

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Olympus Corporation, OM Digital Solutions Corporation, FUJIFILM Corporation, FUJIFILM North America Corporation, Nikon Corporation, Panasonic Entertainment & Communication Co., Ltd.,
Petitioners,

v.

Optimum Imaging Technologies LLC,
Patent Owner.

U.S. Patent No. 10,873,685
Case No. IPR2024-01220

**DECLARATION OF ROBERT STEVENSON IN
SUPPORT OF PETITION FOR INTER PARTES REVIEW
OF ALL CLAIMS OF U.S. PATENT 10,873,685**

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Table of Exhibits

Exhibit	Description
Ex-1001	U.S. Patent No. 10,873,685 (“’685 Patent”)
Ex-1002	Prosecution History of the application that led to the ’685 Patent (excluding NPL submissions)
Ex-1004	Curriculum Vitae of Expert Witness, Dr. Robert L. Stevenson
Ex-1005	Certified Translation of Japanese Patent App. Pub. No. 2000-041179 (“Iwasawa”)
Ex-1006	U.S. Patent No. 7,245,319 (“Enomoto”)
Ex-1007	Certified Translation of Japanese Patent App. Pub. No. 6-113309 (“Ito”)
Ex-1008	U.S. Patent App. Pub. No. 2005/140801 (“Prilutsky”)
Ex-1009	U.S. Patent No. 6,791,608 (“Miyazawa”)
Ex-1010	Certified Translation of Japanese Patent App. Pub. No. 2004-266768 (“Matsutani”)
Ex-1011	U.S. Patent No. 6,603,885 (“Enomoto ’885”)
Ex-1012	Prosecution History of Application that Led to U.S. Patent No. 8,451,339 (“’339 Patent”), the Parent of the ’685 Patent
Ex-1013	Dkt. No. 1, Complaint, <i>Optimum Imaging Technologies LLC v. Olympus Corporation and OM Digital Solutions</i> , 4:23-CV-00924-ALM (E.D. Tex. Oct. 18, 2023) (“Complaint”)
Ex-1014	Japanese Patent App. Pub. No. 2000-041179 (“Iwasawa-JP”)
Ex-1015	Japanese Patent App. Pub. No. 6-113309 (“Ito-JP”)
Ex-1016	U.S. Patent No. 5,522,832 (“Kawasaki”)
Ex-1017	U.S. Patent App. Pub. No. 2002/0135688 (“Niikawa”)
Ex-1018	Certified Translation of Japanese Patent App. Pub. No. 2005-25703 (“Yamada”)

Ex-1019	Japanese Patent App. Pub. No. 2005-25703 (“Yamada-JP”)
Ex-1020	U.S. Patent App. Pub. No. 2007/0080280 (“Havens”)
Ex-1021	U.S. Patent No. 7,738,015 (“Steinberg”)
Ex-1022	U.S. Patent No. 7,936,392 (“Ng”)
Ex-1023	U.S. Patent App. Pub. No. 2004/0150726 (“Gallagher”)
Ex-1024	Japanese Patent App. Pub. No. 2004-266768 (“Matsutani-JP”)
Ex-1026	“The Filmmaker’s Handbook: A Comprehensive Guide for the Digital Age,” Steven Ascher and Edward Pincus (1999), p. 103
Ex-1027	“Wiley Electrical Electronics Engineering Dictionary,” Steven M. Kaplan (2004), pp. 169, 840
Ex-1028	U.S. Patent App. Pub. No. 2004-264918 (“Turner”)
Ex-1029	U.S. Patent No. 5,280,354 (“Nakamura”)
Ex-1030	U.S. Patent App. Pub. No. 2003/0179948 (“Gindele”)
Ex-1031	Certified Translation of Japanese Patent App. Pub. No. 5-3568 (“Shiomi”)
Ex-1032	Japanese Patent App. Pub. No. 5-3568 (“Shiomi-JP”)
Ex-1033	Certified Translation of Japanese Patent App. Pub. No. 11-205652 (“Ichiyama”)
Ex-1034	Japanese Patent App. Pub. No. 11-205652 (“Ichiyama-JP”)
Ex-1035	“Digital Image Correcting Method for Digital Camera,” Guan <i>et al.</i> (2005)
Ex-1036	Declaration of Kiyoto Nagai (July 15, 2020)

I. Introduction

1. My name is Robert L. Stevenson. I have been retained by counsel for Olympus Corporation, OM Digital Solutions Corporation, FUJIFILM Corporation, FUJIFILM North America Corporation, Nikon Corporation, and Panasonic Entertainment & Communication Co., Ltd. (“Petitioners”) as an expert witness in this *inter partes* review to examine whether claims 1-30 of U.S. Patent 10,873,685 (the “’685 Patent” or “Ex-1001”) are patentable over certain prior art. I understand the ’685 Patent is currently assigned to Optimum Imaging Technologies LLC (“Patent Owner”).

2. I have personal knowledge of all the facts set forth herein, and if called to testify at any hearing in this *inter partes* review, I would competently testify and verify that testimony contained herein.

3. I am being compensated at my hourly rate of \$750 per hour. I am also being reimbursed for out-of-pocket expenses. My compensation does not depend in any way on the outcome of this proceeding or the particular opinions I express, or the testimony I give.

4. I expect to be available for deposition and to testify at the evidentiary hearing in this *inter partes* review to the extent required.

5. This declaration contains my conclusions and a summary of my analysis including a summary of my conclusions; an overview of my qualifications

as an expert; an overview of the scope and terms of my engagement for this declaration; an overview of the materials I have considered in arriving at my conclusions; an overview of the terminology and legal principles that I applied in my analysis; an overview of the technical background of the subject matter; an overview of the '685 Patent; an analysis of the level of ordinary skill in the art related to the '685 Patent; and an analysis of the asserted references; and a patentability analysis of the challenged claims.

6. This declaration is based on information currently available to me. I intend to continue my investigation and study, which may include a review of documents and information that may yet be produced, as well as deposition testimony from depositions for which transcripts are not yet available or that may yet be taken in this review. Therefore, I expressly reserve the right to expand or modify my opinions as my investigation and study continue, and to supplement my opinions in response to any additional information that becomes available to me, any matters raised by Patent Owner and/or other opinions provided by Patent Owner's expert(s), or in light of any relevant orders from the Patent Trial and Appeal Board or other authoritative body.

II. Background and Qualifications

7. My qualifications and professional experience are described in my Curriculum Vitae, a copy of which can be found in Ex-1004. The following is a brief summary of my relevant qualifications and professional experience.

8. I have a bachelor's degree in Electrical Engineering from the University of Delaware and a Ph.D. degree in Electrical Engineering from Purdue University. My Ph.D. research was on communications and signal processing.

9. I am presently a Professor in the Department of Electrical Engineering and in the Department of Computer Science and Engineering at the University of Notre Dame. I first joined the faculty at the University of Notre Dame as an Assistant Professor in the Department of Electrical Engineering in 1990. I was granted tenure and promoted to the rank of Associate Professor in August 1996. I attained the rank of Professor in the Department of Electrical Engineering in August 2002, and I continue to serve in that capacity. I have served concurrently as a Professor in the Department of Computer Science and Engineering at the University of Notre Dame from January 2003 through June 2018.

10. Since 2013 I have served as an Associate Chair of the Department of Electrical Engineering. I also serve as the Director of Undergraduate Studies in Electrical Engineering. In this role I oversee the department's undergraduate program in Electrical Engineering.

11. I spent the summer of 1992 at the Air Force Research Lab in Rome, New York and I spent the summer of 1993 at the Intel® Corporation in Hillsboro, Oregon. Several leading computing companies, including Intel®, Sun Microsystems®, Apple® Computer, and Microsoft®, have supported my research at Notre Dame. During the past 20 years, I have published over 150 technical papers related to the field of image processing and digital systems.

12. I am a member of the Institute of Electronics and Electrical Engineers, The International Society for Optical Engineering, and the Society for Imaging Science and Technology. I am a member of the academic honor societies Eta Kappa Nu, Tau Beta Pi, and Phi Kappa Phi.

13. For the past 20 years my work has focused on the design of techniques, hardware, and software for the processing of digital signals using digital computing devices. As an academic researcher I attempt to develop novel ideas for systems, then publish and present those ideas to the technical community. My success as an academic is directly related to the insights and techniques that provide the basis for new generations of products. My early work on digital techniques for printing and image capture devices led to significant interaction with companies developing desktop computers products in the early 1990's as they tried to incorporate those ideas into their products.

14. My interaction with Apple's Imaging Group focused on various imaging devices such as digital cameras, scanners, and printers and how to best support those devices on desktop computers. At Intel, I worked in Intel's Architecture Lab at the time the MMX multimedia instructions were being incorporated into the Pentium processor. My work there dealt with developing video compression techniques for CD-ROM's and network communications that were well matched to the Pentium architecture. I also gave a series of talks on how advanced communication and video processing techniques could be better supported on the Pentium platform. Similarly, my interaction with Sun Microsystem's group examined how advanced signal processing techniques could be best implemented using Sun's new Visual Instruction Set on the Sparc architecture.

15. I have also received significant support for my research from several U.S. Department of Defense Agencies. The Air Force Research Laboratory has funded my work to develop advanced parallel processing algorithms that exploited an ad-hoc network of mixed computers to achieve significant computational advantages over their previously implemented techniques. Other Department of Defense agencies have supported my work in image and video enhancement.

16. Through my work I have contributed significantly to the understanding and modeling of the limitations of and aberrations found in optical image capture systems. For example I directed a Ph.D. dissertation entitled "Modeling,

Approximation, and Estimation of Spatially-varying Blur in Photographic Systems” with my student John Simpkins and co-authored several papers in the 2011-2016 directly on the modeling of optical systems.

17. Additionally, I have developed numerous novel computational algorithms to overcome such issues with optical capture systems over the past 30 years. Some examples include “Improved Definition Image Expansion” (1994), “Color Palette Restoration” (1995), “Extraction of High-Resolution Frames from Video Sequences” (1996), “Reduced-Complexity Iterative Post-Filtering of Video” (2001), “Improving the Performance of Single Chip Image Capture Devices” (2003), “Estimation Theoretic Approach to Dynamic Range Improvement Through Multiple Exposures” (2003), “A Parameterized Spatially-Varying PSF Model” (2014), “Multi-Image Motion Deblurring Aided By Inertial Sensors” (2016), “Inertial Sensor Aided Multi-Image Nonuniform Motion Blur Removal Based on Motion Decomposition” (2018), “Deep Motion Blur Removal Using Noisy/Blurry Image Pairs” (2021), and “DeblurExpandNet: Image Motion Deblurring Network Aided by Inertial Sensor Data” (2022). These references were all published in peer referred international journals and have collectively been cited thousands of times in the field. I have also presented such work at international conferences around the world. Complete citations to this work can be found in my curriculum vitae which is included as Ex-1004.

18. I have published over 150 papers in international journals and international conferences.

19. I am an inventor of U.S. Patent No. 6,081,552, "Video Coding Using a Maximum A Posteriori Loop Filter," June 27, 2000.

20. Additional information concerning my background, qualifications, publications, conferences, honors, and awards are described in my Curriculum Vitae (Ex-1004).

III. Materials Reviewed

21. In reaching the conclusions described in this declaration, I have relied on the documents and materials recited herein as well as those identified in this declaration, including the '685 Patent, the prosecution history of the '685 Patent, the prior art references, and information discussed and any other references specifically identified in this declaration.

IV. Summary of Opinions

22. Ground 1: Claims 1, 3, 6, 11-14, 17, and 19 of the '685 Patent are unpatentable as obvious by Iwasawa.

23. Ground 2: Claims 1-3, 5-7, 10-15, 17-19, 23, 24, 27, 28, and 30 of the '685 Patent are unpatentable as obvious by Iwasawa and Enomoto.

24. Ground 3: Claims 4, 8, 9, and 16 of the '685 Patent are unpatentable as obvious by Iwasawa and Ito.

25. Ground 4: Claims 4, 8, 9, and 16 of the '685 Patent are unpatentable as obvious by Iwasawa, Enomoto, and Ito.

26. Ground 5: Claim 20 of the '685 Patent is unpatentable as obvious by Iwasawa and Prilutsky.

27. Ground 6: Claim 20 of the '685 Patent is unpatentable as obvious by Iwasawa, Enomoto, and Prilutsky.

28. Ground 7: Claim 21 of the '685 Patent is unpatentable as obvious by Iwasawa and Miyazawa.

29. Ground 8: Claim 21 of the '685 Patent is unpatentable as obvious by Iwasawa, Enomoto, and Miyazawa.

30. Ground 9: Claims 22, 25, 26 and 29 of the '685 Patent are unpatentable as obvious by Iwasawa and Matsutani.

31. Ground 10: Claims 22, 25, 26 and 29 of the '685 Patent are unpatentable as obvious by Iwasawa, Enomoto and Matsutani.

V. Understanding of the Law

32. I am not a legal expert. In forming my opinions, I have been informed of and applied the legal standards as follows. I understand that the legal standards relating to anticipation and obviousness apply to the '685 Patent and have been instructed to assume an effective filing date of July 11, 2006.

33. I understand that a patent claim is invalid if the claimed invention is not new. For a claim to be invalid on the basis of anticipation because it is not new, all of its elements must be present, either expressly or inherently, in a single previous device or method, or described, either expressly or inherently, in a single previous publication or patent.

34. I understand that the description in a reference does not have to be in the same words as the claim, but all the requirements of the claim must be there, either stated expressly or necessarily implied or inherent to one of ordinary skill in the field of technology of the patent at the time of the invention, so that someone of ordinary skill in the field of technology of the patent looking at that one reference would be able to make and use the claimed invention. I further understand that to be necessarily implied or inherent, the claim element must be a necessary part of the reference that is not expressly disclosed. Merely being one option is not sufficient for a claim element to be necessarily implied or inherent to a person of ordinary skill in the art (“POSA” or “POSITA”).

35. I have been informed that in relying upon the theory of inherency, there must be a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.

36. I understand that a patent claim is “obvious” and therefore invalid when the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA to which the subject matter pertains.

37. In making an obviousness determination, I understand that there are several factors to consider: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art at the time of the effective filing date of the claimed invention; (3) the differences between the claimed invention and the prior art, if any, and (4) objective considerations, if any exist, such as any commercial success, copying, prior failure by others, licenses, longstanding need, and unexpected results.

38. I understand that prior art used to show that a claimed invention is obvious must be “analogous art.” Prior art is analogous art to the claimed invention if (1) it is from the same field of endeavor as the claimed invention (even if it addresses a different problem) or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not from the same field of endeavor as the claimed invention).

39. I have been informed and understand that the U.S. Supreme Court has recognized several rationales for combining references or modifying a reference to show obviousness of claimed subject matter. Some of these rationales include the following: (a) combining prior art elements according to known methods to yield

predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

40. Also, I have been informed and understand that obviousness does not require physical combination/bodily incorporation, but rather consideration of what the combined teachings would have suggested to a POSITA at the time the claimed invention was made.

41. I understand that it is improper to engage in hindsight when trying to determine the obviousness of a patent claim. I understand that the obviousness inquiry must be conducted from the standpoint of a POSITA at the time the claimed invention was made. What is known today, and what is learned from the teachings and disclosures of the patent itself containing the claim under analysis, should not be considered.

42. I have been informed that various “secondary considerations” (sometimes referred to as objective indicia of non-obviousness) may support a

determination of non-obviousness and that such secondary considerations must be considered as part of an obviousness analysis. I have been informed that secondary considerations of non-obviousness may include:

- commercial success of a product due to the merits of the claimed invention;
- a long felt need for the solution provided by the claimed invention;
- unsuccessful attempts by others to find the solution provided by the claimed invention;
- copying of the claimed invention by others;
- unexpected and superior results from the claimed invention; and
- acceptance by others of the claimed invention as shown by praise from others in the field or from the licensing of the claimed invention.

43. I understand that in order for such “secondary considerations” evidence to be relevant to the obviousness inquiry, there must be a relationship or “nexus” between the advantages and features of the claimed invention and the evidence of secondary considerations.

44. I understand that if a claim is not obvious, then the claims that depend from it are not obvious.

45. I have been advised that in an inter partes review the claim terms generally should be given their ordinary and customary meaning as a POSITA would

have understood them at the time of the effective filing date of the claimed invention and in light of the patent and its prosecution history. Furthermore, I have been instructed that a claim's plain language can help guide the interpretation of the claim terms in question, and the manner in which a claim term is used in a claim may be informative of its meaning.

46. Further, I have been informed that in an inter partes review proceeding, only claim terms that are actually in dispute need be construed. Thus, terms that are not in dispute, or ones for which alternative constructions would not render a different finding, do not need to be construed.

47. I have also been advised that the claim terms being construed must be construed in light of, and consistent with, the intrinsic evidence of the patent. I understand that a patent's intrinsic evidence includes the patent's prosecution history (which includes the prior art considered by the Examiner(s)), the patent's claims, and the patent's written description as given in the specification of the patent.

48. I have also been advised that when the meaning of a patent's claim term is disputed, the specification of the patent itself is the best guide to the meaning of that claim term. I understand that while embodiments given by the specification can help understand the meaning of claim terms, preferred embodiments and other examples given in the specification should not further limit the claims by being read into the claim terms being construed.

49. I also understand that an inventor may be his or her own lexicographer by specifically defining his or her own terms within the specification such that they then possess a specific meaning that can be different than the meaning they would otherwise have. I also understand that such an inventor can overcome the plain and ordinary meaning of a given claim term if he or she clearly and explicitly defines or redefines a claim term.

50. I have also been advised that after the patent's claims and specification, the next critical source of evidence regarding the meaning of a patent's claim terms comes from the patent's prosecution history. I understand that the prosecution history contains remarks made by the applicant during prosecution of the application that issues as the patent and those remarks may act to define, redefine, disclaim, or limit the meaning of a claim term, and that if a patentee made statements during prosecution that so limits the scope of a claim term, it is improper for a patent owner to regain the scope given up during prosecution that leads to the issuance of the patent.

51. I have also been advised that in addition to the intrinsic evidence discussed above, extrinsic evidence may also be considered when construing claims, although it is generally not as significant as the intrinsic record itself when understanding the meaning of a claim term. It is my understanding that extrinsic evidence is any relevant evidence that would inform the understanding of the claim

terms such as textbooks, dictionaries, expert testimony, treatises, or other like material.

52. I understand that a patent claim must particularly point out and define the boundaries of the subject matter to be protected by that claim. I understand that this requires that a patent claim be sufficiently definite. I understand that a patent claim is indefinite, and thus invalid, if its claims, when read in light of the intrinsic record, fail to inform a POSITA with reasonable certainty about the scope of the invention.

VI. Level of Ordinary Skill in the Art

53. In rendering the opinions set forth in this declaration, I was asked to consider the patent claims and the prior art through the eyes of a POSA at the time the claimed invention was made, which I understand is potentially as early as July 11, 2006 (the earliest priority date identified on the face of the '685 Patent). I understand that the factors considered in determining the ordinary level of skill in a field of art include the level of education and experience of persons working in the field; the types of problems encountered in the field; the teachings of the prior art, and the sophistication of the technology at the time the claimed invention was made. I understand that a POSA is not a specific real individual, but rather is a hypothetical individual having the qualities reflected by the factors above. I understand that a

POSA would also have knowledge from the teachings of the prior art, including the art cited below.

54. Based on the technologies disclosed in the '685 patent, I believe that a POSA would have been a person with a Bachelor of Science degree in electrical engineering, physics, or a related field, with at least two years of industry experience or research, both concerning digital camera system design and image processing at the time the claimed invention was made.

55. Well before July 11, 2006 (the earliest priority date identified on the face of the '685 Patent), my level of skill in the art was at least that of a POSA. I am qualified to provide opinions concerning what a POSA would have known and understood at the time the claimed invention was made, and my analysis and conclusions herein are from the perspective of a POSA as of that date.

VII. Claim Construction

56. For the purpose of this declaration, all claim terms should be given their ordinary meaning to a POSA.

VIII. Background on the State of the Art in In-Camera Digital Image Correction

57. The '685 Patent states that “software systems [e.g., Photoshop] have been developed that deal with problems post-production” “[i]n order to transcend the optical and digital limits of present camera systems...” (Ex-1001, 6:39-44) and that “[i]n the past, [] optical filtration processes were added after the production

process via editing software such as Photoshop. However, in the present system, these combinations of processes are performed in-camera by user-adjusted settings” (Ex-1001, 13:19-13:23). Thus, the ’685 Patent seeks to disclose and claim camera systems that deal with aberrations in-camera. However, such techniques were old hat by the time the ’685 Patent was filed. For example, as in other prior art discussed herein, *Digital Image Correcting Method for Digital Camera*, published December 1, 2005, shows using “image processing software embedded in the digital camera” as a “method to correct the aberrations and intensity of a small compact digital camera with a wide-angle zoom lens.” Ex-1035, Abstract. *Digital Image Correcting Method for Digital Camera* shows formulas that use adjustable coefficients to correct distortion, peripheral shading and chromatic shift that change with zoom position, aperture value and shooting distance. Ex-1035, Summary. Additionally, Japanese Patent App. Pub. No. 11-205652 (“Ichiyama”) discloses two additional methods of correction. The first method involves comparing a captured calibration image to an ideal (reference) image in memory, ascertaining the differences between the two images, and generating a correction equation that is stored in memory and used to correct subsequently captured images. Ex-1033, paras. 5-8, 15-16. The second involves using a fast-Fourier transform (FFT) to transform captured image data to the frequency domain and applying previously derived and stored frequency-domain correction equation to correct the image, and finally, performing an inverse-

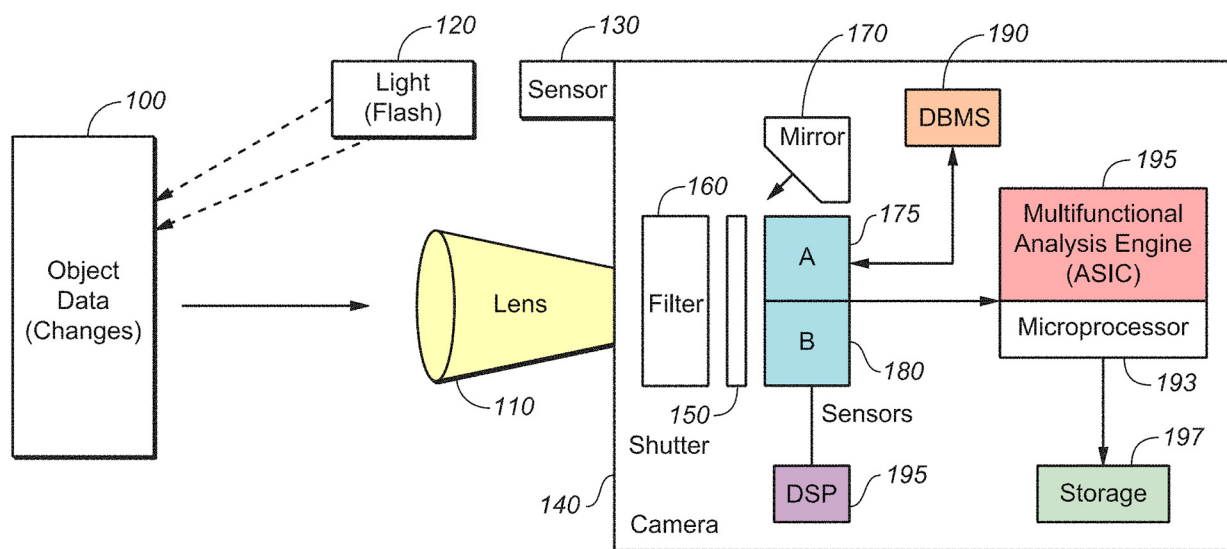
Fourier transform (IFFT) to complete the image processing. Ex-1033, paras. 26, 29, 30, fig. 6. Further, not only can correction equations be stored in memory, but correction data and correction coefficients may also be stored in a database in memory. For example, Japanese Patent App. Pub. No. 5-3568 (“Shiomi”) describes a video camera device that corrects chromatic aberration resulting from the use of a zoom lens. Ex-1031, Abstract. Shiomi discloses tables that store tables of “aberration correction coefficients” indexed to “focal length information f_M and a focusing lens movement amount ΔN ” of the zoom lens. Ex-1031, para. 21, figs. 6(b)-(c).

IX. Overview of the ’685 Patent

A. Brief Description

58. The Background of the ’685 Patent describes existing optical technologies that were used to correct for imaging aberrations, both in film and digital photography. For example, the ’685 Patent discussed the advent of auto-focus technology, image stabilization, in camera automation, and known processes for correcting aberrations in images. Ex-1001, 1:57-6:62. In particular, the ’685 Patent discusses correction of optical lens aberrations in both prior film photography and digital photography. The ’685 Patent asserts that the prior technologies lacked “in-camera modification capabilit[ies] for each specific image problem.” Ex-1001, 6:63-67. The ’685 Patent describes a digital video camera capable of identifying

and correcting for optical image aberrations using well-known components: (i) an optical lens mechanism (e.g., lens 110, yellow), (ii) a digital sensor (e.g., digital sensor 175 or 180, blue), (iii) an integrated circuit (e.g., ASIC 195, red) with a digital signal processor (e.g., DSP 195, purple) for accessing a database management system (e.g., DBMS 190, orange), and (iv) a memory storage sub-system (e.g., storage 197, green). Ex-1001, claim 1.



Ex-1001, fig. 1.

B. Prosecution History

59. The prosecution history has no substantive discussion of the references cited here, or any references other than the previously issued patents by the same inventor. Iwasawa, as well as supplemental references Ito, Prilutsky, Miyazawa, and Matsutani, were never cited and Enomoto merely cited in an information disclosure statement filed after issuance of the sole rejection.

X. Overview of the Prior Art References

60. I have reviewed and am familiar with the following prior art references: (1) Iwasawa, (2) Enomoto, (3) Ito, (4) Prilutsky, (5) Miyazawa, and (6) Matsutani.

A. Iwasawa

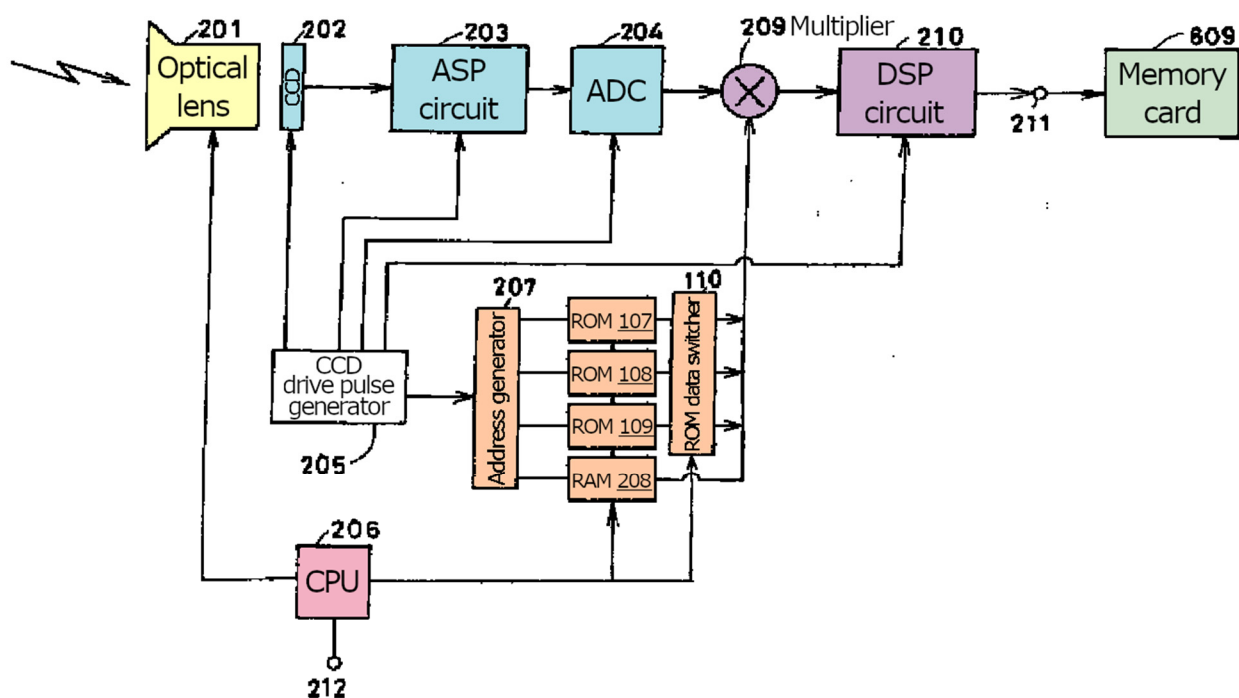
61. Iwasawa published on February 8, 2000. It regards “image input devices” (IIDs) that are configured to capture video and correct for “shading characteristics,” a class of aberrations that includes vignetting. Ex-1005, para. 1, 4, 7.

62. Iwasawa teaches two express embodiments for correcting shading characteristics. Figure 2 illustrates one embodiment, with an IID that includes an optical lens 201, a charge-coupled device (CCD) 202, a CPU 206, a RAM 208, a multiplier 209, and a digital signal processing (DSP) circuit 210. Ex-1005, paras. 1, 19. These and other components of the Figure 2 IID operate to capture and digitize an imaging signal, obtain shading correction data corresponding to characteristics of the lens, and correct for aberrations accordingly. Ex-1005, para. 19-22.

63. Iwasawa illustrates another embodiment in Figure 1, with an IID similar to that of Figure 2 with read-only memories (ROMs) 107-109 and a ROM data switcher 110 (whereas Figure 2 includes a CPU and RAM). Ex-1005, para. 15. ROMs 107-109 store shading correction data and the ROM data switcher 110 selects a ROM according to a lens control signal. Ex-1005, para. 16. Figure 6 of Iwasawa

illustrates a “conventional[]” IID that includes a memory card 609 for storing imaging signals. Ex-1005, para. 2.

64. Below is an illustration of the Figure 2 IID, modified to include a straightforward combination of the ROMs 107-109 and ROM data switcher 110 of Figure 1 and the memory card 609 of Figure 6. For simplicity, I refer to the combination as a “Combined IID.”



Combined IID.

B. Enomoto

65. I have been informed that Enomoto qualifies as prior art. Enomoto discloses “a digital image shooting device” (e.g., a video camera) designed to compensate for a low-quality lens 32 by correcting for aberrations caused thereby. Ex-1006, 1:7-13. To that end, the device includes a data processing unit 16 with a

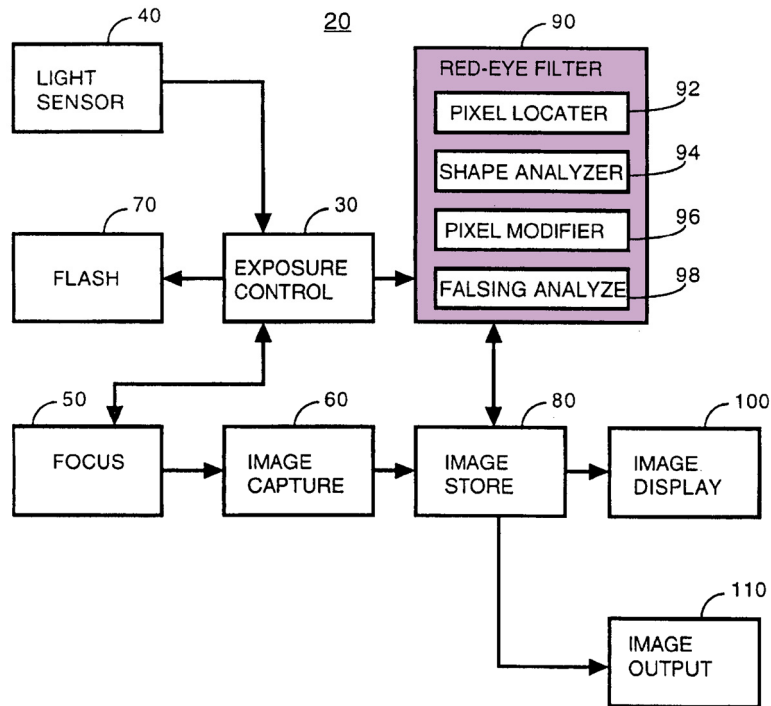
lens characteristic correction unit that corrects for various types of aberrations. Ex-1006, 3:44-49.

C. Ito

66. I have been informed that Ito (Ex-1007) qualifies as prior art. Ito discloses a digital video camera including an imaging means for imaging an incident image from an optical lens system and correction means for correcting chromatic aberration of RGB signals from the imaging means. Ex-1007, para. 7. Ito includes the use of a fast Fourier transform (“FFT”) as the chromatic aberration correction that is applied by digital signal processing. Ex-1007, para. 17.

D. Prilutsky

67. I have been informed that Prilutsky (Ex-1008) qualifies as prior art. Prilutsky discloses “[a] method of filtering a red eye phenomenon from a digitized image....” Ex-1008, para. 15. This method involves analyzing regions of a digitized image to determine whether red eye is present. Ex-1008, para. 15. If it is, the relevant regions are modified by applying sub-filters to remove the red eye. Ex-1008, para. 21. Figure 1 of Prilutsky is a block diagram for a camera 20 configured to perform this method. Ex-1008, para. 33.



Ex-1008, fig. 1.

E. Miyazawa

68. I have been informed that Miyazawa (Ex-1009) qualifies as prior art. Miyazawa teaches a method for judging whether dust is adhering on an image sensor device unit. Ex-1009, 2:58-67. (Note, Miyazawa uses “dirt” to refer collectively to dirt and dust. Ex-1009, 1:26-27.) When dust is detected on an image element, normal surrounding image data is utilized to correct the image defect caused by the dust. Ex-1009, 6:31-37.

F. Matsutani

69. I have been informed that Matsutani (Ex-1010) qualifies as prior art. Matsutani discloses an image processing system that corrects image aberrations in a

digital camera 1. Ex-1010, para. 23. Aberrations are corrected by a real-time processing unit (RPU) that loads correction processes from a ROM 15. Ex-1010, para. 26-27. Corrected aberrations include spherical aberration, coma, astigmatism, and field curvature. Ex-1010, para. 3.

XI. Ground 1: Regarding Iwasawa and Claims 1, 3, 6, 11-14, 17, and 19

70. In my opinion, Iwasawa discloses or at least renders all elements of claims 1, 3, 6, 11-14, 17, and 19 obvious.

A. Combining Iwasawa's Embodiments

71. Iwasawa is in the same field of endeavor as the '685 Patent and Iwasawa—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Additionally, it is relevant to the alleged problem (Ex-1001, 1:18-21) of providing a camera capable of performing onboard aberration correction, and uses a similar correction data storage scheme. Ex-1005, Abstract, paras. 1, 16.

72. In this section, I rely on the combination of Iwasawa's embodiments I discussed above (Section IX(A)) which incorporates the ROMs 107-109 and ROM data switcher 110 of Figure 1 and the memory card 609 of Figure 6 into the IID of Figure 2. As I discuss in more detail below, there was ample motivation to create this straightforward combination.

73. In my opinion, inclusion of prestored shading correction data, as in the IID of Figure 1 of Iwasawa, in the IID of Figure 2, would have been motivated by the disclosure of Iwasawa.

74. From Iwasawa's disclosure, the IID of Figure 2 could include correction data stored in advance. For example, the IID of Figure 2 could be modified to include ROMs 107-109. The ROMs 107-109 could be controlled by the CPU 206 of Figure 2 or the ROM data switcher 110 could also be included. Alternatively, shading correction could be stored prior to image capture in the RAM 208. Ex-1005, paras. 19-21. The motivation for this is at least threefold.

75. *First*, Iwasawa expressly discloses that the memory structures that include the prestored shading correction data "do not need to be ROMs as long as they are means that can be selected using the control signal output from the optical lens 101." Ex-1005, para. 16. Iwasawa also states that the RAM 208 is a means that can be selected using the control signal output from the optical lens 201. Ex-1005, para. 19. Accordingly, Iwasawa teaches that shading correction data can be stored in advance in other memory types, including in the RAM 208 of Iwasawa's Figure 2.

76. *Second*, Iwasawa expressly discloses that the IID of Figure 2 could be modified to include ROMs 107-109, with or without the ROM data switcher 110. Ex-1005, para. 19. Iwasawa indicates that several elements in the embodiment of

Figure 2 “are the same as the first embodiment.” Ex-1005, para. 19. Additions in Figure 2 include the CPU 206 and RAM 208 and subtractions in Figure 2 include the ROMs 107-109 and ROM data switcher 110. Iwasawa often refers to the first embodiment and the second embodiment as operating in the same manner. Ex-1005, para. 22, fig. 5. The similarities between the embodiments demonstrate the ability to modify the embodiments.

77. The ROMs 107-109 and ROM data switcher 110 provide access to shading correction data stored in advance and the CPU 206 and RAM 208 allow for calculation of shading correction data as necessary. That is, the ROMs 107-109 and ROM data switcher 110 serve a different purpose as compared to CPU 206 and RAM 209. The functionalities provided by the ROMs 107-109 and ROM data switcher 110 could be combined with the functionalities provided by the CPU 206 and the RAM 208, allowing for some correction data to be stored in advance and some shading correction data to be calculated as necessary. This combination would allow a camera to store correction data for a known set of the manufacturer’s existing lens types (e.g., in the ROMs or a portion of the RAM) while also allowing for additional lens types to be added and still supported by the system (e.g., through uploading new correction programs for the additional lens types).

78. *Third*, in addition or as an alternative to Iwasawa’s express motivations, additional motivation is provided by a desire to construct a commercially desirable

digital camera which would include the capabilities of accessing prestored correction data and calculating correction data for a lens in a single IID. As I discussed above, the use of prestored correction data allows for fast access to corrections for known lenses, such as a standard set of lenses provided by the camera manufacturer, allowing faster operation of the camera when switching lenses. Iwasawa discloses that calculation of correction data by the CPU provides “flexible handling... when a different type of optical lens is adopted.” Ex-1005, para. 21.

79. Including prestored correction data in the IID of Figure 2 provides the advantages of both allowing fast access to correction data for a set of known lenses and efficient calculation of correction data when a new lens is adopted. A digital video camera including prestored correction data and the capability to calculate correction data for new lenses would provide added commercial appeal for consumers given the capability to support both new and existing lenses.

80. Moreover, having correction data prestored on the camera enhances speed, consistency, and reliability by allowing for instant, automatic adjustments without requiring network access or manual configuration. Access to prestored data ensures uniform image quality across all photos and simplifies the shooting process, enabling photographers to focus on creativity. Additionally, the use of prestored correction data improves processing efficiency and optimizes battery usage, while also offering future-proofing through easy firmware updates for new lenses or

features. Overall, prestored correction data can provide a more convenient, efficient, and high-quality photography experience.

81. At a minimum, modifying the IID of Figure 2 to include correction data determined in advance (stored in RAM 208) would have been obvious as a simple substitution of one known element (RAM 208) for another (ROMs 107-109) to obtain predictable results (correction data stored in advance in RAM 208) or as a combination of prior art elements (ROMs 107-109 and IID of Figure 2) according to known methods (including the ROM data switcher 110 or embodying functionality in the CPU 206) to yield predictable results (correction data stored in advance).

82. During prosecution of the application that became U.S. Patent 8,451,339, the inventor similarly confirmed that CPUs were a known component included in digital cameras that “controls the computing functions of the camera.” Ex-1012, 154-155. The inventor further indicated that a CPU “may use memory circuits... in order to access data to perform a set of control functions.” The inventor admitted that “these digital circuitry components are generally accepted to be used in a digital camera.” The CPU 206 of Figure 2 of Iwasawa is one such known component that could control the computing functions of a camera, and that such control included accessing memory circuits, such as the ROMs 107-109 of Figure 1.

83. Furthermore, there was a reasonable expectation of success in combining the embodiments in Iwasawa, as the combination is well within the skill level of a POSA (e.g., incorporating prestored correction data and newly calculated correction data were simple and straightforward modifications). Modifying Iwasawa to pre-store correction data is straightforward because it primarily involves software updates, which can be easily integrated into the camera's existing firmware.

84. Cameras, such as the IIDs described by Iwasawa, would have the necessary computational power, storage capacity, and standardized metadata systems to support software update and data pre-storage functionality. Firmware updates can deliver new or updated correction profiles and the camera's modular design allows for easy implementation of these features with, at most, minimal hardware changes. Overall, the existing infrastructure and capabilities of the IIDs described by Iwasawa would make it simple to add pre-stored lens correction data. In short, combining elements from Iwasawa's embodiments would have been a predictable variation that would not require a leap of inventiveness.

85. Additionally, Iwasawa's teachings motivate the incorporation of memory card 609 of Figure 6 into the IID of Figure 2.

86. The video signal output 211 generated by the DSP 210 would inherently need to be stored (e.g., to allow for retrieval of such data from the IID). Iwasawa teaches that storage of a processed digital imaging signal in a memory card

609 was part of conventional IID systems. Ex-1005, para. 2. Iwasawa further discloses that the problems identified in conventional IIDs, specifically the requirement to change the reference voltage output from an A/D converter 604 and wait for stabilization of the A/D converter 604, is solved by introducing the multiplier 209 to apply corrections to the digital signal output of the A/D converter 204. Ex-1005, para. 7.

87. The DSP 605 and the DSP 210 are each configured to synchronize a digital imaging signal initially obtained from a CCD to output an imaging signal obtained in digital signal processing. Ex-1005, paras. 2, 15, 21. Therefore, the output of DSP 210, like the output of the DSP 605, would inherently be stored in a memory structure of some kind, such as a memory card.

88. Even where the IID of Iwasawa does not expressly include a memory structure for storing video output signal 211, there was ample motivation to add a memory structure, such as the memory card 609. Iwasawa provides express motivation for this modification, stating that memory card 609 is “for storing an imaging signal obtained in digital signal processing....” Ex-1005, para. 2.

89. The DSP 605 and DSP 210 are each DSPs configured to output a signal after signal processing and the output of each is an imaging signal obtained in digital signal processing for later in-camera storage which would necessarily need to be stored. Ex-1005, paras. 2, 21. Without storage, commercial desirability of

Iwasawa's camera would have been reduced, as consumers at the time desired their captured videos to be available for later viewing and not for ephemeral purposes. This further confirms the motivation to include a memory structure for storing corrected video files in Iwasawa (to the extent this was not already inherent).

90. In addition to Iwasawa's express motivations for combining the embodiments, modifying the IID of Figure 2 to include the memory card 609 would have been a combination of prior art elements (e.g., Figure 2 and memory card 609) according to known methods (e.g., including a memory card for image and video storage) to yield predictable results (e.g., memory card configured to store an imaging signal obtained in digital signal processing).

91. As I noted above, both the DSP 605 and the DSP 210 output an imaging signal and the output of the DSP 210 could be stored in memory card 609 in the same manner as the output of DSP 605. It is obvious for a digital camera to have memory for storing images because this functionality is essential to its operation. Unlike film cameras, digital cameras rely on electronic storage to save captured images and videos. Memory is a fundamental component that allows digital cameras to retain the video they capture, making it a basic and necessary feature.

92. Additionally, the use of memory for storing data has long been established in digital devices, so its inclusion in digital cameras is natural and expected. Consumers also anticipate that digital cameras will store the captured

video for later retrieval and viewing, whether temporarily or permanently, which further reinforces the necessity of memory in these devices.

93. Like the prior combination, the embodiments of Figures 2 and 6 in Iwasawa are combinable for the reasons provided earlier, there was a reasonable expectation of success in combining these embodiments, and the combination is well within the skill level of a POSA (e.g., incorporating prestored correction data and adding a memory card were simple and straightforward modifications). Such modification would have been a predictable variation that would not require a leap of inventiveness.

B. Claim 1

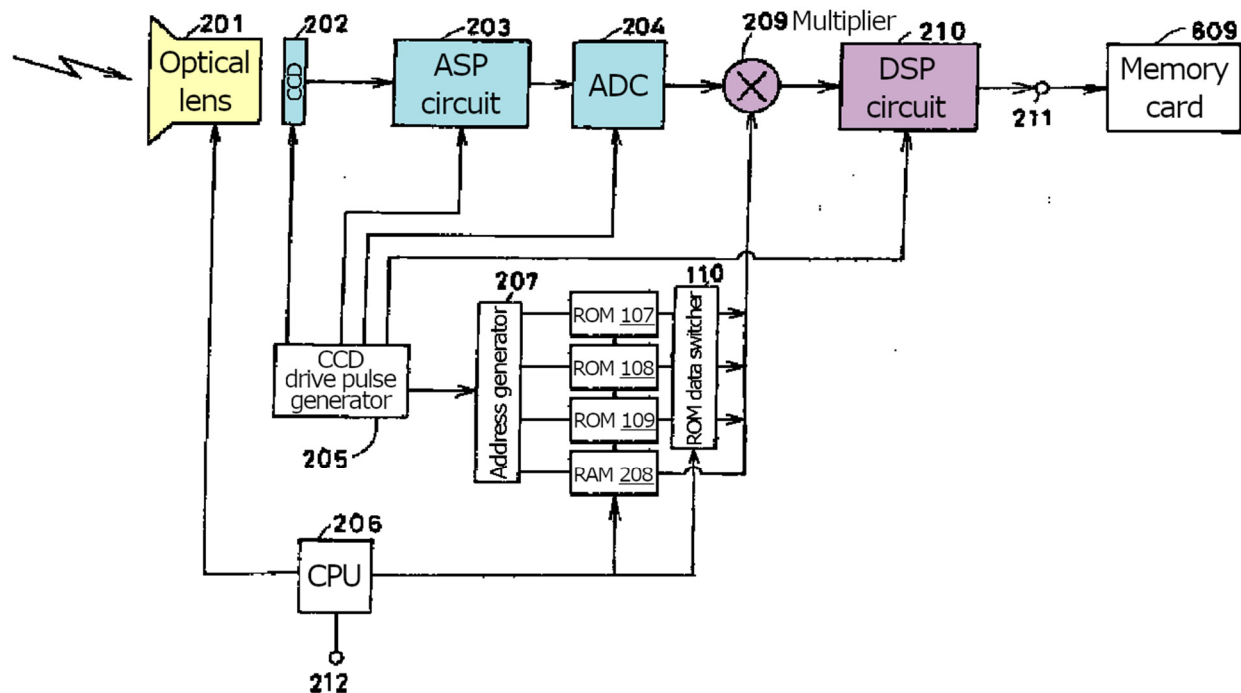
1. Element 1[pre]

“A digital imaging system for correcting optical image aberrations in a digital video, comprising:”

94. Element 1[pre] recites a “digital imaging system” and indicates that the system is intended “for correcting optical image aberrations in a digital video” (though, the body of the claim notably does not seem to require multiple aberrations).

95. In my opinion, Iwasawa teaches or suggests a “digital imaging system” with its embodiments of “an image input device... such as an electronic still camera or a video camera.” Ex-1005, para. 1. Iwasawa includes an optical lens 201 (yellow), a charge-coupled device (CCD) 202, which operates in conjunction with

an analog signal processing (ASP) circuit 203 and an analog digital convertor 204 (A/D convertor), (blue) for producing an imaging signal, and a multiplier 209 and DSP 210 (purple) for performing shading correction on the imaging signal and generating a video output signal 211. Ex-1005, para. 19-21.



Combined IID.

96. Further, in my opinion, Iwasawa renders the correction of multiple aberrations obvious. Iwasawa corrects optical image aberrations as it includes the data needed to correct shading characteristics—including vignetting aberrations—for different lenses, aperture values, and zoom levels. Iwasawa discloses “a shading correction method of an [IID] for correcting the shading characteristics of [a] lens.” Ex-1005, paras. 1, 16, 19.

97. In Iwasawa, correction of shading characteristics refers to correction of various aberrations, including correction of a decrease in the amount of light input through an optical lens in the digital sensor closer to the edges of the lens (e.g., farther away from the center of the lens). Ex-1005, para. 4. A decrease in light farther away from a center of a lens is known as vignetting. This is confirmed by *The Filmmaker's Handbook* (1999), which defines vignetting as “an optical phenomenon in which less light reaches the edge of the image than the center.” Ex-1026. Likewise, the *Wiley Electrical and Electronics Engineering Dictionary* (2004) defines vignetting as “a reduction in brightness at the edges of an image.” Ex-1027, p. 840.

98. I pause here to note that I personally obtained *The Filmmaker's Handbook* from my own library and scanned copies of the relevant pages myself, which I understand is being submitted as Ex-1026. I am familiar with these types of documents and the reference included identifiers I would have expected for a reference of this type. Likewise, I personally obtained the *Wiley Dictionary* from the Notre Dame library and made copies of the relevant pages. I am familiar with these types of documents and the reference included identifiers I would have expected for a reference of this type.

99. Iwasawa teaches that correction of shading characteristics is based on lens parameters, with correction data being selected for a particular aperture value,

zoom position, and lens type. Ex-1005, para. 7. A lens having an adjustable aperture value and/or an adjustable zoom position would have different shading characteristics (e.g., different vignetting) at each adjustment of the aperture value and/or zoom position. Accordingly, Iwasawa discloses multiple aberrations in the form of vignetting at each pairing of aperture and zoom value for a single lens.

100. Iwasawa further teaches that correction data is selected based on a lens type. Ex-1005, para. 7. The lens type signal indicated that different types of interchangeable lenses may be used with the IID. Each of the different lenses would have different shading characteristics, such as different vignetting. Ex-1005, para. 7. Therefore, Iwasawa discloses multiple aberrations in the form of vignetting for pairs of aperture and zoom values for each of the interchangeable lenses.

101. Additionally, if “optical image aberrations” requires different aberrations for a single lens at a single aperture value and zoom position, Iwasawa discloses that each color signal has different shading characteristics, i.e., different aberrations, requiring different correction data. Ex-1005, para. 24. These aberrations impact quality of an image obtained by Iwasawa’s optical lens, and thus each of these aberrations requires correction for each lens at each pairing of aperture and zoom values.

102. Lenses exhibit different aberrations at various aperture settings and zoom values because of how light interacts with the optical elements within the lens.

At wider apertures, more light passes through the edges of the lens elements, which can lead to spherical aberration, where light rays focus at different points, causing blurring. Wide apertures can also increase chromatic aberration, resulting in color fringing, and vignetting, where the corners of the image become darker. As the aperture is narrowed, these aberrations typically decrease since light is restricted to the central part of the lens, though very small apertures can introduce diffraction, softening the image.

103. Zoom lenses, which have complex designs to cover different focal lengths, experience changes in aberrations as the zoom level changes. At different zoom settings, the positions of lens elements shift, leading to varying degrees of distortion, such as barrel or pincushion distortion, and changes in field curvature, where the image plane may not be perfectly flat. Chromatic aberration can also vary across the zoom range because the lens elements may not be able to perfectly correct for color dispersion at all focal lengths. These factors contribute to the differing performance of lenses at various aperture and zoom settings.

104. Therefore, Iwasawa renders obvious “[a] digital imaging system [IID] for correcting optical image aberrations [vignetting at different aperture and zoom pairings and for different lenses] in a digital video [imaging signal].”

2. Element 1[a]

“a digital video camera including in-camera software, an optical lens mechanism, at least one digital sensor for

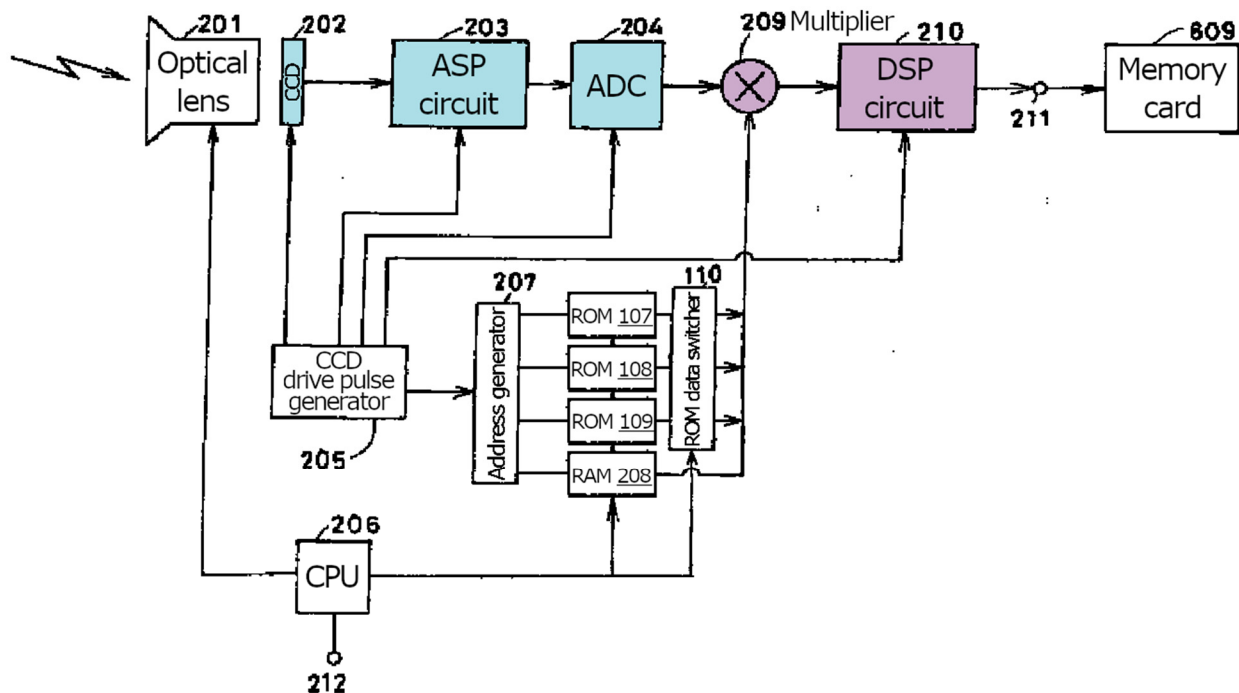
capturing the digital video, an integrated circuit including; a digital signal processor configured to access a database management system including a plurality of optical image aberration corrections, and a memory storage sub-system;”

105. It is my opinion that Iwasawa teaches or suggests 1[a].

106. Element 1[a] recites “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.” I address each of the sub-elements in turn.

a. Digital Video Camera

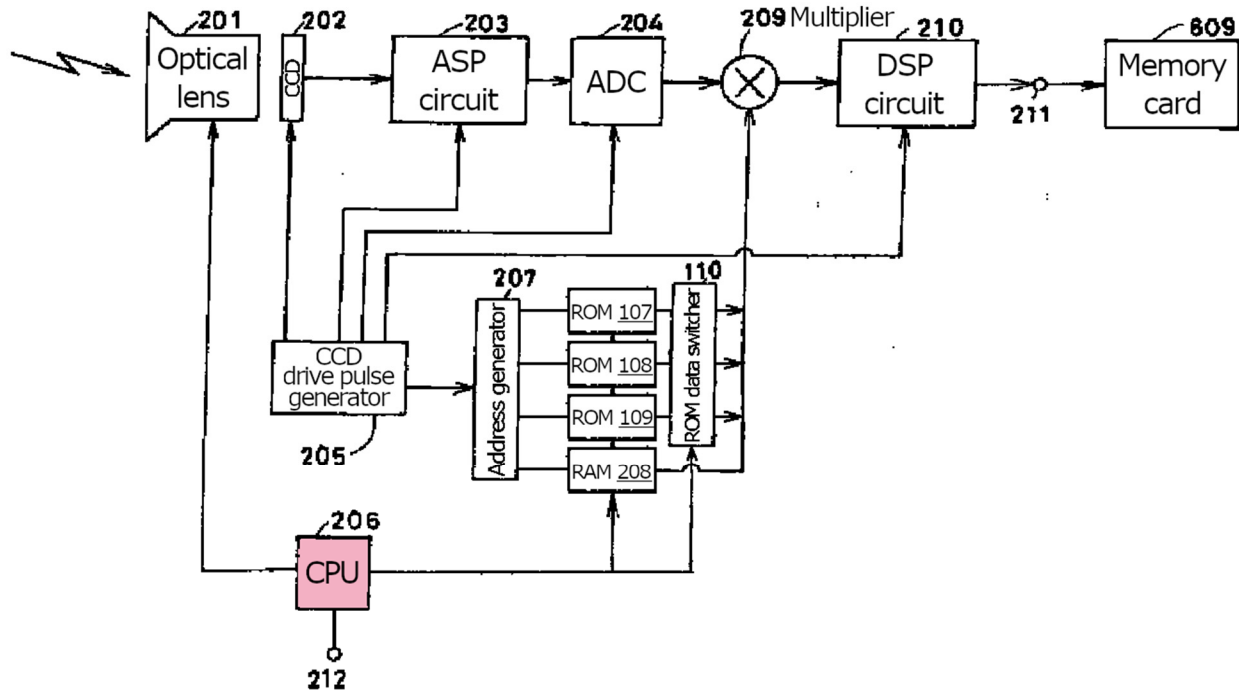
107. The subject matter of Iwasawa “relates to an image input device having an optical system lens such as... a video camera.” Ex-1005, para. 1. Iwasawa includes a charge-coupled device (CCD) 202 that receives an image input using an optical lens 201. Ex-1005, paras. 1, 21. The CCD generates an analog signal that is converted to a digital signal by the A/D converter 204. Ex-1005, paras. 1, 21. After performing shading correction, the digital imaging signal is provided to DSP 210, which synchronizes different color signals in the digital imaging signal to generate a video signal output 211. Ex-1005, paras. 1, 21. Iwasawa discloses that the color synchronization generates “a video signal that can be used in video or the like....” Ex-1005, para. 24.



Combined IID.

b. In-Camera Software

108. Iwasawa includes a CPU 206 that has programs for performing certain camera functions, such as obtaining shading correction data or executing a program corresponding to the scene of a subject. Ex-1005, paras. 19-21. The CPU 206 is located within the camera, and processing performed by a CPU within Iwasawa is performed in-camera.

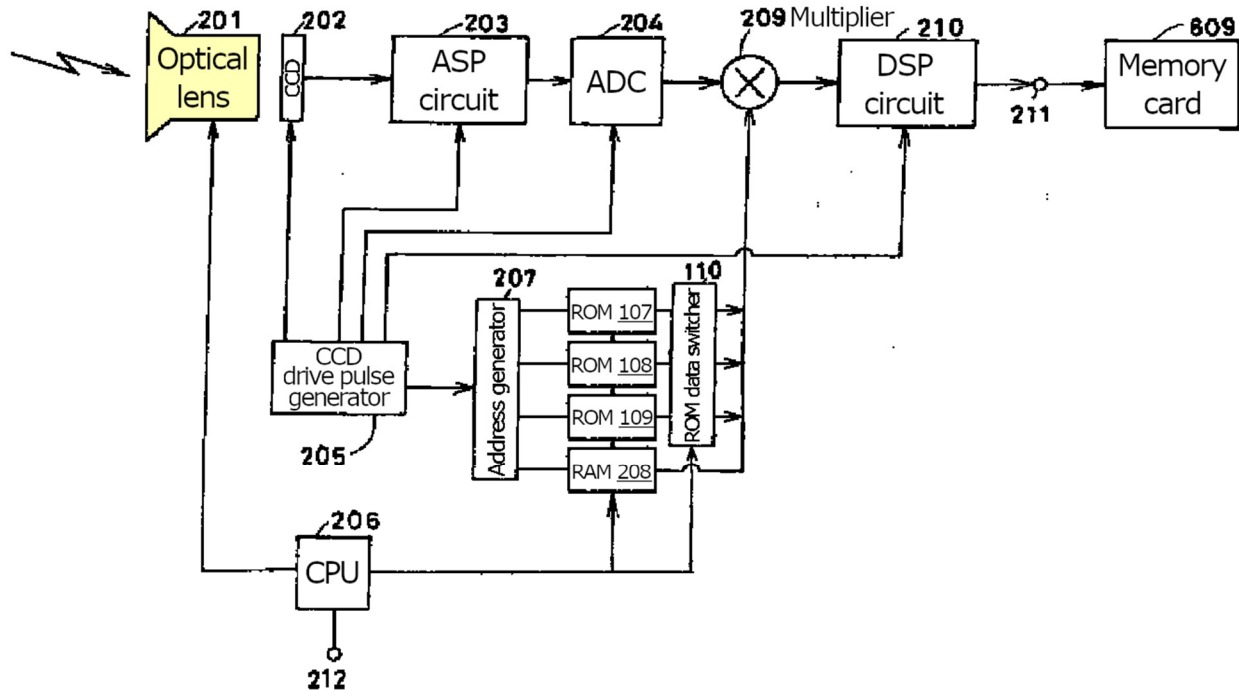


Combined IID.

109. The programs implemented by the CPU may be input from an outside source using a program input 212. Ex-1005, para. 19. Programs implemented by CPU 206 would be software. Ex-1005, para. 19. Therefore, the programs implemented by the CPU 206 of Iwasawa constitute in-camera software.

c. Optical Lens Mechanism

110. Iwasawa includes an optical lens 201 “capable of outputting one or more control signals of an aperture value, a zoom position, and a lens type.” Ex-1005, paras. 15, 21.

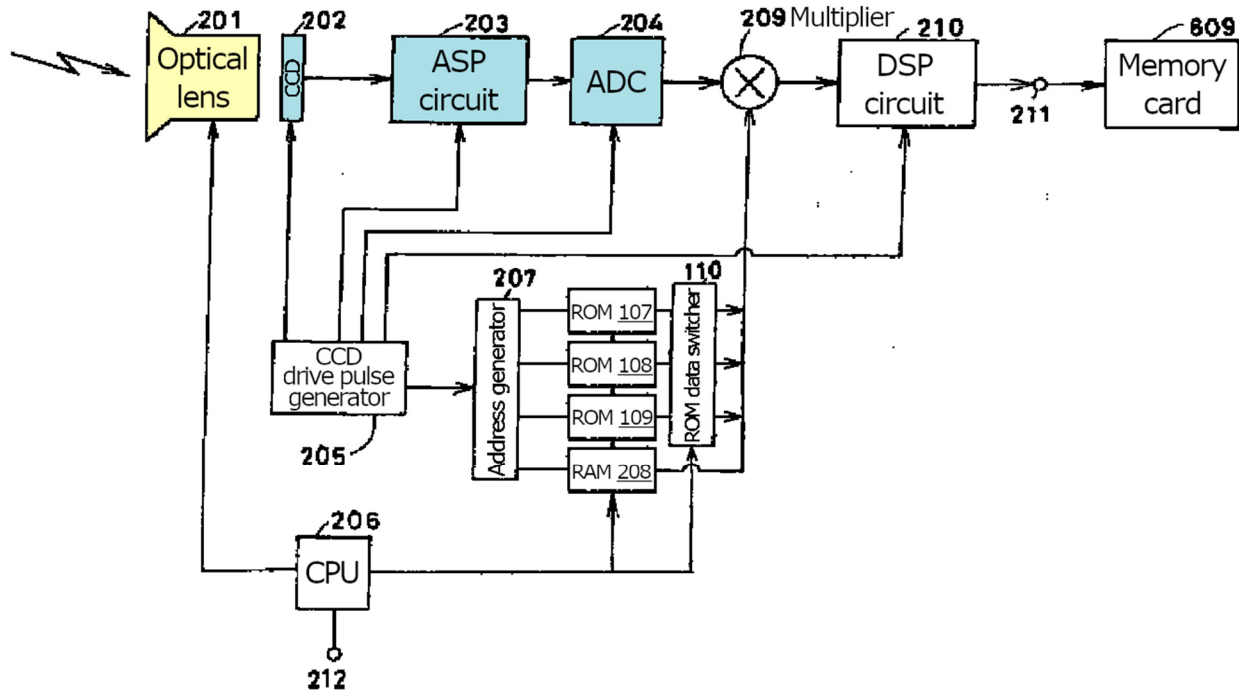


Combined IID.

111. To output a control signal, the optical lens 201 must include one or more components for generating the control signal, and the additional elements constituted a mechanism. Notably, the '685 Patent does not use the phrase “optical lens mechanism” outside of the claims and the only example in the '685 Patent is an optical lens 110, just like what Iwasawa teaches for its optical lens 201.

d. Digital Sensor

112. Iwasawa includes a CCD 202, “a plate type imaging element wherein photoelectric conversion elements for performing photoelectric conversion are arranged in two dimensions and color filters of different colors are arranged on the photoelectric conversion elements....” Ex-1005, paras. 15, 21.



Combined IID.

113. The '685 Patent itself identifies a CCD as a type of digital sensor, thus confirming that Iwasawa's CCD is a digital sensor. Ex-1001, 18:12-15, 35:21-26. To the extent the digital sensor outputs a digital signal, the CCD 202, ASP 203, and A/D Converter 204 collectively generate a digital signal to capture the digital video, and are a digital sensor.

e. Integrated Circuit

114. Iwasawa includes a multiplier 209 and a DSP 210 that together receive correction data and process the digital imaging signal (e.g., apply shading correction) to output a corrected video signal. Ex-1005, para. 17. The multiplier 209 is a calculation means for applying a correction operation, such as a multiplication operation. Ex-1005, paras. 16, 22.

115. As noted in the '685 Patent, a “DSP applies the filtration [] to correct the optical aberrations from the lenses.” Ex-1001, 32:42-44. Similarly, the multiplier 209 applies the shading correction (e.g., filtration) to correct the shading characteristics (e.g., optical aberrations) from a lens. Although Iwasawa labels element 210 as “digital signal processing” in the figures, multiplier 209 performs shading correction and therefore teaches or suggests, either on its own or in conjunction with DSP 210, the “digital signal processor” of claim 1. Multiplier 209 and DSP 210 collectively correct digital input data and output an encoded output video signal by synchronizing color signals in a corrected digital image signal. Ex-1005, para. 15, 21.

116. The concept of filtration refers to concept of modification of the pixel values in an image by modifying each and every image pixel based on the computation of some function of the original pixel values. Different filtering techniques have different computational requirements. For example, spatial filters typically will compute a function using the original pixel value and the values of pixels that are spatially near the pixel. DSP hardware is designed to efficiently implement such filters. Other filtering techniques can employ a much simpler function and as a result can utilize less complex hardware. A filter which only utilizes the pixel value in the computation is sometimes referred to as a post process.

The shading correction described in Iwasawa is an example of such a point process filter. It can be implemented in the multiplier 209 or in the more capable DSP.

117. Further, it was an obvious design choice to implement Iwasawa's multiplier 209, DSP 210, and CPU 206 on an integrated circuit, as integrating these components in this manner was routine and straightforward in this time period. U.S. Patent No. 7,738,015 ("Steinberg") teaches that many of the processes implemented in a digital camera may be implemented in or controlled by software operating in a microprocessor, central processing unit (CPU), controller, digital signal processor (DSP) and/or an application specific integrated circuit (ASIC). Ex-1021 4:4-14. U.S. Patent No. 7,936,392 ("Ng") teaches sensor data processing circuitry can include one or more microprocessors, Application-Specific Integrated Circuits (ASICs), digital signal processors (DSPs), and/or programmable gate arrays (FPGAs), depending upon the implementation. Ex-1022 23:59-24:4.

118. Below, I make various references to the "multiplier alone or with DSP 210," and by this I mean to refer to three potential design-choice options: (i) the multiplier 209 alone, (ii) the multiplier 209 and DSP 210 as they are arranged in the Combined IID, and (iii) the multiplier 209, DSP 210, and CPU 206 as an integrated circuit.

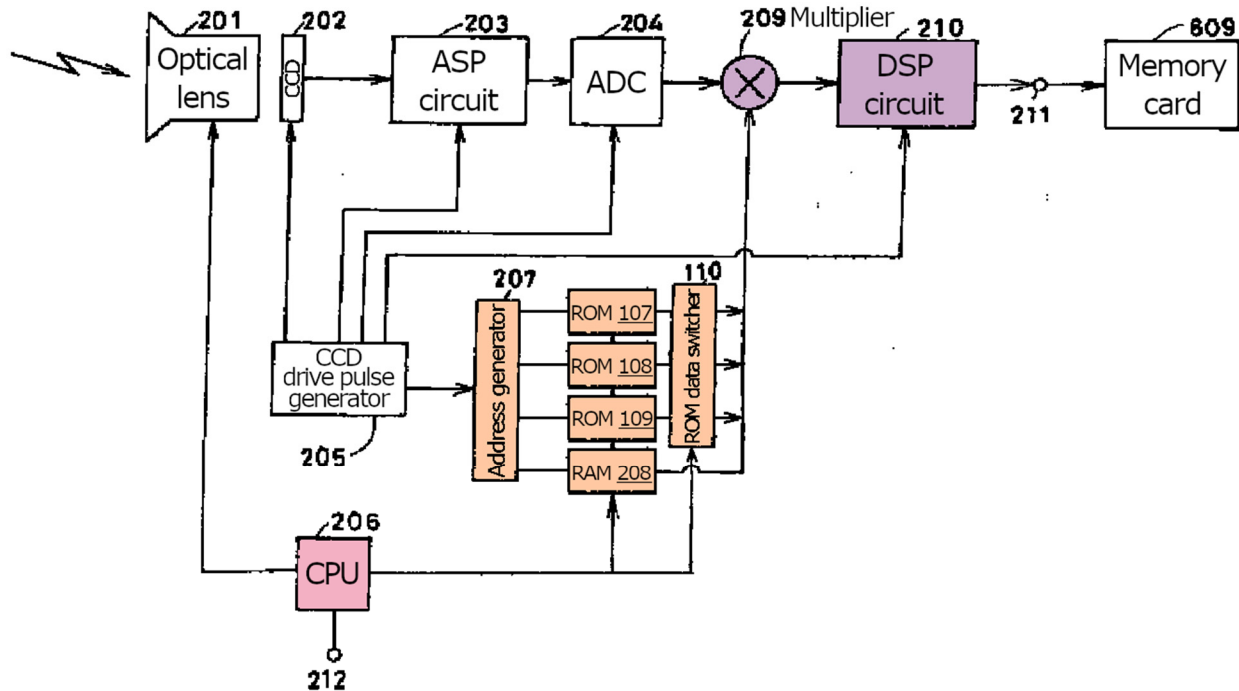
119. The integrated circuit of Iwasawa (i.e., multiplier 209, alone or with DSP 210) receives shading correction data that is stored in advance, either in RAM

208 or from one of ROMs 107-109. Ex-1005, para. 16, 19. The data storage elements (RAM 208 or ROMs 107-109) store correction data for corresponding aperture value, zoom value, and lens types that is selected based on control signals from the optical lens 201. Ex-1005, para. 16, 19. A POSA would understand that Iwasawa's shading correction data—arranged in a manner that it corresponds to aperture value, zoom value, and lens types and stored in the ROMs 107-109 and/or the RAM 208—is an organized collection of data (e.g., a database).

120. For example, data stored in RAM 208 would be addressable based on RAM addresses, and therefore would be a database. Similarly, data stored in ROMs 107-109 would be organized based on addressable ROMs 107-109. Additionally, software database schemes were well known prior to June 2006, and it would have been obvious to implement storage within the data storage mechanisms (e.g., RAM 208 and/or ROMs 107-109) using a known software database schema, such as a relational database schema.

121. Iwasawa includes CPU 206, which alone or in conjunction with ROM data switcher 110, can provide a controller for accessing RAM 208 and/or ROMs 107-109, and therefore is a database management system for accessing the database structure embodied by RAM 208 and/or ROMs 107-109. In Iwasawa, the control signal from optical lens 201 identifies lens, aperture, and zoom values that would be

used by CPU 206 to select the corresponding memory location having the appropriate shading correction data.



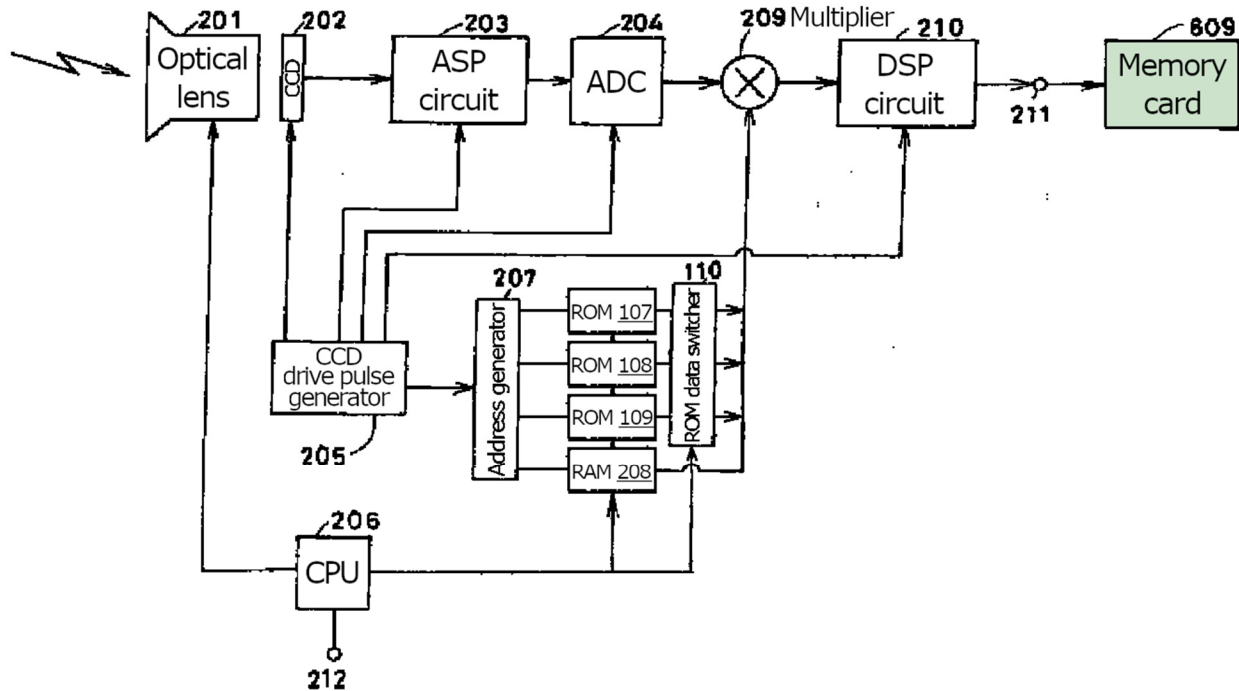
Combined IID.

122. For example, in straightforward implementation options including shading correction data prestored in RAM 208, CPU 206 outputs a signal to RAM 208 identifying the address(es) within RAM 208 containing the prestored shading correction data. As another example, in implementation options including the shading correction data prestored in ROMs 107-109, and including ROM data switcher 110, CPU 206 passes the control signal to ROM data switcher 110 to select the one of ROMs 107-109 containing the corresponding correction data.

123. As yet another example, in implementation options including the shading correction data prestored in ROMs 107-109, but omitting ROM data switcher 110, CPU 206 embodies the functionality of ROM data switcher 110 and selects the corresponding ROM 107-109 based on the lens control signal. As taught in Iwasawa, shading correction may be performed by selecting prestored shading correction data, inputting correction data to the multiplier, and multiplying by the digital signal. Ex-1005, para. 16, 21. Modified Iwasawa would use the CPU 206 to select prestored shading correction data from RAM 208 and/or ROMs 107-109, i.e., providing access to the database management system including a plurality of optical image aberration corrections by the multiplier 209 (e.g., the integrated circuit including a digital signal processor).

f. Memory Storage Sub-System

124. Although Figure 2 of Iwasawa does not expressly depict memory, storage of imaging signals was a standard and necessary process for IIDs, as I discussed above. Section X(A). For example, the video signal 211 is necessarily stored somewhere in Iwasawa and a memory card, such as memory card 609, is an obvious storage mechanism. For this reason, as well as the detailed discussion above regarding combination of Iwasawa's embodiments, Iwasawa necessarily included a memory storage sub-system, and incorporation of the memory card 609 would have been achievable with a reasonable expectation of success.



Combined IID.

125. Therefore, Iwasawa renders obvious “a digital video camera [IID] including in-camera software [programs executed by CPU], an optical lens mechanism [optical lens 201], at least one digital sensor [CCD 202] for capturing the digital video [imaging signals], an integrated circuit including[] a digital signal processor [multiplier 209, alone or with DSP 210] configured to access a database management system [CPU 206 configured to select RAM/ROM containing corresponding correction data] including a plurality of optical image aberration corrections [correction data with corrections for aberrations], and a memory storage sub-system [necessary memory in Iwasawa, memory card 609, or both].”

3. Element 1[b]

“wherein the optical lens mechanism is a zoom lens or a fixed focal length lens;”

126. In my opinion, Iwasawa teaches or suggests 1[b].

127. Element 1[b] recites “wherein the optical lens mechanism is a zoom lens or a fixed focal length lens.” This element presents alternative options, so disclosing one of a zoom lens or a fixed focal lens meets this element.

128. Iwasawa selects shading correction data based on control signals generated by an optical lens such that “the shading correction of an optimal imaging optical system is automatically performed even when the aperture value, the zoom position, and the lens type of the optical lens are changed.” Ex-1005, *para.* 8. Similarly, the recording means of Iwasawa “stores shading correction data corresponding to one or more conditions of the aperture value, zoom position, and lens type of the optical lens.” Ex-1005, *para.* 12. An optical lens capable of changing a zoom position is a zoom lens.

129. Additionally, Iwasawa supported interchangeable lenses (Section X(B)(2)(c)) and interchangeable lenses would have included fixed focal length lenses. For example, U.S. Patent 6,603,885 (“Enomoto ’885”) teaches that a focal length of a lens “which has no zooming capability may be acquired from the information for identifying the lens type....” Ex-1011, 40:46-49. Similarly, U.S.

Patent No. 5,227,832 (“Kawasaki”) teaches attachment of a zoom lens, a single focus lens, or a single focus macro lens. Ex-1016, 5:48-53.

130. Cameras commonly support interchangeable lenses because each lens has benefits and drawbacks. Zoom lenses allow quick adjustment of composition that allows a user deal with the demands of a changing environment where there is a need to quickly adapt to different shooting conditions. On the other hand, while fixed focal length (typically referred to as prime lens) do not have this advantage they will generally have a higher optical quality and fewer aberrations due to their less complex design. A typically user of a camera with interchangeable lenses will have several type of lenses, including both zoom and prime lenses so that they can choose the lens that is most appropriate for the situation.

131. To have a changeable aperture value or zoom position, the optical lens of Iwasawa would have included mechanical elements for adjusting the optical lens to change the aperture value or zoom position. For example, U.S. Patent Publication 2002/0135688 (“Niikawa”) teaches a digital camera with autofocus capabilities. Ex-1017, paras. 58, 60, 84, 89, 90, 101, 177. The focal length of the lens in Niikawa is user adjustable and a shading correction circuit performs shading correction with reference to a plurality of correction tables stored in a shading ROM for different optical conditions such as focal length at the time of imaging, similar to Iwasawa.

132. U.S. Patent No. 5,227,832 (“Kawasaki”) similarly teaches an auto-focus process that can be performed by an in-camera auto-focus motor. Ex-1016 1:7-10, 2:26-31; 4:65-5:2, 7:56-64, 3:65-4:4, 5:10-24, 7:56-64, 11:34-46. Kawasaki’s camera performs aberration corrections based on aberration correction data corresponding to photographer-adjustable focal length of lens.

133. Therefore, Iwasawa renders obvious “wherein the optical lens mechanism [optical lens 201] is a zoom lens [lens capable of changing zoom position] or a fixed focal lens [interchangeable, fixed focal length lens].”

4. Element 1[c]

“wherein the integrated circuit uses the in-camera software to identify at least one optical image aberration and 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”

134. In my opinion, Iwasawa teaches or suggests 1[c].

135. Element 1[c] recites “wherein the integrated circuit uses the in-camera software to identify at least one optical image aberration and 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.”

136. Iwasawa uses the CPU 206 to identify the correction data to be applied to the received image signal. In Iwasawa, the multiplier 209 receives correction data from a database (RAM 208, ROMs 107-109) selected by the CPU and its programs

(in-camera software) based on the control signal identifying the optical lens 201. For example, CPU 206 receives a control signal from the optical lens 201 indicating aperture, zoom, and lens type and identifies the appropriate correction data based on the control signal. Ex-1005, para. 19. In Iwasawa, a CPU configured to receive a control signal and select correction data for corresponding aperture value, zoom position, and lens type is identifying the at least one optical image aberration that is corrected by the selected correction data. Ex-1005, para. 19. Similarly, a CPU configured to select shading correction for each of three color channels is identifying the at least one optical image aberration that is present within the corresponding color channel. Ex-1005, para. 19.

137. Turning to aberration correction, Iwasawa receives the shading correction data identified by the CPU 206 and uses that data to correct the corresponding shading characteristics in the received image signal. Ex-1005, para. 21.

138. As I discussed above, Iwasawa captures an image input and generates a video output signal 211. Section X(B)(2). To generate a video signal, the image signal would necessarily include at least one frame of a digital video. Storage of digital video in the form of multiple still image frames (digital image frames) in memory, such as on a frame-by-frame basis, was well-known prior to the '685 Patent. For example, Enomoto teaches a digital video camera that performs image

correction and stores corrected image data on a frame-by-frame basis. Ex-1006 9:65-10:13. Japanese Patent Publication 2005-25703 (“Yamada”) includes a similar teaching. Ex-1018, paras. 6, 38, 39, 47, 52, 58, 61, 62, 71, 72. Additionally, the ’685 Patent itself recognizes that video can be “viewed as merely a very rapid (30 to 60 frames per second) application of still photography. Ex-1001, 27:32-38.

139. The shading correction is applied to the digital image signal and, therefore, would be applied to each frame in the image signal. Ex-1005, para. 16.

140. Therefore, Iwasawa renders obvious “wherein the integrated circuit [multiplier 209, alone or with DSP 210] uses the in-camera software [programs executed by the CPU 206] to identify at least one optical image aberration [shading characteristics including vignetting] and to correct the at least one optical image aberration in at least one frame of the digital video [image signal] using at least one of the plurality of optical image aberration corrections [correction data provided by the CPU 206 to the multiplier 209] in the database [RAM and/or ROMs storing correction data].”

5. Element 1[d]

“wherein the video is captured by the at least one digital sensor and is forwarded to the digital signal processor”

141. In my opinion, Iwasawa teaches or suggests 1[d].

142. Element 1[d] recites “wherein the video is captured by the at least one digital sensor and is forwarded to the digital signal processor.” For purposes of this

Declaration, I understand “the video” as referring to the “digital video” of claim element 1[a].

143. Iwasawa images a subject image on a CCD 202 using optical lens 201. Ex-1005, para. 21. The CCD 202 generates an imaging signal that is provided to an analog signal processing circuit 203 for sampling and amplification and is converted to a digital signal by the A/D converter 204. Ex-1005, para. 21. The output signal from the A/D converter 204 is provided to, i.e., is forwarded to, the multiplier 209 and the DSP 210. Ex-1005, para. 21.

144. I have been informed that Patent Owner has previously asserted that “[t]he data collected by the sensor [e.g., CCD] must necessarily be forwarded to the image processor in order to process the image.” Ex-1013, para. 79. Therefore, based on that assertion, the video collected by the CCD 202 of Iwasawa must necessarily be forwarded to the multiplier 209 to process the image.

145. Therefore, Iwasawa renders obvious “wherein the video [image signal] is captured by the at least one digital sensor [CCD 202] and is forwarded to the digital signal processor [multiplier 209, alone or with DSP 210].”

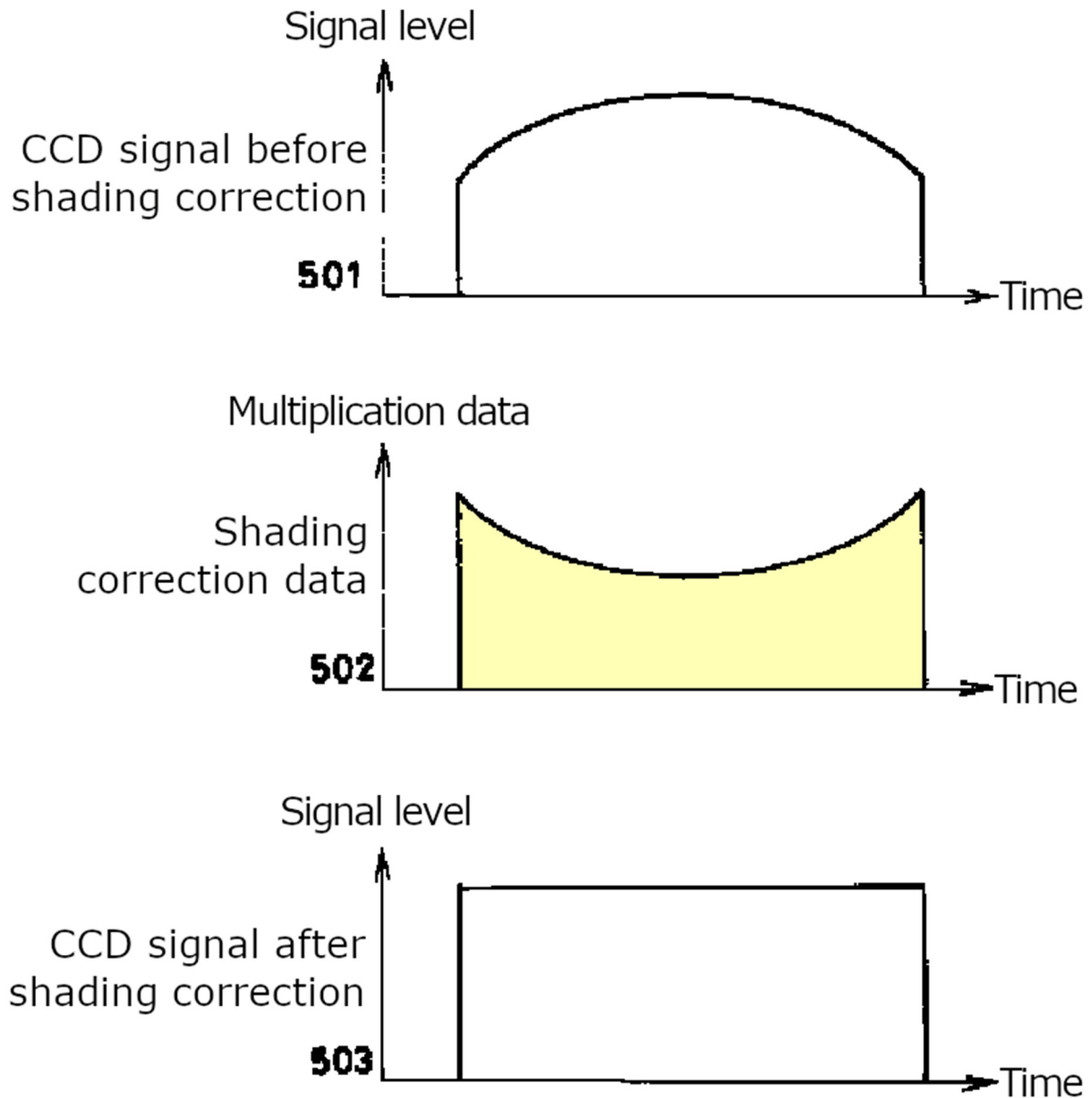
6. Element 1[e]

“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”

146. In my opinion, Iwasawa teaches or suggests 1[e].

147. Element 1[e] recites “wherein the video image file with the at least one optical image aberration is corrected by applying digital filtration using the digital signal processor.” For purposes of this Declaration, I understand “the video image file” as referring to the “digital video” of claim element 1[a].

148. Iwasawa corrects the image signal generated by the CCD 202 and the A/D converter 204 by applying shading correction data. Ex-1005, para. 20. The multiplier 209 applies the shading correction to the digital image signal generated by the CCD 202 and the A/D converter 204 to correct aberrations (e.g., vignetting). Ex-1005, para. 20. The ‘685 Patent recognizes correction of vignetting as digital filtration. Ex-1001, 9:55-10:37 (presenting vignetting correction in a section entitled “Digital Filters to Correct Optical and Digital Aberrations” and referring to vignetting correction as digital application of a “center-neutral density filter to compensate for the light fall-off on the edges.”). Similarly, Iwasawa corrects vignetting by filtering digital video. Ex-1005, fig. 5.



Iwasawa, fig. 5.

149. Therefore, Iwasawa renders obvious “wherein the video image file [image signal] with the at least one optical image aberration [e.g., vignetting] is corrected by applying digital filtration [using correction data to correct vignetting] using the digital signal processor [multiplier 209, alone or with DSP 210].”

7. Element 1[f]

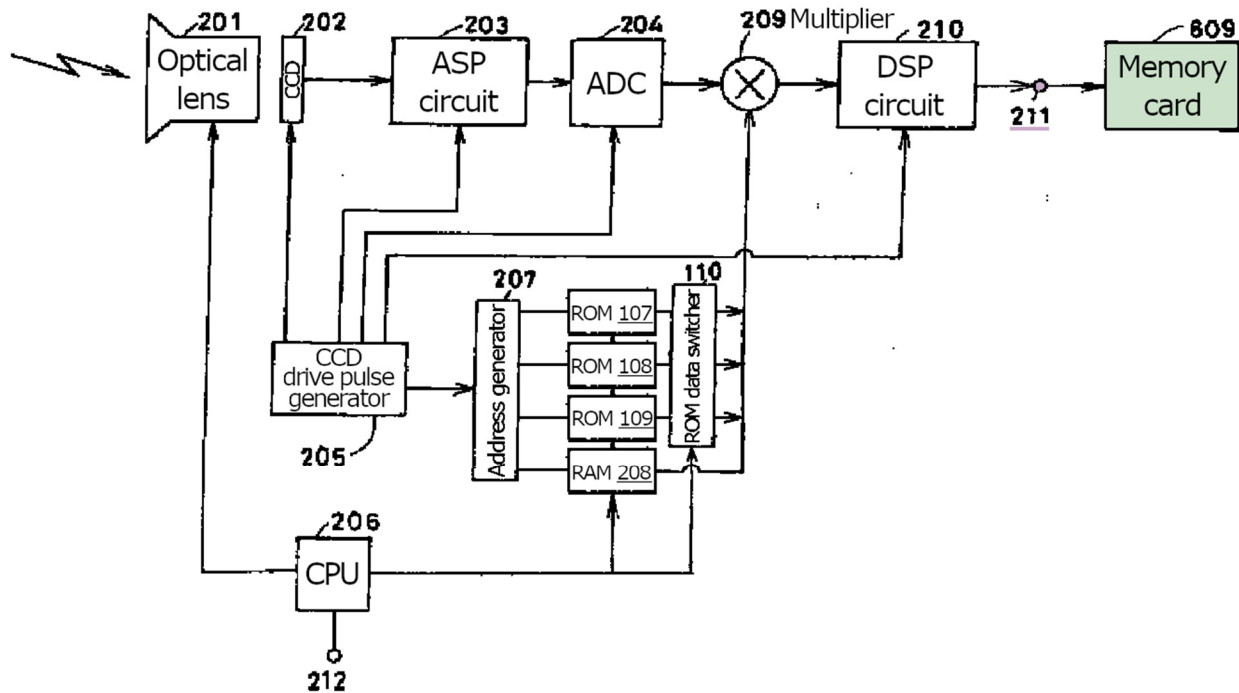
“wherein the corrected video consisting of the digital data optimized from the at least one optical image aberration that are corrected from the original video image is stored in the memory storage sub-system.”

150. In my opinion, Iwasawa teaches or suggests 1[f].

151. Element 1[f] recites “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.” For purposes of this Declaration, I understand (i) “the original video message” as referring to the output of the digital sensor (e.g., the image signal), (ii) “the digital data optimized from the at least one optical image aberration” as referring to the image signal with post-aberration correction, and (iii) “the corrected video consisting of the digital data... that are corrected from the original video image” as referring to the video output (e.g., video signal output 211) of the DSP (e.g., multiplier 209, alone or with DSP 210).

152. As I discussed above, Iwasawa generates a corrected image signal by applying selected shading correction data that corrects corresponding shading characteristics (i.e., optical image aberrations) in the image signal. Section X(B)(4). Iwasawa teaches that correction of shading characteristics optimizes the image signal, selecting “optimal shading correction data” based on a control signal from the optical lens. Ex-1005, para. 16. Memory card 609 provides for storage of the

corrected image signal in the memory storage sub-system (e.g., storage of video signal 211). Iwasawa stores the corrected image signal (i.e., “the corrected video consisting of the digital data optimized from the at least one optical image aberration....”).



Combined IID.

153. Therefore, Iwasawa renders obvious “wherein the corrected video [video signal output 211] consisting of the digital data optimized [image signal with shading correction applied] from the at least one optical image aberration [vignetting] that are corrected from the original video image [image signal] is stored in the memory storage sub-system [inherent memory, memory card 609, or both].”

C. Claim 3

154. Claim 3 depends from claim 1, which Iwasawa renders obvious. Section X(B). In my opinion, Iwasawa further teaches or suggests the additional elements of claim 3.

1. Element 3[a]

“wherein the optical image aberration is vignetting”

155. Element 3[a] recites “wherein the optical image aberration is vignetting.”

156. As I explained in the preceding section, Iwasawa discloses correction of vignetting, and therefore discloses “wherein the optical image aberration is vignetting.”

2. Element 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 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 of the image; and”

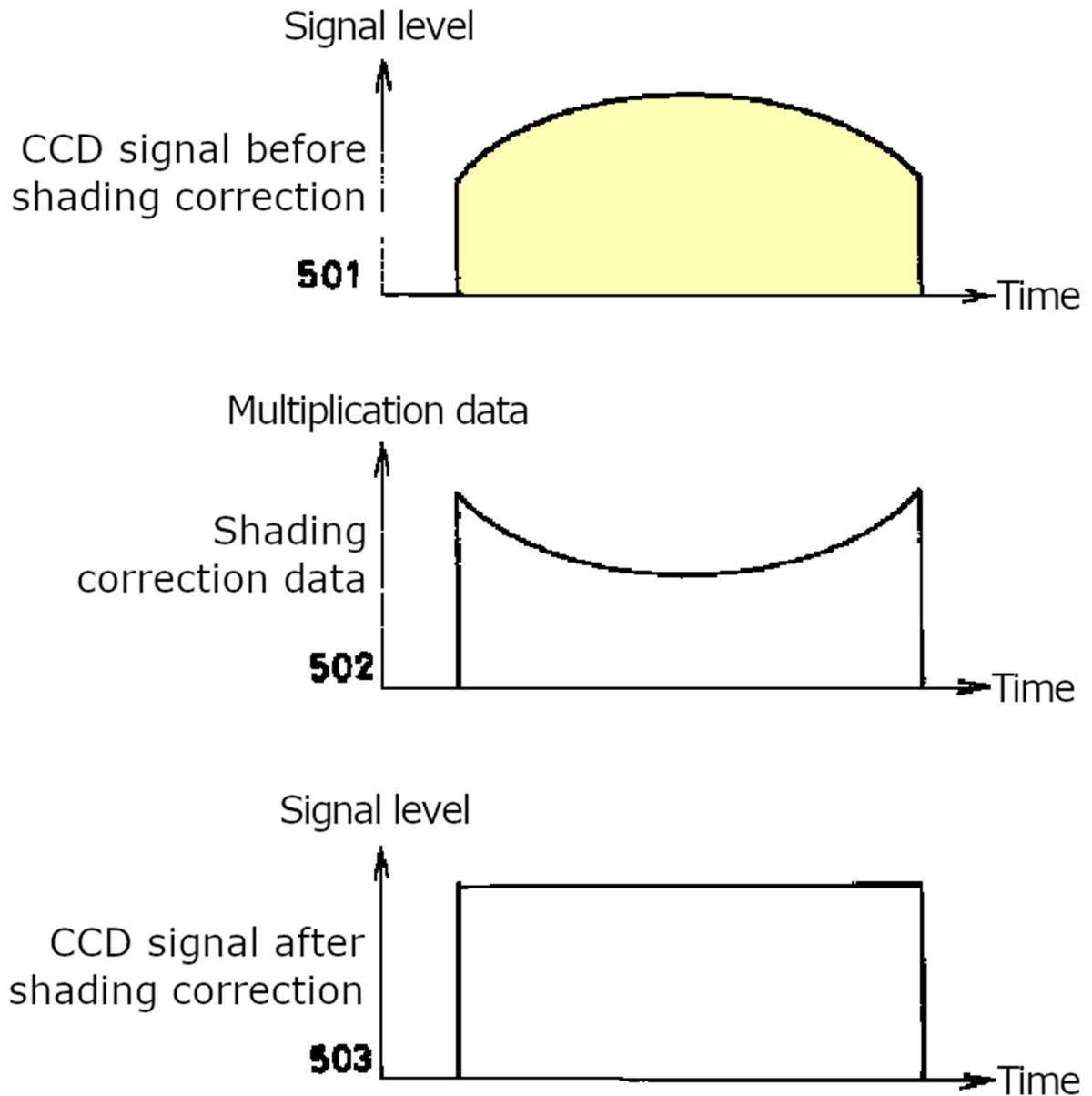
157. In my opinion, Iwasawa teaches or suggests 3[b].

158. Element 3[b] recites “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 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 of the image.” For purposes of this Declaration, I understand “the comers” to mean “the corners” and “the image” as referring to the “at least one frame of the digital video” of claim element 1[c].

159. This claim element is written in the alternative, requiring only one of: (1) the digital signal processor applies neutral density filtration from one third of a stop to three stops in the center of the image; (2) the digital signal processor applies an algorithm to lighten the comers of the image or the digital signal processor applies both neutral density filtration in the image center; or (3) an algorithm to lighten the comers of the image.

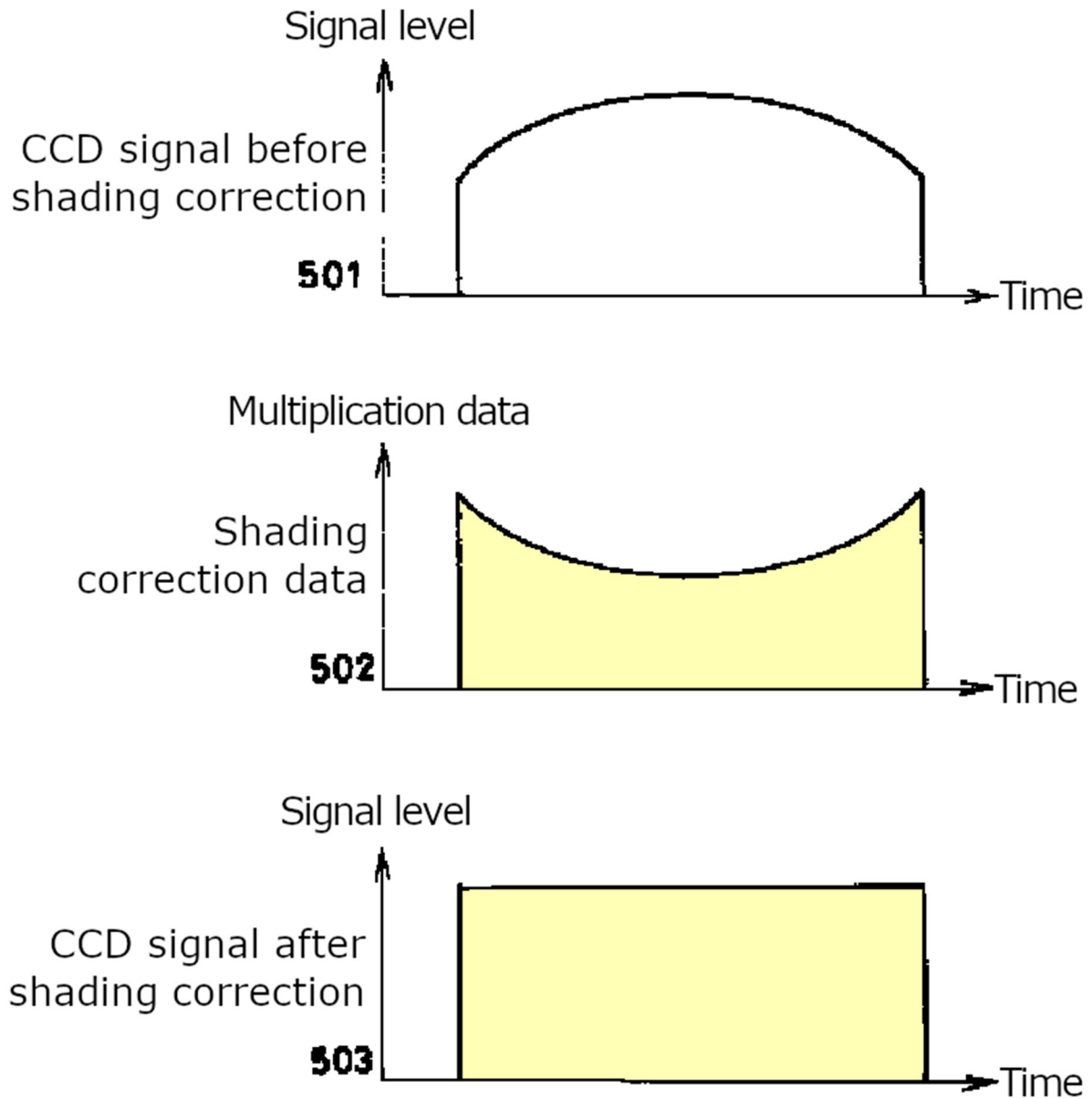
160. Iwasawa’s imaging signal from the CCD 202 is a “point sequential signal of different color signals such as an R-G line 402 and a G-B line 403 for each line.” Ex-1005, para. 24. The CCD 202 includes a grid of photoelectric conversion elements with corresponding color filters that are transferred (e.g., read out) through a vertical CCD to a horizontal CCD and output by an output amplifier. Ex-1005, para. 23. Prior to shading correction, the output of CCD 202 will have higher values near a center and lower values at a beginning and end of the signal, for example as illustrated in FIG. 5 of Iwasawa:



Ex-1005, fig. 5.

161. The beginning and end of the image signal represent values for photoelectric conversion elements located at the periphery of the CCD that correspond to locations farther from the center of the optical lens 201. Ex-1005, paras. 17, 24-25.

162. Shading correction data, such as shading correction data 502, has higher values at the beginning and end of the shading correction data and a lower value at a mid-point. Ex-1005, fig. 5. When the shading correction data is applied to the CCD signal, a substantially parallel corrected CCD signal is generated:



Ex-1005, fig. 5.

163. The higher values at the beginning and end of the shading correction data result in a lightening of the image signal at the beginning and ending, corresponding to the edge positions of the lens.

164. The correction data, and application thereof by the multiplier 209, is an algorithm. The correction data is a sequential set of values that are applied by the multiplier 209 to the CCD signal sequentially to generate the output corrected CCD signal. Ex-1005, fig. 5.

165. It would have also been obvious to perform shading correction via one or more algorithms that use shading correction data, as the method of applying correction data is a design choice. For example, Enomoto '885 teaches using correction formulae (algorithms) and correction coefficients (correction data) to process distortion corrections including shading corrections. Ex-1011 24:10-13, 53:17-25.

166. Therefore, Iwasawa renders obvious “wherein the digital signal processor [multiplier 209, alone or with DSP 210] applies an algorithm [correction data and application thereof by multiplier 209] to lighten the corners of the image.”

3. Element 3[c]

“wherein the image exposure is optimized to correct the vignetting.”

167. In my opinion, Iwasawa teaches or suggests 3[c].

168. Element 3[c] recites “wherein the image exposure is optimized to correct the vignetting.” For purposes of this declaration, I understand the “image exposure” as referring to the “at least one frame of the digital video” of claim element 1[c].

169. As I discussed above, Iwasawa discloses correction of vignetting. Section X(C)(1). Iwasawa further discloses that “optimal shading correction data” is selected based on a control signal from the optical lens. Ex-1005, para. 16. Optimization of image exposure included correction of values received at a corresponding aperture value to correct for light fall off at the edges of the lens.

170. Iwasawa provides “an optimal imaging optical system” that performs correction automatically based on the aperture value, zoom position, and lens type of the optical lens, Ex-1005, para. 8, and therefore optimizes the image signal for the corresponding aperture value, zoom position, and lens type. The correction data is applied to the CCD image signal to generate a substantially parallel corrected CCD signal, i.e., optimized image exposure that corrects shading characteristics (i.e., vignetting). Ex-1005, fig. 5.

171. Therefore, Iwasawa renders obvious “wherein the image exposure [image signal] is optimized to correct the vignetting.”

D. Claim 6

1. Element 6[pre]

“A digital imaging system for correcting image aberrations comprising”

172. In my opinion, Iwasawa teaches or suggests the preamble of claim 6.

173. Element 1[pre] recites “[a] digital imaging system for correcting image aberrations comprising.”

174. This element is substantially the same as the preamble of claim 1 and is taught by Iwasawa for the reasons I discussed above with respect to element 1[pre]. Section X(B)(1).

2. Element 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;”

175. In my opinion, Iwasawa teaches or suggests 6[a].

176. Element 6[a] recites “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.”

177. This element is substantially the same as element 1[a] and is taught by Iwasawa for the reasons I discussed above with respect to that element. Section X(B)(2).

3. Element 6[b]

“wherein the optical lens mechanism is a zoom lens or a fixed focal length lens”

178. In my opinion, Iwasawa teaches or suggests 6[b].

179. Element 6[b] recites “wherein the optical lens mechanism is a zoom lens or a fixed focal length lens.”

180. This element is substantially the same as element 1[b] and is taught by Iwasawa for the reasons I discussed above with respect to that element. Section X(B)(3).

4. Element 6[c]

“wherein the video is forwarded to storage in memory”

181. In my opinion, Iwasawa teaches or suggests 6[c].

182. Element 6[b] recites “wherein the video is forwarded to storage in memory.”

183. As I discussed above in Section X(B)(7), Iwasawa renders obvious storing the corrected video in memory. A POSA likewise would have found it obvious to store the video in memory prior to correcting it as the video would inherently need to be stored somewhere between capture and correction. This

memory could be the memory card 609 discussed above or other, more transitory memory (e.g., RAM 209).

184. Therefore, Iwasawa renders obvious “wherein the video is forwarded to storage in memory [memory card 609, RAM 209, or other inherent memory].”

5. Element 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”

185. In my opinion, Iwasawa teaches or suggests 6[d].

186. Element 6[d] recites “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.”

187. As I discussed above, Iwasawa discloses that “at least one optical aberration... of the digital video are identified using the in-camera software and the integrated circuit.” Section X(B)(4).

188. Iwasawa teaches identifying at least one optical aberration (i.e., the same aberration) **in at least two frames** of a digital video. Iwasawa generates a “video signal output 211” based on a corrected digital image signal received from an A/D converter 104. Ex-1005, para. 15, 22. Digital video includes multiple frames. Digital video cameras work by capturing frames in rapid sequence, with each frame captured as in still digital photography. For example, the ’685 Patent

itself indicates that “video be viewed as merely a very rapid (30 to 60 frames per second) application of still photography.” Ex-1001 27:32-38.

189. For example, Enomoto teaches a digital video camera that performs image correction and stores corrected image data on a frame-by-frame basis. Ex-1006 9:65-10:13. Japanese Patent Publication 2005-25703 (“Yamada”) includes a similar teaching. Ex-1018, paras. 6, 38, 39, 47, 52, 58, 61, 62, 71, 72. A video obtained at a constant aperture value, zoom position, and lens type would have at least two frames that each have the same shading characteristics, i.e., the same optical aberrations. Accordingly, after receiving the lens control signal for each frame in a video signal, Iwasawa’s IID would select prestored shading correction data containing corresponding shading correction data for each frame.

190. I understand “at least one optical aberration in at least two frames of the digital video” to refer to correcting a same aberration in the at least two frames, which Iwasawa does, as I discussed above. To the extent this language requires correcting different aberrations in two frames, Iwasawa teaches that as well. Changes in aperture or zoom value during video capture would lead to different shading characteristics across different frames. Section X(B)(1). Moreover, correcting aberrations in multiple frames is a mere duplication of Iwasawa’s correction for a single image frame, without any new or unexpected result.

191. Applying the same aberration correction to each frame of a video having the same zoom and aperture values is essential for maintaining consistent visual quality and ensuring a seamless viewing experience. It prevents disruptions like flickering or shifting distortions, which can break the continuity of motion and distract the viewer. Consistent correction also preserves the intended visual effects and aesthetic, avoids introducing artifacts that could degrade the video's appearance, and streamlines the post-production process by eliminating the need for frame-by-frame adjustments. This uniformity is key to producing a polished and professional final product.

192. Therefore, Iwasawa renders obvious “wherein at least one optical aberration [vignetting] in at least two frames of the digital video [image signal] are identified using the in-camera software and the integrated circuit [programs executed by CPU 206 and/or the multiplier 209, alone or with DSP 210].”

6. Element 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”

193. In my opinion, Iwasawa teaches or suggests 6[e].

194. Element 6[e] recites “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.”

195. Iwasawa discloses “wherein at least one optical aberration from the optical lens mechanism... are corrected by using the digital signal processor to apply at least one digital filtration algorithm” for reasons explained above. Section X(B)(6). Doing this for at least two frames is also taught or suggested. The “video signal output 211” is generated by correcting the image signal received from an A/D converter 104. Ex-1005, para. 15, 22. Where the image signal contains multiple frames, such as in a video signal (at a minimum necessarily), each frame would undergo shading correction before being stored and therefore each frame of a video would undergo shading correction.

196. Therefore, Iwasawa renders obvious “wherein the at least one optical aberration [vignetting] from the optical lens mechanism [optical lens 201] of at least two frames of the digital video [frames of image signal] are corrected by using the digital signal processor [multiplier 209, alone or with DSP 210] to apply at least one digital filtration algorithm [correction data and application thereof by multiplier 209].”

7. Element 6[f]

“wherein the corrected digital video file is stored in memory.”

197. In my opinion, Iwasawa teaches or suggests 6[f].

198. Element 6[f] recites “wherein the corrected digital video file is stored in memory.”

199. This element is substantially the same as element 1[f] and is taught by Iwasawa for the reasons I discussed above with respect to that element. Section X(B)(7).

E. Claim 11

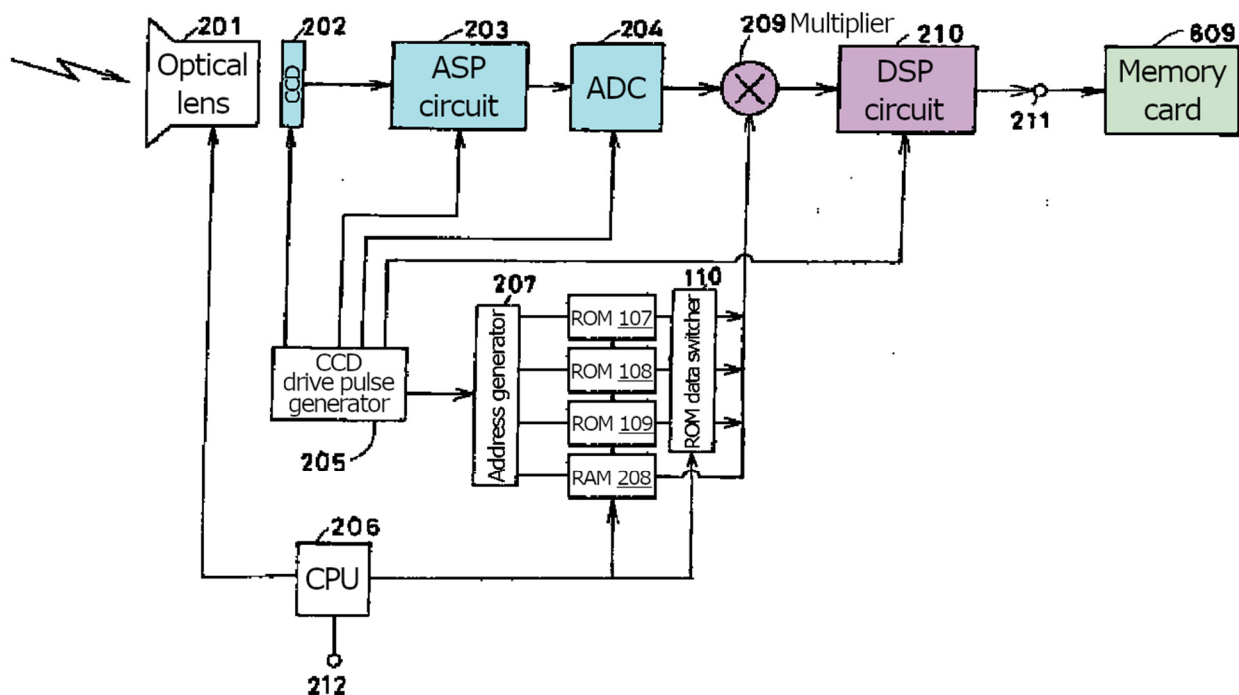
“The system of claim 6: wherein the digital video is filtered to correct at least one optical and/or digital aberrations after initial capture and before the digital video is initially sent to storage.”

200. Claim 11 depends from claim 6, which Iwasawa renders obvious. Section X(D). In my opinion, Iwasawa further teaches or suggests the additional elements of claim 11.

201. The body of claim 11 recites “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.”

202. As I discussed above, Iwasawa teaches filtering to correct at least one optical and/or digital aberration (i.e., shading characteristics). Section X(B)(6). The multiplier 209 corrects the digital image signal prior to the video signal output 211 being generated by the DSP 210 (thus after capturing the image). Ex-1005, para. 21. The video signal output 211 is stored on the memory card 609 after the video signal

output 211 is generated by the DSP 210, and therefore after the shading correction:



Combined IID.

203. Therefore, Iwasawa renders obvious “wherein the digital video is filtered to correct at least one optical and/or digital aberration[] [e.g., vignetting corrected for Iwasawa’s image signal] after initial capture and before the digital video [video signal output] is initially sent to storage [memory card 609].”

F. Claim 12

“The system of claim 6: wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip.”

204. Claim 12 depends from claim 6, which Iwasawa renders obvious. Section X(D). Claim 12 recites “wherein the integrated circuit may be a microprocessor, an application specific integrated circuit or a system on a chip.” If

Claim 12's inclusion of "may" options limits the scope of claim 6, then, in my opinion, Iwasawa teaches or suggests the additional elements of claim 12.

205. As I discussed above (Section X(B)(2)(e)), it would have been obvious to integrate the multiplier 209, the DSP 210, and the CPU 206 on an integrated circuit. Such a circuit would be application-specific because it includes circuitry specifically configured for aberration correction applications—in other words, an ASIC.

206. Also, it would have been obvious to implement the CPU 206 as a microprocessor. Using processors (such as an MPU, a DSP, or a CPU) and ASICs, either alone or collectively, to process image data was well-known in the art. The division of labor among different components, and structure thereof, could be altered as a matter of design preference.

207. For example, U.S. Patent Pub. No. 2007/0080280 ("Havens") teaches that the actual division of labor between processors and an ASIC will naturally depend on the type of off-the-shelf microprocessors that are available, the type of image sensor used, the rate at which image data is output by imaging assembly, etc. Ex-1020, para. 47. Havens also teaches that special purpose processors may be eliminated entirely if a general purpose processor is fast enough and powerful enough to perform all of the functions performed by the special purpose processors.

208. Similarly, U.S. Patent No. 7,738,015 (“Steinberg”) teaches that many of the processes implemented in a digital camera may be implemented in or controlled by software operating in a microprocessor, central processing unit (CPU), controller, digital signal processor (DSP) and/or an application specific integrated circuit (ASIC). Ex-1021 4:4-14. U.S. Patent No. 7,936,392 (“Ng”) teaches sensor data processing circuitry can include one or more microprocessors, Application-Specific Integrated Circuits (ASICs), digital signal processors (DSPs), and/or programmable gate arrays (FPGAs), depending upon the implementation. Ex-1022 23:59-24:4.

209. Therefore, Iwasawa renders obvious “wherein the integrated circuit may be a microprocessor [CPU 206], an application specific integrated circuit [an ASIC including multiplier 209] or a system on a chip.”

G. Claim 13

The system of claim 6:

wherein the optical image aberration is vignetting;

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 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 of the image of at least two image frames; and

wherein the image exposure for at least two frames in the digital video file is optimized to correct the vignetting.

210. Claim 13 depends from claim 6, which Iwasawa renders obvious. Section X(D). Beside recitations of “at least two image frames,” which Iwasawa teaches or suggests (Section X(D)(3)), Claim 13 is otherwise analogous to claim 3 and is therefore obvious for similar reasons. Section X(C).

H. Claim 14

1. Elements 14[pre]

“A digital imaging system for correcting image aberrations comprising”

211. In my opinion, Iwasawa teaches or suggests the preamble of claim 14.

212. Element 14[pre] recites “[a] digital imaging system for correcting image aberrations comprising.”

213. This element is substantially the same as the preamble of claim 1 and is taught by Iwasawa for the reasons I discussed above with respect to element 1[pre]. Section X(B)(1).

2. Element 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”

214. In my opinion, Iwasawa teaches or suggests element 14[a].

215. Element 14[a] recites “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.”

216. This element is substantially the same as element 1[a] and is taught by Iwasawa for the reasons I discussed above with respect to that element. Section X(B)(2).

3. Element 14[b]

“wherein the optical lens mechanism is a zoom lens”

217. In my opinion, Iwasawa teaches or suggests element 14[b].

218. Element 14[b] recites “wherein the optical lens mechanism is a zoom lens.”

219. This element requires an optical lens mechanism to be a zoom lens, which as I discussed above with respect to element 1[b], is taught by Iwasawa. Section X(B)(3).

4. Element 14[c]

“wherein the zoom lens changes focal length positions”

220. In my opinion, Iwasawa teaches or suggests 14[c].

221. Element 14[c] recites “wherein the zoom lens changes focal length positions.”

222. The optical lens 201 of Iwasawa is “capable of outputting one or more control signals of an aperture value, a zoom position, and a lens type.” Ex-1005, para. 15. The output zoom position of the optical lens 201 corresponds to a selected zoom position of a zoom lens, as without an adjustable zoom position (e.g., for a fixed focal length lens), the lens type and aperture value would be sufficient to identify shading characteristics of a lens. The inclusion of a zoom position value in the control signal indicates an adjustable zoom position (e.g., a zoom lens). Further, the inclusion of a zoom position value in the control signal indicates that the zoom lens was capable of changing focal length positions during use, and therefore teaches this element.

223. Other references demonstrate that it was well-understood that zoom lenses were capable of changing focal length positions during use and correction of image data for the corresponding focal length. For example, Niikawa teaches that the focal length of a lens is user adjustable and a shading correction circuit performs shading correction with reference to a plurality of correction tables stored in the

shading ROM for different optical conditions such as focal length at the time of imaging. Ex-1017, para. 58, 60, 84, 177.

224. Similarly, U.S. Patent App. Pub. No. 2004/0150726 (“Gallagher”) teaches a camera that can use user-adjustable focal length as a type of image capture metadata to find or match, or generate appropriate correction parameters stored in the correction database to correct image. Ex-1023, paras. 25, 33. As another example, Kawasaki teaches a camera that can perform aberration correction based on aberration correction data corresponding to photographer-adjustable focal length of lens. Ex-1016, 3:65-4:4, 5:10-24, 7:56-64, 11:34-46.

225. Therefore, Iwasawa renders obvious “wherein the zoom lens [optical lens 201] changes focal length positions [zoom positions].”

5. Element 14[d]

“wherein when the digital video is forwarded to the digital signal processor and to memory”

226. In my opinion, Iwasawa teaches or suggests 14[d].

227. Element 14[d] recites “wherein when the digital video is forwarded to the digital signal processor and to memory.” As I discussed above, Iwasawa forwards digital video (image signal) to a DSP (multiplier 209, alone or with DSP 210). Section X(B)(5). Additionally, image data, whether pre-correction or post-correction, would necessarily be stored in memory (e.g., inherent memory or memory card 609). Section X(B)(7). To the extent the inclusion of “when” in the

claim language is not a typo, Iwasawa discloses that obtaining correction data and correction of an image signal (the steps recited in elements 14[e]-14[f] below) occur “in response to an imaging signal read out from the CCD 202” (e.g., when the image signal is read out). Ex-1005, para. 21.

228. Therefore, Iwasawa renders obvious “wherein when the digital video is forwarded to the digital signal processor [multiplier 209, alone or with DSP 210] and to memory [inherent memory, memory card 609, or both].”

6. Element 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”

229. In my opinion, Iwasawa teaches or suggests 14[e].

230. Element 14[e] recites “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.”

231. This element is substantially similar to element 1[c], with element 14[e] requiring identification occur “at any focal length of a zoom lens configuration.” Iwasawa discloses that correction data is obtained based on aperture value, zoom position, and lens type, and thus included correction data at any focal length of a corresponding lens. Ex-1005, para. 19. To the extent Iwasawa does not expressly disclose “any” zoom position, it would have been obvious to include correction data

for any potential zoom position of a lens to allow correction at all functionalities of the lens.

232. Including correction data for every potential zoom lens position is obvious because zoom lenses exhibit varying optical aberrations, such as vignetting, across different focal lengths and apertures as recognized by Iwasawa. To maintain consistent image quality throughout the zoom range, it is necessary to apply specific corrections at each zoom position. This ensures uniform sharpness, color accuracy, and overall image quality, which is expected by users of the camera.

233. Implementing correction data for every potential zoom lens position is not difficult due to the predictable nature of lens behavior, the processing power disclosed in Iwasawa, and the storage capacity disclosed by Iwasawa. The necessary corrections can be pre-calculated and easily integrated into the camera's firmware, allowing for real-time adjustments without user intervention. This automation not only improves the user experience by delivering optimal results in real-time but also aligns with the technological teachings of Iwasawa that allow for efficient handling of complex correction algorithms across the entire zoom range. This ensures consistent image quality across all zoom settings, making it a practical, efficient and obvious enhancement of Iwasawa.

7. Elements 14[f] and 14[g]

“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;

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”

234. In my opinion, Iwasawa teaches or suggests 14[f] and 14[g].|

235. Element 14[f] recites “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” and element 14[g] recites “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.”

236. These elements are substantially similar to elements (i) 1[c] and (ii) 1[d]-1[f], respectively. Elements 14[f] and 14[g] differ slightly in that they recite “[a] filtration correction algorithm” (instead of the optical image aberration correction of claim 1). Additionally, element 14[f] states that the algorithm is “forward[ed]... to the digital signal processor.” And element 14[g] indicates that the algorithm is “appl[ied]... to optimize the digital video.” As I discussed above,

the correction of vignetting is filtering (Section X(E)), and application of the correction data by the multiplier 209 of Iwasawa is an algorithm (Section X(D)(2)). Therefore, the correction data and application thereof by the multiplier 209 of Iwasawa is a filtration correction algorithm.

237. Given that the Combined IID of Iwasawa has its CPU retrieving shading correction data and passing that to the DSP/multiplier, it also would have been obvious to have the CPU retrieve and pass associated information for applying that shading correction data, e.g., retrieving and passing the shading correction data and an associated mathematical function for use in applying that data to correct the aberration. This is confirmed because such a technique was common general knowledge. For example, Enomoto '885 describes “aberration correcting parameters... [which] may include *correction functions*... for performing aberration corrections.” Ex-1011, 48:15-20. With respect to these parameters, Enomoto '885 describes characteristics supply subsections 114 and 124, each of which “searches through the stored aberration correcting parameters, selects the aberration correcting parameters for the identified lens, and supplies them to the correction parameter transforming subsection 126 [of an imaging processing apparatus].” Ex-1011, 46:21-28. Additionally, element 14[g] requires application of the filtration algorithm to optimize the digital video, as well as correcting the optical image aberration in at least one video frame for the at least one focal length in the zoom

lens configuration. Iwasawa teaches correcting an optical image aberration by applying digital filtration data (i.e., Iwasawa's correction data and application thereof by the multiplier 209, is a filtration correction algorithm (or would have been obvious to apply as an algorithm) and is for at least one focal length in the zoom lens configuration). Sections X(B)(6), X(C)(5). Iwasawa teaches correcting optical image aberrations in at least one video frame. Section X(B)(6).

238. Therefore, Iwasawa renders obvious “wherein the integrated circuit [an ASIC including multiplier 209] accesses the database [ROMs/RAM] to obtain at least one filtration correction algorithm [correction data and application thereof by multiplier 209] to the optical image aberration [vignetting] of at least one frame in the video file and forwards the at least one filtration algorithms to the digital signal processor; [and] wherein the digital video is forwarded to the digital signal processor which applies at least one filtration algorithm [correction data and application thereof by multiplier 209] 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.”

8. Element 14[h]

“wherein the corrected digital video is stored in memory.”

239. In my opinion, Iwasawa teaches or suggests 14[h].

240. Element 14[h] recites “wherein the corrected digital video is stored in memory.”

241. This element is substantially the same as element 1[f] and is taught by Iwasawa for the reasons I discussed above with respect to that element. Section X(B)(7).

I. Claim 17

“The system of claim 14: wherein each focal length of a zoom lens in at least one video image frame is analyzed for a different set of optical aberrations.”

242. Claim 17 depends from claim 14, which Iwasawa renders obvious. Section X(H). In my opinion, Iwasawa further teaches or suggests the additional elements of claim 17.

243. The body of claim 17 recites “wherein each focal length of a zoom lens in at least one video image frame is analyzed for a different set of optical aberrations.”

244. Shading characteristics for different focal lengths are different sets of optical aberrations. Section X(B)(6). Further, Iwasawa teaches that shading characteristics are corrected for a zoom position (i.e., focal length) when the image data is captured. Ex-1005, para. 15. A video image frame would include a single zoom position and the aberrations corrected for the frame would correspond to the single zoom position in that frame.

245. Adjusting the correction in a video as you zoom is essential because the optical characteristics of a lens change with different focal lengths. Aberrations like vignetting vary depending on the zoom setting, requiring different corrections to maintain consistent image quality. Without these adjustments, the video might display inconsistencies in sharpness, color accuracy, and overall image integrity, leading to a jarring viewing experience. By adapting the correction in real-time, you ensure smooth transitions and preserve the professional quality of the video, regardless of changes in focal length based on the zoom position.

246. Iwasawa teaches that different zoom positions have different vignetting values, which is a different set of optical aberrations. Section X(B)(6). Therefore, a change in zoom position of the optical lens 201 would result in a subsequent image, i.e., at least one video image frame, being analyzed for a different set of shading characteristics, i.e., a different set of optical aberrations.

247. Therefore, Iwasawa renders obvious “wherein each focal length [zoom position] of a zoom lens [optical lens 201] in at least one video image frame [image signal] is analyzed for a different set of optical aberrations [vignetting].”

J. Claim 19

The system of claim 14:

wherein the optical image aberration is vignetting;

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

wherein the image exposure for at least one frame in the digital video file is optimized to correct the vignetting.

248. Claim 19 depends from claim 14, which Iwasawa renders obvious. Section X(H). Claim 19 is otherwise analogous to claim 3 and is obvious for similar reasons. Section X(B)(3).

XII. Ground 2: Regarding Iwasawa, Enomoto, and Claims 1-3, 5-7, 10-15, 17-19, 23, 24, 27, 28, and 30

249. Iwasawa and Enomoto disclose or at least render all elements of claims 1-3, 5-7, 10-15, 17-19, 23, 27, 28, and 30 obvious.

A. Combining Iwasawa and Enomoto

250. Enomoto is in the same field of endeavor as the '685 Patent and Iwasawa—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Additionally, it is relevant to the alleged problem (Ex-1001, 1:18-21) of providing a camera capable of performing onboard aberration correction, and uses a similar correction data storage scheme. Ex-1006 1:7-13, 4:16-20.

251. As I discussed above, Iwasawa “provide[s] an image input device that selects shading correction data according to aperture value, zoom position, and lens type, and performs shading correction according to the imaging scene” via

embodiments of an IID that include a multiplier to apply shading correction to a digital image signal. Section X(B). Iwasawa further teaches that programs for additional corrections can be uploaded to the CPU 206 and applied to the imaging signal, Ex-1005, para. 19, which provides motivation to incorporate Enomoto's chromatic aberration correction into Iwasawa.

252. From Iwasawa's disclosure, additional aberration corrections that could be applied to an image signal by a digital camera to produce even higher-quality finished images and videos would have been desired. Similarly, the '685 Patent recognizes multiple types of optical aberrations and corresponding corrections were well known in both digital and film-based photography before the priority date of the '685 Patent. Ex-1001, 1:39-6:62.

253. Enomoto discloses a digital image shooting device that includes an image forming lens, an image sensor element, a data processing unit, an image memory for storing the digital image data, and a lens characteristic correction unit. Ex-1006 Abstract. The lens characteristic correction unit performs "a process for correcting a deterioration of an image quality" of digital image data by using a lens characteristic of the image forming lens. Ex-1006 Abstract. The lens characteristic correction unit "corrects a chromatic aberration of magnification and distortion aberration originating in the lens characteristic, and more preferably, corrects aberrations such a decrease in marginal lumination and defocusing." Ex-1006, 3:44-

49. The correction of multiple aberrations provides for high quality image output from comparatively low-price lenses. Ex-1006, Abstract, 1:60-65.

254. Enomoto further discloses that characteristics of chromatic aberrations or distortion aberrations are stored as lens characteristics. Ex-1006, 8:23-32. For a zoom lens, lens characteristics at a plurality of focal lengths are stored and utilized based on the focal length when photographing through the corresponding lens. Ex-1006, 6:65-7:6. Enomoto further includes correction of vignetting. Ex-1006, 8:4-22. Corrections may be selected or not selected such that a specific set of corrections is carried out. Ex-1006, 8:42-45.

255. Incorporation of the aberration corrections taught in Enomoto into Iwasawa to provide for correction of additional aberrations caused by an imaging lens would have been motivated by a desire to improve image quality. Iwasawa recognized the importance of producing high-quality finished images and videos, including by correcting for vignetting, and other references, such as Enomoto, provide additional aberrations that could be corrected by in-camera processing to thereby produce even higher-quality finished images and videos (e.g., to appeal to more consumers and produce a successful digital video camera).

256. The combination itself provides additional motivation and reasonable expectation of success because Enomoto's correction method is similar to that of Iwasawa. Ex-1006, 3-24-49 (describing a data processing unit 16 configured to

correct for aberrations). Both references disclose receiving lens identification (e.g., lens characteristics in Enomoto and control signals in Iwasawa), retrieving correction data for corrections from a memory (lens characteristics of image forming lens incorporated into Enomoto's digital video camera and Iwasawa's RAM 208/ROMs 107-109), and utilizing a correction component (characteristic correction unit 36 in Enomoto and multiplier 209 in Iwasawa) to apply the correction data to correct a video signal for aberrations. Ex-1005, paras. 7, 15, 16, 19; Ex-1006 4:16-20, 10:31-40.

257. Additionally, Enomoto teaches that correction of multiple aberrations, such as chromatic aberration of magnification and distortion aberrations, is desirable as it provides for a "high-quality image with a stability that there is neither the distortion nor the color deviation, and a cost for the digital camera can be remarkably reduced." Ex-1006, 4:12-15. Such modification includes a combination of known prior art elements (IID of Iwasawa and correction data of Enomoto) according to known methods (storage in memory and retrieval based on lens data) and applying a known technique (e.g., the chromatic and distortion aberration corrections of Enomoto) to a known device ready for improvement (e.g., IID of Iwasawa). Ex-1006, 4:12-15.

B. Claims 1, 3, 6, 11-14, 17, and 19

258. Iwasawa renders claim 1 obvious. Section X(B). To the extent 1[pre] requires correction of different types of optical aberrations, Iwasawa and Enomoto together also teach or suggest this.

259. Enomoto discloses barrel distortion and chromatic aberration correction. Ex-1006, 4:34-40, 6:53-56. Incorporation of the barrel distortion and chromatic aberration correction of Enomoto into Iwasawa would have provided for a “high-quality image with a stability that there is neither the distortion nor the color deviation...” Ex-1006, 4:12-15. For these reasons and the reasons I discussed above regarding combining Iwasawa and Enomoto, addition of barrel distortion and/or chromatic aberration correction data to the prestored correction data in RAM 208 and/or ROMS 107-109 (e.g., the database) of Iwasawa would have been desirable and would have had a reasonable certainty of success.

260. Including barrel distortion and chromatic aberration correction in a camera that corrects for lens aberrations is essential for enhancing overall image quality. Barrel distortion correction ensures that straight lines in images remain true to life, while chromatic aberration correction eliminates color fringing around high-contrast edges, resulting in sharper and more accurate colors. These corrections help deliver consistently high-quality images across different lenses and shooting

conditions, reducing the need for post-processing and providing professional-quality results straight out of the camera.

261. Implementing barrel distortion and chromatic aberration correction in a camera is relatively straightforward given the disclosure of the algorithms of Enomoto, the processing power disclosed by Iwasawa, and the ability to update firmware in such a system. These corrections can be applied in real-time due to the powerful processors of Iwasawa, ensuring seamless and automatic improvements to image quality without requiring additional user input.

262. Therefore, Iwasawa-Enomoto renders obvious “[a] digital imaging system [IID] for correcting optical image aberrations [vignetting, chromatic aberrations, and/or barrel distortion] in a digital video [imaging signal].” Iwasawa-Enomoto renders obvious claims 3, 6, 11-14, 17, and 19 for similar reasons discussed above. Sections X(C)-X(J).

C. Claim 2

“The system of claim 1: 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.”

263. Claim 2 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 2. As I discussed above,

incorporation of the barrel distortion and/or chromatic aberration correction data of Enomoto into Iwasawa was obvious. Section XI(A).

264. The body of claim 2 recites “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.”

265. Claim 2 presents alternative options, and I understand that inclusion of any one of the listed aberrations meets this element. As I discussed above in Section XI(A), incorporation of the barrel distortion and/or chromatic aberration correction data of Enomoto into Iwasawa was obvious and easily achievable.

266. Additionally, the decrease of light input through the optical lens corresponds to a “signal level decrease [of the imaging signal] as the distance increases from the center [of the lens] with respect to the imaging signal level near the center of the optical lens....” Ex-1005, para. 17. A reduction of light input at the edges of a lens resulting in a corresponding reduction in an image signal is a lens distortion aberration. Confirming this, the ’685 Patent also recognizes “light fall-off in peripheral areas of an image” as lens distortions. Ex-1001, 3:51-59.

267. Therefore, Iwasawa in view of Enomoto renders obvious “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.”

D. Claim 5

268. Claim 5 depends from claim 1, which Iwasawa renders obvious. Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 5.

1. Element 5[a]

“wherein each lens type is registered in the camera database”

269. In my opinion, Iwasawa teaches or suggests 5[a].

270. Element 5[a] recites “wherein each lens type is registered in the camera database.” For purposes of this Declaration, I understand “the camera database” as referring to the “database” of claim element 1[c].

271. Iwasawa discloses that shading correction data is obtained based on the control signal received from the optical lens 201 identifying the aperture value, zoom position, and the *lens type*. Ex-1005, paras. 7, 15, 18, 19. According to my understanding, to allow this retrieval to function, each lens type would be registered in the ROMs and/ or RAM (Iwasawa’s database) in some fashion (e.g., as having an association in the memory structure/ database with the retrieved shading correction data).

272. Therefore, Iwasawa renders obvious “wherein each lens type is registered [stored/associated with shading correction data] in the camera database.”

2. Element 5[b]

“wherein the multiple optical aberrations of each lens is listed in the database”

273. In my opinion, Iwasawa, alone or with Enomoto, teaches or suggests 5[b].

274. Element 5[b] recites “wherein the multiple optical aberrations of each lens is listed in the database.”

275. Iwasawa’s ROMs and/or RAM list multiple optical aberrations of each lens at least because shading correction data is obtained based on the control signal received from the optical lens 201 which identifies the *aperture value, zoom position*, and the lens type. Ex-1005, para. 16, 21. Each set of shading correction data for different aperture values and/or zoom positions of a lens type corresponded to “multiple optical aberrations of each lens,” which are prestored in Iwasawa’s database.

276. To the extent 5[b] requires data for different aberration types, Iwasawa modified to include the barrel distortion and/or chromatic aberration correction of Enomoto would list multiple optical aberrations of each lens in the database. As I discussed above, incorporation of the aberration corrections of Enomoto into Iwasawa was obvious and easily achievable. Section XI(A).

277. Both Enomoto and Iwasawa teach correction data being stored (i.e., listed) according to lens data and the additional aberration data incorporated into Iwasawa from Enomoto would be similarly listed by aperture value, zoom position, and lens type. Registering data in a database involves systematically entering, validating, and organizing the data within the database's structure. Registering data allows it to be managed and utilized effectively within the database system, supporting various operations such as searching, reporting, and analysis.

278. Therefore, Iwasawa, alone or in combination with Enomoto, renders obvious “wherein the multiple optical aberrations [e.g., vignetting for each aperture value and/or zoom position or vignetting, chromatic aberrations, and/or barrel distortion] of each lens is listed in the database [Iwasawa’s ROMs and/or RAM].”

3. Element 5[c]

“wherein the filtration solutions to the lens optical aberrations are listed in the database”

279. In my opinion, Iwasawa teaches or suggests 5[c].

280. Element 5[c] recites “wherein the filtration solutions to the lens optical aberrations are listed in the database.” For purposes of this Declaration, I understand (i) “the filtration solutions” as referring to the “plurality of optical image aberration corrections” of claim element 1[a] and (ii) “the lens optical aberrations” as referring to the “multiple optical aberrations” of claim element 5[b].

281. The correction data of Iwasawa include filtration solutions. As I discussed above, shading characteristics include vignetting (Section X(B)(2)) and corresponding corrections are stored in a database (Section X(B)(4)). Further, as I discussed in the prior section, modification of Iwasawa to include the aberration corrections of Enomoto would include correction data for multiple aberrations being listed in the database. Section XI(B)(1).

282. The shading correction applied by Iwasawa suppresses undesirable unevenness between the increased signal value corresponding to the location of a center of an optical lens and decreased signal value corresponding to locations further away from the center of the optical lens. Ex-1005, para. 17. Similarly, Enomoto discloses that functions for correction chromatic aberrations or distortion aberrations correct aberrations based on pixel locations from the center of an image. Ex-1006 4:34-40.

283. As I discussed before, image filtration is the process of applying algorithms to an image to modify, enhance, or extract specific features from an image. Shading and chromatic aberration corrections are considered forms of filtration because they involve processing the image data to remove specific distortions. Shading correction adjusts the brightness levels across an image, particularly increasing the brightness in darker corners to create uniform lighting.

This process filters out the unwanted shading effect, resulting in a more evenly lit image.

284. Chromatic aberration correction filters out color fringing caused by different colors of light not converging at the same point after passing through a lens. By adjusting the red, green, and blue channels of the image, this filtration process aligns the colors correctly, reducing color distortions and sharpening edges. Both corrections enhance overall image quality by filtering out these optical imperfections. Therefore, shading characteristic corrections and/or chromatic aberration corrections are filtration solutions to lens optical aberrations.

285. Therefore, Iwasawa renders obvious “wherein the filtration solutions [correction data] to the lens optical aberrations [vignetting, chromatic aberrations] are listed in the database [the correction data is stored in Iwasawa’s ROMs and/or RAM].”

4. Element 5[d]

“wherein the filtration of each lens optical aberration is applied by the digital signal processor; and”

286. In my opinion, Iwasawa teaches or suggests 5[d].

287. Element 5[d] recites “wherein the filtration of each lens optical aberration is applied by the digital signal processor.”

288. As I previously discussed, shading characteristic correction of Iwasawa is filtration of lens optical aberrations. Section XI(B)(1). Similarly, as I discussed

above, the correction data of Iwasawa is applied by a digital signal processor. Section X(B)(2).

289. Therefore, Iwasawa renders obvious “wherein the filtration [correction] of each lens optical aberration [vignetting, chromatic aberration, barrel distortion] is applied by the digital signal processor [multiplier 209, alone or with DSP 210].”

5. Element 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.”

290. In my opinion, Iwasawa, alone or with Enomoto, teaches or suggests 5[e].

291. Element 5[e] recites “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.” For purposes of this Declaration, I understand “the corrected digital file” as referring to the “corrected video” of claim element 1[f].

292. As I discussed above, vignetting correction of Iwasawa and the chromatic aberration and/or barrels distortion incorporated into Iwasawa from Enomoto are filtration of lens optical aberrations. Section XI(C). The correction data of Iwasawa is applied by a DSP. Section X(B)(5). Further, as I discussed above, Iwasawa stores the video signal output after the correction data is applied.

Section X(B)(6). Storage of the video signal output is in the form of a file stored in memory, such as a file stored on memory card 609. Section X(B)(6).

293. Therefore, Iwasawa renders obvious “wherein after the digital signal processor [multiplier 209, alone or with DSP 210] applies the filtration [using correction data] to correct the optical image aberrations [vignetting at different aperture and zoom pairings chromatic aberrations, and/or barrel distortion] the corrected digital file [video signal output 211] is forwarded to storage in memory [memory card 609].”

E. Claim 7

“The system of claim 6: 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.”

294. Claim 7 depends from claim 6, which Iwasawa renders obvious. Section X(D). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 7.

295. The body of claim 7 recites “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,” which is analogous to claim 2 and is therefore obvious for similar reasons. Section XI(C).

F. Claim 10

The system of claim 6: wherein the digital signal processor applies color filtration to at least two frames of the digital video image.”

296. Claim 10 depends from claim 6, which Iwasawa renders obvious. Section X(D). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 10.

297. The body of claim 10 recites “wherein the digital signal processor applies color filtration to at least two frames of the digital video image.”

298. As I discussed above, it was obvious to include the chromatic aberration corrections of Enomoto in Iwasawa. Section XI(C). Correction of chromatic aberrations is inherently color filtration. Chromatic aberration correction filters out color fringing caused by different colors of light not converging at the same point after passing through a lens. By adjusting the red, green, and blue channels of the image, this filtration process aligns the colors correctly, reducing color distortions and sharpening edges. As a result, the correction for chromatic aberrations are a type of color filtration.

299. As further discussed above, Iwasawa renders obvious applying corrections to at least two frames in a digital video. Section X(D). Accordingly, Iwasawa in combination with Enomoto rendered obvious “wherein the digital signal

processor [multiplier 209, alone or with DSP 210] applies color filtration [chromatic aberration correction] to at least two frames of the digital video image.”

G. Claim 15

“The system of claim 14: wherein the optical aberrations include vignetting, spherical, comatic, lens distortion, chromatic aberrations, curvature of field, pin cushion, barrel distortion, scattered light, and/or flare types of optical aberrations.”

300. Claim 15 depends from claim 14, which Iwasawa renders obvious. Section X(H). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 15.

301. The body of claim 15 recites “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,” which is analogous to claims 2 and portions of claim 3 and is therefore obvious for similar reasons. Sections XI(C) and X(C).

H. Claim 18

“The system of claim 14: wherein the digital signal processor applies color filtration to at least one frame of the digital video image.”

302. Claim 18 depends from claim 14, which Iwasawa renders obvious. Section X(H). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 18.

303. The body of claim 18 recites “wherein the digital signal processor applies color filtration to at least one frame of the digital video image,” which is analogous to claim 10 and is therefore obvious for similar reasons. Section XI(F).

I. Claim 23

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for chromatic aberrations.”

304. Claim 23 depends from claim 1, which Iwasawa renders obvious. Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 23.

305. As I discussed above, modification of Iwasawa to include the chromatic aberration corrections of Enomoto was obvious and easily achievable. Sections XI(A). Further, and as I discussed above in Section X(B), the CPU 206 implements programs to perform corrections, and the integrated circuit in Iwasawa would implement instructions for performing functions, each of which are in the form of machine readable instructions for a system.

306. Therefore, Iwasawa-Enomoto renders “wherein the system includes machine readable instructions for the system to correct for chromatic aberrations” obvious.

J. Claim 24

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for scattered light aberrations.”

307. Claim 24 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 24.

308. As I discussed above in Section XI(A), modification of Iwasawa to include the white, gray, and color balances and sharpness processes of Enomoto would have been obvious and easily achievable. White balancing, gray balancing, and color balancing are each processes for adjusting the amount, or contrast, of the corresponding colors within an image.

309. Similarly, sharpness processes also correct contrast in an image to increase clarity of the image. The '685 Patent indicates that scattered light corrections prevent adverse impacts to contrast. Ex-1001, 11:37-39. Enomoto's contrast corrections are scattered light corrections. Additionally, correcting for scattered light was common general knowledge. For example, U.S. Patent App. Pub. No. 2004/264918 (“Turner”) teaches a process for adjusting (i.e., correcting for) “light scattering effects.” Ex-1028, para. 27. As another example, U.S. Patent No. 5,280,354 (“Nakamura”) teaches a video camera that performs flare correction (i.e., correcting for scattered light aberration). Ex-1029, 1:11-18, 2:34-58, Fig. 4.

As yet another example, U.S. Patent App. Pub. No. 2003/0179948 (“Gindele”) teaches that flare light is derived from scatter light off the optical elements of a camera. Ex-1030, paras. 2, 6, 10, 12. Gindele further teaches that flare light can be corrected by a flare correcting circuit (e.g., Nakamura’s circuit) or a method for digitally compensating a digital image for the effects of flare light in order to generate an enhanced digital image. Ex-1030, paras. 2, 6, 10, 12. Further, and as I discussed above in Section XI(I), the CPU implements programs to perform corrections which are in the form of machine-readable instructions for a system.

310. Therefore, Iwasawa-Enomoto renders “wherein the system includes machine readable instructions for the system to correct for scattered light aberrations” obvious.

K. Claim 27

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for lens distortion aberrations.”

311. Claim 27 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 27.

312. Claim 27 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 27.

313. The body of claim 27 recites “wherein the system includes machine readable instructions for the system to correct for lens distortion aberrations.”

314. As I discussed above in Section XI(A), modification of Iwasawa to include the lens distortion corrections of Enomoto was obvious and easily achievable. Ex-1006, 3:44-49, 6:53-59. Further, and as I discussed in Section X(B), the CPU 206 implements programs to perform corrections, which are in the form of machine-readable instructions for a system.

315. Therefore, Iwasawa-Enomoto renders obvious “wherein the system includes machine readable instructions for the system to correct for lens distortion aberrations” and “wherein the system includes machine readable instructions for the system to correct for barrel distortion aberrations.”

L. Claim 28

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for pin cushion aberrations.”

316. Claim 28 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 28.

317. As I discussed above in Section XI(A), modification of Iwasawa to include the various aberration corrections of Enomoto was obvious and easily achievable. This includes correcting for the “bobbin winder” aberration described

in Enomoto, which is a pin cushion aberration. Ex-1006, 6:53-56. Further, and as I discussed above in Section X(B), the CPU 206 implements programs to perform corrections, which are in the form of machine-readable instructions for a system.

318. Therefore, Iwasawa-Enomoto renders obvious “wherein the system includes machine readable instructions for the system to correct for pin cushion aberrations.”

M. Claim 30

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for barrel distortion aberrations.

319. Claim 30 depends from claim 1, which Iwasawa renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa and Enomoto together teach or suggest the additional elements of claim 30.

320. As I discussed above in Section XI(A), modification of Iwasawa to include the lens distortion corrections (e.g., barrel distortion corrections) of Enomoto was obvious and easily achievable. Ex-1006, 3:44-49, 6:53-59. Further, and as I discussed above in Section X(B), the CPU implements programs to perform corrections, which are in the form of machine-readable instructions for a system.

321. Therefore, Iwasawa-Enomoto renders obvious “wherein the system includes machine readable instructions for the system to correct for barrel distortion aberrations.”

XIII. Grounds 3 and 4: Regarding Iwasawa-Ito, Iwasawa-Enomoto-Ito, and Claims 4, 8, 9, and 16

A. Combining Iwasawa, either alone or as modified by Enomoto, and Ito

322. Ito (like Iwasawa and Enomoto) is in the same field of endeavor as the '685 Patent—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Ex-1001, 1:18-21; Ex-1007, para. 6. Like the '685 Patent (and Iwasawa and Enomoto), Ito also presents a capability to correct aberrations in-camera for specific image problems. Ex-1007, para. 6.

323. As I discussed above in Section X(B)(4), Iwasawa seeks to correct optical aberrations such as vignetting. Iwasawa further teaches that programs for additional corrections can be uploaded to the CPU 206 and applied to the imaging signal. Ex-1005, para. 19. This would have prompted consideration of additional changes to Iwasawa to use its updateable programs to address additional aberrations, providing motivation to incorporate Ito's chromatic aberration correction via FFT into Iwasawa.

324. Programs embodying additional aberration corrections could be uploaded to the CPU and applied by the CPU. Even the '685 Patent admits that multiple types of optical aberrations were well known in both digital and film-based

photography, confirming the motivation to seek out other known aberration corrections for implementation by Iwasawa. Ex-1001, 1:39-6:62.

325. Following these motivations, Ito would have provided a disclosure of correction of an optical aberration in the form of chromatic aberration in a digital video. Ex-1007, para. 12. The correction that is applied by the digital signal processing in Ito can be an FFT. Ex-1007, paras. 17-18; Ex-1001, 32:56-57 (providing FFT as an example of digital filtration).

326. It is my opinion that incorporation of the FFT-based chromatic aberration correction taught in Ito into Iwasawa is motivated by a desire provide for correction of chromatic aberrations. During prosecution of the Parent, the inventor confirmed that incorporation of FFTs would be obvious, as “[t]here is no reason not to include” FFTs in this time period. Ex-1012 157.

327. Iwasawa’s recognition of the importance of aberration correction, and in particular the importance of color-based corrections that suppressed false colors such as the disclosed shading correction, provides additional or alternative motivation to consult other references, such as Ito, for additional aberration corrections that could be applied by in-camera processing to address issues with colors in images. The chromatic aberration correction of Ito could be embodied in a program uploaded to the CPU 206 and implemented within Iwasawa.

328. This modification allows for correction for loss of sharpness in an image and image coloring caused by chromatic aberrations. Ex-1007, para. 3. At a minimum, this modification is a combination of known prior art elements according to known methods and applying a known technique (e.g., the FFT chromatic aberration of Ito) to a known device ready for improvement (e.g., IID). Ex-1007, para. 3.

329. A reasonable expectation of success existed too as Ito discloses that the FFT chromatic correction is applied by digital signal processing, which Iwasawa similarly uses for the disclosed shading correction processes, so the updates to use FFT in Iwasawa would have been straightforward and easily achievable.

B. Claim 4

“The system of claim 1: wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration.”

330. Claim 4 depends from claim 1, which Iwasawa, either alone or in view of Enomoto, renders obvious for the reasons I discussed in Section X(B). In my opinion, Iwasawa, either alone or in combination with Enomoto, and Ito together teach or suggest the additional elements of claim 4.

331. The body of claim 4 recites “wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration.”

332. As noted by Ito, chromatic aberration occurs due to refractive index of glass in an optical lens that causes loss of sharpness in an image and image coloring. Ex-1007, paras. 2-3. Ito discloses chromatic aberration correction performed by a DSP. Ex-1007, paras. 13-15. As I discussed above, inclusion of the correction of chromatic aberrations in order to correct for loss of sharpness in an image and image coloring was obvious and easily achievable. Section XI(C). After such modification, “the at least one optical image aberration” would be a chromatic aberration as well as the aberrations explained above from Iwasawa.

333. The aberration correction disclosed in Ito can use an FFT. Ex-1007, paras. 17-18. The focal-length correction values for chromatic aberration of Ito, which are similar to the focal-length correction values for shading correction of Iwasawa, could be similarly selected based on a control signal from optical lens 201 and applied by the multiplier 209, alone or with the DSP 210.

334. When modifying Iwasawa to include correction of chromatic aberrations, a the chromatic aberration corrections provided by Ito, including the focal-length FFT correction values, would be adopted as the focal-length FFT correction values could be easily accessed in the same manner as the shading correction data taught in Iwasawa, i.e., based on a control signal that includes a zoom position (e.g., focal length). These reasons, as well as the detailed discussion set forth in the Motivation to Combine section, provide motivation to add the FFT-based

chromatic aberration corrections of Ito to the IID of Iwasawa and would have had a reasonable expectation of success.

335. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Ito renders obvious “wherein the digital signal processor [multiplier 209, alone or with DSP 210] applies at least one fast Fourier transform (FFT) algorithm [focal-length FFT correction values] to correct the at least one optical image aberration [chromatic aberration].”

C. Claim 8

“The system of claim 6: wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration.”

336. Claim 8 depends from claim 6, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(D) and XI(B). In my opinion, Iwasawa, either alone or in combination with Enomoto, and Ito together teach or suggest the additional elements of claim 8.

337. The body of claim 8 recites “wherein the digital signal processor applies at least one fast Fourier transform (FFT) algorithm to correct the at least one optical image aberration,” which is analogous to claim 4 and therefore obvious for similar reasons. Section XII(B).

D. Claim 9

“The system of claim 6: 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.”

338. Claim 9 depends from claim 6, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(D) and XI(B). In my opinion, Ito teaches or suggests the additional elements of claim 9.

339. The body of claim 9 recites “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.”

340. As I discussed above, Iwasawa renders obvious applying corrections to at least two frames in a digital video (Section X(B)(3)) and, as modified by Ito, discloses applying an FFT algorithm to correction aberrations (Section XII(A)).

341. Iwasawa recognizes that application of shading correction data can result in a loss of “correlation with an imaging signal corresponding to a nearby and adjacent different filter,” resulting in false color. Ex-1005, para. 5. The loss of correlation is caused by multiplication of a digital image signal (Ex-1005, para. 5), which is a digital aberration.

342. As I discussed above, Iwasawa, either alone or in combination with Enomoto, in view of Ito renders obvious a DSP applying an FFT to correct aberrations. Section XII(B). In particular, Ito teaches correction of color-based aberrations (e.g., chromatic aberrations). Similar aberrations could be corrected in

a similar manner, and thus an FFT-based correction, as taught by Ito, could be applied to correct false color caused by shading correction.

343. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Ito renders obvious “wherein the digital signal processor [multiplier 209, alone or with DSP 210] applies a[n] [FFT] algorithm [FFT-based correction] to correct digital aberrations [false color] of at least two frames in the digital video.”

E. Claim 16

“The system of claim 14: wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations in the digital video.”

344. Claim 16 depends from claim 14, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Section X(H). In my opinion, Iwasawa and Ito together teach or suggest the additional elements of claim 16.

345. The body of claim 16 recites “wherein the digital signal processor applies a fast Fourier transform (FFT) algorithm to correct optical and/or digital aberrations in the digital video,” which is analogous to claims 8 and 9 and therefore obvious for similar reasons. Sections XII(C) and XII(D).

XIV. Grounds 5 and 6: Regarding Iwasawa-Prilutsky, Iwasawa-Enomoto-Prilutsky, and Claim 20

A. Combining Iwasawa, either alone or as modified by Enomoto, and Prilutsky

346. Prilutsky (like Iwasawa and Enomoto) is in the same field of endeavor as the '685 Patent—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Ex-1001, 1:18-21; Ex-1008, para. 2. Like the '685 Patent (and Iwasawa and Enomoto), Prilutsky presents a capability to correct various aberrations in-camera for specific image problems. Ex-1008, para. 2.

347. As I discussed above, Iwasawa seeks to correct aberrations such as vignetting and scene-specific aberrations. Section X(B)(4). In seeking to construct Iwasawa's system, additional teachings to correct additional known aberration types to further Iwasawa's goals of "high-speed and accurate" aberration corrections would have been considered to "readily expand[]" Iwasawa's corrections. Ex-1005, paras. 8, 27. Iwasawa also indicates that "it is possible to freely switch the program for calculating" corrections (Ex-1005, para. 0019), providing motivation to incorporate Prilutsky's red-eye correction by freely switching Iwasawa's program.

348. Additionally, or alternatively, inclusion of red-eye correction would have created a commercially desirable digital video camera that produced higher-quality corrected videos as better video was a desirable feature for consumers and

inclusion of Prilutsky's red-eye correction would have met that need. Red-eye correction was desirable, as red-eye is an objectionable phenomenon in photography. Ex-1008, para. 3. Even the '685 Patent admits that multiple types of aberrations were well known. Accordingly, digital cameras need to correct more aberrations to produce higher-quality videos. Ex-1001, 1:39-6:62.

349. These motivations would have led to Prilutsky, which discloses a red-eye filter 90 that “analyzes the stored image for characteristics of red-eye, and if found, modifies the image and removes the red-eye phenomenon....” Ex-1008, para. 33. “The red-eye filter includes a pixel locator 92 for locating pixels having a color indicative of red-eye, a shape analyzer 94 for determining if a grouping of at least a portion of the pixels located by the pixel locator comprise a shape indicative of red-eye; a pixel modifier 96 for modifying the color of pixels within the grouping; and a[n] falsing analyzer 98 for further processing the image around the grouping for details indicative of an image of an eye.” Ex-1008, para. 33. Prilutsky expressly notes that “many of the processes implemented in the digital camera may be implemented in or controlled by software operating in a microcomputer or [DSP] and/or an [ASIC].” Ex-1008, para. 33.

350. Adding Prilutsky's red-eye correction to Iwasawa would have been straightforward, requiring updates to the prestored data in the ROMs and/or updates

to Iwasawa's programs to address Prilutsky's red-eye issues. Success for this modification would have been reasonably certain.

351. At a minimum, this modification includes a combination of known prior art elements according to known methods (e.g., merely updating software or introducing additional data to Iwasawa's ROMs and/or RAM, or incorporating Prilutsky's red-eye correction components described above) and applying a known technique (e.g., Prilutsky's red-eye correction) to a known device ready for improvement (Iwasawa's IID). Further, as Prilutsky recognizes, the processes for performing red-eye correction could be implemented in software operating in a microcomputer or a digital signal processor, both of which appear in Iwasawa's IID. Ex-1008, para. 33.

B. Claim 20

“The system of claim 1, wherein the system is configured to correct red-eye.”

352. Claim 20 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B) and XI(B). In my opinion, Prilutsky teaches or suggests the additional elements of claim 20.

353. The body of claim 20 recites “wherein the system is configured to correct red-eye.”

354. As explained above, the Iwasawa-Prilutsky system would be “configured to correct red-eye” either through the use of Prilutsky's red-eye

correction components in Iwasawa and/or by updating Iwasawa's ROMs and/or RAM to have the data necessary to perform the red-eye correction described in Prilutsky.

355. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Prilutsky renders obvious "wherein the system [IID] is configured to correct red-eye [using red-eye filter 90]."

XV. Grounds 7 and 8: Regarding Iwasawa-Miyazawa, Iwasawa-Enomoto-Miyazawa, and Claim 21

A. Combining Iwasawa, either alone or as modified by Enomoto, and Miyazawa

356. Miyazawa (like Iwasawa and Enomoto) is in the same field of endeavor as the '685 Patent—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Ex-1001, 1:18-21; Ex-1009, 1:16-18. Similar to the '685 Patent (and Iwasawa and Enomoto), Miyazawa also presents a capability to correct various aberrations in-camera for specific image problems. Ex-1009, 1:16-18.

357. As I discussed above, Iwasawa seeks to correct aberrations, such as vignetting and scene-specific aberrations. Section X(B)(4). In seeking to construct Iwasawa's system, additional teachings to correct additional known aberration types to further Iwasawa's goals of "high-speed and accurate" aberration corrections

would have been considered to “readily expand[]” Iwasawa’s corrections. Ex-1005, paras. 8, 27.

358. Iwasawa also indicates that “it is possible to freely switch the program for calculating” corrections (Ex-1005, para. 19), thus further prompting correction of other known aberration types to be included when freely switching Iwasawa’s program. Additionally, or alternatively, inclusion of corrections for dust would have created a commercially desirable digital video camera that produced higher-quality corrected videos as better videos was a desirable feature for consumers and inclusion of dust correction would have that need.

359. Dust correction was desirable, as dust on an image sensor can cause image failure. Ex-1009, 1:38-45. Even the ’685 Patent admits that multiple types of aberrations were well known and thus the need to correct more aberrations to produce higher quality videos was also known. Ex-1001, 1:39-6:62.

360. These motivations would have led directly to Miyazawa, which teaches a camera case 100 that has a detachable mount for a lens 200. Ex-1009, 3:63-65. The camera case 100 houses a CCD 103’ that forms image data through the lens 200. Ex-1009, 3:65-4:2. The CCD 103’ is coupled to a CPU 110 which is also in communication with a A/D convertor 113, an image processor 115 comprising a DSP, and a dust position storing memory 117 for storing a position of a picture element in the CCD 103’ having an image failure due to dust. Ex-1009, 4:8-17. The

camera case 100 and changeable lens 200 of Miyazawa are similar to the IID and optical lens 101 in the Combined IID of Iwasawa.

361. Miyazawa further teaches “a method for detecting a position of a picture element having failure caused by dust...” Ex-1009, 5:12-15. The method identifies pixels of the image sensor (e.g., CCD 103') that have a failure due to dust being present on the image sensor. Ex-1009, 5:16-53. At the time of photographing, “if the address of read-out image data corresponds to the address of a picture element having dust, the image data are corrected using surrounding normal image data...” Ex-1009, 6:31-34.

362. Adding Miyazawa's dust correction to Iwasawa would have been straightforward—requiring updates to the prestored data in the ROMs and/or updates to Iwasawa's programs to address Miyazawa's dust issues, thus success was reasonably certain. At a minimum, this modification includes a combination of known prior art elements according to known methods (e.g., merely updating software or introducing additional data to Iwasawa's ROMs and/or RAM, or incorporating Miyazawa's dust correction components described above) and applying a known technique (e.g., the dust detection and correction of Miyazawa) to a known device ready for improvement (Iwasawa's IID). Further, as Miyazawa recognizes, the processes for performing dust detection and correction would be

implemented by operating a CPU and DSP, each of which is similarly disclosed by Iwasawa.

B. Claim 21

“The system of claim 1, wherein the system is configured to correct for dust.”

363. Claim 21 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B) and XI(B). In my opinion, Miyazawa further teaches or suggests the additional elements of claim 21.

364. The body of claim 21 recites “wherein the system is configured to correct for dust.”

365. Miyazawa discloses a dust detection and correction method. Ex-1009, 5:12-6:34. At the time of photographing, “if the address of read-out image data corresponds to the address of a picture element having dust, the image data are corrected using surrounding normal image data....” Ex-1009, 6:31-34. Dust (e.g., dirt) correction was desirable, as dust on a CCD results in image defects. Ex-1009, 1:31-34. For these reasons, as well as the detailed discussion set forth in the Motivation to Combine section, it is my opinion that addition of the dust detection and correction process of Miyazawa into Iwasawa would have obvious with a reasonable certainty of their success.

366. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Miyazawa renders obvious “wherein the system [Iwasawa’s IID] is configured to correct for dust.”

XVI. Grounds 9 and 10: Regarding Iwasawa-Matsutani, Iwasawa-Enomoto-Matsutani, and Claims 22, 25, 26 and 29

A. Combining Iwasawa, either alone or as modified by Enomoto, and Matsutani

367. Matsutani (like Iwasawa and Enomoto) is in the same field of endeavor as the ’685 Patent—namely, digital signal processing techniques, such as aberration correction, for imaging systems like digital and video cameras. Ex-1001, 1:18-21; Ex-1010, para. 21. Similar to the ’685 Patent (and Iwasawa and Enomoto), Matsutani also corrects various aberrations in-camera for specific image problems. Ex-1010, para. 21.

368. As I discussed above, Iwasawa seeks to correct optical aberrations including shading characteristics. Section X(B)(4). In seeking to construct Iwasawa’s system, additional teachings to correct additional known aberration types to further Iwasawa’s goals of “high-speed and accurate” aberration corrections would have been considered to “readily expand[]” Iwasawa’s corrections. Ex-1005, paras. 8, 27.

369. Iwasawa also indicates that “it is possible to freely switch the program for calculating” corrections (Ex-1005, para. 19), thus further prompting

consideration of other known aberration types to be included when freely switching Iwasawa's program. Additionally, or alternatively, creating a commercially desirable digital video camera that produced higher-quality corrected videos would have fueled the motivation too as better videos was a desirable feature for consumers and manufacturers would have sought to meet that need.

370. A POSA understood that correcting for aberrations based on photographing conditions was desirable. Ex-1010, paras. 3. These motivations would have led a POSA directly to Matsutani, which teaches a digital camera 1 that includes an optical mechanism 10, an image sensor 11, an image-processing LSI 13, RAM 14, and ROM 15. Ex-1010, para. 23.

371. The image sensor 11 generates an image signal and can be, for example, a CCD array sensor. Ex-1010, para. 24. The LSI 13, which includes a real-time processing unit (RPU) 21, transfers correction data from the ROM 15 based on a control process executed by the control unit 22. Ex-1010, para. 27. Aberrations are corrected by the RPU 21 based on transferred correction data. Ex-1010, para. 29. Matsutani discloses aberrations including, but not limited to, spherical aberration, coma, astigmatism, and field curvature. Ex-1010, para. 3.

372. Adding Matsutani's aberration correction to Iwasawa would have been straightforward for a POSA—requiring updates to the prestored data in the ROMs and/or updates to Iwasawa's programs to address Matsutani's aberrations, thus

success was reasonably certain. At a minimum, this modification includes a combination of known prior art elements according to known methods (e.g., merely updating software or introducing additional data to Iwasawa's ROMs and/or RAM or incorporating Matsutani's LSI 13, which I described above) and applying a known technique (e.g., the aberration corrections of Matsutani) to a known device ready for improvement (Iwasawa's IID). Further, as Matsutani teaches, the aberration corrections are performed by processing blocks and therefore could be included in Iwasawa.

B. Claim 22

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for spherical aberrations.”

373. Claim 22 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B) and XI(B). In my opinion, Matsutani teaches the additional elements of claim 22.

374. The body of claim 22 recites “wherein the system includes machine readable instructions for the system to correct for spherical aberrations.”

375. Matsutani recognizes that image data captured with an optical sensor often includes various aberrations, including “chromatic aberration, *spherical aberration*, coma aberration, astigmatism, field curvature and distortion,” and so on. Ex-1010, para. 3. These aberrations, Matsutani explains, can be corrected using

spatial filters and multiplication. Ex-1010, para. 4. Matsutani goes on to explain how its RPU 21 can be used to correct such aberrations. Ex-1010, para. 29.

376. Further, and as I discussed above in Section X(B), Iwasawa's CPU 206 implements programs to perform corrections, and the integrated circuit in Iwasawa would implement instructions for performing functions, each of which are in the form of machine readable instructions for a system. It would have been obvious to have Iwasawa's CPU 206 execute instructions corresponding to the corrections performed by Matsutani's RPU 21.

377. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Matsutani renders obvious "wherein the system includes machine readable instructions for the system to correct for spherical aberrations."

C. Claim 25

"The system of claim 1, wherein the system includes machine readable instructions for the system to correct for comatic aberrations."

378. Claim 25 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B), XI(B). In my opinion, Matsutani teaches the additional elements of claim 25.

379. The body of claim 25 recites "wherein the system includes machine readable instructions for the system to correct for comatic aberrations."

380. Matsutani recognizes that image data captured with an optical sensor often includes various aberrations, including “chromatic aberration, spherical aberration, *coma aberration* [i.e., comatic aberration], astigmatism, field curvature and distortion,” and so on. Ex-1010, para. 3. These aberrations, Matsutani explains, can be corrected using spatial filters and multiplication. Ex-1010, para. 4. Matsutani goes on to explain how its RPU 21 can be used to correct such aberrations. Ex-1010, para. 29.

381. Further, and as I discussed above in Section X(B), the CPU 206 implements programs to perform corrections, which are in the form of machine readable instructions for a system. It would have been obvious to have Iwasawa’s CPU 206 execute instructions corresponding to the corrections performed by Matsutani’s RPU 21.

382. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Matsutani renders obvious “wherein the system includes machine readable instructions for the system to correct for comatic aberrations.”

D. Claim 26

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for astigmatism aberrations.”

383. Claim 26 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B) and XI(B). In my opinion, Matsutani teaches the additional elements of claim 26.

384. The body of claim 26 recites “wherein the system includes machine readable instructions for the system to correct for astigmatism aberrations.”

385. Matsutani recognizes that image data captured with an optical sensor often includes various aberrations, including “chromatic aberration, spherical aberration, coma aberration, *astigmatism*, field curvature and distortion,” and so on. Ex-1010, para. 3. These aberrations, Matsutani explains, can be corrected using spatial filters and multiplication. Ex-1010, para. 4. Matsutani goes on to explain how its RPU 21 can be used to correct such aberrations. Ex-1010, para. 29.

386. Further, and as I discussed above in Section X(B), the CPU 206 implements programs to perform corrections, which are in the form of machine readable instructions for a system. It would have been obvious to have Iwasawa’s CPU 206 execute instructions corresponding to the corrections performed by Matsutani’s RPU 21.

387. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Matsutani renders obvious “wherein the system includes machine readable instructions for the system to correct for astigmatism aberrations.”

E. Claim 29

“The system of claim 1, wherein the system includes machine readable instructions for the system to correct for curvature of field aberrations.”

388. Claim 29 depends from claim 1, which Iwasawa, either alone or in combination with Enomoto, renders obvious. Sections X(B) and XI(B). In my opinion, Matsutani teaches the additional elements of claim 29.

389. The body of claim 29 recites “wherein the system includes machine readable instructions for the system to correct for curvature of field aberrations.”

390. Matsutani recognizes that image data captured with an optical sensor often includes various aberrations, including “chromatic aberration, spherical aberration, coma aberration, astigmatism, *field curvature* and distortion,” and so on. Ex-1010, para. 3. These aberrations, Matsutani explains, can be corrected using spatial filters and multiplication. Ex-1010, para. 4. Matsutani goes on to explain how its RPU 21 can be used to correct such aberrations. Ex-1010, para. 29.

391. Further, and as I discussed above in Section X(B), the CPU 206 implements programs to perform corrections, which are in the form of machine readable instructions for a system. It would have been obvious to have Iwasawa’s

CPU 206 execute instructions corresponding to the corrections performed by Matsutani's RPU 21.

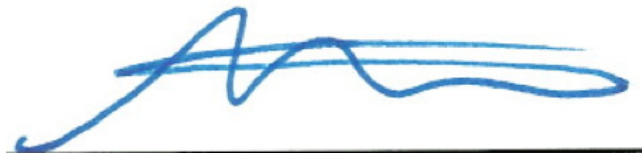
392. Therefore, Iwasawa, either alone or in combination with Enomoto, in view of Matsutani renders obvious "wherein the system includes machine readable instructions for the system to correct for curvature of field aberrations."

XVII. Conclusion

393. For the reasons set forth above, in my opinion, all limitations of all claims of the '685 Patent are disclosed by the prior art (and combinations thereof) cited herein.

394. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the results of these proceedings.

395. Executed on August 29, 2024 in Notre Dame, Indiana.

A handwritten signature in blue ink, appearing to be 'Robert Stevenson', is written over a horizontal line.

Robert Stevenson