 1011 at [0059] (“[C]orrection filtering is performed for each image height through an MTF inverse function table 87 on the results of the FFT calculations by the FFT calculating portion 83.”) [0060] (“As the method for determining the MTF correcting filter of the MTF inverse function table 87, it is selected and determined through referencing a table that is determined in advance using the zoom value, the defocusing value, and the iris value as keys.”). An aberration is corrected using a filter on the image data, which data was converted to the spatial domain using a fast Fourier transform. Ex. 1011 at [0046], [0057]-[0058]. This allows the camera

system to improve image quality based on various lens characteristics. Ex. 1002 at ¶¶ 57-65, 75-77.

A POSA would be motivated to combine Niikawa with Kita because, among other things, they are both in the same field of endeavor: digital image processing. Ex. 1002 at ¶¶ 157-60. More particularly, they both execute correction of lens aberrations in a similar manner on similar components. One of the main features of both references is that they store aberration information for different lenses such that the camera can access the stored aberration information to apply specific corrections corresponding to the installed lens's corresponding aberrations. *Compare* Ex. 1006 at [0083]; *see also* [0077], [0084], [0107]-[0108] *with* Ex. 1011 at [0057]-[0060]. Thus, a POSA would have readily understood that spatial domain processing and filtering based on lens characteristics from Kita would be applicable to Niikawa's aberration correction process. Moreover, the technology in this regard was straightforward such that a POSA could combine the references with a reasonable expectation of success. Ex. 1002 at ¶¶ 157-60.

Of note, while Kita does not explicitly use the term "chromatic aberration," a POSA would understand that Kita refers to chromatic aberration. A POSA would understand that "axial" aberration is a type of chromatic aberration. Ex. 1011 at [0018]; Ex. 1002 at ¶ 161.

The application of Niikawa and Kita to claims 2, 4, 15 and 16 , is detailed in the claim chart below.

Claim Clause	Niikawa Grounds
2. The system of claim 1:	
wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations.	Kita discloses axial aberration, a type of chromatic aberration. Ex. 1011 at [0018]. Ex. 1002 at ¶ 161.
4. The system of claim 1:	
wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical aberration.	Kita applies a fast Fourier transform as part of its filtering process. Ex. 1011 at [0026] (“[A] 512 x 512 image B (2) is sampled from an original image A (1), and a Fourier transform (FFT) 3 is applied to the image B (2) to generate an FFT image 4. The image can be expressed on a frequency axis from the FFT image 4. Following this, an MTF filter 5 is applied to the FFT image 4 through a multiplier 6. Finally, an inverse Fourier transform (IFFT) 7 is performed on the multiplication result, to generate an IFFT image 8 to which the lens filter process has been applied.”). The same is used to correct an optical aberration. Ex. 1011 at [0046]. Ex. 1002 at ¶¶ 162-63.

Claim Clause	Niikawa Grounds
15. The system of claim 14:	
wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.	<i>See</i> Claim 2 above. Ex. 1002 at ¶¶ 164-65.
16. The system of claim 14:	
wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations.	<i>See</i> Claim 4 above. Ex. 1002 at ¶¶ 166-67.

iii. Ground 3: Obviousness of Claims 3 and 18 over U.S. Patent Application Publication No. 2002/0135688 (“Niikawa”) in view of JP2004-343358 (“Kishida”)

Claims 3 and 18 depend from claims addressed in Ground 1, and further recite correcting for a vignetting aberration. For that feature, Niikawa is combined with Kishida. Specifically, while Niikawa describes a process of correcting lens

aberrations, including peripheral shading (vignetting), it does not explicitly state that the same is corrected through an exposure adjustment.

Kishida is a Japanese Patent Application that published December 2, 2004. Kishida qualifies as prior art under 35 U.S.C. § 102(b) (pre-AIA). Kishida describes an imaging device that corrects shading aberrations. Ex. 1009 at [Means for Resolution], [0010]. As Kishida explains, shading aberrations were known to be a problem in cameras, particularly peripheral shading issues due to lens aberrations (vignetting). Ex. 1009 at [0003], [0062] (“[T]he brightness levels of the pixels on the peripheral part of the observation image are raised in respect to the center portion of the observation image, so that the shading is corrected appropriately.”). Kishida acknowledges that such an aberration is corrected by optimizing the exposure. Ex. 1009 at [0030]-[0031], [0037]-[0039].

Kishida captures an image and subjects the same to aberration correction, due to lens issues, using various processors and circuits. Ex. 1009 at [0002] (Shading is generally “due to the effects of the characteristics of the focusing optics system itself, such as the lenses, and the like.”), [0027]-[0032]. Specifically, the lens aberration is corrected using various exposure correction circuits. Ex. 1009 at [0030]-[0031]. The aberration is corrected by calculating the gain and using the gain to optimize the exposure. Ex. 1009 at [0037]-[0039]. When there is a reduction in brightness around the periphery of the image, Kishida uses its

automatic exposure evaluating unit 39 to correct the brightness values at the peripheral parts of the image. Ex. 1009 at [0108].

A POSA would be motivated to combine Niikawa and Kishida because, among other things, they are both seek to cure lens aberrations, particularly related to peripheral shading. *Compare* Ex. 1006 at [0012], [0082]-[0083]; *see also* [0109]-[0110] *with* Ex. 1011 at [0018], [0037]-[0039], [0062], [0072]; Ex. 1002 at ¶¶ 79, 168-72. Niikawa does not explicitly describe an exposure adjustment in connection with the peripheral correction operation (although it does discuss exposure adjustments in general). Ex. 1006 at [0109]-[0110], [0119]. Kishida, on the other hand, adjusts exposure as part of its correction of peripheral shading. Ex. 1009 at [0037]-[0039]. Thus, a POSA would readily understand that Kishida's correction processes would be a known option for correcting the peripheral shading issue explicitly discussed in Niikawa. Ex. 1009 at [0012] (explaining the efficiency of its system compared to the art). Moreover, the technology in this regard was straightforward such that a POSA could combine the references with a reasonable expectation of success. Ex. 1002 at ¶¶ 168-72. Indeed, Niikawa already discusses the need for vignetting correction and the ability shows the existing capability for adjusting exposure.

Of note, while Kishida devotes much of its discussion to correcting aberrations in microscopy photography, Kishida appreciates that such aberrations

are generally caused by the optics systems of cameras. Ex. 1009 at [0003]. A POSA would have understood that correcting for vignetting would be applicable to a camera regardless of the use of the camera (e.g., for a microscope, for a telescope, for a landscape). Ex. 1009 at FIG. 2, [0024]-[0033]. Thus a POSA would be able to combine Niikawa at Kishida with a reasonable expectation of success. Ex. 1002 at ¶¶ 168-72.

The application of Niikawa and Kishida to claims 3 and 18 is detailed in the claim chart below.

Claim Clause	Niikawa Grounds
3. The system of claim 1:	
wherein the optical aberration is vignetting;	Niikawa describes shading aberration as the level of image data decreasing as the distance from the center of the image increases (vignetting). Ex. 1006 at [0012]. Kishida is also directed toward correcting peripheral shading, including where the brightness varies nonuniformly due to the lens. Ex. 1009 at [PRIOR ART] (“A phenomenon, generally termed ‘shading,’ occurs wherein the brightness of an image that has been captured will vary nonuniformly within the image due to the effects of the characteristics of the focusing optics system.”), [0108] (describing a drop-off in brightness from the center of the image toward the peripheral part), [0062] (raising the brightness in the peripheral part of the image to correct shading), [0070]. Ex. 1002 at ¶ 173.

wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or <i>wherein the digital signal processor applies an algorithm to lighten the corners of the image</i> or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the corners of the image;	With respect to applying an algorithm to lighten the corners of the image, shading correction circuit 123 lightens the periphery of the image by multiplying the shading curve by its inverse. Ex. 1006 at [0082]-[0083]; <i>see also</i> FIG. 1, FIG. 7 (disclosing a correction table). “[B]y subjecting every pixel data to the multiplication by the inverse of the correction coefficient (coefficient process), the shading can be corrected.” Ex. 1006 at [0083]. This suggests that the corners of the image are lightened to correct the shading aberration. Kishida also lightens the corners of the image to correct shading using an algorithm. Ex. 1009 at [0062] (“[T]he brightness levels of the pixels on the peripheral part of the observation image are raised in respect to the center portion of the observation image, so that the shading is corrected appropriately.”), [0110] (“values, wherein the brightness values at the peripheral parts have been corrected.”). Ex. 1002 at ¶¶ 174-75.
and wherein the image exposure is optimized to correct the vignetting.	Niikawa addresses vignetting. Ex. 1006 at [0082]-[0083]. Niikawa also describes exposure adjustment. Ex. 1006 at [0109]-[0110]. Kishida optimizes exposure to correct vignetting. Ex. 1009 at [0018]. The brightness distribution detecting unit 43 in Kishida generates control data for controlling the exposure correction. Ex. 1009 at [0037]. The image data correcting unit 44 uses the control data sent from the brightness distribution detecting unit 43 to perform a correction process and outputs the image data to the AE (automatic exposure) evaluating unit 39. Ex. 1009 at [0037]. The AE evaluating unit 39 calculates a brightness summation value and outputs that value to the AE setting unit 38. Ex. 1009 at [0038]. As Kishida

	explains, “the image data correcting unit 44 outputs, to the AE [automatic exposure] evaluating unit 39, values, wherein the brightness values at the peripheral parts have been corrected.” Ex. 1009 at [0110]. Ex. 1002 at ¶ 176.
18. The system of claim 14:	
wherein the optical aberration is vignetting;	<i>See Claim 3 above.</i> Ex. 1002 at ¶¶ 177-78.
wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the corners of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the corners of the image;	<i>See Claim 3 above.</i> Ex. 1002 at ¶ 179
and wherein the image exposure is optimized to correct the vignetting.	<i>See Claim 3 above.</i> Ex. 1002 at ¶ 180.

G. WATANABE GROUNDS

i. Ground 4: Obviousness of Claims 1-3, 5, 14-15, 17-18 over U.S. Patent Application Publication No. 2005/0280877 (“Watanabe”)

Watanabe published December 22, 2005. Watanabe qualifies as prior art under, at least, 35 U.S.C. § 102(e) and 102(a) (pre-AIA).

Watanabe describes an image processing system for executing, e.g., a distortion aberration correction or peripheral light intensity correction. Ex. 1007 at [0002]. As Watanabe explains, different interchangeable lenses have various distortion and shading aberrations, which require their own specific corrections. Ex. 1007 at [0006], [0047]. In particular, distortion aberration correction and peripheral light intensity correction are performed. Ex. 1007 at [0037]-[0039], [0046]-[0047]. Watanabe uses a look-up table to select the proper correction option, based on lens type, focal point and zoom position, for example. Ex. 1007 at [0006], [0047]. The relevant correction data is stored ahead of time in the internal memory and table. Ex. 1007 at [0039]; [0046]-[0047].

Watanabe digitally captures an image and then performs aberration correction through various processors and circuits. Ex. 1007 at [0046]-[0047], [0058]-[0059].

As discussed, the claims at issue recite a microprocessor, a digital signal processor (“DSP”), and system software. As discussed above the ’339 patent is imprecise in its use of those terms. *See* Sec. V.f.i, above.

A POSA would have understood that a camera may have a processor with various functional components for performing the various needs of image processing, and that the same can be addressed using dedicated hardware as well as a combination of hardware and software, as needed. Ex. 1002 at ¶¶ 78, 66-71, 190-94. Watanabe includes a microprocessor in that it describes, at least, a CPU 57. Ex. 1007 at [0059] (“[T]he CPU 57 also constitutes an image processing device.”). Watanabe also describes a DSP in the form of, at least, a digital signal processing circuit 56. Ex. 1007 at [0038] (“In addition, the digital signal processing circuit 56 sorts out the image data inputted from the A/D converter 55 into color-difference data and brightness data, and executes various processes, correction and a data process for image compressing/extracting.”). A POSA would nevertheless appreciate that certain functions as claimed can be performed by different ones of these elements (e.g., the DSP may be considered a combination of DSP circuit 56 and CPU 57) and that it would be obvious to provide the hardware as needed, without substantively changing Watanabe’s system or operation. Ex. 1002 at ¶¶ 66-71, 190-94.

While Watanabe describes a camera with an optical lens mechanism, it does not explicitly describe a fixed focal length lens. Ex. 1007 at [0036]. Figure 3 shows that the lens type is saved in the process information. Ex. 1007 at FIG. 3. This would suggest to a POSA that the lens mechanism is interchangeable. Ex. 1002 at ¶¶ 50-56, 201. A POSA would have understood that there are two classes of lenses, zoom and fixed focal length. A POSA would have understood that a digital camera, such as the one described in Watanabe, would have been expected to receive either type of lens. The POSA also would have understood that the correction process would not have materially differed for either type. Indeed, the only difference is that correction information is provided per focal length. Thus, a fixed focal length lens would typically have a single focal length-related correction option, while a zoom lens would have a correction operation for each possible zoom setting (i.e., each different focal length).

Similarly, while Watanabe does not use the exact term “vignetting,” a POSA would understand that Watanabe provides a correction for vignetting. Ex. 1007 at [0009], [0032], [0054], [0055], FIG. 8. Specifically, Watanabe teaches a degradation of light intensity of a peripheral portion, which is vignetting. *Id.*; see Ex. 1001 at 3:45-46 (“[O]ptical vignetting affects peripheral illumination.”); Ex. 1004 at p. 9-10 (construing the term “vignetting” to mean “an effect in which the edges of an image are darker than the image’s center”).

Finally, Watanabe teaches that its correction data is stored in an internal memory and a table. Ex. 1007 at [0039], [0047]. Because Watanabe stores aberration and correction information a POSA would understand that the internal memory and a table function as a database for storing correction information and aberration information. Ex. 1002 at ¶¶ 52-56, 78, 195-99.

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1. A digital imaging system for correcting optical image aberrations comprising:	Watanabe discloses a digital imaging system for image correction. Ex. 1007 at [0002] (“Particularly, the present invention relates to an image recording apparatus and an image processing system capable of automatically and simply executing an image process such as distortion aberration correction or peripheral light intensity correction.”) Ex. 1002 at ¶¶ 181-82.
a digital camera mechanism,	Watanabe discloses a digital camera. Ex. 1007 at [0035] (“[A] digital camera 100.”). Ex. 1002 at ¶ 183.
an optical lens mechanism,	Watanabe teaches an optical lens. Ex. 1007 at [0035] (disclosing a “lens 50”), [0036]. Ex. 1002 at ¶¶ 184-85.
a digital sensor,	Watanabe discloses a digital sensor. Ex. 1007 at [0035], [0037] (“The CCD 53 is a circuit for converting an image inputted through the lens unit to electrical signals.”). Ex. 1002 at ¶¶ 186-89.

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a microprocessor,	Watanabe describes a microprocessor in the form of a CPU. Ex. 1007 at [0035], [0042] (“[T]he CPU controls operation of each part of the digital still camera.”). Ex. 1002 at ¶ 190.
a digital signal processor,	The digital signal processor is Watanabe’s digital signal processing circuit 56, in combination with CPU 57. Ex. 1007 at [0038] (“In addition, the digital signal processing circuit 56 sorts out the image data inputted from the A/D converter 55 into color-difference data and brightness data, and executes various processes, correction and a data process for image compressing/extracting.”), [0059] (“[T]he CPU 57 also constitutes an image processing device.”). Ex. 1002 at ¶¶ 191-92.
system software,	Watanabe teaches software in the form of a processing program. Ex. 1007 at [0035], [0039], [0042], [0062], [0085]; <i>see also</i> FIG. 3, [0071] (discussing an image processing program). Ex. 1002 at ¶¶ 193-94.
a database management system and	Watanabe’s database management system includes internal memory 69 and tables 70. Ex. 1007 at [0039], [0047]. Ex. 1002 at ¶¶ 195-99.
a memory storage sub-system;	Watanabe discloses a memory card 60 and a memory card interface 60a. Ex. 1007 at [0035]. Ex. 1002 at ¶ 200.
wherein the optical lens mechanism is a fixed focal length lens;	Watanabe teaches an optical lens mechanism. Ex. 1007 at [0036]. FIG. 3 shows that the lens type is saved in the process information. <i>See</i> Ex. 1007 at FIG. 3. This

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	suggests to a POSA that the lens is interchangeable and can accept a fixed focal length lens. Ex. 1002 at ¶ 201.
wherein a microprocessor uses system software to identify at least one optical aberration by accessing the database;	CPU 57 “determines a [correction] table according to a lens type.” Ex. 1007 at [0047]. Specifically, image capture information such as lens characteristics are added to the image data and stored to identify specific optical aberrations. Ex. 1007 at [0046]-[0047]. Further, stored software “controls operation” of CPU 57. Ex. 1007 at [0042], [0062], [0071], FIG. 3. Ex. 1002 at ¶¶ 202-06.
wherein the microprocessor uses the database to identify at least one algorithm to use to correct the at least one optical aberration;	Once the correction table identified, the CPU 57 uses the values from the table to identify a distortion aberration correction value (i.e. correction algorithm) to correct distortion. Ex. 1007 at [0047] (“[T]he CPU determines a table according to a lens type and determines correction values according to focusing point and a zoom position.”). Ex. 1002 at ¶¶ 207-11.
wherein when the image file is captured by the digital sensor the digital file is forwarded to the digital signal processor;	The image data formed on the CCD (sensor) is forwarded to the digital signal processing circuit 56 (DSP). Ex. 1007 at FIG. 1a, FIG. 1b, [0037]-[0038] (“[T]he A/D converter converts analogue image data inputted from the CCD 53 [T]he digital signal processing circuit 56 sorts out the image data inputted from the A/D converter.”). Ex. 1002 at ¶¶ 212-13.
wherein the image file with the at least one optical	The digital signal processing circuit 56 corrects aberrations in the image file, which aberrations are caused by the lens system. Ex. 1007 at [0038] (receiving

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aberration is corrected by applying digital filtration by using at least one algorithm in the digital signal processor;	the image file from the A/D converter and performing various processing and correction), [0046]-[0049] (determining a correction value from the table and then obtaining the image data “data results from produced image data on which a distortion aberration correction process is executed according to a lens type, a focusing point and a zoom position, data results from produced image data on which a peripheral light intensity correction process is executed according to a lens type, a focusing point and a zoom position.”). A corrected image is produced from the correction process, which employs filtration algorithms (e.g., a “formula”). Ex. 1007 at [0050]-[0056]. Ex. 1002 at ¶¶ 214-15.
and wherein the modified digital file consisting of the digital data optimized from the at least one optical aberration that are corrected from the original optical image is stored in memory.	After correction, the modified image files are stored in memory. Ex. 1007 at [0039], [0058] Ex. 1002 at ¶ 216.
2. The system of claim 1:	
wherein the optical aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field,	Watanabe discloses lens distortion. Ex. 1007 at [0046], [0088] (storing a “lens distortion aberration rate” in a look-up table). Ex. 1002 at ¶¶ 217-18.

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pin cushion, barrel distortion, chromatic aberrations, scattered light, red eye, dust and/or flare types of optical aberrations.	
3. The system of claim 1:	
wherein the optical aberration is vignetting;	Watanabe discloses degradation of light intensity of a peripheral portion (vignetting). Ex. 1007 at [0009], [0032]. Figure 8 shows that the areas close to the periphery and further from the center suffer from a decrease in light intensity. Ex. 1007 at [0055], FIG. 8. Ex. 1002 at ¶¶ 219-20.
wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or <i>wherein the digital signal processor applies an algorithm to lighten the corners of the image</i> or the digital signal processor applies both neutral density filtration in the image center	Watanabe lightens the corners of an image to correcting vignetting by using a formulaic algorithm. Ex. 1007 at [0056] (“By way of correcting brightness of a peripheral portion of an image according to the cosine fourth law so that it may be substantially the same brightness of the center portion, the light intensity of the peripheral portion of the image can be corrected.”); <i>see also</i> [0055], FIG. 8. Ex. 1002 at ¶ 221.

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and/or an algorithm to lighten the corners of the image;	
and wherein the image exposure is optimized to correct the vignetting.	It was known in the art that vignetting is caused by decreased aperture efficiency. Ex. 1007 at [0007]. A POSA would understand that exposure optimization would also be part of the shading correction, in that a lightening of the periphery of an image is a change in exposure for that area of the image. Ex. 1002 at ¶¶ 222-23.
5. The system of claim 1:	
wherein each lens type is registered in the camera database;	A table is prepared in advance with the different lens types. Ex. 1007 at [0047]-[0049], [0006]. Ex. 1002 at ¶¶ 224-26.
wherein the multiple optical aberrations of each lens is listed in the database;	Information relevant to lens characteristic i.e. “relative to distortion aberration” can be stored. Ex. 1007 at [0046]-[0047] (explaining that various information is stored corresponding to both aberrations and corrections on a lens by lens basis). The correction information is provided not only based on the focal length, but also for different focusing points, such that multiple corrections are provided for a given lens. Ex. 1007 at [0047] Ex. 1002 at ¶¶ 227-28.
wherein the filtration solutions to the lens optical aberrations are listed in the database;	Watanabe stores multiple correction solutions in its tables. Ex. 1007 at [0047] (explaining that from the stored tables “the CPU determines a table according to a lens type and determines correction values according to a focusing point and a zoom position.”).

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	Ex. 1002 at ¶¶ 229-30.
wherein the filtration of each lens optical aberration is applied by the digital signal processor;	Watanabe's digital signal processing circuit 56 (DSP) performs filtration. Ex. 1007 at [0038] ("In addition, the digital signal processing circuit 56 sorts out the image data inputted from the A/D converter 55 into color-difference data and brightness data, and executes various processes, correction and a data process for image compressing/extracting."), Ex. 1002 at ¶¶ 231-32.
and wherein after the digital signal processor applies the filtration to correct the optical aberrations the corrected digital file is forwarded to storage in memory.	After correction, the images are stored in memory. Ex. 1007 at [0039], [0058] Ex. 1002 at ¶ 233.
14. A digital imaging system for correcting image aberrations comprising:	See claim 1. Ex. 1002 at ¶¶ 234-35.
a digital camera mechanism,	See claim 1. Ex. 1002 at ¶ 236.
an optical lens mechanism,	See claim 1. Ex. 1002 at ¶ 237.
a digital sensor,	See claim 1. Ex. 1002 at ¶ 238.
a microprocessor,	See claim 1. Ex. 1002 at ¶ 239.

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a digital signal processor,	See claim 1. Ex. 1002 at ¶ 240.
system software,	See claim 1. Ex. 1002 at ¶ 241.
a database management system and	See claim 1. Ex. 1002 at ¶ 242.
a memory storage sub-system;	See claim 1. Ex. 1002 at ¶ 243.
wherein the optical lens mechanism is a zoom lens;	Watanabe teaches an optical lens. Ex. 1007 at [0035] (disclosing a “lens 50”), [0036]. Watanabe also teaches that the correction process considers zoom level and that the user interface has a zoom key, indicating a zoom lens. Ex. 1007 at [0041] (disclosing “a zoom key”), [0047] (storing zoom information), [0048] (executing correction based on zoom). Ex. 1002 at ¶¶ 244-45.
wherein the zoom lens changes focal length positions;	A zoom lens changes focal length positions for the different zoom settings/levels. Watanabe describes zoom levels. Ex. 1007 at [0041] (disclosing “a zoom key” for performing zooming), [0047] (storing zoom information), [0048] (executing correction based on zoom). Ex. 1002 at ¶¶ 246-47.
wherein when the image file is captured by the digital sensor the file is forwarded to the digital signal	See claim 1. Ex. 1002 at ¶ 248.

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processor and to memory;	
wherein the microprocessor uses system software to access the database to identify at least one optical aberration in the image file at any focal length of a zoom lens configuration;	CPU 57 “determines a [correction] table according to a lens type and determines correction values.” Ex. 1007 at [0047]. Specifically, image capture information such as lens characteristics are added to the image data and stored to identify specific optical aberrations. Ex. 1007 at [0046]-[0047]. Distortion aberration correction values are chosen from tables 70 based on focusing points and zoom positions. Ex. 1007 at [0047]. Further, stored software “controls operation” of CPU 57. Ex. 1007 at [0042], [0062], [0071], [0059], FIG. 3. Ex. 1002 at ¶¶ 249-52.
wherein the microprocessor accesses the database to obtain at least one filtration correction algorithm to the optical aberrations and forwards the at least one filtration algorithms to the digital signal processor;	The CPU selects the correction algorithm from the relevant table. Ex. 1007 at [0046]-[0047]. The correction algorithm is then executed based on lens type and zoom level. Ex. 1007 at [0049]. The digital signal processing circuit 56 executes correction processing. Ex. 1007 at [0038]; <i>see also</i> [0059] (explaining that the CPU 57 (DSP) executes image processing) [0047]-[0049] (image correction processing is performed by the CPU). Ex. 1002 at ¶¶ 253-54.
wherein the image file is forwarded to the digital signal processor which applies at least one filtration algorithm to optimize the image and corrects	The image data captured by the CCD is forwarded to the digital signal processing circuit 56 (DSP) where it undergoes a correction filtration algorithm. Ex. 1007 at [0037]-[0038] (“[T]he A/D converter converts analogue image data inputted from the CCD 53 [T]he digital signal processing circuit 56 sorts out the image data inputted from the A/D converter.”), FIG. 1a, FIG. 1b. Signal processing circuit 56 applies the correction

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the at least one optical aberration at the specific focal length in the zoom lens configuration;	algorithm selected by the CPU based on, in part, zoom level. Ex. 1007 at [0046]-[0047]. Ex. 1002 at ¶¶ 255-58.
and wherein the modified image file consisting of the digital data optimized from the at least one optical aberration of a specific focal length of the zoom lens that are corrected from the original optical image is stored in memory.	See claim 1. Ex. 1002 at ¶ 259.
15. The system of claim 14:	
wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, red eye, dust and/or flare types of optical aberrations.	<i>See Claim 2 above.</i> Ex. 1002 at ¶¶ 260-61.
17. The system of claim 14:	

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wherein each focal length of a zoom lens is analyzed for a different set of optical aberrations.	CPU 57 “determines a [correction] table according to a lens type and determines correction values.” Ex. 1007 at [0047]. Specifically, image capture information such as lens characteristics are added to the image data and stored to identify specific optical aberrations. Ex. 1007 at [0046]-[0047]. Distortion aberration correction values and peripheral light intensity correction values are chosen from tables 70 based on focusing position and zoom. Ex. 1007 at [0047]. Further, stored software “controls operation” of CPU 57. Ex. 1007 at [0042], [0062], [0071], FIG. 3 Ex. 1002 at ¶¶ 262-64.
18. The system of claim 14:	
wherein the optical aberration is vignetting;	<i>See</i> Claim 3 above. Ex. 1002 at ¶¶ 265-266.
wherein the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image and/or wherein the digital signal processor applies an algorithm to lighten the corners of the image or the digital signal processor applies both neutral density filtration in the	<i>See</i> Claim 3 above. Ex. 1002 at ¶ 267.

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image center and/or an algorithm to lighten the corners of the image;	
and wherein the image exposure is optimized to correct the vignetting.	See Claim 3 above. Ex. 1002 at ¶ 268.

ii. Ground 5: Obviousness of Claims 4 and 16 over Watanabe in view of Kita

Watanabe and Kita have been described in detail above. A POSA would look to combine Watanabe with Kita because Kita provides specific mechanisms for making the aberration corrections for which Watanabe calls. Ex. 1002 at ¶¶ 269-273. Watanabe mentions that the digital processing circuit is capable of performing several different types of processing in addition to correction, e.g. sorting image data into color difference data, brightness data, and “various processing.” Ex. 1007 at [0038]. A main feature of both references is that they store aberration information for lens characteristics such that the camera can access the stored aberration information to apply specific corrections corresponding to the corresponding lens and lens characteristics aberrations. *Compare* Ex. 1007 at [0046]-[0049] *with* Ex. 1011 at [0057]-[0060]. Thus, a POSA would readily understand that spatial domain processing and filtering based on lens characteristics from Kita could be integrated into Watanabe’s aberration correction

process based on lens characteristics. Ex. 1002 at ¶¶ 269-273. Kita explains that it was known in the art that spatial frequency processing is a useful image processing technique. Ex. 1011 at [0002]-[0004]. A POSA would understand that spatial frequency processing methods called for in Kita would be useful for analyzing and correcting the distortion and shading aberrations correcting in Watanabe. Ex. 1002 at ¶¶ 269-273. For instance, while Watanabe does not mention using Fourier transforms in image processing corrections, Kita teaches how various aberrations are corrected using the same. Ex. 1011 at [0026] (“[A] 512 x 512 image B (2) is sampled from an original image A (1), and a Fourier transform (FFT) 3 is applied to the image B (2) to generate an FFT image 4. The image can be expressed on a frequency axis from the FFT image 4. Following this, an MTF filter 5 is applied to the FFT image 4 through a multiplier 6. Finally an inverse Fourier transform (IFFT) 7 is performed on the multiplication result, to generate an IFFT image 8 to which the lens filter process has been applied.).

Given that Kita is an imaging device, i.e. digital camera, for image processing and aberrations correction, like Watanabe, a POSA would have had a reasonable expectation of success combining these references. Ex. 1002 at ¶¶ 269-273.

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4. The system of claim 1:	
wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical aberration.	In Watanabe, “the digital signal processing circuit 56 sorts out image data inputted from the A/D converter 55 into color-difference data and brightness data and executes various processing.” Ex. 1007 at [0038]. Kita applies a Fourier transform as part of its filtering process. Ex. 1011 at [0026] (“[A] 512 x 512 image B (2) is sampled from an original image A (1), and a Fourier transform (FFT) 3 is applied to the image B (2) to generate an FFT image 4. The image can be expressed on a frequency axis from the FFT image 4. Following this, an MTF filter 5 is applied to the FFT image 4 through a multiplier 6. Finally an inverse Fourier transform (IFFT) 7 is performed on the multiplication result, to generate an IFFT image 8 to which the lens filter process has been applied.”). Ex. 1002 at ¶¶ 274-76.
16. The system of claim 14:	
wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations.	<i>See</i> Claim 4 above. Ex. 1002 at ¶¶ 277-78.

VII. CONCLUSION

As demonstrated above, a reasonable likelihood exists that the Challenged Claims are unpatentable. Accordingly, Petitioner respectfully requests *inter partes* review of the Challenged Claims.

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Respectfully submitted,

/Justin J. Oliver/

Justin Oliver (Reg. No. 44,986)
VENABLE LLP
600 Massachusetts Ave., NW
Washington, DC 20001

Michael P. Sandonato
Nicholas D. Marcello
Venable LLP
1290 Avenue of the Americas
New York, NY 10104
(212) 218-2100 (telephone)
(212) 218-2200 (facsimile)
MSandonato@Venable.com
JOliver@Venable.com
NDMarcello@Venable.com
Attorneys for Petitioner Canon Inc.

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. § 42.24(d), I hereby certify that the foregoing Petition for *Inter Partes* Review contains 12,438 words as measured by the word processing software used to prepare the document, in compliance with 37 C.F.R. § 42.24(a).

DATED: July 20, 2020

Respectfully submitted,

By: /Justin J. Oliver/
Justin Oliver (Reg. No. 44,986)
VENABLE LLP
600 Massachusetts Ave., NW
Washington, DC 20001

CERTIFICATE OF SERVICE

I hereby certify that true and correct copies of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 8,451,339 and accompanying exhibits were served on July 20, 2020 via USPS EXPRESS MAIL to the following address:

Correspondence Address of Record for U.S. Patent No. 8,451,339

SCHWEGMAN LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS MN 55402

DATED: July 20, 2020

Respectfully submitted,

By: /Justin J. Oliver/
Justin Oliver (Reg. No. 44,986)
VENABLE LLP
600 Massachusetts Ave., NW
Washington, DC 20001