

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SONY CORPORATION,
Petitioner,

v.

OPTIMUM IMAGING TECHNOLOGIES, LLC,
Patent Owner.

IPR2024-00923
Patent No. 10,873,685

**PETITION FOR INTER PARTES REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §42.1 et seq**

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EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 10,873,685
1002	Prosecution History of U.S. Patent No. 10,873,685
1003	Declaration of Leonard Laub
1004	Curriculum Vitae of Leonard Laub
1005	U.S. Patent Publication No. 2005/0280877 (“Watanabe”)
1006	Certified Translation Of Japanese Patent Application No. JP2004-233872 (“JP-872”)
1007	Certified Translation Of Japanese Patent No. JPA 2004-343358 (“Kishida”)
1008	Certified Translation Of Japanese Patent Application Publication JP 2004-328506A (“Kita”)
1009	U.S. Patent Publication No. 2003/0223007 A1 (“Takane”)
1010	Certified Translation Of Japanese Patent No. JP 06-319106A (“Hisamatsu”)
1011	U.S. Patent Publication No. 2004/0264918 (“Turner”)
1012	U.S. Patent No. 8,559,743 (“Liege”)
1013	U.S. Patent No. 7,688,384 (“Davis”)
1014	U.S. Patent Publication No. 2006/0132646 (“Komatsu”)
1015	SMPTE 244M-2003 SMPTE Standard for Television – System M/NTSC Composite Video Signals – Bit-Parallel Digital Interface, The Society of Motion Picture and Television Engineers (2003) (“SMPTE-240”)
1016	SMPTE 170-M-2004 SMPTE Standard for Television – Composite Analog Video Signal – NTSC for Studio Applications, The Society of Motion Picture and Television Engineers (2004) (“SMPTE-170M”)
1017	National Television System Committee, NTSC Signal Specifications (Dec. 1953)
1018	PCT Publication No. WO 2004/093438 A1 (“Dutta”)
1019	Texas Instruments, TMS320C8x System-Level Synopsis (Sep. 1995)
1020	Texas Instruments, Product Bulletin: TMS320C5470 and TMS320C5471 System-Level DSPs (2002)
1021	Chaoui, Jamil, et al. “Open multimedia application platform: enabling multimedia applications in third generation wireless terminals through a combined RISC/DSP architecture.” <i>2001 IEEE International Conference on Acoustics, Speech, and Signal Processing. Proceedings</i> (Cat. No. 01CH37221). Vol. 2. IEEE, 2001.

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1022	U.S. Patent No. 9,063,982 (“Bestgen”)
1023	U.S. Patent No. 6,920,443 (“Cesare”)
1024	U.S. Patent Publication No. 2006/0268357 A1 (“Vook”)
1025	U.S. Patent No. 5,739,691 (“Hoenninger”)
1026	Prosecution History of U.S. Patent No. 8,451,339
1027	Dkt. No. 88, Claim Construction Memorandum Opinion and Order, <i>Optimum Imaging Technologies LLC v. Canon Inc.</i> , No. 2:19-cv-00246 (E.D. Tex. June 11, 2020)
1028	<i>digital filter</i> , Comprehensive Dictionary of Electrical Engineering (2d ed. CRC Press 2005)
1029	<i>database management system</i> , Newton’s Telecom Dictionary (CMP Books, 2005)
1030	<i>Canon Inc. v. Optimum Imaging Technologies LLC</i> , IPR2020-1322, Paper 1 (Jul. 20, 2020) (“-01322 Petition”)
1031	<i>Canon Inc. v. Optimum Imaging Technologies LLC</i> IPR2020-1322, Paper 9 (Mar. 1, 2021) (“-01322 D.I.”)
1032	<i>Canon Inc. v. Optimum Imaging Technologies LLC</i> , IPR2020-1321, Paper 1 (Jul. 20, 2020) (“-01321 Petition”)
1033	<i>Canon Inc. v. Optimum Imaging Technologies LLC</i> , IPR2020-1321, Paper 10 (Mar. 1, 2021) (“-01321 D.I.”)
1034	U.S. Patent No. 6,529,237 (“Tsay”)
1035	U.S. Patent Publication No. 2006/0050335 A1 (“Dorrell”)
1036	U.S. Patent Publication No. 2006/0098253 A1 (“Masuno”)
1037	Dkt. No. 1, Complaint, <i>Optimum Imaging Technologies LLC v. Sony Corp.</i> , No. 4:23-cv-00928 (E.D. Tex. Oct. 18, 2023)
1038	Docket report in <i>Optimum Imaging Technologies LLC v. Sony Corp.</i> , No. 4:23-cv-00928 (E.D. Tex. Oct. 18, 2023) as of May 13, 2024
1039	Eastern District of Texas, U.S. District Court—Judicial Caseload Profile, as of May 13, 2024
1040	U.S. Patent No. 7,206,136 (“Labaziewicz”)
1041	U.S. Patent No. 5,444,482 (“Misawa”)
1042	U.S. Patent No. 5,742,806 (“Reiner”)
1043	U.S. Patent No. 7,245,319 (“Enomoto”)
1044	Certified Translation Of Japanese Patent No. JPH (1999)-313250 (“Yamagata”)
1045	U.S. Patent No. 5,905,530 (“Yokota”)
1046	U.S. Patent Publication No. 2004/0150732 (“Yamanaka II”)

Exhibit	Description
1047	GUAN et al., <i>Digital Image Correcting Method for Digital Camera</i> (December 2005) (“Ricoh”)
1048	U.S. Patent No. 5,999,330 (“Goosey”)
1049	U.S. Patent No. 7,738,015 (“Steinberg I”)
1050	U.S. Patent No. 7,590,305 (“Steinberg II”)
1051	Certified Translation Of Japanese Patent No. JPA 2002-190979 (“Kuniba”)
1052	Certified Translation Of Japanese Patent No. JPA 2000-184247 (“Imai”)
1053	GONZALEZ & WOODS, <i>DIGITAL IMAGE PROCESSING</i> , (Prentice Hall, 2d ed. 2002) (“Gonzalez”)
1054	JOHN C. RUSS, <i>THE IMAGE PROCESSING HANDBOOK</i> (CRC Press, 4th ed. 2002) (“Russ”).
1055	U.S. Patent No. 7,609,297 (“Master”)
1056	U.S. Patent Publication No. 2007/0080280 (“Havens”)
1057	U.S. Patent No. 7,936,392 (“Ng”)
1058	Certified Translation Of PCT Publication No. WO 2002/069214 (“Takae”)
1059	U.S. Patent No. 6,279,004 (“Lee”)
1060	Certified Translation Of Japanese Patent Application Publication No. JP 2001-251546A (“Iida”)
1061	U.S. Patent No. 5,818,524 (“Juen”)
1062	M. Gottardi and W. Yang. “A CCD/CMOS image sensor array with integrated A/D conversion.” <i>1997 IEEE International Symposium on Circuits and Systems (ISCAS)</i> . Vol. 3. IEEE, 1997.
1063	U.S. Patent Publication No. 2002/0135688 (“Niikawa”)
1064	U.S. Patent No. 4,903,204 (“Dobbins”)
1065	U.S. Patent No. 5,414,782 (“Carasso”)
1066	Certified Translation Of Japanese Patent No. JPA 2006-72660 (“Yamazaki”)
1067	U.S. Patent Publication No. 2003/0095197 (“Wheeler”)
1068	U.S. Patent No. 7,554,584 (“Lim”)
1069	U.S. Patent No. 5,630,153 (“Intrater”)
1070	U.S. Patent No. 5,864,409 (“Kashida-409”)
1071	PCT Publication No. WO 1993-020536 A1 (“Reddig”)
1072	U.S. Patent No. 5,475,420 (“Buchin”)
1073	U.S. Patent No. 4,562,436 (“Coleman”)
1074	U.S. Patent No. 6,816,625 (“Lewis”)

Exhibit	Description
1075	U.S. Patent No. 6,798,449 (“Hsieh”)
1076	P. Strumillo and M. Strzelecki, Fourier Transform of Images, available at http://mstrzel.elel.p.lodz.pl/mstrzel/pattern_rec/fft_ang.pdf (visited May 10, 2024).

MANDATORY NOTICES

A. Real Party-In-Interest

Sony Corporation (“Sony” or “Petitioner”) is the Real Party-in-Interest.

B. Related Matters

A decision in this proceeding could affect or be affected by the following:

1. United States Patent & Trademark Office

The application from which U.S. Patent No. 10,873,685 issued is a Continuation of U.S. Patent Application No. 12/586,221 (U.S. Patent No. 8,451,339), which is a Continuation of U.S. Patent Application No. 11/825,521 (U.S. Patent No. 7,612,805), which claims priority from provisional application 60/807,065.

The following U.S. patent applications claim the benefit of priority to U.S. Patent No. 10,873,685:

(i) U.S. Patent Application No. 16/692,939 (U.S. Patent No. 11,106,032), filed November 22, 2019; (ii) U.S. Patent Application No. 16/692,972 (U.S. Patent No. 10,877,266), filed November 22, 2019; (iii) U.S. Patent Application No. 16/694,850 (U.S. Patent No. 10,877,267), filed November 25, 2019; (iv) U.S. Patent Application No. 16/694,838, filed November 25, 2019; (v) U.S. Patent Application No. 17/383,602 (U.S. Patent No. 11,774,751), July 23, 2021; (vi) U.S. Patent Application No. 18/454,196, filed August 23, 2023.

2. U.S. District Court Litigation

The '685 patent was asserted or is otherwise at issue in these cases.

a. U.S. District Court for the Eastern District of Texas

(i) *Optimum Imaging Technologies LLC v. FUJIFILM Corporation*, Case No. 4-23-cv-00922; (ii) *Optimum Imaging Technologies LLC v. Nikon Corporation*, Case No. 4-23-cv-00923; (iii) *Optimum Imaging Technologies LLC v. Olympus Corporation*, et al., Case No. 4-23-cv-00924; (iv) *Optimum Imaging Technologies LLC v. Panasonic Corporation*, Case No. 4-23-cv-00926; (v) *Optimum Imaging Technologies LLC v. Sony Corporation*, Case No. 4-23-cv-00928 (“the Litigation”).

b. U.S. District Court for the Western District of Texas

Canon Inc. v. Optimum Imaging Technologies LLC, Case No. 1-20-cv-01238 (Terminated April 28, 2021).

c. U.S. District Court for the Northern District of California

Panasonic Entertainment & Communication Co. v. Optimum Imaging Technologies LLC, Case No. 3-24-cv-02466.

C. Counsel and Service Information - § 42.8(b)(3) and (4)

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A power of attorney is submitted with the Petition. Counsel for Petitioner consents to service of all documents via electronic mail.

Sony Corporation (“Sony” or “Petitioner”) requests *inter partes* review and cancellation of U.S. Patent No. 10,873,685 (EX1001, “the ’685 patent”) claims 1-19 and 22-30 (the “Challenged Claims”).

I. INTRODUCTION

The ’685 patent concerns automated imaging distortion correction in digital camera systems. The patent classifies distortions as “optical aberrations” from the physical optics or “digital aberrations” from processes or other components. A camera system’s processing platform identifies a corresponding optical image aberration correction from a plurality in a database for correcting aberrations from a given lens, component, or process before storing a corrected image in memory. EX1001, 7:30-37, 8:11-17.

During prosecution the examiner did not apply any prior art in rejecting the ’685 patent claims despite the fact that at the time of invention in 2007 it was well-known to automate correcting optical and/or digital aberrations in digitally captured image data—such as video—before finally storing the image.

Watanabe (EX1005) is a 2005 patent publication assigned to Ricoh, a digital camera manufacturer. Watanabe provides a digital signal processing circuit that automates processing captured video to correct image aberrations. Watanabe identifies distortion aberration and peripheral light intensity corrections for correcting captured image data before finally storing the image (Watanabe, [0047])

and processes the digitized video to apply the corrections (Watanabe, [0032], [0048]-[0064]). **Ground 1** shows that Watanabe renders obvious independent claims 1, 6, and 14, and many dependent claims.

Grounds 2-7 show that Watanabe, in combination with various other references addressing particular distortions or implementation details, renders obvious the remaining challenged dependent claims.

Takane (EX1009) is a 2003 patent publication assigned to Fuji Photo Film, a digital camera manufacturer. Takane describes a digital imaging system that captures video and provides image processing that corrects aberrations. Takane's digital camera includes a memory that stores various parameters and provides automated processing to remove such aberrations from the captured video. Takane, [0033], Figs. 1, 2. **Ground 8** shows that Takane, applying Watanabe's teachings, renders obvious independent claims 1, 6, and 14, and many dependent claims.

Accordingly, Petitioner respectfully requests that the Board order *inter partes* review of the '685 patent and cancel claims 1-19 and 22-30.

II. STANDING CERTIFICATION

The '685 patent is available for IPR. Sony is neither barred nor estopped from requesting IPR. 37 C.F.R. §42.104(a).

III. UNPATENTABILITY GROUNDS

Pre-AIA law applies because the '685 patent was filed before March 16, 2013. EX1001, code (22). The claims are obvious under pre-AIA §103(a).

Ground	Reference(s)	Claim(s)
1	Watanabe	1-2, 5-7, 11-12, 14-15, 17, 27, 29
2	Watanabe+Kishida	3, 13, 19
3	Watanabe+Kita	4, 8, 9, 16
4	Watanabe+Takane	10, 18, 28, 30
5	Watanabe+Hisamatsu	22-23, 25
6	Watanabe+Turner	24
7	Watanabe+Liege	26
8	Takane+Watanabe	1-2, 6-7, 10, 12, 14-15, 17-18, 27-28, 30

The '685 patent issued from a continuation of an application filed July 6, 2007. EX1001, code (63). The Patent Owner ("PO") bears the burden to show that any claim merits an earlier effective-filing date. *Dynamic Drinkware v. National Graphics*, 800 F.3d 1375, 1380 (Fed. Cir. 2015). Each reference is prior art to every Challenged Claim as follows:

Reference	Priority	Publication	Basis
Watanabe (EX1005)	2005-06-07	2005-12-22	§§102(a), (b), (e)
Kishida (EX1007)		2004-02-12	§102(b)
Kita (EX1008)		2004-11-18	§102(b)
Takane (EX1009)	2003-06-03	2003-12-04	§102(b)
Hisamatsu (EX1010)		1994-11-15	§102(b)
Turner (EX1011)	2003-06-30	2004-12-30	§102(b)
Liege (EX1012)	2002-06-05		§102(e)

IV. '685 PATENT¹

The '685 patent concerns systems and methods for correcting well-known optical aberrations in digital video frames using information concerning lens-specific aberrations. “The invention applies to any imaging system that includes interactions between optics, digital image sensors, post-capture integrated circuits [“ICs”] and digital storage components.” 1:24-27. The specification describes well-known optical aberrations (3:45-48) and “optical vignetting” that affects “peripheral illumination” (3:51-59), each “characterized according to lens type” (3:30-32, 32:28-38). The '685 patent replaces physical filters correcting these aberrations with “in-camera digital filters” that correct aberrations using “in-camera digital filtration,” e.g., digital signal processing. 7:30-37, 8:11-17.

The imaging system connects a sensor to a digital signal processor (“DSP”) and a microprocessor. 31:26-43, Fig. 1. The sensor comprises photoelectric sensors, including a charge coupled device (“CCD”). 2:43-56, 18:11-37, Fig. 17. The system identifies an optical aberration from a specific lens used at image capture and corrects the aberration with a digital filter. 32:21-55, Figs. 5-7. The system stores the corrected image. *Id.*

¹ Unless otherwise noted, Section IV citations refer to EX1001. All emphasis in the Petition is added unless otherwise noted.

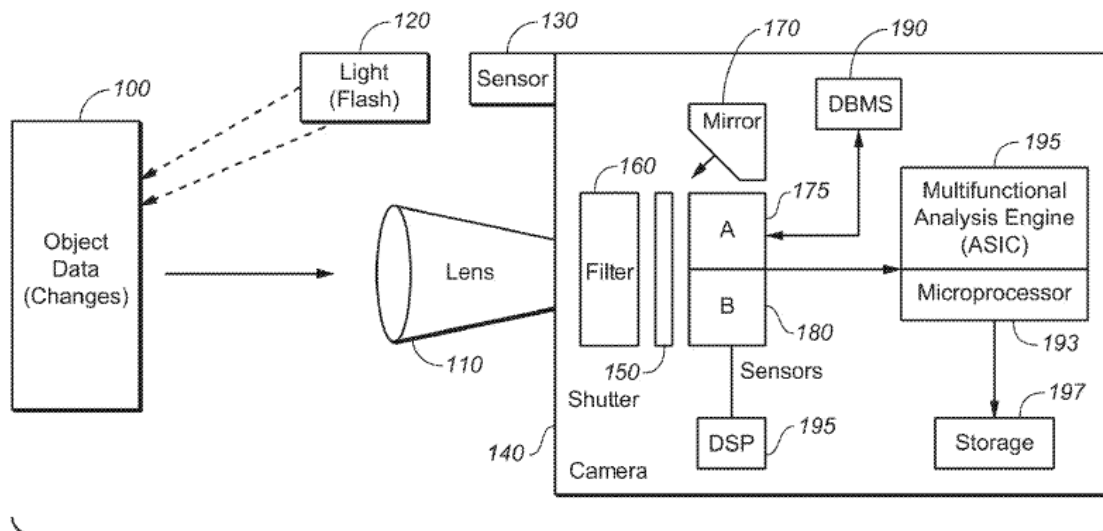


FIG. 1

A. Challenged Claims

The claim list (Appendix A) reproduces claims 1-30. All claims recite a “digital imaging *system*” comprising conventional components and describe how the system “uses” the components. Independent claim 1 is representative.

Independent claims 6 and 14 repeat the claim 1 limitations with minor differences. Claim 6 recites forwarding video to “storage in memory” ([6.c]) and correcting “at least *two* frames” of digital video ([6.d]) rather than *one* frame ([1.d]). Claim 14 recites forwarding video to a DSP ([14.d]), and a “zoom lens” that “changes focal length positions” ([14.c]).

Dependent claims add limitations concerning particular known aberrations (claims 2-3, 7, 13, 15, and 19, 22-30), using well-known fast Fourier transform algorithms (claims 4, 8-9, and 16), database contents (claim 5), and obvious variations on independent claim limitations (claims 10-12, 17-18).

B. Prosecution History

The '685 patent issued from No. 13/691,685, a continuation of applications that issued as U.S. Patent Nos. 8,451,339 and 7,612,805 (whose claims Sony challenges in co-pending IPRs). The Examiner rejected the '685 application-claims for obviousness-type double patenting over the parent '339 claims. EX1002, 132-138. PO thereafter amended application-claims 1, 6, and 14 by replacing “an [IC], a [DSP], system software, a database management system” with “an [IC] *including* a [DSP] *configured to access* a database management system *including a plurality of optical image aberration corrections*[.]” EX1002, 226-230.² The Examiner allowed the claims without meaningful explanation. EX1002, 1573-1576.

C. Canon IPRs

While the '685 patent has never been tested in IPR, the parent '339 patent was challenged in IPR2020-01322 (EX1030), and its ancestor '805 patent in IPR2020-01321 (EX1032). The Board discretionarily denied both petitions under

² A typographical error in claim 1 reprints the claim amendment's comma deletion after “[IC] including” (e.g., “;”) as a semicolon not found in the prosecution history. EX1002, 226. The same language in claims 6 and 14 issued without this error.

Fintiv. EX1031, 12 (-01322 denial); EX1033, 12 (-01321 denial). The Board did not consider the merits for any ground.

D. POSA

A person having ordinary skill in the art (“POSA”) would have had a bachelor’s degree in electrical engineering, physics, or a related field, with at least two years of industry experience and/or research, both concerning digital camera system design and image processing. EX1003 (“Laub”), ¶54.

V. CLAIM INTERPRETATION

The Board construes claim terms using ordinary meaning in light of the specification and prosecution history. 37 C.F.R. §42.100(b). The Board need only construe terms to the extent needed to resolve disputes. *Nidec v. Zhongshan*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); 83 Fed. Reg. 51340, 51353.

A. “uses... software to identify at least one optical image aberration”

All claims recite a version of [1.c] “wherein the [IC] uses... in-camera software to identify at least one optical image aberration.” *See, e.g.*, [6.d], [14.e].

In the Litigation, PO contends software that identifies corrections to an optical aberration based on information about the optical system—like the lens or focal length—is “software to identify at least one optical image aberration.” EX1037, ¶76 (citing software providing user-selectable aberration compensation for given camera), ¶79 (accusing “photo shooting functionality *that automatically*

corrects optical aberrations based on the lens being used”), ¶¶80-81 (identifying software “lens compensation” settings). The ’685 patent agrees. EX1001, 11:24-26 (“[E]ach lens... will have specific aberrations, the corrections for which will be accessible in a database.”).

Under PO’s contentions, software accessing a database to obtain correction parameters based on particular optical system parameters like the lens and focal length meets [14.e]. *10X Genomics v. Bio-Rad Labs.*, IPR2020-00086, Paper 8, 17-19 (April 27, 2020) (claim constructions based on patent owner’s infringement contentions comply with 37 C.F.R. §42.104(b)(3)).

B. “vignetting”

Claims 3, 13, 15, and 19 recite “vignetting.” In prior litigation the district court construed “vignetting” in the parent ’339 claims as “an effect in which the edges of an image are darker than the image’s center.” EX1027, 9-10. The ’685 specification supports that construction. EX1001, 3:51-52 (“[V]ignetting affects peripheral illumination.”), 32:5-6 (“In vignetting, the lens (300) makes the edges of the image significantly darker as the light falls off[.]”).

All other terms should be given their ordinary meaning to a POSA.

VI. GROUND 1: WATANABE RENDERS OBVIOUS CLAIMS 1-2, 5-7, 11-12, 14-15, 17, 27, 29

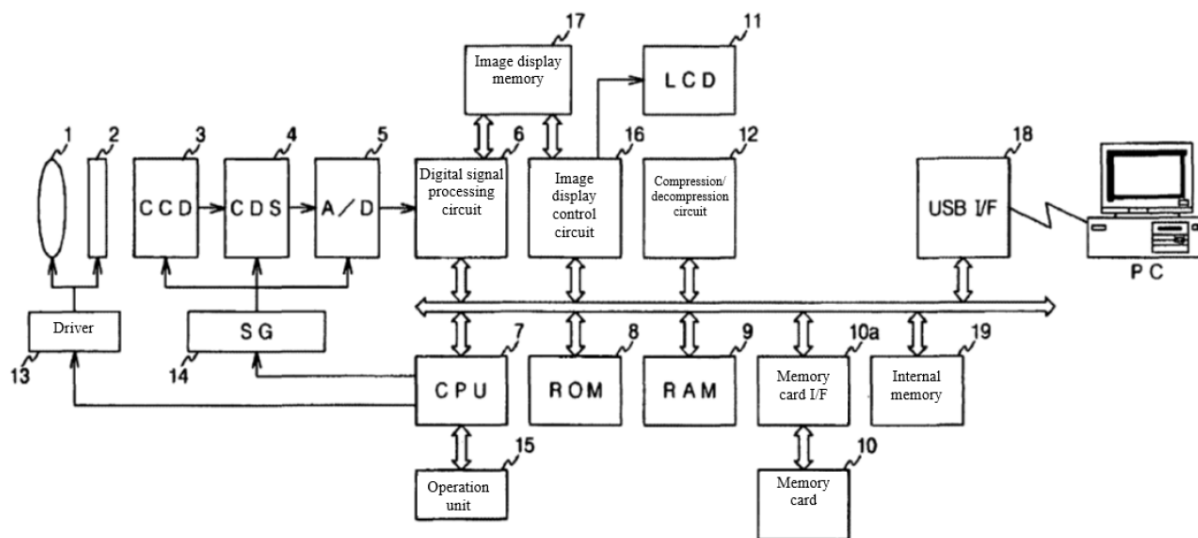
A. Watanabe

Watanabe, entitled “Image Recording Apparatus and Image Processing System,” incorporates JP2004-233872 (EX1006, “JP-872”). Watanabe, code (54), [0015]. The incorporation makes JP-872 “effectively part of” Watanabe.

Advanced Display Sys. v. Kent State Univ., 212 F.3d 1272, 1282 (Fed. Cir. 2000).

Watanabe describes an image processing system for a digital camera that—as JP-872 describes—uses CCD sensors to capture video. JP-872, [0006]-[0007], Fig. 1; Watanabe, [0035] (digital camera 100 with CCD 53); Laub, ¶¶123-125.

Watanabe digitizes video “at an optimal sampling frequency” for “an NTSC signal.” JP-872, [0006]; Watanabe, [0037]; Laub, ¶¶126, 142-147. An “NTSC signal” is video comprising several images (frames) per second. *Infra* §VI.B.2.a (limitation [1.a]).



JP-872, Fig. 1.

Watanabe adds “information related to lens characteristics” including “lens type... focal length at the time of shooting... and the zoom position” to image data and identifies “distortion aberration correction” and “peripheral light amount correction” based on “focal length” and “zoom position” for each lens. JP-872, [0007]; Watanabe, [0046]-[0047]; Laub, ¶¶128-132.

A “digital signal processing circuit 6... performs various processing” and “correction” to “video input” that the A/D converter 5 has digitized. JP-872, [0006]; *see also* Watanabe, [0038] (“digital signal processing circuit 56... executes various processes” and “correction” to digitized images). Watanabe identifies distortion aberration and peripheral light intensity corrections (JP-872, [0007]; Watanabe, [0047]) and processes the digitized video to apply the corrections (JP-872, [0006]-[0008]; Watanabe, [0032], [0048]-[0064]). Laub, ¶¶131-134.

Watanabe’s image processing at [0044]-[0064] corrects aberrations (including peripheral lighting) in still and video images because a digital video comprises a series of images (frames) that Watanabe processes just like any other image. JP-872, [0006]-[0007]; EX1001, 27:36-38; *infra* §VI.B.4 (limitation [1.d]); Laub, ¶133.

B. Claim 1

1. Limitation [1.PRE]

1.PRE	A digital imaging system for correcting optical image aberrations in a digital video, comprising:
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If [1.PRE] is limiting, Watanabe meets it by describing a digital imaging system. JP-872, [0006]-[0008]; Watanabe, [0002], [0032], [0035]. Watanabe corrects optical image aberrations in digital video as explained *infra* §§VI.B.2-VI.B.7 ([1.a]-[1.g]). Laub, ¶¶70-97.

2. Limitation [1.a]

1.a	a digital video camera including in-camera software, an optical lens mechanism, at least one digital sensor for capturing the digital video, an integrated circuit including; [sic] a digital signal processor configured to access a database management system including a plurality of optical image aberration corrections, and a memory storage sub-system;
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Watanabe meets [1.a] as shown below.

a. “digital video camera including in-camera software”

Watanabe’s “digital camera” (JP-872, [0006], Fig. 1; Watanabe, [0035], Figs. 1A-1B) is a “digital video camera” because it captures video with a CCD and digitizes its output. JP-872, [0006] (“digital camera” comprising “CCD 3... that converts... *video* input”), Fig. 1; Watanabe, Abstract, [0002], [0009], [0034], [0035] (“digital camera 100” with CCD 53), Fig. 1A (100); Laub, ¶¶112-116, 141-142. Watanabe teaches an “imaging system” that “provides digital video.” EX1001, 28:30. Watanabe’s digital camera captures video—making it a “digital video camera”—because Watanabe describes digitizing video at sampling frequencies optimized “for an NTSC signal.” JP-872, [0006]; Watanabe, [0037]. NTSC is a moving picture video format comprising several images (frames) per second. Laub, ¶¶142-147 (discussing EX1015, 1.1; EX1016, 1.2; EX1017, I.F.2); EX1013 (“Davis”), 5:3-9, 6:1-14, 7:33-34 (discussing NTSC); EX1014 (“Komatsu”), [0004]-[0034] (describing NTSC format).

If the Board finds Watanabe—including the incorporated JP-872 disclosure—does not disclose a digital video camera, then POSAs would nonetheless have understood it would have been routine to use a digital video camera to achieve what Watanabe describes. Laub, ¶¶148-149 (discussing EX1041, 2:45-49).

POSAs would have had a reasonable expectation of success applying Watanabe's image processing teachings to digital video because this was routine and because—as the '685 patent admits (EX1001, 27:36-38)—POSAs would have known that digital video comprises successive digitized images (called frames) with aberrations correctable the same way aberrations could be corrected in a still image. EX1041, 2:45-49; Laub, ¶¶148-149.

The specification describes “processing software” as “stored in either a microprocessor or an ASIC.” EX1001, 22:42-43. POSAs would have understood the '685 patent as describing all processing intelligence in the claimed system as software, from software “stored in” a microprocessor or ASIC (*id.*; limitation [1.c] (IC uses “in-camera software”)) to application layer programs (EX1001, 6:41-44, describing “Adobe Photoshop”). Laub, ¶¶150-151. POSAs would have understood the '685 patent uses software as encompassing all Open Systems Interconnection (“OSI”) stack layers because the '685 patent describes network and communication applications whose functionality is provided by software represented in the OSI stack. E.g., EX1001, Figs. 33, 35 (“DBMS in Distributed Network”), 7:3-17, 8:33-47, 25:12-15, 31:50-64; Laub, ¶¶151-152. Watanabe's image recording apparatus includes “in-camera software” because it “stores programs” in read-only memory (“ROM”). JP-872, [0006], Fig. 1 (ROM8); Watanabe, [0039] (“ROM 58 stores programs”), [0042] (“control program stored

in ROM 58”), Fig. 1B (ROM 58), Fig. 3 (image processing program 71); Laub, ¶153.

b. “digital sensor for capturing the digital video”

Although a CCD provides an analog signal that requires digitization, the ’685 specification identifies a CCD as a “*digital* sensor[]” in which “photons are recorded by electrically charged pixels.” EX1001, 14:17-26; *id.*, 2:47-56, 18:11-15, 31:65-67 (analog-to-digital converter (“ADC”) 210 digitizes analog signal from CCD), 8:52-53 (describing analog-to-digital (“A/D”) conversion process), 30:25-26 (same), Fig. 2 (ADC 210). Watanabe discloses a CCD that captures video, which is digitized. JP-872, [0006] (CCD 3, A/D converter 5), Fig. 1; Watanabe, [0035] (CCD 53, A/D converter 55), [0037] (“A/D converter converts analogue image data... to digital image data”), Fig. 1A; *supra* §VI.B.2.a; Laub, ¶154.

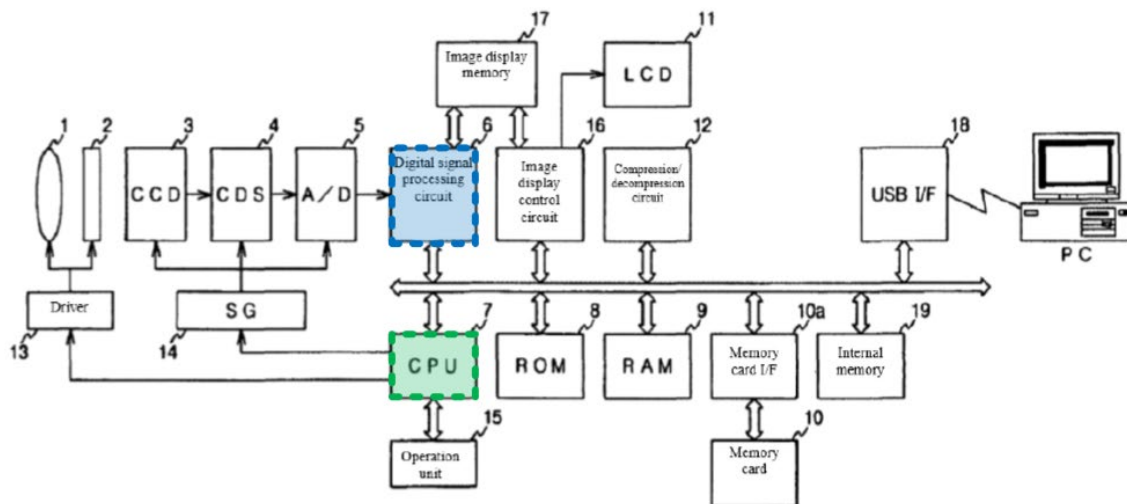
c. “optical lens mechanism”

Limitation [1.b] defines “optical lens mechanism” as “a zoom lens or a fixed focal length lens.” Watanabe discloses a zoom lens because it describes “zoom position” and correcting distortion “based on... zoom position for each lens.” JP-872, [0007]; Watanabe, [0047], [0049], Fig. 3; Laub, ¶155. A “mechanical mechanism” that includes “autofocus” moves the lens. JP-872, [0006], Fig. 1 (lens 1, “mechanical mechanism 2”); Watanabe, [0035] (“lens 51” and “mechanical structure 52” with autofocus), [0036] (lens unit), Fig. 1A (51, 52); Laub, ¶156.

d. “IC including a DSP”

An “[IC] including a [DSP]” means an IC comprising a DSP.³ Watanabe’s digital camera includes a CPU and digital signal processing circuit. JP-872, [0006] (CPU 7, circuit 6), Fig. 1; *see also* Watanabe, [0035], [0038], Fig. 1B (CPU 57, circuit 56). A DSP is a digital signal processing circuit. Laub, ¶¶157-158. During the parent ’339 prosecution, PO admitted that DSPs routinely processed digital images. EX1026, 155.

Watanabe leaves the CPU and DSP implementation details to the POSA because it does not describe whether they are provided as discrete components or integrated in a system-on-chip (“SoC”). E.g., JP-872, Fig. 1 (functional block diagram showing DSP and CPU); Watanabe, Fig. 1B, Laub, ¶¶159-162.



JP-872, Fig. 1 (annotated).

³ *Amgen v. Hoechst Marion Roussel*, 314 F.3d 1313, 1344–1345 (Fed. Cir. 2003).

i. Known to combine CPU and DSP on single IC.

It was well-known to integrate a general-purpose processor (CPU) and DSP in an SoC comprising a single IC—rather than use discrete components—and that such SoC were commercially available and regularly used for image processing. E.g., EX1018 (“Dutta”), 4:2-9 (single-chip application processor comprises SoC including CPU and “image processing block”); EX1021, 1009-1010; Laub, ¶¶163-168 (discussing EX1019, SL: 1-1, 2-1, 2-3), 269 (discussing EX1020).

POSAs would have known that an SoC comprising a single IC combining one or more CPU and DSP provided several benefits over using discrete components. Laub, ¶¶167, 267-273. For example, compared with discrete components, the SoC was known to reduce system size, power consumption, and cost. E.g., EX1019, SL: 1-1, 1-2, 1-6, 1-7, 1-8, 2-1, 2-2; EX1020, 1 (describing “Key Benefits” and how “Integration Enables Fast, Robust System Development”); Laub, ¶167. Compared to discrete implementations, the SoC increases system performance by facilitating optimized task partitioning between DSP and other processors, provides fast communication and efficient memory sharing between DSP and other processor cores, and reduces processing delay compared to implementations in discrete components. EX1019, SL2-2, 4-2; Laub, ¶167. POSAs would have had reasons to use a SoC comprising a single IC

including Watanabe’s DSP and CPU to achieve these benefits in Watanabe’s system. Laub, ¶169.

POSAs would have had a reasonable expectation of success because SoCs were known and used for video processing. Laub, ¶168. Implementing Watanabe’s system with SoCs was well-within the POSA’s ordinary skill. Laub, ¶169.

ii. SoC was a predictable design choice.

Furthermore, implementing Watanabe’s CPU and DSP as (1) discrete components, or (2) in an SoC, posed a design choice between two predictable alternatives. *KSR v. Teleflex*, 550 U.S. 398, 417, 421 (2007); *Uber Techs. v. X One*, 957 F.3d 1334, 1340 (Fed. Cir. 2020) (§103 bars obvious variations because POSA “has good reasons to pursue the known options within [their] technical grasp”); *ACCO Brands v. Fellowes*, 813 F.3d 1361, 1367 (Fed. Cir. 2016) (where POSA “would... be left with two design choices ... [e]ach of these two design choices is an obvious combination”); *In re Larson*, 340 F.2d 965, 968 (CCPA 1965) (“obvious engineering choice” to make two components integral). Implementing Watanabe’s system with a single IC including a DSP was an obvious choice.

Implementing Watanabe’s CPU and DSP in an SoC provides “an [IC] including a [DSP]” meeting [1.a]. Laub, ¶¶170-171.

- e. **“[IC] including a [DSP] configured to access a [DBMS] including a plurality of optical image aberration corrections”**

- i. **DBMS**

The “digital imaging system” components do not comprise a DBMS. Instead, [1.a] requires the IC “including a DSP” is “configured to access” a DBMS. A DBMS is “software used to create, store, retrieve, change, manipulate, sort, format and print... information in a database.” EX1029, 238; Laub, ¶¶174-176.

- ii. **Watanabe’s IC including a DSP accesses a control program that comprises a DBMS.**

The claims confirm that an IC configured to use system software, e.g., a control program, to access a database, meets an “[IC] including a [DSP] configured to access a DBMS.” E.g., [14.a], [14.e], [14.f]. Watanabe describes an IC including a DSP “configured to access” software (e.g., a DBMS) that interacts with—can access—a database.

Watanabe describes “tables 70 including distortion aberration correction values and peripheral light intensity correction values in accordance with focusing points and zoom positions” that “are prepared... on a lens-to-lens basis[.]” Watanabe, [0047], Fig. 3 (“correction value table 70”). Watanabe’s tables are a database. EX1022 (“Bestgen”), 2:8-12 (“a database may be viewed as one or more tables of information”); EX1023 (“Cesare”), 1:36-39 (“Data records in a computer database are maintained in tables[.]”); Laub, ¶¶172-173. Watanabe’s “table 20 of

correction values” is “prepared” to correct distortion aberration and peripheral lighting based on “focal length and zoom position for each lens[.]” JP-872, [0007]; Laub, ¶172.

Watanabe discloses “a control program stored in the ROM 58” that CPU 57 uses to “control[] each part” of the camera including “a correction process on image data.” Watanabe, [0042]; *id.*, [0048] (“distortion aberration correction process is executed according to distortion aberration information”), [0059] (“CPU 57... control[s] each part of the apparatus according to the image processing program”), Fig. 4 (step S104 image processing); Laub, ¶177.

Watanabe’s “control program” comprises a DBMS because it is software that retrieves image correction data associated with lens-specific focusing points and zoom positions from the database (tables 70, table 20). Watanabe, [0042], [0047], [0049] (“a distortion aberration correction process is executed according to a lens type, a focusing point, and a zoom position”), Fig. 3; JP-872, [0007] (“using the image correction processing program 21, the CPU 7 determines a correction value table based on the lens type, determines a correction value based on the zoom position and focal length, and obtains corrected image data 22”); Laub, ¶¶177-178.

Watanabe’s IC including a DSP is “configured to access” a DBMS because the IC executing Watanabe’s image processing software retrieves image correction

data from the database comprising the correction value table 20 (JP-872, [0007]) or tables 70 (Watanabe, [0047], Fig. 3) and sends the data to the DSP, which uses it to process images. JP-872, [0006]; Watanabe, [0038] (DSP circuit 56 “executes various processes” including “correction” to “image data”), [0060]-[0062], Figs. 1A-1B (DSP receives digitized image data under CPU 57 control); Laub, ¶¶178. In other words—as Watanabe’s Figs. 1A-1B diagrams suggest—the DSP processes captured images and corrects distortion aberrations and peripheral light intensity under CPU control (Watanabe, [0042]), using the correction data from database table 20 (JP-872, [0007], Fig. 3) or table 70 (Watanabe, [0047]-[0049], Fig. 3). Laub, ¶¶180-181.

If Watanabe is regarded as not teaching an IC including a DSP configured to access a DBMS, then a POSA nonetheless would have understood that this was an obvious variation of Watanabe’s disclosure. “If a [POSA] can implement a predictable variation, §103 likely bars its patentability.” *KSR*, 550 U.S. at 417. It was known to have a DSP access a database using software. EX1024 (“Vook”), [0017], [0022], [0025]-[0026], [0035] (video camera has “processor 220” that can executing “image correction algorithm 260” using “image correction data 240”); EX1060, [0015], [0031], Fig. 1; Laub, ¶¶182-186.

iii. “including a plurality of optical image aberration corrections”

Limitation [1.a] recites an IC including a DSP that is “configured to access a [DBMS] *including a plurality of optical image aberration corrections*[.]”

Watanabe’s DBMS accesses a database (tables 70 in Watanabe, [0047], table 20 in JP-872, [0007]) that provides distortion aberration and peripheral light intensity corrections for different lenses at different focus points (e.g., focal length) and zoom positions. Watanabe, [0047], [0049]; JP-872, [0007]. These are a “plurality of optical image aberration corrections” because the peripheral light correction concerns vignetting, an optical image aberration, ([3.a]; *infra* §§VII.C.1 ([13.a]), VI.J (claim 15)), and because Watanabe describes correcting distortions including curvature and lens aberrations (*infra* §VI.C (claim 2)). Laub, ¶187.

f. “memory storage sub-system”

Watanabe discloses a “memory storage sub-system.” Read only memory (“ROM”) 8 “stores programs and data,” random access memory (“RAM”) 9 “temporarily stores data,” and “memory card 10 and built-in memory 19” store image data in “an image data file.” JP-872, [0006], Fig. 1; *see also* Watanabe, [0035] (memory card 60, memory card interface 60a), [0042]; Laub, ¶¶188-189.

3. Limitation [1.b]

1.b	wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;
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Watanabe meets [1.b] because it discloses a zoom lens. *Supra* §VI.B.2.c (limitation [1.a]); Laub, ¶¶190-191.

4. Limitations [1.c] and [1.d]

1.c	wherein the [IC] uses the in-camera software to identify at least one optical image aberration and
1.d	to correct the at least one optical image aberration in at least one frame of the digital video using at least one of the plurality of optical image aberration corrections in the database;

In [1.d] “the database” has no antecedent basis. Limitation [1.a]’s DBMS is software interfacing *between* an application and a database—not a database itself. *Supra* §VI.B.2.e ([1.a]). Regardless, Watanabe discloses a database. *Id.*

Watanabe meets [1.c] and [1.d] because Watanabe’s in-camera software adds “information related to distortion” for “aberration correction” and “peripheral light amount” (e.g., “at least one optical image aberration”) to image data based on the lens used to capture the image. JP-872, [0007]; Watanabe, [0046]; Laub, ¶¶192-195.

Watanabe meets [1.c] because its IC (*supra* §VI.B.2.d) runs software (*supra* §VI.B.2.a) that identifies an optical image aberration correction—and therefore also identifies “at least one optical image aberration”—by database lookup based

on the lens type, focal length, and zoom position for the image capture. Watanabe, [0047] (“CPU determines a table according to a lens type and determines correction values according to a focusing point and a zoom position”); JP-872, [0007] (“using the image correction processing program 21, the CPU 7 determines a correction value table based on the lens type, [and] determines a correction value based on the zoom position and focal length”); *supra* §VI.B.2.e (discussing Watanabe’s database); Laub, ¶192.

Watanabe describes correcting the digital video capture. JP-872, [0006] (DSP “performs various processing” on digitized video input), [0007], [0008], Fig. 4 (step 104); Watanabe, [0047]-[0049]; Laub, ¶193. Watanabe corrects the aberration(s) by applying the correction values. JP-872, [0007]; Watanabe, [0048].

POSAs would have understood that a “frame of the digital video” ([1.d]) means a still image, while a video is a sequence of still images played at a frame rate (frames per second). E.g., Davis, 5:3-9 (NSTC video format comprises 525 lines per frame at 29.97 frames per second); EX1115 (“SMPTE-240”), 1; EX1001, 27:36-38 (“video [can] be viewed as merely a very rapid (30 to 60 frames per second) application of still photography.”); Laub, ¶194. Since Watanabe’s video capture comprises a series of still images, processing the video includes processing at least one frame of the video. Laub, ¶195.

5. Limitation [1.e]

1.e	wherein the video is captured by the at least one digital sensor and is forwarded to the [DSP];
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Watanabe meets [1.e] because Watanabe's CCD captures video and forwards it to the DSP. JP-872, Fig. 1, [0006] (A/D converter 5 digitizes CCD image capture and passes signal to DSP circuit 6); Watanabe, Figs. 1A-1B, [0037]-[0038], [0061]-[0062] (steps 103, 203); *supra* §VI.B.2.b (CCD is "digital sensor"); Laub, ¶¶196-197.

6. Limitation [1.f]

1.f	wherein the video image file with the at least one optical image aberration is corrected by applying digital filtration using the [DSP]; and
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The term "video image file" has no antecedent basis in claim 1. To the extent "video image file" comprises the "at least one frame of the digital video" in [1.d], then Watanabe's DSP corrects it as described below. Watanabe applies "a correction process on image data" recorded in "an image data file" in memory. Watanabe, [0042]; *cf. id.*, [0039] (compressed image data stored as "image data files").

Watanabe meets [1.f] because Watanabe's DSP corrects optical image aberrations in video images (frames, *supra* §VI.B.4) by applying corrections from the database. JP-872, [0006] (DSP "performs various processing" on digitized

video input), [0007] (describing “distortion correction processing”), [0008], Fig. 4 (step 104); Watanabe, [0038] (DSP circuit 56 “executes various processes” including “correction” to “image data”), Figs. 1A-1B (DSP receives digitized image data under CPU 57 control), [0049] (“distortion aberration correction process is executed”), [0061]-[0062] (steps 103 and 203); Laub, ¶¶202-204. Watanabe’s DSP processes the captured images under CPU control (Watanabe, [0042], [0059]-[0060], Figs. 1A-1B) using the correction data from the database table 70 as shown in Fig. 3. Laub, ¶205.

The DSP applies “digital filtration” because it numerically processes the image. EX1028, 193 (“digital filter” is “the computational process or algorithm by which a sampled signal or sequence of numbers (acting as an input) is transformed into a second sequence of numbers termed the output signal.”); JP-872, [0008] (“image processing program... performs image processing on the image data”); Watanabe, [0048]-[0049], [0062]-[0063]; Laub, ¶¶98-111, 198-201. The ’685 specification uses “digital filtration” the same way. EX1001, 15:20, 15:36-39 (describing data interpolation as example of “digital filtration”), 32:42-33:2 (citing fast Fourier transform as an example of a “digital filtration process”).

7. Limitation [1.g]

1.g	wherein the corrected video consisting of the digital data optimized from the at least one optical image aberration that are corrected from the original video image is stored in the memory storage sub-system.
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Watanabe meets [1.g] because it discloses memory card 10 and memory card interface 10a storing processed image data (“corrected video”). JP-872, [0006] (“CPU 7 controls the recording operation of image data to the memory card 10”), [0007] (“it is possible to record data that has been subjected to distortion aberration correction”), [0008] (step 206); *see also* Watanabe, Fig. 1B (memory card 60), Fig. 3 (corrected image data 72), [0058] (corrected image data “is recorded on the memory card 60”), [0063] (step 206); Laub, ¶207.

C. Claim 2

For claims 2, 5-6, 27, and 29, Watanabe meets claim 1. *Supra* §VI.B.

2.PRE	The system of claim 1:
2.a	wherein the optical image aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, and/or flare types of optical image aberrations.

Limitation [2.a] recites “optical image aberrations include at least one of” particular aberrations joined by “and/or.” A single “optical image aberration” from the list meets [2.a]. The *plural* “optical image aberrations” has no antecedent basis in claim 1, which recites a *singular* “optical image aberration” in [1.a], [1.c], [1.d],

[1.f], and [1.g]. A single aberration in claim 1 is consistent with a single aberration (“at least one”) from the list in claim 2.

Watanabe meets [2.a] because it describes correcting “curvature aberration” (JP-872, [0007]) and lens distortion. Watanabe, [0006] (in “table look-up method... a *lens distortion aberration rate* is predetermined at each focusing point and zoom position”), [0049] (distortion aberration corrected for each lens type, focusing point, and zoom position); JP-872, [0002] (“lens distortion rate”), [0004] (“[d]istortion aberration correction processing based on the lens type, focal length, and zoom position”); Laub, ¶¶210-211.

D. Claim 5

1. Limitations [5.PRE] and [5.a]

5.PRE	The system of claim 1:
5.a	wherein each lens type is registered in the camera database;

POSAs would have understood that “registered in the camera database” meant that a database associated correction data ([5.c] “filtration solutions”) with “each lens type.” Laub, ¶¶214-215 (citing EX1058, Abstract; EX1023, 1:36-39).

Watanabe meets [5.a] because its tables (“camera database”) associate each lens type with correction data for a given focal length and zoom position. Watanabe, [0047] (tables 70); JP-872, [0007] (table 20); *supra* §VI.B.2.e.ii (limitation [1.a]); Laub, ¶¶216-220.

2. Limitation [5.b]

5.b	wherein the multiple optical aberrations of each lens is listed in the database;
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Watanabe meets [5.b] because its tables store corrections for curvature aberration, lens distortion, and vignetting (“multiple optical aberrations”) for each lens used in the imaging system. *Supra* §VI.C (curvature aberration, lens distortion), *infra* §VI.J (vignetting); Laub, ¶¶221.

3. Limitation [5.c]

5.c	wherein the filtration solutions to the lens optical aberrations are listed in the database;
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The “filtration solutions” are parameters for implementing the digital filter providing aberration correction in [1.d] and [1.f]. *Supra* §§VI.B.4 ([1.d]), VI.B.6 ([1.f]); Laub, ¶¶222-223. Watanabe meets [5.c] because its tables (“the database”) store the corrections (“filtration solutions”) for the lens optical aberrations. *Supra* §§VI.A, VI.B.2.e.ii ([1.a]), VI.B.6 ([1.f]); Bestgen, 2:8-12; Laub, ¶224. POSAs would have understood that listing filter solutions to correct lens aberrations was a conventional use of a database for correcting lens optical aberrations. E.g., Vook,

[0023], [0035]; EX1025 (“Hoenninger”), 4:11-14 (database stores filter coefficients); Laub, ¶225.

4. Limitation [5.d]

5.d	wherein the filtration of each lens optical aberration is applied by the digital signal processor; and
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Watanabe meets [5.d] because its DSP applies corrections (“the filtration”) for “each lens optical aberration.” *Supra* §VI.B.6 (limitation [1.f]); Laub, ¶226.

5. Limitation [5.e]

5.e	wherein after the digital signal processor applies the filtration to correct the optical image aberrations the corrected digital file is forwarded to storage in memory.
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Watanabe meets [5.e] for the same reason it meets limitation [1.g]. *Supra* §VI.B.7; Laub, ¶227.

E. Claim 6

1. Limitations [6.PRE], [6.a], [6.b], and [6.f]

Watanabe meets [6.PRE], [6.a], [6.b], and [6.f] for the same reasons

Watanabe meets the corresponding limitation in claim 1. Laub, ¶229.

Limitation	Corresponding Limitation	Discussion
[6.PRE]	[1.PRE]	§VI.B.1
[6.a]	[1.a]	§VI.B.2
[6.b]	[1.b]	§VI.B.3
[6.f]	[1.g]	§VI.B.7

While “corrected video file” in [6.f] has no antecedent basis in claim 6, Watanabe discloses saving corrected video in memory as explained for [1.g]. Laub, ¶230. Watanabe stores corrected video in a file. E.g., Watanabe, [0039] (data stored in memory “as image data files”), [0063] (“processed data are recorded on a file” in “memory card 60”); Laub, ¶231.

Watanabe meets the remaining limitations in claim 6 as follows.

2. Limitation [6.c]

6.c	wherein the video is forwarded to storage in memory;
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Claim 6 confirms that [6.c] recites a capability to store video *before* correcting digitized video as recited in [6.g]. E.g., [6.g] (DSP corrects aberration in video), [6.f] (“corrected digital video file is stored in memory”).

Watanabe meets [6.c] in at least two ways. First, Watanabe describes “a recording device capable of adding additional information to an image in an image file and of recording the image to which the additional information is added[.]” Watanabe, [0013], Figs. 10-11. Watanabe’s RAM 59 “temporarily stores data to be processed,” e.g., stores the image data before digital processing. Watanabe, [0039]; JP-872, [0006] (RAM 9); Laub, ¶232. Second, Watanabe discloses storing compressed image data—which is not required to be corrected—in a memory card and internal memory. JP-872, [0006] (memory card 10, built-in memory 19); Watanabe, [0035] (memory card 60, internal memory 69); Laub, ¶233.

Furthermore, POSAs would have had reasons to store captured video in order to provide a temporary buffer before processing the image. EX1061 (“Juen”), Abstract, 1:15-35; Laub, ¶¶234-237. A temporary buffer facilitated “synchronous control of the whole camera.” Juen, Abstract, 1:15-35; Laub, ¶¶234-235. The buffer capacity accounts for data volume and system processing power. Juen, 3:59-63; Laub, ¶236. Buffering the image data in this manner would have provided Watanabe’s system more time to process aberrations in each video frame or to devote processing to intermittent (e.g., asynchronous) tasks without disrupting the ability to process sequential video frames. Laub, ¶¶235-237.

3. Limitation [6.d]

6.d	wherein at least one optical aberration in at least two frames of the digital video are identified using the in-camera software and the integrated circuit;
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Watanabe discloses using the IC and in-camera software to identify and correct at least one optical aberration in at least one frame of digital video. *Supra* §VI.B.4 ([1.d]). Watanabe identifies and corrects aberrations in successive frames, e.g., “in at least *two* frames of the digital video,” because the video is a series of still images, any one of which was expected to contain an optical aberration. JP-872, [0006]-[0008]; Watanabe, [0046]-[0049]; *supra* §VI.B.4 ([1.d]); Davis, 5:3-9; SMPTE-240, 1; EX1001, 27:36-38; Laub, ¶¶239-241. There was little point in Watanabe correcting a single frame in a digital video without also correcting

distortion aberrations in other frames, particularly since NTSC video provided 29.97 frames a second. Laub, ¶¶242-243.

4. Limitation [6.e]

6.e	wherein the at least one optical aberration from the optical lens mechanism of at least two frames of the digital video are corrected by using the digital signal processor to apply at least one digital filtration algorithm; and
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Watanabe meets limitation [6.e] because it executes an “image process... on image data in accordance with the process information” (Watanabe, [0062] (step 104)) for correcting distortion aberration and peripheral light intensity (Watanabe, [0049]). Laub, ¶245. Watanabe meets [6.e] for successive video frames (“at least two frames”) because it describes processing digital video. *Supra* §§VI.B (claim 1), VI.E.3 ([6.d]); Laub, ¶248.

The “digital filtration algorithm” is an algorithm for applying digital signal processing (“digital filtration”). EX1028, 193; *supra* §VI.B.6 ([1.f]); Laub, ¶¶244-246. Watanabe’s DSP applies a digital filtration algorithm because it applies the correction data retrieved from Watanabe’s tables to correct image data as explained for [1.f]. *Supra* §VI.B.6; Laub, ¶247.

F. Claim 7

For claims 7, 11-12, Watanabe meets claim 6. *Supra* §VI.E. Watanabe meets [7.a] for the same reasons it meets [2.a] *supra* §VI.C. Laub, ¶¶251.

G. Claim 11

Limitation [11.a] recites “the digital video is filtered to correct at least one optical and/or digital aberrations [sic] after initial capture and before the digital video is initially sent to storage.” The ’685 patent describes “digital aberrations” as “digital artifacts” from, e.g., dust or aliasing. EX1001, 8:15-17.

Watanabe meets [11.a] because Watanabe describes correlated double sampling (“CDS”) on video after its initial capture and before storing it. JP-872, [0006], Fig. 1 (CDS 4); Watanabe, [0035], [0037] (“the CDS circuit... reduc[es] noise for the CCD-type image photographing device”), Fig. 1A (CDS 54); Laub, ¶¶254-264. CDS enhances the signal-to-noise ratio in a CCD image capture and removes fixed-pattern noise. EX1034 (“Tsay”), 1:28-32; EX1062, 1911; Laub, ¶¶256-260. The noise suppressed by CDS is a “digital aberration” because it is an image artifact from a digital sensor (the CCD). EX1001, 6:32-34 (“Additional aberrations are linked to the unique design of each type of digital sensor, with trade-offs presented between types of CCDs or CMOS chips.”); Laub, ¶¶261-262. Watanabe’s CDS “filters” the “digital video” because CDS blocks low-frequency noise components, e.g., it provides a form of high-pass filter. Laub, ¶263.

H. Claim 12

Watanabe meets claim 12 because an SoC is an obvious design choice for implementing Watanabe. *Supra* §VI.B.2.d ([1.a]); Laub, ¶¶267-273.

I. Claim 14

1. Limitations [14.PRE], [14.a], [14.b], and [14.h]

Watanabe meets these claim 14 limitations for the same reasons Watanabe meets the corresponding limitation in claim 1. Laub, ¶275.

Limitation	Corresponding Limitation	Discussion
[14.PRE]	[1.PRE]	§VI.B.1
[14.a]	[1.a]	§VI.B.2
[14.b]	[1.b]	§VI.B.3
[14.h]	[1.g]	§VI.B.7

Watanabe meets the remaining limitations in claim 14 as follows.

2. Limitation [14.c]

14.c	wherein the zoom lens changes focal length positions;
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Watanabe meets [14.c] because it describes a zoom lens and a “mechanical mechanism” that includes autofocus and moves the lens, thereby changing its focal length position, as explained for [1.a]-[1.b]. *Supra* §§VI.B.2.c-VI.B.3; JP-872, [0007] (correcting distortion aberration and peripheral light intensity based on “focal length and zoom position for each lens”); Watanabe, [0049] (same for “focusing point and a zoom position”); Laub, ¶¶276-281.

3. Limitation [14.d]

14.d	wherein when the digital video is forwarded to the [DSP] and to memory;
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Watanabe meets [14.d] for the same reasons it meets [1.e] and [6.c]. *Supra* §§VI.B.5, VI.E.2; Laub, ¶282.

4. Limitation [14.e]

14.e	wherein the [IC] uses system software to access the database to identify at least one optical aberration in at least one frame of the video at any focal length of a zoom lens configuration;
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Watanabe meets [14.e] because the in-camera software (“system software”) accesses Watanabe’s database and identifies at least one optical aberration in a video frame based on lens, focal length, and zoom position. *Supra* §VI.B.4 ([1.c]-[1.d]); Laub, ¶283. Watanabe discloses distortion aberration and peripheral light intensity corrections for different lens focal lengths. JP-872, [0007] (correcting distortion aberration and peripheral light intensity based on “focal length and zoom position for each lens”); Watanabe, [0049] (same for “focusing point and a zoom position”); Laub, ¶¶284-285. Watanabe can correct each frame of a digital video as explained *supra* §§VI.B.2.a ([1.a]), VI.B.4 ([1.c]-[1.d]).

5. Limitation [14.f]

14.f	wherein the [IC] accesses the database to obtain at least one filtration correction algorithm to the optical image aberration of at least one frame in the video file and forwards the at least one filtration algorithms to the [DSP];
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a. Terms.

The “video file” in [14.f] has no antecedent basis in claim 14. *Cf.* [1.f] (“video image file”), *supra* §VI.B.6. Regardless, POSAs would have understood that Watanabe was capable of applying corrections to a frame in a video file. E.g., Watanabe, [0039] (data stored in memory “as image data files”); Laub, ¶287.

A POSA would have understood that a “filtration correction algorithm” includes a “specific sequence of operations” applied by the DSP. E.g., EX1069, 6:37-62; EX1070, 1:48-50, 2:14-16, 2:50-56; EX1071, 13:8-17; EX1072, 10:28-32; Laub, ¶288.

b. Watanabe makes algorithm storage a design choice.

Watanabe does not explain where it stores the algorithms that its DSP applies, leaving this detail to a POSA. A POSA would have understood that there were two known alternatives: (1) storing the algorithm(s)—as executable code—in the DSP, or (2) storing them in other memory or computer-readable medium and loading them into the DSP as needed. Laub, ¶¶289-290. It was known to select and load algorithms from memory to provide particular signal processing (“filtration”) at the DSP. Laub, ¶¶288 (discussing EX1069-EX1072), 291. A design choice between two known implementations is obvious. *ACCO Brands*, 813 F.3d at 1367.

A POSA would have understood to store or—at a minimum—identify the DSP filtration algorithm for a particular aberration correction in Watanabe’s database in order to employ the stored parameters (for example as memory offset or look-up address in the database to the algorithm memory location). Laub, ¶¶292. Thus, Watanabe’s IC would “obtain” the correction algorithm by accessing the database for the algorithm—or information identifying it—then “forward” the algorithm to the DSP so that it could apply the filter and correct the aberration. Laub, ¶¶292-293. The retrieval option frees the DSP from having to store every aberration correction algorithm used by the system and instead load them as needed.

Watanabe meets the remaining language in [14.f] because it teaches correcting distortion aberration or peripheral light intensity in at least one digital video frame as explained *supra* §§VI.B.4 ([1.d] one frame); VI.E.4 ([6.e] “in at least two frames”). Watanabe forwards the “at least one filtration algorithm[]” to the DSP because Watanabe teaches the DSP applying the digital filter to correct optical image aberrations as explained *supra* §VI.B.6 ([1.f] DSP applies “digital filtration” based on corrections from database). Laub, ¶¶294-298.

6. Limitation [14.g]

14.g	wherein the digital video is forwarded to the [DSP] which applies at least one filtration algorithm to optimize the digital video and corrects the at least one optical image aberration in at least one video frame for the at least one focal length in the zoom lens configuration; and
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Watanabe meets [14.g] because it teaches forwarding the video to the DSP as explained for [1.e]. *Supra* §VI.B.5; Laub, ¶299.

Watanabe's DSP applies the distortion aberration and peripheral light intensity corrections to "at least one video frame" using "digital filtration." *Supra* §§VI.B.4 ([1.d]), VI.B.6 ([1.f]), VI.I.5 ([14.f]). Laub, ¶300. The DSP correction applies a "filtration algorithm" because the correction implements digital filtering. *Supra* §§VI.B.6 ([1.f]), VI.D.3 ([5.c]). EX1028, 193; Laub, ¶301. The corrections are "for... at least one focal length in the zoom lens configuration" because Watanabe describes selecting corrections based on lens, focal length, and zoom position. JP-872, [0007]; Watanabe, [0049]; Laub, ¶302.

J. Claim 15

For claims 15 and 17, Watanabe meets claim 14. *Supra* §VI.I. Watanabe meets [15.a] for the same reasons it meets [2.a]. *Supra* §VI.C; Laub, ¶306.

Watanabe further describes correcting “vignetting” [15.a]. *Infra* VII.C.1 ([13.a]); Laub, ¶307.

K. Claim 17

Limitation [17.a] recites “*each focal length of a zoom lens...* is analyzed for *a different set of optical aberrations.*” Aberrations associated with each focal length for a given zoom lens are a “different set of optical aberrations” because each focal length is associated with one or more aberrations. Laub, ¶310.

Watanabe meets [17.a] because tables 20 and 70 (the database) contain correction data for optical aberrations, at each focal length and zoom position, for each lens type. *Supra* §§VI.B.2.e ([1.a]), VI.I.4 ([14.e]); JP-872, [0007]; Watanabe, [0046]-[0049]; Laub, ¶311.

L. Claim 27

Watanabe meets claim 27 because it stores a “control program” that includes an “image processing program” that contains “machine readable instructions.” JP-872, [0006]-[0008]; Watanabe, [0042]-[0064]; Laub, ¶313. Watanabe’s program corrects lens distortion. *Supra* §VI.C (claim 2).

M. Claim 29

Watanabe meets claim 29 because its image processing program corrects curvature aberrations. *Supra* §VI.C ([2.a]); JP-872, [0007]; Laub, ¶315.

VII. GROUND 2: WATANABE IN VIEW OF KISHIDA RENDERS OBVIOUS CLAIMS 3, 13, 19

A. Kishida

Kishida describes image processing software to “[p]rovide an appropriate image by achieving both shading... and exposure correction[.]” Kishida, Abstract, [0020] (image processing techniques embodied in computer software). Kishida describes an imaging system that optimizes exposure based on a prediction of shading that will occur in an image. Kishida, [0011]. Kishida’s methodology reduces processing power requirements for exposure and shading correction. Kishida, [0012]; Laub, ¶¶316-322.

B. Watanabe In View Of Kishida

Watanabe describes correcting peripheral lighting (e.g., shading or vignetting) in digital video but does not describe optimizing exposures, alone or in cooperation with shading corrections. Laub, ¶323.

POSAs would have had reasons to use Kishida’s exposure and shading correction teachings with Watanabe in order to improve Watanabe’s image processing. Laub, ¶¶324-325. Exposure optimization was a known imaging problem regardless of vignetting. Using Kishida’s teachings in Watanabe would provide an imaging system that could correct exposure and vignetting problems while avoiding the known problems with processing requirements for prior approaches. Kishida, [0008], [0012]; Laub, ¶¶325, 327.

POSAs would have had a reasonable expectation of success because Kishida implemented its techniques in software that POSAs knew how to implement in Watanabe's control program. Kishida, [0020]; Laub, ¶326. The programming implementing Kishida's teachings in Watanabe was within the POSA's ordinary skill and would produce predictable results. Laub, ¶¶326-327.

C. Claim 13

1. Limitations [13.PRE] and [13.a]

13.PRE	The system of claim 6:
13.a	wherein the optical image aberration is vignetting;

Watanabe in view of Kishida (hereinafter "Watanabe+Kishida") meets claim 6 for the reasons Watanabe meets claim 6 (*supra* §VI.E). Watanabe+Kishida meets [13.a] because Watanabe describes correcting peripheral light intensity (Watanabe, [0032], [0048]-[0049], Fig. 8), e.g., "correcting brightness of a peripheral portion of an image" (Watanabe, [0056]), which corrects vignetting. *Supra* §V.B (claim construction); Laub, ¶330.

2. Limitation [13.b]

13.b	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 comers [sic] of the at least two image frames or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the comers [sic] of the image of at least two image frames; and
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The typographical error “comers” should read “corners.” Cf. [19.b]; Laub, ¶331. An image “corner” is a peripheral portion of an image. Laub, ¶¶331-333.

Watanabe+Kishida meets [13.b] because Watanabe’s DSP “applies an algorithm to lighten the [corners] of the at least two image frames” as follows. Watanabe explains that image brightness decreases from the center to a peripheral portion. Watanabe, [0024] (“Fig. 8... show[s] degradation of light intensity of a peripheral portion”), [0054], Fig. 8; Laub, ¶¶334-335. Watanabe corrects “the light intensity of a peripheral portion of the image” by “correcting brightness... according to the cosine fourth law [a peripheral portion] so that it may be substantially the same brightness of the center portion[.]” Watanabe, [0056]; Laub, ¶336. This applies an algorithm (the “cosine fourth law”) to “lighten” the image’s “peripheral portion,” which includes “corners.” Laub, ¶337. POSAs would have understood that this correction applied to “at least two image frames” for the reasons explained for limitation [6.e]. *Supra* §VI.E.4; Laub, ¶338.

3. Limitation [13.c]

13.c	wherein the image exposure for at least two frames in the digital video file is optimized to correct the vignetting.
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Watanabe+Kishida meets [13.c] because Kishida describes “exposure correction control based on shading prediction.” Kishida, [0010]; *id.*, [0015]; Laub, ¶¶339-340. Kishida’s shading phenomenon is vignetting. Kishida, [0002]-[0003], [0017], [0070]; Laub, ¶318. Kishida’s coordinated vignetting and exposure control optimizes the image exposure to correct vignetting. Laub, ¶¶339-341. Watanabe+Kishida applies Kishida’s optimization to “at least two frames” of a digital video in the same manner as optimizing a single still photograph because video is a series of images. EX1001, 27:37-38; *supra* §§VI.B.4 ([1.d]), VI.E.4 ([6.e]); Laub, ¶342.

D. Claims 3 and 19

Watanabe+Kishida meets claims [3.PRE] and [19.PRE] for the same reasons that Watanabe meets claim 1 (*supra* §VI.B) and claim 14 (*supra* §VI.I), respectively. Watanabe+Kishida meets remaining claim 3 and 19 limitations for the reasons it meets the corresponding limitation in claim 13. Laub, ¶347.

Limitation	Corresponding Limitation	Discussion
[3.a], [19.a]	[13.a]	§VII.C.1
[3.b], [19.b]	[13.b]	§VII.C.2
[3.c], [19.c]	[13.c]	§VII.C.3

VIII. GROUND 3: WATANABE IN VIEW OF KITA RENDERS OBVIOUS CLAIMS 4, 8, 9, 16

A. Kita

Kita describes correcting image aberrations from a lens by filtering in the spatial frequency domain, then transforming the corrected image back to image space. Kita, Abstract, [0008]-[0010]; Laub, ¶348. Kita transforms images between image space and spatial frequency space using a fast Fourier transform (“FFT”) and its inverse. Kita, [0026]; Laub, ¶348. Kita restores the image (removes aberrations) by applying a filter representing the inverse of the lens modulation transfer function (“MTF”), which represents the filtering effect of the lens on a captured image. Kita, [0008]-[0010], [0012], [0027], [0041]; Laub, ¶¶348-353. The inverse MTF filter changes with the lens and optical system characteristics like zoom value, focus value, and iris value when the image is taken. Kita, [0011], [0014], [0016]-[0017], [0021], [0059], [0078]; Laub, ¶¶348, 354.

B. Watanabe In View Of Kita

Excepting vignetting Watanabe does not detail a methodology for correcting optical aberrations. Kita provides detailed explanations for correcting optical aberrations using principles and techniques based on Fourier optics and inverse MTF filters for a lens under different settings including zoom lens position and focus. Kita, [0059]; Laub, ¶¶355-356.

POSAs would have had reasons to apply Kita’s filtering and image restoration teachings with Watanabe’s teachings to implement Watanabe’s aberration corrections (a detail left to POSAs). Laub, ¶357. This would combine familiar techniques and components (Kita’s image restoration with Watanabe’s imaging and image processing system) yielding predictable results. Laub, ¶358; *KSR*, 550 U.S. at 416. POSAs would have had a reasonable expectation of success because Kita’s techniques used software that could be implemented in Watanabe’s system, and doing so was within the POSA’s ordinary skill. Laub, ¶359. POSAs would have known that Kita’s technique applied to Watanabe’s digital video captures because Kita’s technique applied to images and the digital video is a series of images. EX1001, 27:36-38; *supra* §VI.B.4 ([1.c], [1.d]); Laub, ¶360.

C. Claims 4, 8, 9, and 16

Watanabe in view of Kita (hereinafter “Watanabe+Kita”) meets the claims 4, 8-9, and 16 preambles/dependency for the same reasons that Watanabe meets the independent claims:

Limitation	Independent Claim	Discussion
[4.PRE]	1	§VI.B
[8.PRE], [9.PRE]	6	§VI.E
[16.PRE]	14	§VI.I

1. Limitations [4.a], [8.a], [16.a]

Limitations [4.a] and [8.a] recite the DSP “applies at least one fast Fourier transform (FFT) algorithm” to correct “at least one optical image aberration,” while [16.a] recites “to correct optical... aberration in the digital video.”

Watanabe+Kita meets [4.a], [8.a], and [16.a] because Kita describes correcting optical image aberrations by transforming an image using FFT, applying the inverse MTF filter, then recovering the original image—corrected for lens aberrations—by inverse FFT. Kita, [0027]; Laub, ¶367. The “MTF correction filtering” uses “the MTF inverse function table 87” with parameters determined from optical system settings including zoom value, defocusing value, and iris parameters. Kita, [0059]-[0061]; Laub, ¶368. The inverse MTF filter corrects for the optical aberrations introduced by the lens. Kita, Abstract (inverse function for MTF restores “original image”), [0011] (“restoration filtering” uses “the filter of the curve of the inverse function of the... transfer function” depending on the “optical adjustment” values for the optical system), [0027]; Laub, ¶369.

Watanabe+Kita further meets [16.a] because Watanabe corrects “optical aberrations” in digital video. *Supra* §VI.E.4 ([6.e]). Laub, ¶370.

2. Limitation [9.a]

Limitation [9.a] recites the DSP using FFT to correct “digital aberrations of at least two frames in the digital video.” Kita teaches that during the image

restoration “the IFFT image [e.g., the corrected image in image space] generated by filtering may be tiled, resulting in a very unsightly image.” Kita, [0039]; Laub, ¶371. The tiling is a “digital aberration” because it is a “digital artifact” like the result of “aliasing and dust.” EX1001, 8:15-17; Laub, ¶372. Kita corrects these digital aberrations by sampling smaller pixel blocks within the image. Kita, [0040]; Laub, ¶373. Watanabe-Kita can correct successive frames of digital video for the same reasons that Watanabe can. *Supra* §VI.E.4 ([6.e]); Laub, ¶374.

IX. GROUND 4: WATANABE IN VIEW OF TAKANE RENDERS OBVIOUS CLAIMS 10, 18, 28, 30

A. Takane

Takane describes image processing for dynamic images from a digital video camera ([0006]) that provides corrections to “pin-cushion” and “barrel” distortion ([0005]) and “white balance adjustment, gamma correction, sharpness correction, and the like” ([0044]) in addition to distortion correction ([0043]). Laub, ¶¶375-378.

B. Watanabe In View Of Takane

Watanabe describes correcting optical image aberrations and peripheral lighting but does not explicitly describe other corrections like white balance adjustment, or correcting pin-cushion or barrel distortions in particular. Laub, ¶379.

POSAs would have had reasons to use Takane’s white balance adjustment and distortion correction teachings with Watanabe’s image processing in order to improve and extend Watanabe’s functionality. Laub, ¶¶380. Watanabe describes correcting lens distortion (*supra* §VI.C), which Takane describes as including pin-cushion and barrel distortion (Takane, [0005]). Laub, ¶¶381-383. POSAs would have had a reasonable expectation of success because Takane teaches correcting images in a distortion correcting circuit operating on digital image data (Takane, [0043]), which POSAs would have known could be accomplished by adding Takane’s corrections to software that executed corrections in Watanabe’s DSP. Laub, ¶¶384, 386. Watanabe’s system with software implementing at least Takane’s white balance adjustment and correcting pin-cushion and barrel distortion is Watanabe+Takane. Laub, ¶¶387-390.

C. Claims 10 and 18

Watanabe+Takane meets [10.PRE] and [18.PRE] for the same reasons that Watanabe meets claims 6 (*supra* §VI.E) and 14 (*supra* §VI.I), respectively.

1. Limitation [10.a]

Limitation [10.a] recites “wherein the [DSP] applies color filtration to at least two frames of the digital video image.” Watanabe+Takane meets [10.a] because Takane discloses a “signal processing circuit” that makes corrections to “digital image data” including “white balance adjustment[.]” Takane, [0044];

Laub, ¶¶394-395. “White balance” adjusts a digital photograph to make its colors appear more realistic. EX1035 (“Dorrell”), [0003], [0025], [0145]-[0146]; Laub, ¶388. When a DSP adjusts an image white balance, it applies color filters (“color filtration”). Dorrell, [0155]; Laub, ¶396. Takane’s image processing applies to “dynamic images,” meaning video. Takane, [0043]; Laub, ¶397.

Watanabe+Takane applies to “at least two frames of the digital video” for the same reasons Watanabe’s processing applies to “at least two frames of the digital video.” *Supra* §VI.E.4 ([6.e]); Laub, ¶¶397-398.

2. Limitation [18.a]

Watanabe+Takane meets [18.a] for the same reasons it meets [10.a]. Laub, ¶399.

D. Claims 28 and 30

Claims 28 and 30 depend from claim 1, which Watanabe+Takane meets for the reasons Watanabe meets claim 1 (*supra* §VI.B).

Claim 28 recites machine readable instructions to correct pin cushion distortion aberrations. Watanabe+Takane meets claim 28 because Takane describes correcting pin-cushion distortions (Takane, [0005]), and Watanabe+Takane implements the corrections in machine readable instructions (*supra* §IX.A). Laub, ¶¶402-404.

Claim 30 recites machine readable instructions to correct barrel distortion aberrations. Watanabe+Takane meets claim 30 because Takane describes correcting barrel distortions (Takane, [0005]), and Watanabe+Takane implements the corrections in machine readable instructions (*supra* §IX.A). Laub, ¶¶405-407.

X. GROUND 5: WATANABE IN VIEW OF HISAMATSU RENDERS OBVIOUS CLAIMS 22-23, 25

A. Watanabe In View Of Hisamatsu

Hisamatsu describes correcting digital image “data” from an “image capture element” in a digital camera using “optical characteristic data” ([0005], [0006]) of a lens ([0007]) in an “arithmetic operation circuit that... performs data arithmetic operation processing” ([0019]), where the “optical characteristic data” of the “optical lens is... aberration data” ([0007]). Laub, ¶410. Hisamatsu specifically describes aberration data including well-known spherical, chromatic, and coma aberrations from optical lenses. Hisamatsu, [0002]; Laub, ¶¶408-411.

Watanabe describes correcting distortion aberrations but does not specifically describe correcting spherical, chromatic, or coma aberrations. POSAs would have had reasons to include Hisamatsu’s spherical, chromatic, or coma aberration corrections in Watanabe because this would have improved Watanabe’s system and extended its distortion correction capabilities to include other known imaging defects. Laub, ¶¶411-414.

POSAs would have had a reasonable expectation of success because the programming to implement Hisamatsu's corrections on a DSP was within the POSA's ordinary skill. Laub, ¶415. POSAs would have had a reasonable expectation that Hisamatsu's corrections to still images would work with digital video because digital video is a series of images. *Supra* §VI.B.4 ([1.c], [1.d]). Laub, ¶416.

B. Claims 22-23, 25

Claims 22-23 and 25 recite a system that includes “machine readable instructions” for correcting spherical (claim 22), chromatic (claim 23), and coma (claim 25) aberrations. Watanabe in view of Hisamatsu meets claims 22-23 and 25 because it includes machine readable instructions to correct these distortions. Hisamatsu, [0002]; Laub, ¶¶418-420.

XI. GROUND 6: WATANABE IN VIEW OF TURNER RENDERS OBVIOUS CLAIM 24

Turner describes software “for correcting... light scattering... in digital images.” Turner, Abstract; *id.*, [0006]. Watanabe does not specifically describe correcting light scattering. POSAs would have had reasons to use Turner's teachings in Watanabe's image processing program to extend Watanabe's functionality and improve its system to include other known imaging defects. Laub, ¶¶424-425. POSAs would have had a reasonable expectation of success

because the programming to implement Turner’s teachings in Watanabe’s digital image processing was within the POSA’s ordinary skill. Laub, ¶426.

Thus, Watanabe in view of Turner (“Watanabe+Turner”) renders claim 24 obvious because it meets claim 1 for the reasons Watanabe meets claim 1 (*supra* §VI.B), and because Watanabe+Turner includes “machine readable instructions for the system to correct scatter light aberrations.” Laub, ¶¶421, 427.

XII. GROUND 7: WATANABE IN VIEW OF LIEGE RENDERS OBVIOUS CLAIM 26

A. Watanabe In View Of Liege

Liege describes correcting images from digital video frames for “defect[s] related to the characteristics of the optical system” (e.g., the lens) including astigmatism. Liege, 9:1-24, 30:18-20, 31:55-56, 39:58-40:32 (claim 1), 40:58-62 (claim 4). Liege describes a database “integrated into the image-capture appliance” containing “formatted information” for the optical system characteristics. Liege, 22:7-13; Laub, ¶428. The “formatted information” is “associated” with images and includes “distortion characteristics” for the “technical characteristics of [the] image-capture appliance” (e.g., the lens). Liege, 21:59-64; Laub, ¶428. The “formatted information” can be “structured into one or more tables” and includes focal distance and geometric defects “at the moment of filming” including astigmatism. Liege, 22:29-23:4; Laub, ¶428.

Watanabe does not specifically describe correcting astigmatism. POSAs would have had reasons to use Liege's astigmatism correction in Watanabe's system because this would improve Watanabe's functionality by adding an additional distortion correction; would provide a known solution (Liege's astigmatism correction) to a known imaging problem (aberrations from astigmatism); and would apply familiar techniques (Liege's astigmatism correction) to known components (Watanabe's imaging and image processing system) yielding predictable results. Laub, ¶429; *KSR*, 550 U.S. at 416. POSAs would have had a reasonable expectation of success because Watanabe describes image processing components supporting Liege's astigmatism correction, including a database comprising tables associating particular distortion corrections with optical system lenses at different focal length and zoom settings, to which astigmatism corrections would simply add additional tables. Laub, ¶430. POSAs would have understood that adding software to Watanabe's system implementing Liege's astigmatism correction was within the POSA's ordinary skill. Laub, ¶¶431-432.

B. Claim 26

Watanabe in view of Liege ("Watanabe+Liege") meets claim 1 for the reasons Watanabe meets claim 1 (*supra* §VI.B). Watanabe+Liege meets claim 26 because it includes software implementing Liege's astigmatism correction in

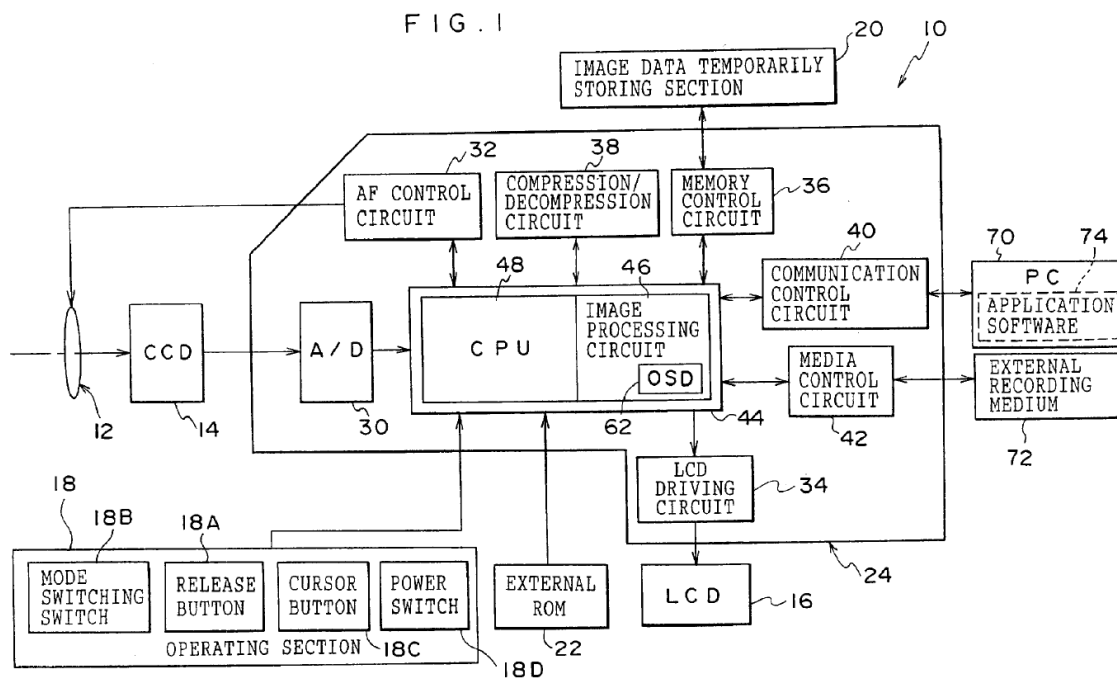
images from digital video. *Supra* §XII.A; Laub, ¶434. The software is “machine readable instructions for the system to correct astigmatism aberrations.” Laub, ¶¶435-436.

XIII. GROUND 8: TAKANE IN VIEW OF WATANABE RENDERS OBVIOUS CLAIMS 1-2, 6-7, 10, 12, 14-15, 17-18, 27-28, 30

A. Takane In View Of Watanabe

Takane describes a digital imaging system that captures video and provides image processing that corrects distortion. Takane, Abstract; Laub, ¶437. Takane’s digital camera includes “external ROM 22 in which various programs, parameters, conversion tables and the like are stored in advance[.]” Takane, [0033], Figs. 1-2.

Takane describes storing polynomial coefficients (hereinafter “correction parameters”) that “approximate[] the amount of displacement of the optical distortion... in advance” in distortion correction circuits 56 and 58 of image processing circuit 46 (Fig. 1, below), which “correct the optical distortion” in image data “using these parameters.” Takane, [0054]. Takane also stores correction parameters based on “image size.” Takane, [0060]; Laub, ¶439.



Takane, Fig. 1.

While Takane explains that it was known to store parameters “for each focal length” of different lenses and to “carry[] out correction by selecting the parameters in accordance with the focal length at the time of photographing” ([0008]), Takane leaves the camera’s data storage and retrieval techniques to the POSA. Laub, ¶¶440-442.

Watanabe discloses an imaging system that uses different lenses and storing optical distortion correction parameters by lens, focal length, and zoom position in tables. *Supra* §§VI.A, VI.B.2.e ([1.a]), VI.B.4 ([1.d]). Watanabe’s tables comprise a database. *Supra* §VI.B.2.e.ii ([1.a]); Bestgen, 2:8-12; Cesare, 1:36-39; Laub, ¶443. Watanabe’s control program retrieves image correction data

associated with lens-specific focusing points and zoom positions from the database (tables 70, table 20), thus comprising a DBMS. *Supra* §VI.B.2.e.i ([1.a]); Laub, ¶444. Watanabe's software provides the distortion correction parameters to the DSP to correct image distortions. *Supra* §VI.B.2.e ([1.a]); Laub, ¶444.

POSAs would have had reasons to use Watanabe's interchangeable lenses, database, and DBMS teachings in order to implement Takane's system by organizing distortion correction parameters by image size, lens, focal length, and zoom position in tables comprising a database, then identifying and retrieving parameters, and providing them to Takane's distortion correction circuits to correct distortion, because Watanabe demonstrates these techniques were conventional. Laub, ¶445. POSAs would have known that Watanabe's database techniques were compatible with Takane's description of storing correction parameters for each lens focal length (Takane, [0008]), and selecting parameters based on focal length for the lens used at image capture (Takane, [0060]). Laub, ¶¶446-448.

Using Watanabe's multiple lens, database and DBMS teachings was within the POSA's ordinary skill and would have benefited Takane in the same manner as Watanabe. Laub, ¶449; *KSR*, 550 U.S. at 417. POSAs would have had a reasonable expectation of success because Watanabe demonstrates that digital cameras using different lenses, storing correction parameters in a database, and

DBMS software retrieving parameters from the database were conventional. Laub, ¶450.

Takane in view of Watanabe (hereinafter “Takane+Watanabe”) modifies Takane’s teachings with Watanabe’s interchangeable lens and table (database) teachings to organize and store parameters for optical distortion correction for each image size, lens, focal length, and zoom position in Takane’s ROM 22 for simplified and streamlined access. Laub, ¶451. Takane’s software—a “control routine” (Takane, [0028]) and a “dynamic image photographing processing... sub-routine” (Takane, [0030])—uses Watanabe’s teaching to retrieve parameters from the database and loads them into the distortion correction circuits based on the image size, lens, focal length, and zoom position at image capture. Laub, ¶¶452-453.

B. Claim 1

1. Limitation [1.PRE]

If [1.PRE] is limiting Takane+Watanabe meets it because Takane describes a digital photographing device that corrects optical distortion by digital signal processing on images captured by “dynamic image photographing in which continuous results of photographing by the CCD... are outputted.” Takane, [0041]; *id.*, [0006], [0011], [0014], [0017]; Laub, ¶455. The “dynamic image

photographing” means digital video. Laub, ¶455. Takane corrects optical image aberrations in a digital video. *Infra* §§XIII.B.2-XIII.B.7 ([1.a]-[1.g]).

2. Limitation [1.a]

Takane+Watanabe meets [1.a] as shown below.

a. “digital video camera including in-camera software”

Takane describes a “digital photographing device” that includes a “digital video camera.” Takane, [0015], [0041]-[0042]; Laub, ¶459. The digital video camera captures video in a “dynamic image photographing mode.” Takane, [0015], [0034], [0041], [0102] (“continuous photographing by the CCD”), [0105] (similar); Laub, ¶460.

Takane’s digital camera includes external ROM 22 that stores “programs... in advance[.]” Takane, [0033]. Takane’s device executes a “control routine” that includes dynamic image (video) processing. Takane, [0028], [0030], [0051] (distortion circuits and CPU each connect to a common bus); [0073], [0079] (CPU 48 drives distortion circuit 56); [0100]-[0111], Fig. 2 (bus 60 connects external ROM 22 to CPU 48 and distortion circuits 56); Fig. 3 (step 106), Fig. 5. The stored programs and the routines that Takane’s camera executes are “in-camera software” meeting [1.a]. Laub, ¶¶461-464.

b. “digital sensor for capturing the digital video”

Takane captures “dynamic images” (e.g., video) using a CCD, which it digitizes to provide digital image data. Takane, [0033], [0035], [0039], [0041]-

[0042], [0044], Fig. 1 (CCD 14, A/D 30); EX1001, 2:47-56 (CCD is digital sensor); Laub, ¶¶465-466.

c. “optical lens mechanism”

Takane describes an “optical unit 12” that “is structured as a zoom lens whose focal length can be changed[.]” Takane, [0038]; *infra* §XIII.B.3 ([1.b]); Laub, ¶¶467-469.

d. “IC including a DSP”

Takane’s “main controlling section 24” is “structured as a one-chip LSI (large scale integrated circuit)” that includes CPU 48 and image processing circuit 46, which further includes signal processing circuits 50, 52, 54 and distortion correction circuits 56, 58. Takane, [0036]; *id.*, [0035], Fig. 1 (control section 24, CPU 48, image processing circuit 46), Fig. 2 (image processing circuit 46 detail); Laub, ¶¶471-473.

A DSP is a signal processing circuit. *Supra* §VI.B.2.d (Ground 1, [1.a]). Takane does not describe how distortion correction circuits 56 or 58 are implemented, leaving the decision to the POSA. Laub, ¶474. POSAs would have had reasons to implement circuits 50, 52, 54, 56, and 58 using DSP(s), with a reasonable expectation of success, because DSPs were designed and routinely used for digital signal processing—including image processing—and Takane describes circuits 50, 52, 54, 56, and 58 as providing digital signal processing. *Supra*

§VI.B.2.d ([1.a], discussing DSP); Takane, [0043]-[0047], [0050], [0054]-[0059], [0078]; Laub, ¶¶475-479.

POSAs would have understood that using a DSP for distortion correction in circuits 56 and 58 would advantageously provide greater flexibility for such functions as Takane expressly suggested. Takane, [0133]. Thus, a POSA would have recognized the benefits of DSP implementation to leverage the programmability of the DSP to apply different correction circuit options as explicitly taught by Takane. *Id.* Laub, ¶480.

Thus, Takane’s control section 24 including one or more DSPs implementing image processing circuit 46 meets [1.a]. Laub, ¶481.

e. “[IC] including a [DSP] configured to access a [DBMS] including a plurality of optical image aberration corrections”

In Takane+Watanabe, Takane’s IC executes software that accesses a database comprising tables with correction parameters that it provides to the DSP comprising distortion correction circuit 56. *Supra* §XIII.A (discussing combination). The software accessing the database is a DBMS. *Id.*; *supra* §VI.B.2.e (discussing DBMS); Laub, ¶¶482-484. The database contains parameters for correcting optical distortion. *Supra* §XIII.A; *infra* §XIII.B.4 ([1.d]); Laub, ¶485. Thus, Takane+Watanabe provides an “[IC] including a [DSP]

configured to access a [DBMS] including a plurality of optical image aberration corrections.” Laub, ¶486.

f. “memory storage sub-system”

Takane describes “storing section 20” comprising SRAM or SDRAM, under control of memory control circuit 36. Takane, [0033], [0065], Figs. 1, 2; *see also id.*, [0066] (media control circuit 42, external recording medium 72); Laub, ¶¶487-488.

3. Limitation [1.b]

Takane+Watanabe meets [1.b] because Takane describes a zoom lens. *Supra* §XIII.B.2.c ([1.a]).

4. Limitations [1.c] and [1.d]

Takane+Watanabe meets [1.c] and [1.d] because Takane’s “main controlling section 24” is the IC that includes CPU 48 and image processing circuit 46, with first distortion correction circuit 56. *Supra* §XIII.B.2.d. Takane’s IC executes software (*supra* §XIII.B.2.a ([1.a] “in-camera software”)) that identifies “parameters which are peculiar to the predetermined image size... at the time of dynamic image photographing” that have been “stored for each of a plurality of predetermined focal distances.” Takane, [0060]; *supra* §XIII.A (describing combination); Laub, ¶¶490-495.

The ’685 specification describes matching a lens type with its aberrations. E.g., EX1001, 10:38 (“each lens has specific aberrations”), 10:38-41, 10:60-62,

12:54-63. During the parent '339 prosecution, PO argued that “[s]pecific lenses have different types of optical aberration[.]” EX1026, 157. Knowing the lens type identifies the aberrations for that lens. Takane describes correcting aberrations based on the lens type.

Takane’s software selects “optimal parameters” for a particular lens, at a particular focal length for the video capture, then applies image processing to correct aberrations from different lens and focal lengths. Takane, [0060]; Laub, ¶494. This meets [1.c] because it identifies “at least one optical image aberration” because an optical image aberration is associated with each particular lens, at a particular focal length at video capture. Takane, [0054]-[0059]); Laub, ¶495. Takane identifies both “pin-cushion” and “barrel distortion” aberrations that are correctable by Takane’s method. Takane, [0005]; Laub, ¶497.

Takane’s image processing circuit 46, and first distortion correction circuit 56, “carries out predetermined digital signal processing” and corrects optical distortion on dynamic images, and thus on successive frames and “at least one frame” of the digital video comprising “dynamic images.” Takane, [0043], [0100]-[0102], Fig. 3 (step 106), Fig. 5 (step 142); Laub, ¶496. Takane stores correction parameters “in advance” in first distortion correction circuit 56 based on the lens and focal length, then corrects optical distortion in digital video using the correction parameters. Takane, [0054]; Laub, ¶¶497-498.

5. Limitation [1.e]

Takane+Watanabe meets [1.e] because Takane's CCD captures "dynamic images" (video). Takane, [0041]; Laub, ¶499. Takane's A/D converter digitizes the video and sends it to signal processing circuit 50, dynamic image signal processing circuit 52, and first distortion correction circuit 56, which comprise a DSP. *Supra* §XIII.B.2.d ([1.a]), Takane, [0042]-[0045], [0053]. Figs. 1, 2; Laub, ¶¶500-501.

6. Limitation [1.f]

Takane+Watanabe meets [1.f] because Takane's first distortion correction circuit 56 comprising a DSP (*supra* §XIII.B.2.d ([1.a])) corrects optical distortion in the image data using the polynomial parameters relating to distortion based on the particular lens and focal length used for the image capture. Takane, [0054]-[0062], [0100]-[0102]; *supra* §XIII.A (discussing combination); Laub, ¶502. Takane describes determining the image before correction using nearest-neighbor or bi-linear interpolation and a multidimensional function parameterized by the coefficients associated with the lens focal length (Takane, [0056]-[0057]), then correcting optical distortion by "making the pixel data... into pixel data of the coordinates (x, y) in the image after correction." Takane, [0058]; Laub, ¶503. This process applies "digital filtration" meeting [1.f]. Laub, ¶¶504-505.

7. Limitation [1.g]

Takane+Watanabe meets [1.g] because Takane stores corrected image data in storing section 20. Takane, [0065], [0102]; Laub, ¶506.

C. Claim 2

Takane+Watanabe meets claim 2 because Takane describes that pin-cushion and barrel distortion from lens refraction “is determined in accordance with a distance from the optical center.” Takane, [0005]; Laub, ¶509. Takane corrects optical distortion based on “a polynomial which approximates the amount of displacement of the optical distortion.” Takane, [0054]-[0059]; Laub, ¶510. Takane’s optical distortion correction applies to pin-cushion and barrel distortion. Laub, ¶511.

D. Claim 6

1. Limitations [6.PRE], [6.a], [6.b], and [6.f]

Takane+Watanabe meets [6.PRE], [6.a], [6.b], and [6.f] for the same reasons it meets the corresponding limitation in claim 1. Laub, ¶514.

Limitation	Corresponding Limitation	Discussion
[6.PRE]	[1.PRE]	§XIII.B.1
[6.a]	[1.a]	§XIII.B.2
[6.b]	[1.b]	§XIII.B.3
[6.f]	[1.g]	§XIII.B.7

While “corrected video file” in [6.f] has no antecedent basis in claim 6, Takane discloses saving corrected video in memory. *Supra* §XIII.B.7 ([1.g]);

Laub, ¶515. Takane+Watanabe meets the remaining limitations in claim 6 as follows.

2. Limitation [6.c]

Takane+Watanabe meets [6.c] because Takane describes “an image data temporarily storing section 20 such as an SRAM or SDRAM or the like, for temporarily storing the digital image data obtained by photographing by the CCD 14[.]” Takane, [0033]; Laub, ¶516.

3. Limitation [6.d]

Takane+Watanabe meets [6.d] because Takane’s software (*supra* §XIII.B.2.a (“in-camera software”)) selects “parameters which are peculiar to the predetermined image size” for a lens and focal length at image capture to correct optical distortion. Takane, [0060], [0101]; *supra* §XIII.A (discussing combination); Laub, ¶517. The parameters associated with image capture identify the optical aberration in the video. Laub, ¶518. Takane describes making the corrections in “the sequence processings (dynamic image photographing processing)” (Takane, [0100]), meaning Takane applies distortion correction to successive video frames (e.g., “at least two frames”). Laub, ¶¶519-520.

4. Limitation [6.e]

Takane+Watanabe meets [6.e] because Takane’s first distortion circuit 56 is a DSP that uses the parameters identified in [6.d] and an interpolation algorithm to correct optical distortion in successive digital video frames. Takane, [0054]-

[0061], [0100]-[0102]; Laub, ¶521. Takane’s distortion correction and interpolation scheme is a form of digital filtering. Takane, [0055]-[0058]; Laub, ¶522.

E. Claim 7

For claims 7, 10 and 12, Takane+Watanabe meets claim 6 (*supra* §XIII.D). Takane+Watanabe meets claim 7 for the same reasons it meets claim 2 (*supra* §XIII.C). Laub, ¶¶524-525.

F. Claim 10

Takane+Watanabe meets [10.a] because Takane describes signal processing circuit 50—a DSP (*supra* §XIII.B.2.d)—making white balance adjustment. Takane, [0044]; Laub, ¶¶528-529. The white balance adjustment is color filtration. *Supra* §IX.C (Ground 4, claim 10). Takane applies white balance to “at least two frames” of digital video because it corrects successive frames in “dynamic images,” which are video. Takane, [0043]-[0044]; Laub, ¶¶529-530.

G. Claim 12

Takane+Watanabe meets [12.a] because Takane’s “main controlling section 24 is structured as a one-chip... large scale [IC].” Takane, [0036]; *supra* §XIII.B.2.d ([1.a]). POSAs would have recognized Takane’s main controlling section 24 as a SoC, meeting [12.a], because it combined different processor types (CPU and DSP) in a single IC, connected by a bus 60, and the component

integration made Takane's system "compact, reliable, and inexpensive." Takane, [0036], Fig. 2; Laub, ¶¶533-534.

H. Claim 14

1. Limitations [14.PRE], [14.a], [14.b], [14.h]

Takane+Watanabe meets the following claim 14 limitations for the same reasons it meets the corresponding limitation in claim 1. Laub, ¶536.

Limitation	Corresponding Limitation	Discussion
[14.PRE]	[1.PRE]	§XIII.B.1
[14.a]	[1.a]	§XIII.B.2
[14.b]	[1.b]	§XIII.B.3
[14.h]	[1.g]	§XIII.B.7

Takane+Watanabe meets the remaining limitations in claim 14 as follows.

2. Limitation [14.c]

Takane+Watanabe meets [14.c] because Takane's "optical unit 12 is structured as a zoom lens whose focal length can be changed[.]" Takane, [0038]; *supra* §XIII.B.2.c ([1.a]); Laub, ¶537.

3. Limitation [14.d]

Takane+Watanabe meets [14.d] because Takane forwards digitized video from the A/D converter to image processing circuit 46 and the DSP comprising signal processing circuit 50, dynamic image signal processing circuit 52, and first distortion correction circuit 56. Takane, [0053], Fig. 2; *supra* §XIII.B.2.d ([1.a])

discussing DSP); Laub, ¶538. Takane forwards the digital video to memory as explained for [6.c]. *Supra* §XIII.D.2; Takane, [0038]; Laub, ¶539.

4. Limitation [14.e]

Takane+Watanabe meets [14.e] because as modified Takane's IC executes software to retrieve correction parameters from the database based on, *inter alia*, the lens and focal length used at image capture. *Supra* §§XIII.A (discussing combination), XIII.B.2.d ([1.a] discussing IC), XIII.B.2.a ([1.a] "in-camera software"), XIII.B.6 ([1.f]); Takane, [0054]-[0062], [0100]-[0102]; Laub, ¶540.

Takane describes correcting distortions in "dynamic images" that are video comprising successive images, and thus identifies corrections "in at least one frame of the video" based on the zoom lens focal length at image capture. Takane, [0038]; *supra* §§XIII.B.4 ([1.c], [1.d]), XIII.H.2 ([14.c]); Laub, ¶541.

5. Limitation [14.f]

The "video file" in [14.f] has no antecedent basis in claim 14. *Supra* §VI.I.5 (Ground 1, [14.f]). Regardless, POSAs would have understood that Takane+Watanabe as modified applies corrections to a frame in a video file because Takane describes correcting distortions in "dynamic images" that are video comprising successive images. *Supra* §XIII.B.4 ([1.c] and [1.d]); Laub, ¶543.

Takane does not explain where it stores the multi-dimensional function(s) $F(d)$ that its DSP uses with parameters “stored in advance” to determine “displacement of the optical distortion” (Takane, [0054]-[0055]), leaving this detail to a POSA. A POSA would have understood that there were two known alternatives: (1) storing the algorithm(s) implementing the function $F(d)$ for a particular lens as executable code in the DSP, or (2) storing them in other memory or computer-readable medium and loading them into the DSP as needed. Laub, ¶¶544-545. It was known to select and load algorithms from memory to provide particular signal processing (“filtration”) at the DSP. Laub, ¶¶288 (discussing EX1069-EX1072), 546. A design choice between two known implementations is obvious. *ACCO Brands*, 813 F.3d at 1367.

In Takane+Watanabe, a POSA would have understood to store or—at a minimum—identify the DSP filtration algorithm for a particular aberration correction in Watanabe’s database in order to employ the stored parameters (for example as memory offset or look-up address in the database to the algorithm memory location). Laub, ¶547. Thus, Takane’s IC would “obtain” the correction algorithm by accessing the database for information identifying the algorithm (or the algorithm itself) then “forward” the algorithm to the DSP so that it could apply the filter and correct the aberration. Laub, ¶548. The retrieval option frees the

DSP from having to store every aberration correction algorithm used by the system in advance by loading them on an as-needed basis. Laub, ¶549.

Takane+Watanabe meets [14.f] because as modified Takane's main controlling section 24—the IC (*supra* §XIII.B.2.d) —uses in-camera software (*supra* §XIII.B.2.a) to access a database to obtain correction parameters associated with the lens and focal length at t image capture, which the IC provides to the distortion correction circuit. *Supra* §§XIII.A (discussing combination), XIII.B.2.d ([1.a]), XIII.B.6 ([1.f]); Takane, [0054]-[0062], [0100]-[0102]; Laub, ¶550. The correction parameters “express[] a polynomial which approximates the amount of displacement of the optical distortion.” Takane, [0054]. Constructing this polynomial for each image size and focal length is an algorithm, as is digital filtration that uses that polynomial to interpolate pixel positions and correct distortion. Takane, [0054]-[0060]; Laub, ¶551. The “multidimensional function F(d)” is stored, then provided to the DSP distortion circuit 56 for use with the “parameters” that “express the polynomial and enable a filtration algorithm. Takane, [0055]-[0059]; Laub, ¶552.

6. Limitation [14.g]

Takane+Watanabe meets [14.g] because Takane forwards digital video to a first distortion correction circuit comprising a DSP. *Supra* §§XIII.B.5 ([1.e]), XIII.H.3 ([14.d]). The distortion correction circuit corrects optical aberrations

(including at least pin-cushion and barrel distortion) in digital video based on parameters associated with Takane's zoom lens and focal length when the image was taken. *Supra* §§XIII.A (discussing combination), XIII.B.2.d ([1.a]), XIII.B.6 ([1.f]); Takane, [0054]-[0062], [0100]-[0102]; Laub, ¶¶553-554. This corrects aberrations in "at least one video frame." Laub, ¶555.

I. Claim 15

For claims 15, 17-18, Takane+Watanabe meets claim 14 (*supra* §XIII.H). Takane+Watanabe meets [15.a] for the same reasons it meets claim 2 (*supra* §XIII.C).

J. Claim 17

Takane+Watanabe meets [17.a] because Takane uses a zoom lens (*supra* §XIII.B.2.a ([1.a])) and Takane+Watanabe stores correction parameters for each lens focal length. Takane, [0008], [0038]-[0039], [0060], [0064]; *supra* §XIII.A (combination); Laub, ¶¶557.

K. Claim 18

Takane+Watanabe meets [18.a] for the same reasons it meets [10.a] (*supra* §XIII.F).

L. Claims 27-28 and 30

Takane+Watanabe meets claims 27, 28 and 30 because it meets claim 1 (*supra* §XIII.B), and because Takane's distortion correction technique applies to pin-cushion distortion (claim 28) and barrel distortion (claim 30). *Supra* §XIII.C

(claim 2); Laub, ¶559. Takane describes pin-cushion and barrel distortion as specific kinds of distortion “due to refraction of the lens,” e.g., “lens distortion” (claim 27). Takane, [0005]; Laub, ¶560. Takane implements distortion correction using software (e.g., “machine readable instructions”) stored in ROM 22. Takane, [0029] (image processing sub-routine); *supra* §XIII.B.2.a ([1.a] “in-camera software”); Laub, ¶561.

XIV. NO BASIS FOR DISCRETIONARY DENIAL

A. *Fintiv*

1. Stay Potential

While Petitioner will seek pre-institution stay, without “specific evidence” how the court will rule this factor is neutral. *Sand Revolution II v. Continental Intermodal Group–Trucking*, IPR2019-01393, Paper 24, 7 (June 16, 2020) (informative).

2. Trial Timing

Petitioner filed this Petition before the district court has held an initial scheduling conference, so Factor 2 weighs against denial. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11, 11 (Mar. 20, 2020) (precedential) (“expeditiously” filed petitions weigh against denial).

FWD can be expected in November 2025. Sony was served with the complaint on May 13. It has not answered or filed any motion (EX1038), and the court has not set a trial date. While the median-time-to-trial is 21.4 months

(EX1039), Director’s Interim Procedure (“IP”) at 3, without accounting for such late service the median-time-to-trial analysis is inapplicable. This weighs against discretionary denial. IP, 9; *Sand Revolution II*, 9-10 (“relatively close proximity” of FWD and “scheduled trial date” weighs against discretionary denial).

3. Litigation Investment

PO filed a complaint, but Petitioner has not answered, filed any motion, and the court has not even held an initial scheduling conference. EX1038. This weighs against denial. *Samsung Elecs. v. Netlist*, IPR2022-00063, Paper 13, 8 (May 5, 2022) (instituting where no “claim construction and merits determinations” had occurred).

4. Issue Overlap

Sony challenges 28 claims, while in the Litigation PO only asserts claim 1. EX1037, ¶¶68-88. Challenging claims the district court will not address weighs against denial. *Markforged v. Continuous Composites*, IPR2022-00679, Paper 7, 32-33 (Oct. 25, 2022).

5. Litigation Defendants

Petitioner is a district court defendant, which “is far from an unusual circumstance.” *Sand Revolution II*, Paper 24, 12-13. This factor is neutral.

6. Other Considerations

Ground 1 shows that a single reference renders claims 1-2, 5-7, 11-12, 14-15, 17, 27, 29 unpatentable. The Petition’s “strong showing on the merits” (*supra* §§VI-

XIII) weighs against denial. *Data Company v. Bright Data*, IPR2022-00138, Paper 12, 15-16 (May 11, 2022).

7. Compelling Evidence

If the Board finds Factors 1-5 favor denial then the Grounds provide “compelling evidence” of unpatentability. The Petition demonstrates the prior art teaches the Challenged Claims—in some cases via a single reference—while dependent claims simply add well-known aberration types to the base claim. E.g., *supra* §VI.B (Ground 1). If unrebutted at trial the Grounds show at least one Challenged Claim is unpatentable, foreclosing discretionary denial under *Fintiv*. IP, 3-5; *Nokia v. TQ Delta*, IPR2022-00471, Paper 11, 19-21 (Aug. 18, 2022); *CommScope Techs. v. Dali Wireless*, IPR2022-01242, Paper 23, 4-5 (Dir. Feb. 27, 2023) (precedential).

B. Section 325(d) discretionary denial is unwarranted.

1. Advanced Bionics Step One.

Discretionary denial is unwarranted because the Office never considered the patentability of Challenged Claims over the art or arguments in Grounds 2-8, failing *Advanced Bionics* step one. *Advanced Bionics, LLC v. Med-El Elektromedizinische Gerate GMBH*, IPR2019-01469, Paper 6, 8-10 (Feb. 13, 2020) (precedential). The Board does not need to reach step two.

a. The Office never considered Takane, Turner, or Hisamatsu with Watanabe.

The Office initialed Watanabe on an IDS, but as PO only identified Watanabe by IDS after allowance (*infra* §XIV.B.2.a) it was never applied in a rejection for any teaching.

Grounds 4-6 and 8 separately combine Watanabe with references—Takane, Turner, or Hisamatsu—that the Office never considered. The Office never considered patentability over (1) Takane using Watanabe’s database and DBMS teachings (Ground 8); (2) Watanabe using Takane’s white balance, pin-cushion, or barrel distortion corrections (Ground 4); (3) Watanabe+Hisamatsu (Ground 5); or (4) Watanabe+Turner (Ground 6). Nor is the art applied herein substantially similar to any art applied in a rejection, as there were no claim rejections based on prior art teachings. That weighs against discretionary denial.

b. The Office never considered Kishida or Liege with Watanabe.

While the Office initialed Watanabe (EX1002, 1636), Kishida (EX1002, 1633), and Liege’s parent (EX1002, 1632) on an IDS, the Examiner never “meaningfully addressed” the references because he never rejected a claim over those references alone or in combination with Watanabe (Grounds 2, 7). That weighs against discretionary denial. PTAB Rules for 325(d) Considerations, 89 Fed. Reg. 28693, 28705 (2024) (to be codified at 37 C.F.R. §42.108(f)) (proposed

Apr. 19, 2024) (discretionary denial under §325(d) applies only if prior art was “meaningfully addressed”). Further, under *Becton, Dickinson* Factor (d) the Examiner never assessed patentability using the combinations in Grounds 2 or 7, or any art substantially similar thereto.

2. *Advanced Bionics* Step Two.

If the Board reaches *Advanced Bionics* step two, that also weighs against discretionary denial because the Board erred in a manner material to patentability by allowing claims over Watanabe.

a. *BD* Factor (c)

PO identified Watanabe as prior art three months *after* the Examiner had allowed claims (EX1002, 943) as one of seventy references from Canon’s IPRs against the ’339 and ’805 patents (EX1002, 984-988). The Examiner did not use Watanabe in a claim rejection. This weighs against discretionary denial. *Group III v. Targus*, IPR2021-00371, Paper 21, 33 (July 9, 2021); 89 Fed. Reg. 28705 (325(d) discretionary denial only applies if prior art was “meaningfully addressed”).

b. *BD* Factor (e)

The Examiner did not identify or explain a *particular* claim limitation that Watanabe purportedly failed to disclose, nor recognize the pertinence of Watanabe’s disclosure. For example, the Examiner asserted Watanabe disclosed an “image recording apparatus” (EX1002, 1572) but the Examiner never

recognized that Watanabe discloses a *video* camera as claimed. *Supra* §VI.B.2.a ([1.a]). Allowing claims over Watanabe was error material to patentability because—as Ground 1 explains—Watanabe renders claim 1 obvious. *Supra* §VI.B. This weighs against discretionary denial.

c. *BD* Factor (f)

The prosecution did not include the certified translation of JP-872, which may have led the Examiner to misapprehend Watanabe’s significance.

In short, discretionary denial is unwarranted under *Advanced Bionics* step one. If the Board reaches step two, that also weighs against discretionary denial.

XV. CONCLUSION

The Board should institute review and cancel claims 1-19 and 22-30.

Respectfully submitted,
Sony Corporation

Date: May 20, 2024

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APPENDIX A: U.S. PATENT NO. 10,873,685 CLAIM LIST

Ref	Limitation
1.PRE	A digital imaging system for correcting optical image aberrations in a digital video, comprising:
1.a	a digital video camera including in-camera software, an optical lens mechanism, at least one digital sensor for capturing the digital video, an integrated circuit including; a digital signal processor configured to access a database management system including a plurality of optical image aberration corrections, and a memory storage sub-system;
1.b	wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;
1.c	wherein the integrated circuit uses the in-camera software to identify at least one optical image aberration and
1.d	to correct the at least one optical image aberration in at least one frame of the digital video using at least one of the plurality of optical image aberration corrections in the database;
1.e	wherein the video is captured by the at least one digital sensor and is forwarded to the digital signal processor;
1.f	wherein the video image file with the at least one optical image aberration is corrected by applying digital filtration using the digital signal processor; and
1.g	wherein the corrected video consisting of the digital data optimized from the at least one optical image aberration that are corrected from the original video image is stored in the memory storage sub-system.
2.PRE	The system of claim 1:
2.a	wherein the optical image aberrations include at least one of spherical, comatic, lens distortion, astigmatism, curvature of field, pin cushion, barrel distortion, chromatic aberrations, scattered light, and/or flare types of optical image aberrations.
3.PRE	The system of claim 1:
3.a	wherein the optical image aberration is vignetting;
3.b	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 comers [sic] of the image or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the comers [sic] of the image; and
3.c	wherein the image exposure is optimized to correct the vignetting.
4.PRE	The system of claim 1:

Ref	Limitation
4.a	wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration.
5.PRE	The system of claim 1:
5.a	wherein each lens type is registered in the camera database;
5.b	wherein the multiple optical aberrations of each lens is listed in the database;
5.c	wherein the filtration solutions to the lens optical aberrations are listed in the database;
5.d	wherein the filtration of each lens optical aberration is applied by the digital signal processor; and
5.e	wherein after the digital signal processor applies the filtration to correct the optical image aberrations the corrected digital file is forwarded to storage in memory.
6.PRE	A digital imaging system for correcting image aberrations comprising:
6.a	a digital video camera including in-camera software, an optical lens mechanism, at least one digital sensor for capturing digital video, an integrated circuit including a digital signal processor configured to access a database management system including a plurality of optical image aberration corrections, and a memory storage sub-system;
6.b	wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;
6.c	wherein the video is forwarded to storage in memory;
6.d	wherein at least one optical aberration in at least two frames of the digital video are identified using the in-camera software and the integrated circuit;
6.e	wherein the at least one optical aberration from the optical lens mechanism of at least two frames of the digital video are corrected by using the digital signal processor to apply at least one digital filtration algorithm; and
6.f	wherein the corrected digital video file is stored in memory.
7.PRE	The system of claim 6:
7.a	wherein the optical image aberrations include spherical, comatic, lens distortion, astigmatism, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, and/or flare types of optical aberrations.
8.PRE	The system of claim 6:

Ref	Limitation
8.a	wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration.
9.PRE	The system of claim 6:
9.a	wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct digital aberrations of at least two frames in the digital video.
10.PRE	The system of claim 6:
10.a	wherein the digital signal processor applies color filtration to at least two frames of the digital video image.
11.PRE	The system of claim 6:
11.a	wherein the digital video is filtered to correct at least one optical and/or digital aberrations after initial capture and before the digital video is initially sent to storage.
12.PRE	The system of claim 6:
12.a	wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip.
13.PRE	The system of claim 6:
13.a	wherein the optical image aberration is vignetting;
13.b	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 comers [sic] of the at least two image frames or the digital signal processor applies both neutral density filtration in the image center and/or an algorithm to lighten the comers [sic] of the image of at least two image frames; and
13.c	wherein the image exposure for at least two frames in the digital video file is optimized to correct the vignetting.
14.PRE	A digital imaging system for correcting image aberrations comprising:
14.a	a digital video camera including in-camera software, an optical lens mechanism, at least one digital sensor for capturing digital video, an integrated circuit including a digital signal processor configured to access a database management system including a plurality of optical image aberration corrections, and a memory storage sub-system;
14.b	wherein the optical lens mechanism is a zoom lens;
14.c	wherein the zoom lens changes focal length positions;
14.d	wherein when the digital video is forwarded to the digital signal processor and to memory;

Ref	Limitation
14.e	wherein the integrated circuit uses system software to access the database to identify at least one optical aberration in at least one frame of the video at any focal length of a zoom lens configuration;
14.f	wherein the integrated circuit accesses the database to obtain at least one filtration correction algorithm to the optical image aberration of at least one frame in the video file and forwards the at least one filtration algorithms to the digital signal processor;
14.g	wherein the digital video is forwarded to the digital signal processor which applies at least one filtration algorithm to optimize the digital video and corrects the at least one optical image aberration in at least one video frame for the at least one focal length in the zoom lens configuration; and
14.h	wherein the corrected digital video is stored in memory.
15.PRE	The system of claim 14:
15.a	wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, and/or flare types of optical aberrations.
16.PRE	The system of claim 14:
16.a	wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations in the digital video.
17.PRE	The system of claim 14:
17.a	wherein each focal length of a zoom lens in at least one video image frame is analyzed for a different set of optical aberrations.
18.PRE	The system of claim 14:
18.a	wherein the digital signal processor applies color filtration to at least one frame of the digital video image.
19.PRE	The system of claim 14:
19.a	wherein the optical image aberration is vignetting;
19.b	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 at least one image frame 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 of at least one image frame; and

Ref	Limitation
19.c	wherein the image exposure for at least one frame in the digital video file is optimized to correct the vignetting.
20	The system of claim 1, wherein the system is configured to correct red-eye.
21	The system of claim 1, wherein the system is configured to correct for dust.
22	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for spherical aberrations.
23	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for chromatic aberrations.
24	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for scattered light aberrations.
25	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for comatic aberrations.
26	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for astigmatism aberrations.
27	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for lens distortion aberrations.
28	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for pin cushion aberrations.
29	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for curvature of field aberrations.
30	The system of claim 1, wherein the system includes machine readable instructions for the system to correct for barrel distortion aberrations.

CERTIFICATE OF SERVICE UNDER 37 C.F.R. §42.6 (E)(4)

I certify that on May 17, 2024, I will cause a copy of the foregoing document, including any exhibits or appendices filed therewith, to be served via Overnight FedEx at the following correspondence address of record for the patent:

The Law Office of Michael J. Scheer
5531 Murietta Avenue
Sherman Oaks, CA

Date: May 20, 2024

/MacAulay Rush/
MacAulay Rush
Paralegal
WOLF, GREENFIELD & SACKS, P.C.

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24, the undersigned certifies that the foregoing Petition for *Inter Partes* Review contains 13,998 words excluding a table of contents, a table of authorities, Mandatory Notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing. Petitioner has relied on the word count feature of the word processing system used to create this paper in making this certification.

Date: May 20, 2024

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