IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TEXARKANA DIVISION

MAXELL, LTD., **Plaintiff,** **vs.** **APPLE INC.,** **Defendant.**	Civil Action No. 5:19-cv-00036-RWS

OPENING EXPERT REPORT OF DR. ALAN C. BOVIK REGARDING INVALIDITY OF U.S. PATENT NO. 8,339,493

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I. INTRODUCTION

1. My name is Dr. Alan C. Bovik. I am the Ernest J. Cockrell Endowed Chair in Engineering at The University of Texas at Austin, Professor in the Department of Electrical and Computer Engineering and The Institute for Neurosciences, and Director of the Laboratory for Image and Video Engineering (LIVE). I have been retained by defendant Apple Inc. ("Apple" or "Defendant") in connection with civil action *Maxell, Ltd. v. Apple Inc.*, Case No. 5:19-cv-00036-RWS (E.D. Texas), which I understand to be related to alleged infringement of various patents asserted by Maxell, Ltd. ("Maxell" or "Plaintiff"), including certain claims of U.S. Patent No. 8,339,493 (the "'493 patent").

2. In this report I will set forth my opinions regarding the validity of claims 5 and 6 of the '493 patent. This report contains a statement of my opinions formed in this case and provides the bases and reasons for those opinions. I make the following statements based on my own personal knowledge and, if called as a witness, I could and would testify to the following.

3. I have considered the '493 patent, its prosecution history, the cited references, the Court's claim construction order, the materials listed in Appendix A, and other materials as referenced in this report. I have also analyzed portions of Maxell's Second Supplemental Infringement Contentions, served on March 13, 2020, relating to the '493 patent, including Appendices 3 and 3A. Appendix 3A includes only a chart of source code paths/filenames without any explanation of what those files are alleged to contain. I have not been able to review all the cited source code files due to travel restrictions caused by COVID-19. If Maxell's expert relies on the cited source code files to present an infringement theory against Apple's products, I reserve the right to revise, supplement, and amend the opinions stated herein upon my review of the cited source code.

4. My analysis of the materials produced in this case is ongoing. As new material is presented to me I will continue my review of such material. Therefore, this report represents only those opinions I have formed to date, and I reserve the right to revise, supplement, and amend the opinions stated herein based on new information and on my continuing analysis of the materials already produced.

5. I am prepared to use any or all of the above-referenced materials, other materials that may be produced during the course of this proceeding, and supplemental charts, models, schematics, computer graphics/animation, and other demonstratives and representations based on those materials to support my testimony at trial.

II. QUALIFICATIONS

6. I hold a Ph.D. in Electrical and Computer Engineering from the University of Illinois, Urbana-Champaign (awarded in 1984). I also have a Master's degree in Electrical and Computer Engineering (awarded in 1982) and a B.S. in Computer Engineering from the University of Illinois, Urbana-Champaign (awarded in 1980).

7. I am a tenured full Professor and I hold the Cockrell Family Regents Endowed Chair at the University of Texas at Austin. My appointments are in the Department of Electrical and Computer Engineering, the Department of Computer Sciences, and the Department of Biomedical Engineering. I am also the Director of the Laboratory for Image and Video Engineering ("LIVE").

8. My research is in the general areas of digital television, digital cameras, image and video processing, computational neuroscience, and modeling of biological visual perception. I have published over 900 technical articles in these areas and hold nine U.S. patents. I am also the author of The Handbook of Image and Video Processing, Second Edition (Elsevier Academic Press, 2005); Modern Image Quality Assessment (Morgan & Claypool, 2006); The Essential

Guide to Image Processing (Elsevier Academic Press, 2009); and The Essential Guide to Video Processing (Elsevier Academic Press, 2009); and numerous other publications.

9. I received the Progress Medal for 2019 from The Royal Photographic Society. The Progress Medal is awarded in recognition of any invention, research, publication or other contribution which has resulted in an important advance in the scientific or technological development of photography or imaging in the widest sense and is regarded as the oldest and most prestigious honor given in the technical field of photography. This award has been given continuously since 1878. I was also named an Honorary Fellow of The Royal Photographic Society (HonFRPS).

10. I also received the 2019 IEEE Fourier Award with citation: "For seminal contributions and high-impact innovations to the theory and application of perception-based image and video processing." This Technical Field Award and medal is one of the highest honors accorded by the 423,000-member IEEE.

11. I received the 2017 Edwin H. Land Medal from the Optical Society of America in September 2017 with citation: "For substantially shaping the direction and advancement of modern perceptual picture quality computation, and for energetically engaging industry to transform his ideas into global practice."

12. I received a Primetime Emmy Award for Outstanding Achievement in Engineering Development, for the Academy of Television Arts and Sciences, in October 2015, for the widespread use of my video quality prediction and monitoring models and algorithms that are widely used throughout the global broadcast, cable, satellite and internet Television industries.

13. Among other awards and honors, I have received the 2013 IEEE Signal Processing Society's "Society Award," which is the highest honor accorded by that technical

society ("for fundamental contributions to digital image processing theory, technology, leadership and education"). In 2005, I received the Technical Achievement Award of the IEEE Signal Processing Society, which is the highest technical honor given by the Society, for "broad and lasting contributions to the field of digital image processing"; and in 2008 I received the Education Award of the IEEE Signal Processing Society, which is the highest education honor given by the Society, for "broad and lasting contributions to image processing, including popular and important image processing books, innovative on-line courseware, and for the creation of the leading research and educational journal and conference in the image processing field."

14. My technical articles have been widely recognized as well, including the 2009 IEEE Signal Processing Society Best Journal Paper Award for the paper "Image quality assessment: From error visibility to structural similarity," published in IEEE Transactions on Image Processing, vol. 13, no. 4, April 2004; this same paper received the 2017 IEEE Signal Processing Society Sustained Impact Paper Award as the most impactful paper published over a period of at least ten years; the 2013 Best Magazine Paper Award for the paper "Mean squared error: Love it or leave it?? A new look at signal fidelity measures," published in IEEE Transactions on Image Processing, vol. 26, no. 1, January 2009; the IEEE Circuits and Systems Society Best Journal Paper Prize for the paper "Video quality assessment by reduced reference spatio-temporal entropic differencing," published in the IEEE Transactions on Circuits and Systems for Video Technology, vol. 23, no. 4, pp. 684-694, April 2013; the 2017 IEEE Signal Processing Letters Best Paper Award for the paper A. Mittal, R. Soundararajan and A.C. Bovik, "Making a 'completely blind' image quality analyzer," published in the IEEE Signal Processing Letters, vol. 21, no. 3, pp. 209-212, March 2013. This paper describes a unique "blind" (no-reference) video quality tool called NIQE that is being used to control the quality of cloud-based streaming videos globally. Also, the 2018 EURASIP Best Paper Award of the European

Association for Signal Processing for 2018, for the paper "Full-Reference Quality Assessment of Stereopairs Accounting for Rivalry," Signal Processing: Image Communication, vol. 28, no. 10, pp. 1143-1155, October 2013, and the Best Paper Award of the 2018 Picture Coding Symposium for the paper, "Detecting Source Video Artifacts with Supervised Sparse Filters."

15. I received the Google Scholar Classic Paper citation twice in 2017, for the paper "Image information and visual quality," published in the IEEE Transactions on Image Processing, vol. 15, no. 2, pp. 430-444, February 2006 (the main algorithm developed in the paper, called the Visual Information Fidelity (VIF) Index, is a core picture quality prediction engine used to quality-assess all encodes streamed globally by Netflix), and for "An evaluation of recent full reference image quality assessment algorithms," published in the IEEE Transactions on Image Processing, vol. 15, no. 11, pp. 3440-3451, November 2006 (the picture quality database and human study described in the paper, the LIVE Image Quality Database, has been the standard development tool for picture quality research since its first introduction in 2003). Google Scholar Classic Papers are very highly-cited papers that have stood the test of time, and are among the ten most-cited articles in their area of research over the ten years since their publication.

16. I have also been honored by other technical organizations, including the Society for Photo-optical and Instrumentation Engineers (SPIE), from which I received the Technology Achievement Award (2013) "for Broad and Lasting Contributions to the Field of Perception-Based Image Processing," and the Society for Imaging Science and Technology, which accorded me Honorary Membership, which is the highest recognition by that Society given to a single individual, "for his impact in shaping the direction and advancement of the field of perceptual image processing." I was also elected as a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) "for contributions to nonlinear image processing" in 1995, a Fellow of the

Optical Society of America (OSA) for "fundamental research contributions to and technical leadership in digital image and video processing" in 2006, and as a Fellow of SPIE for "pioneering technical, leadership, and educational contributions to the field of image processing" in 2007.

17. Among other relevant research, I have worked with the National Aeronautics and Space Administration ("NASA") to develop high compression image sequence coding and animated vision technology, on various military projects for the Air Force Office of Scientific Research, Phillips Air Force Base, the Army Research Office, and the Department of Defense. These projects have focused on developing local spatio-temporal analysis in vision systems, scalable processing of multi-sensor and multi-spectral imagery, image processing and data compression tools for satellite imaging, AM-FM analysis of images and video, the scientific foundations of image representation and analysis, computer vision systems for automatic target recognition and automatic recognition of human activities, vehicle structure recovery from a moving air platform, passive optical modeling, and detection of speculated masses and architectural distortions in digitized mammograms. My research has also recently been funded by Amazon Prime Video, Netflix, Qualcomm, Facebook, Texas Instruments, Intel, Cisco, and the National Institute of Standards and Technology (NIST) for research on image and video quality assessment. I have also received numerous grants from the National Science Foundation for research on image and video processing and on computational vision.

18. Additional details about my employment history, fields of expertise, and publications are further described in my curriculum vitae, which is attached as Appendix B to this report. The list of litigation matters in which I have been engaged can be found in my CV.

19. I am being compensated at my usual rate of $500 per hour, plus reimbursement for expenses, for my analysis. My compensation does not depend on the content of my opinions or the outcome of this proceeding.

III. SUMMARY OF OPINIONS

20. As explained in detail below, it is my opinion that:

- Claim 5 of the '493 patent is anticipated by or rendered obvious by the Sony MVC-FD83/FD88 camera;
- Claim 6 of the '493 patent is rendered obvious by the Sony MVC-FD83/FD88 camera alone or in combination with U.S. Patent Nos. 5,444,482 ("Misawa");
- Claim 5 of the '493 patent is rendered obvious by the combination of U.S. Patent Nos. 7,903,162 ("Juen") and 6,563,535 ("Anderson"); and,
- Claim 6 of the '493 patent is rendered obvious by the combination of Juen, Anderson, and Misawa.

IV. LEGAL STANDARDS

21. I am not a legal expert and therefore I offer no opinions on the law. However, I have been instructed on the legal standards that apply with respect to patent invalidity. The law that I apply in considering the issue of invalidity of the '493 patent is described briefly as follows.

A. Invalidity

22. I understand that an issued patent claim is presumed valid. I understand that a patent claim may be declared invalid if it is anticipated by, or rendered obvious in view of, prior art.

23. I understand that a patent claim may be declared invalid if it is not sufficiently supported by the specification. Claims must be sufficiently enabled by the specification such

that a person of ordinary skill in the art can make and use the claimed invention without undue experimentation. I also understand that the specification must provide sufficient written description such that a person of ordinary skill in the art understands that the inventor was in possession of the claimed invention as of the priority date of the application.

B. Priority Date and Expiration Date

24. I understand that the inventor bears the burden of proving his or her date of invention by showing either a date of actual reduction to practice or an earlier conception and diligent reduction to practice. Where the inventor cannot prove his or her date of invention through such evidence, the date when an application adequately disclosing the subject matter is filed is presumed to be the date of invention.

25. I understand that a patent may claim the benefit of the filing date of an earlier application, but only if the earlier application provides adequate disclosure of the patent's claims and also has a common inventor. I further understand that to satisfy the disclosure requirement—also referred to as the written description requirement—the disclosure of the earlier filed application must describe the later claimed invention in sufficient detail that one skilled in the art, as of the filing date sought, could clearly conclude that the inventor had invented the claimed subject matter. I understand that while the earlier application need not describe the claimed subject matter in precisely the same terms as found in the claims at issue, the prior application must convey with reasonable clarity to those skilled in the art that, as of the priority date sought, the inventor was in possession of the invention. I also understand that if claims of a later-filed patent contain new matter that was not disclosed by an earlier-filed application, those claims of the later-filed patent are not entitled to the filing date of the earlier filed application.

26. I understand that an issued U.S. patent expires 20 years after its application date in the U.S. or the earliest U.S. application date of any application to which it claims priority. Specifically, 35 U.S.C. § 154(a)(2) states:

> Term. Subject to the payment of fees under this title, such grant shall be for a term beginning on the date on which the patent issues and ending 20 years from the date on which the application for the patent was filed in the United States or, if the application contains a specific reference to an earlier filed application or applications under section 120, 121, 365(c), or 386(c), from the date on which the earliest such application was filed.

27. I also understand that while the expiration term of a patent may be adjusted by a "patent term extension" (which is typically printed on the face of the patent), such extension is overcome by an explicit disclaimer of patent term in the prosecution history. *See* 35 U.S.C. § 154(b)(2)(B) ("No patent the term of which has been disclaimed beyond a specified date may be adjusted under this section beyond the expiration date specified in the disclaimer.").

C. Anticipation

28. It is my understanding that a patent claim is "anticipated" if each and every element of the claim has been disclosed in a single prior art reference. I have been informed that this standard, as it applies to the Asserted Patents, is set forth in pre-AIA 35 U.S.C. §§ 102(a), (b), (e)(2), and (g)(2), which are reproduced in pertinent part below:

> 35 U.S.C. § 102 - A person shall be entitled to a patent unless -
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
> (e) the invention was described in . . . (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent . . . or
> (g) . . . (2) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it. In determining priority of invention under this subsection, there shall be considered not only the respective dates of conception and

> reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

29. I understand that each element of a patent claim may be disclosed by a prior art reference either expressly or inherently. I understand that an element of a patent claim is inherent in a prior art reference if the element must necessarily be present. Furthermore, I understand that inherency cannot be established by mere probabilities or possibilities.

30. I understand that for anticipation to apply, the description in a written prior art reference does not need to be in the same words as in the claim, but all of the requirements of the claim must be present, either stated or necessarily implied, so that the hypothetical person having ordinary skill in the art, looking at that reference at the time of the claimed invention, would be able to make and use the claimed invention.

D. Obviousness

31. I understand a patent claim is invalid if the differences between the patented 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 person of ordinary skill in the art. I have been informed that this standard, as it applies to the applications that led to the Asserted Patents, is set forth in pre-AIA 35 U.S.C. § 103(a), which has been reproduced in pertinent part below:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented 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 person having ordinary skill in the art to which the subject matter pertains.

32. I have also been informed that "a disclosure that anticipates under 35 U.S.C. § 102 also may render the claim unpatentable under 35 U.S.C. § 103, because anticipation is the epitome of obviousness."

33. When considering the issue of obviousness, I understand that I am to do the following: (i) determine the scope and content of the prior art; (ii) ascertain the differences between the prior art and the claims at issue; (iii) determine the level of ordinary skill in the pertinent art; and (iv) consider objective evidence of non-obviousness.

34. With respect to objective evidence of non-obviousness, I have been informed that such evidence may include the following:

- Commercial success: I understand that a strong showing of commercial success that is attributable to the merits of the invention should be considered an indication of non-obviousness.
- Copying: I understand that evidence that an accused party copied the patented invention, as opposed to a prior art device, is an indication of non-obviousness.
- Simultaneous invention: I understand that evidence that others independently developed the claimed invention at about the same time is an indication of obviousness.
- Long-felt need that was recognized, persistent, and not solved by others: I understand that evidence of a persistent problem or need in the art that was resolved by the patented invention is an indication of non-obviousness.
- Prior failure: I understand that evidence that others have tried and failed to solve the problem or to provide the need later resolved by the claimed invention is an indication of non-obviousness.
- Skepticism: I understand that evidence that those of ordinary skill in the art were skeptical as to the merits of the invention, or even taught away from the invention, are indications of non-obviousness.
- Unexpected results: I understand that evidence that those of ordinary skill in the art were surprised by the capabilities of the claimed invention is an indication of non-obviousness.
- Industry praise: I understand that evidence that the claimed technology was praised by those in the industry could be an indication of non-obviousness.

35. I understand that any assertion of the above indicia must be accompanied by a nexus between the merits of the invention and the evidence offered; otherwise, the evidence does not actually tend to show that the invention was non-obvious. Further, I understand that, even

where evidence of non-obviousness exists, the evidence may not be compelling enough to overcome a strong showing of obviousness in light of the prior art.

36. In determining whether the subject matter as a whole would have been obvious at the time that the invention was made to a person having ordinary skill in the art, I have been informed of several principles regarding the combination of prior art elements that are relevant. First, a combination of familiar elements according to known methods is likely to be obvious when it yields predictable results. Second, if a person of ordinary skill in the art can implement a "predictable variation" in a prior art device, and would have seen the benefit of doing so, such a variation would be obvious. In particular, when there is pressure to solve a problem and there are a finite number of identifiable, predictable solutions, it would be reasonable for a person of ordinary skill in the art to pursue those options that fall within his or her technical grasp. If such a process leads to the claimed invention, then the claimed invention is not an innovation, but is rather the result of ordinary skill and common sense.

37. I understand that the "teaching, suggestion, or motivation" test may be a useful guide in establishing a rationale for combining elements of the prior art. This test poses the question as to whether there is an explicit teaching, suggestion, or motivation in the prior art to combine prior art elements in a way that realizes the claimed invention. Although helpful to the obviousness inquiry, I understand that this test is not required.

38. Moreover, I understand that the motivation to combine the teachings of the prior art references may be found in the references themselves and also in: (1) the nature of the problem being solved; (2) the express, implied, and inherent teachings of the prior art; (3) the knowledge of persons of ordinary skill in the art; (4) the predictable results obtained in combining the different elements of the prior art; (5) the predictable results obtained by simple substitution of one known element for another; (6) the use of a known technique to improve

similar devices, methods, or products in the same way; (7) the predictable results obtained in applying a known technique to a known device, method, or product ready for improvement; (8) the finite number of identified, predictable solutions that had a reasonable expectation of success; and (9) known work in various technological fields that could be applied to the same or different technological fields based on design incentives or other market forces.

E. Claim Construction

39. I have been informed that claim terms are interpreted as one of ordinary skill in the art would at the time of the invention. I understand that claim construction is a question of law reserved for the Court.

40. I understand that the issued claims must be read and interpreted with reference to rejected ones and to the state of the prior art; and claims that have been narrowed in order to obtain the issuance of a patent by distinguishing the prior art cannot be sustained to cover that which was previously by limitation eliminated from the patent.

41. I understand that there is rebuttable presumption that a patentee who narrows a claim as a condition for obtaining a patent disavows his claims to the broader subject matter, whether the amendment was made to avoid the prior art or to comply with § 112.

V. THE '493 PATENT

A. Overview of the Patent

42. The '493 patent, titled "Electric Camera," was filed on July 28, 2010 and issued on December 25, 2012. '493 patent at Cover. It names Takahiro Nakano, Ryuji Nishimura, and Toshiro Kinugasa as co-inventors. *Id.* The original assignee of the '493 patent is Hitachi Ltd. *Id.*

43. The application that issued as the '493 patent was filed as a "[c]ontinuation of application No. 10/660,710, filed on Sept. 12, 2003, now Pat. No. 8,059,177, which is a division

of application No. 09/520,836, filed on Mar. 8, 2000, now Pat. No. 6,765,616." '493 patent at Cover. The '493 patent also appears to claim priority to Japanese Patent Application No. 2000-006064 filed on January 11, 2000.

44. I understand that Maxell has asserted a priority date of "Jan. 11, 2000" for the '493 patent. *See* Maxell's Third Supplemental Responses to Apple's First Interrogatories at 28 (Interrogatory No. 7); *see also* Maxell's Second Supplemental Infringement Contentions at 37. I am not aware of any earlier claim of priority for the '493 patent, nor am I aware of any evidence of earlier conception or reduction to practice. Accordingly, for my analysis in this report, I have used January 11, 2000 as the priority date for the '493 patent.

45. The cover of the '493 patent includes a notice of patent term extension of 136 days, which is "subject to a terminal disclaimer."

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 136 days.

This patent is subject to a terminal disclaimer.

46. As explained in the Prosecution History section below, the '493 patent is subject to a Terminal Disclaimer with U.S. Patent No. 6,765,616. As shown on the cover of the '493 patent, U.S. Patent No. 6,765,616 was filed on March 8, 2000. *See* '493 patent at Cover; U.S. Patent No. 6,765,616 at Cover. Accordingly, I understand that both the '493 patent and U.S. Patent No. 6,765,616 expired on March 8, 2020, which was 20 years after the filing of the application that issued as U.S. Patent No. 6,765,616.

47. The '493 patent relates to electric cameras, and more specifically, to an electric camera having an image sensing device having a sufficient number of pixels that is capable of taking highly detailed still images and moving video with reduced image quality without increasing circuitry. '493 patent 3:8–13. The Abstract of the '493 patent recites:

> An electric camera includes an image sensing device with a light receiving surface having N vertically arranged pixels and an arbitrary number of pixels arranged horizontally, N being equal to or more than three times the number of effective scanning lines M of a display screen of a television system, a driver to drive the image sensing device to vertically mix or cull signal charges accumulated in individual pixels of K pixels to produce, during a vertical effective scanning period of the television system, a number of lines of output signals which correspond to 1/K the number of vertically arranged pixels N of the image sensing device, K being an integer equal to or less than an integral part of a quotient of N divided by M, and a signal processing unit having a function of generating image signals by using the output signals of the image sensing device.

'493 patent Abstract.

48. In particular, the '493 patent describes an electric camera including an image sensing device (e.g., a CCD) having a number (e.g., 1200) of vertically arranged pixels and a number (e.g., 1600) of horizontally arranged pixels. '493 patent at 4:34–48. When recording a static image, all of the effective pixels on the image sensing device are used to produce signals with as high a resolution as possible. '493 patent 7:31-39. When recording a moving video, a number (e.g., 1200/240 = 5) of the vertically arranged pixels are mixed or culled, so that the number of lines of output signals from the image sensing device match or conform to the number of effective scanning lines (e.g., 240) of a television monitor. *See Maxell Ltd. v. Huawei Device USA Inc. et al.,* Case No. 5:16-cv-00178-RWS, Dkt. No. 175, Claim Construction Memorandum and Order (January 31, 2018) (the "Huawei Claim Construction Order"); '493 patent 4:64–5:6, 7:40–59, 9:30–36. Finally, when monitoring in a static image mode, the vertically arranged pixels are also mixed or culled, so that the number of output signals from the image sensing device match or conform to the number of effective scanning lines of a display screen used to monitor the static image.

49. The '493 patent states that "[i]n a video camera to photograph moving images, it is generally assumed that the video is viewed on a display such as [a] television monitor" and

thus a prior art video camera "is designed to produce output signals conforming to a television system such as NTSC." *Id.*, 1:30-34, 1:37-43 (the NTSC system "has an effective scanning line number of about 240 lines," which is "the number of scanning lines actually displayed on the monitor").

50. For reasons explained below in Sections VI-VII below, the '493 patent describes an alleged improvement on digital cameras using known and existing technology. For example, the '493 patent does not purport to invent the concept of an "Electric Camera." Rather, it admits that digital cameras "using solid-state image sensors such as CCDs (charge-coupled devices)" were already known. *See id.* at 1:23-26. Moreover, the '493 patent admits that digital cameras having the capability to take both video and still images were already available on the market by its filing. *See id.* at 1:26-29 ("In recent years, video cameras with a still image taking function and digital still cameras with a moving image taking function have become available."). Indeed, by the alleged priority date of the '493 patent, there were many different digital camera products on the market that had the capability to take both video and still images. *See, e.g.*, Sections VI.E below.

51. The '493 patent also admits that various techniques of processing image data to produce an output signal having a resolution different than the image sensor resolution were already known. These known techniques include at least "interpolation" and "mix[ing] and cull[ing]." For example, the '493 patent cites a prior art reference ("JP-A-11-187306") that discloses an "interpolation processing for transformation" of the image data from an image sensor to match "the field cycle and horizontal scan cycle of television." *See id.* at 2:10-17. Similarly, the '493 patent cites another prior art ("JP-A-9-270959") that teaches "an apparatus which mixes together or culls the pixel signals inside the image sensing device to reduce the number of signals to be read and therefore the read cycle." *Id.* at 2:44-47. Indeed, these basic

techniques for image processing were well known to those of ordinary skill in the art. *See, e.g.*, Sections VI.B below.

52. The '493 patent also admits that techniques for digital image stabilization were well known. For example, the '493 patent admits that "[s]ome image sensing devices to take moving images according to the NTSC system have an area of pixels for image stabilization added to the area of effective pixel area" to allow for image stabilization. *See id.* at 1:51-67; *see also* 2:36-43. In such devices, the image sensor has more pixels than needed to generate the output image, and can use a portion of the sensor for each image depending on the movement of the camera. *See id.* Moreover, in such devices, only 480 lines are used to generate an NTSC video signal, but all signals could be used to generate a still image. *See id.* at 1:51-2:9. Indeed, techniques for digital image stabilization were well known to those of ordinary skill in the art. *See, e.g.*, Sections VI.D below.

53. Thus, for reasons explained below in Section VII, claims 5 and 6 of the '493 patent do not recite any new technology disclosed by the '493 patent specification, but merely claim an "electric camera" that includes only known components that perform well known, common operations such as scaling images for preview and recording, and performing digital image stabilization.

B. Prosecution History of the '493 Patent

54. Application No. 12/845,266 (the "'266 Application") was filed on July 28, 2010, and it issued as the '493 patent on December 25, 2012. The '266 Application was filed as a continuation of Application No. 10/660,710 (filed on September 12, 2003, issued as U.S. Patent No. 8,059,177), which was filed as a division of Application No. 09/520,836 (filed on March 8, 2000, issued as U.S. Patent No. 6,765,616). *See* '493 patent at Cover. These applications claim priority to Japanese Patent Application No. 2000-006064 filed on January 11, 2000. *See id.*

55. On March 14, 2012, the U.S. Patent and Trademark Office ("USPTO") issued a Non-Final Office Action rejecting all 16 original claims. *See* '493 patent prosecution history, Non-final Office Action dated 3/14/2012. The Examiner objected to claims 1-4, 9, and 11-16 for including drafting informalities (*see id.* at 2), rejected claims 6 and 12 for lacking enablement in the specification (*see id.* at 3-4), rejected claims 1-5, 7-11, and 13-16 for double-patenting over U.S. Patent No. 6,765,616 (*see id.* at 4-7), and rejected claims 6 and 12 for double-patenting over U.S. Patent No. 6,765,616 in view of U.S. Patent No. 6,906,746 ("Hijishiri") (*see id.* at 7-8). The Examiner also noted in the Office Action that "Udagawa (US 6,519,000) discloses image pickup apparatus with mode switching between a still picture mode and a moving picture mode" and "Iizuka (US 5,847,758) discloses color CCD solid-state image pickup device." *Id.* at 8.

56. On July 16, 2012, the Applicant filed an amendment. The Applicant did not challenge the Examiner's findings. Rather, the Applicant amended the claims to fix all the drafting informalities identified by the Examiner, cancelled claims 6 and 12 that were rejected for lacking enablement, and filed a Terminal Disclaimer to overcome the double-patenting rejections. *See* '493 patent prosecution history, Amendment dated 7/16/2012. The Terminal Disclaimer, excerpted below, disclaimed any patent term that would extend beyond the expiration of U.S. Patent No. 6,765,616. *See* '493 patent prosecution history, Terminal Disclaimer dated 7/16/2012.

TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A PRIOR PATENT	Docket Number (Optional) 500.38315VC3

In re Application of: T. NAKANO
Application No.: 12/845,266
Filed: 7/28/2010
For: ELECTRIC CAMERA

The owner* Hitachi, Ltd., of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application, which would extend beyond the expiration date of the full statutory term defined in 35 U.S.C. 154 and 173, as presently shortened by any terminal disclaimer, of prior Patent No. 6,765,616. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the owner does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term as defined in 35 U.S.C. 154 and 173 of the prior patent, as presently shortened by any terminal disclaimer, in the event that it later: expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

57. On August 6, 2012, the USPTO issued a Final Office Action rejecting pending claims 1-5, 7-11, and 13-16 on the ground that the Terminal Disclaimer filed by the Applicant was not signed by an attorney of record. The Applicant re-filed the Terminal Disclaimer on August 22, 2012.

58. On August 24, 2012, the Examiner issued a Notice of Allowance without issuing any other prior art based rejection. The ’493 patent issued on December 5, 2012.

C. *Inter Partes* Review of the ’493 Patent

59. The ’493 patent was and is subject to several *Inter Partes* Review (IPR) petitions filed before the Patent Trial and Appeal Board (PTAB) of the United States Patent and Trademark Office. I understand that the PTAB has yet to institute a review based on these petitions.

60. On November 22, 2017, ZTE Corporation filed an IPR petition against the ’493 patent in a proceeding numbered IPR2018-00236. ZTE’s petition relied on U.S. Patent Nos. 5,493,335 (“Parulski ’335”); 5,440,343 (“Parulski ’343”); 5,497,192 (“Ishizuka ’192”); 5,828,406 (“Parulski ’406”); and 6,512,541 (“Dunton ’541”). *See* IPR2018-00236, Petition at 3. On June 1, 2018, the PTAB issued an order denying the petition, concluding that ZTE “has not demonstrated a reasonable likelihood that at least one of the challenged claims is unpatentable

based on the asserted grounds." IPR2018-00236, Institution Decision at 18. Thus, the PTAB did not conduct an IPR review of the '493 patent based on ZTE's petition. I do not rely on the prior art presented by ZTE in the "Anticipation and Obviousness" section of my report below.

61. On June 20, 2018, Olympus Corporation filed an IPR petition against the '493 patent in a proceeding numbered IPR2018-00904. ZTE's petition relied on U.S. Patent Nos. 5,444,482 ("Misawa '482"); 6,700,607 ("Misawa '607"); 6,292,218 ("Parulski '218"); and 6,529,236 ("Watanabe '236"). *See* IPR2018-00904, Petition at 7. The petition was dismissed before the PTAB issued its institution decision based on a settlement between Olympus and Maxell. *See* IPR2018-00904, Order to Dismiss Proceeding at 2-3. Thus, the PTAB did not issue an institution decision and did not conduct an IPR review of the '493 patent based on Olympus's petition. Except for Misawa '482, I do not rely on the other prior art presented by Olympus in the "Anticipation and Obviousness" section of my report below.

62. On March 17, 2020, Apple filed an IPR petition against the '493 patent in a proceeding numbered IPR2020-00597. Maxell has yet to file a preliminary patent owner response, and the PTAB has yet to issue a ruling on this petition.

D. Asserted Claims

63. I understand that Maxell is asserting claims 5 and 6 of the '493 patent against Apple.

64. Claim 5 recites:

> 5. An electric camera comprising:
>
> *[a]* an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines;
>
> *[b]* a signal processing unit that generates image signals by processing the output signals of the image sensing device; and
>
> *[c]* a display unit with a display screen, that displays an image

corresponding to the image signals;

> *[d]* wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines;
>
> *[e]* wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance; and
>
> *[f]* wherein when recording the image in a moving video mode, the signal processing unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance, where the second distance is different from the first distance.

65. Claim 6 recites:

> 6. An electric camera according to the claim 5, further comprising:
>
> *[a]* an image-instability detector which detects an image-instability of the electric camera; and
>
> *[b]* wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector.

E. Claim Construction

66. In my analysis, I am applying the following claim constructions agreed to by the parties or ordered by the Court. For claim terms that are not construed below, I have applied their plain and ordinary meaning to a person of ordinary skill in the art (in view of the specification and prosecution history) in my analysis.

1. Agreed Terms

67. I understand that the construction of the following claim terms have been agreed to by the parties:

Claim Term	The Court's Construction
an image-instability detector" '493 patent: claim 6	"a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera"
"an image-instability of the electric camera" '493 patent: claim 6	"instability caused by vertical and/or horizontal movement of the electric camera"

2. The Court's Construction

68. I have reviewed the Claim Construction Memorandum and Order issued by the Court on March 18, 2020. I understand that the Court construed the following claim terms relevant to claims 5 and 6 of the '493 patent:

Claim Term	The Court's Construction
"mixing … signal charges accumulated in the N number of vertically arranged pixel lines" / "mixed … from the N number of vertically arranged pixel lines" '493 patent: claim 5	"mixing . . . signal charges" and "mixed" means "combining signal charges from multiple pixels" and "combined"
"culling signal charges accumulated in the N number of vertically arranged pixel lines" / "culled from the N number of vertically arranged pixel lines" '493 patent: claim 5	"culling signal charges" and "culled" as "reading out only one line of signal charges of pixels for every predetermined number of lines" and "only one line of signal charges of pixels is read out for every predetermined number of lines"

F. Level of Ordinary Skill in the Art

69. Based on my review of the '493 patent and its prosecution history, and based on my years of experience in digital image processing, my opinion is that a person of ordinary skill in the art around the filing of the '493 patent would have had a Bachelor's degree in Electrical Engineering, Computer Engineering, Computer Science, or an equivalent degree with at least 2 years of experience in digital image processing technologies. Additional education may substitute for lesser work experience and vice-versa.

70. I have been informed that Maxell contends that a person of ordinary skill in the art for the '493 patent would be a person with a Bachelor of Science degree in Electrical/Computer Engineering, Computer Science, or an equivalent degree, and at least two years of experience working in the field of image processing. The opinions expressed in this report would not change under my definition or Maxell's definition of a person of ordinary skill in the art.

71. As discussed above, Maxell alleges a priority date of January 11, 2000 for the '493 patent. At around January 2000, I would have qualified as a person of ordinary skill in the art under the definition I provided above or the definition provided by Maxell. By January 2000, I already had B.S., M.S., and Ph.D. degrees and over 15 years of experience in digital image processing. I am also familiar with the level of experience and knowledge of those who qualify as a person of ordinary skill in the art under the definitions set forth above because I was teaching and working with graduate students and researchers with similar levels of experience in 2000. Though my experience exceeds that of a person of ordinary skill in the art in 2000, the opinions stated in this report are provided from the perspective of a person of ordinary skill in the art as defined above.

VI. BACKGROUND OF TECHNOLOGY

72. The '493 patent is titled "Electric Camera" and it generally relates to the capture and processing of digital images. As explained above in Section V.A, the '493 patent describes and claims an "electric camera" that includes only known components that perform well known, common operations such as scaling images for preview and recording, and performing digital image stabilization.

73. The concept of a digital or "electric" camera long predates the '493 patent. Companies began to work on digital camera devices in the 1960s and 1970s. *See, e.g.*, Richard

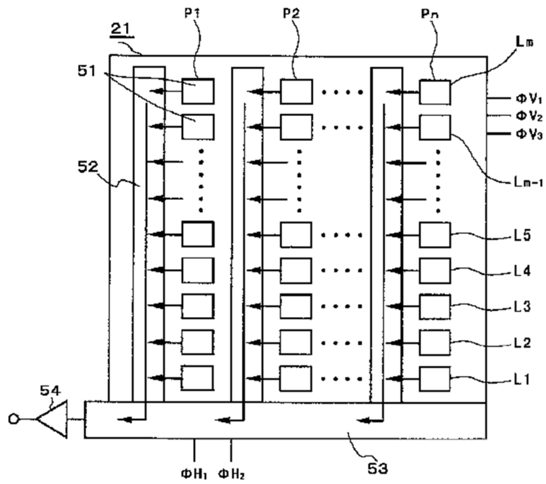
Trenholm, "Photos: The history of the digital camera," CNET.com (Nov. 5, 2007) (at https://www.cnet.com/news/photos-the-history-of-the-digital-camera/). For example, U.S. Patent No. 4,131,919 ("Kodak '919"), titled "Electronic Still Camera," was filed by engineers from the Eastman Kodak Company in 1977. It describes an electronic device that uses a charge coupled device (CCD) for capturing images. *See* Kodak '919 at 3:55-68. By the late 1990s, there were many commercially-available digital cameras on the market.

A. Image Sensors

74. From its earliest days, digital cameras used solid state image sensors to capture signals used to generate a digital image. These sensors included an array of photo-sensitive elements arranged in rows and columns. *See, e.g.*, Kodak '919 at 4:24-37.

75. The '493 patent itself recognizes that CCD image sensors were well known. In its "Background of the Invention" section, the '493 patent describes the use of "solid-state image sensors such as CCDs (charge-coupled devices)" in "so-called video camera or camcorder for taking moving images and a so-called digital still camera for taking still images." '493 patent at 1:23-29. The '493 patent's "Background of the Invention" section also describes a Japanese patent "JP-A-9-270959" for describing an image capturing device. *Id.* at 2:44-47. Figure 4 of Japanese Patent Application Publication H9-270959 ("JP'959"), reproduced below, shows a CCD image sensor having columns and rows of image pixels. *See* JP'959 at ¶ 30, Fig. 4.

【図4】



76. In his October 4, 2019 declaration in support of Maxell's claim constructions, Maxell's expert Dr. Vijay Madisetti discussed U.S. Patent No. 5,828,406 ("Kodak '406"), a patent filed by Kodak engineers in 1994. Kodak '406 is also cited on the face of the '493 patent. *See* '493 patent at References Cited. Kodak '406 describes a CCD image sensor as containing "a two-dimensional array of photosites …, e.g. photodiodes, arranged in rows and columns of image pixels." Kodak '406 at 5:33-67. Moreover, Kodak '406 describes that such CCD image sensors were commercially available on the market, such as the "Kodak model CCD KAI-0400CM image sensor" which had "approximately 512 active lines with approximately 768 active pixels per line." *Id.*

77. Moreover, Maxell's expert Dr. Madisetti testified in deposition that he would have expected a person who qualifies as a person of ordinary skill in the art to "know about different types of image sensors, like CCD sensors, and CMOS image sensors, and so forth" and that such sensors included pixels arranged in "horizontal row[s], and vertical columns." *See* 10/22/19 Madisetti. Dep. Tr. at 40:12-41:21. Thus, the design and use of image sensors, including CCD and CMOS image sensors, was well known by the filing of the '493 patent.

B. Image Processing and Scaling

78. An image sensor has a fixed number of pixels arranged in columns and rows. There are situations, however, when it may be desirable to produce an image at a resolution different from that of the sensor. For example, a user may desire to store an image at a lower resolution in order to reduce the amount of memory the stored data would require. As another example, it may be necessary to downscale or upscale image resolution to match the resolution of a display. The '493 patent recognizes that image processing and scaling were well known. The '493 patent's "Background of the Invention" section describes various known image processing and scaling techniques. *See* '493 patent at 1:30-2:53. For example, the '493 patent describes converting image signals to a format compatible with the "JPEG (Joint Photographic Expert Group" format. *Id.* at 1:60-64. The '493 patent's "Background of the Invention" section also references JP'959 as disclosing "an apparatus which mixes together or culls the pixel signals inside the image sensing device to reduce the number of signals to be read and therefore the read cycle." *Id.* at 2:44-47. JP'959 discloses an operation that "mix[es] the 2 pixels read by the vertical transfer CCD, and furthermore, offset the position in the up and down direction of the mixed pixels in an odd field and an even field." JP'959 at [0003]; *see also id.* at [0032].

79. Kodak '406, which was cited by the '493 patent and thus part of its prosecution history, also describes using "a hardwired digital signal processing circuit [to generate] low resolution, spatially subsampled digital image data which can directly drive the relatively low resolution LCD display." Kodak '406 at 2:40-44. For example, Kodak '406 describes a "line skipping" approach to scale image signals to a resolution lower than that of the image sensor in order to match the resolution of an LCD display. *See id.* at 6:29-33, 7:3-63.

80. Maxell's expert witness, Dr. Madisetti, also testified that he would expect a person of ordinary skill in the art to know about various image processing techniques such as interpolation, decimation, noise removal, pixel collection, compressing, and storage:

> Q. As part of working in image/video processing, would you expect a person skilled in the art to know about image signal processors and image signal processing algorithms?
>
> A. Yes.
>
> Q. What would you expect a person skilled in the art to know in those aspects?
>
> A. Things like -- topics like interpolation, decimation. Topics like noise removal; pixel collection; various types of compression; storage types of techniques.
>
> Q. Right. So, I think the first thing you mentioned was "interpolation." Right?
>
> A. Yes. Interpolation, decimation and others.
>
> Q. So, interpolation refers to taking an image and trying to kind of increase the resolution -- pixel resolution of the image by interpolating between pixels. Is that, generally, correct?
>
> A. Now, as I said, I mean, one of -- it could be one of the uses. That's not a definition. "Interpolation" can be used in many, many ways.
>
> Q. So one example of a use for "interpolation" would be to take a low resolution image and try to increase the resolution by interpolating between pixels. Is that right?
>
> A. That's one example, yes.
>
> Q. And "decimation;" one example of a use for "decimation" would be to take a higher resolution image and reduce the resolution of that image. Is that right?
>
> A. That's -- one again -- one example of "decimation."

10/22/19 Madisetti. Dep. Tr. at 41:22-43:7.

81. The Handbook of Image & Video Processing, first published in 2000, describes various techniques for image and video processing that existed around the time of filing of the '493 patent. *See* A. Bovik (Ed.), Handbook of Image & Video Processing (Academic Press

2000) (hereafter, "Handbook of Image & Video Processing"). For example, Section VII describes various image sampling and interpolation techniques for still and video images. *Id.* at 627-654. As one approach to down-sampling, the book explains that "we simply discard all but every Cth sample in the m direction and all but every Dth sample in the n direction." *Id.* at 635. The Handbook of Image & Video Processing was commonly used as a textbook or reference book for those working in the field of image and video processing, and the techniques described in that book were known to those working in the field of digital image processing in 2000.

C. Image Display and Preview

82. Compared to film cameras, digital cameras can output its captured image data for immediate display on a display device. Thus, it was well known that digital cameras could include a built-in display as an electronic viewfinder, or output its image signals to an external display such as a standard television. For example, the '493 patent's "Background of the Invention" section describes known devices that output their image signals to a standard NTSC television. '493 patent at 1:30-50.

83. Moreover, Kodak '406, which was cited on the face of the '493 patent, describes using "a hardwired digital signal processing circuit [to generate] low resolution, spatially subsampled digital image data which can directly drive the relatively low resolution LCD display." Kodak '406 at 2:40-44. Kodak '406 describes the benefit of such an electronic viewfinder compared to an optical one—it "allow[s] the user to properly frame the subject and view the images as they are being recorded." *Id.* at 1:28-32.

84. By the late 1990s, the technology of including a built-in electronic viewfinder in a digital camera was well known and understood. However, not all commercially-available digital cameras sold in the 1990s included a built-in viewfinder display. For example, Apple released its first digital camera, the Apple QuickTake 100, in 1994. *See* Peter Ha, "Apple QuickTake

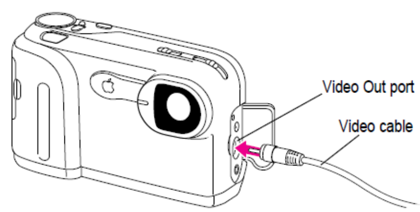
100," Time.com (Oct. 25, 2010) (http://content.time.com/time/specials/packages/article/0,28804,2023689_2023773_2023615,00.html). While other companies sold professional grade digital cameras before Apple, Apple's QuickTake is described as "the first consumer digital camera." *Id.* The QuickTake 100 did not have a built-in viewfinder display.

85. In 1997, Apple released the QuickTake 200, an updated version of the QuickTake Camera. The QuickTake 200 captured images at 640 × 480 resolution and it included a 1.8 inch LCD screen as a viewfinder. *See* QuickTake 200 User Manual at 68 (APL-MAXELL_00712989 to -086).

86. The QuickTake 200 includes 2 MB of built-in memory, which allowed for the storage of up to 20 "high quality images" at the 640 x 480 resolution. *See* QuickTake 200 User Manual at 19. The camera also includes a lower-quality mode that allowed the user to store up to 30 "standard-quality pictures." *Id.* at 20. The QuickTake 200 also included a video output

port that allowed the device to output NTSC television signal to a television. *See id.* at 22. I have used and tested an Apple QuickTake 200 camera. APL-MAXELL_P08. The QuickTake 200 camera captures still images and its "Video Out" port (a standard "RCA" video port) outputs video images to a standard television.

> **IMPORTANT** Your television must meet NTSC (National Television System Committee) color television telecasting specifications (adopted mainly in the United States, Canada, and Japan).
>
> 1 **Make sure the camera and television are turned off.**
>
> 2 **Plug the optional power adapter into your camera to conserve the batteries.**
>
> See "Using the Camera With the Optional AC Power Adapter," later in this chapter.
>
> 3 **Set the mode dial to Play ( ).**
>
> 4 **Connect the video cable to the Video Out port on the camera.**



> 5 **Connect the other end of the video cable to the video input port on the television.**
>
> 6 **Turn on the camera.**

87. Thus, Apple's decision to include a built-in viewfinder display and a video-out port in the larger QuickTake 200 but not in the smaller QuickTake 100 demonstrates that these features were well known design choices known to those of ordinary skill in the art.

88. While including a display enhances the camera's functionality and allows for better framing of the captured image, it also increases the cost of the device, its size, and its power consumption. Thus, it was a matter of design choice whether a particular camera included a built-in viewfinder display or not.

D. Image Stabilization

89. One problem that has always existed in photography—whether film or digital—is the blur caused by unintentional movement of the camera during image capture. In the fields of

photography and digital image processing, the techniques for correcting for unintended movement is called "image stabilization."

90. The Handbook of Image & Video Processing includes a section on "Image Sequence Stabilization, Mosaicking, and Superresolution." Handbook of Image & Video Processing at § 3.13. As explained in the book: "Image stabilization is a differential process that compensates for the unwanted motion in an image sequence." *Id.* at 263. The book describes optical stabilization techniques, which "work by perturbing the optical patch of the device to compensate for unsteady motion." *Id.* The book also describes electronic stabilization, which "can be realized in electronic imaging systems by rewarping the generated sequence in the digital domain, with no need for expensive transducers or moving parts." *Id.* Various techniques for image stabilization, including two-dimensional stabilization and three-dimensional stabilization, were well known by the filing of the '493 patent. *Id.* at 263-268.

91. Image stabilization has been known since at least the 1980s. For example, U.S. Patent No. 4,612,575 ("Ishman"), filed on July 24, 1984 and issued on September 16, 1986, addressed this issue. It describes a video camera that corrects for "motion induced blurring" by "measuring the motion of the video camera by orthogonally mounted rate gyros" that detect the camera's motion. Ishman at Abstract. "Motion output signals of the rate gyros are processed in a Fourier transform computed Wiener filter to produce the video deblurring signal which is combined with the Fourier transform of the video camera signal." *Id.*; *see also id.* at 1:49-2:24, 2:25-36, 2;58-61, 3:62-4:19, 7:24-35, Figs. 1-3. Thus, the use of a gyroscope to detect camera movement and perform video stabilization was known at least 15 years before the filing of the '493 patent.

92. As another example, an IEEE paper published in 1989 titled "VHS Camcorder with Electronic Image Stabilizer" describes techniques for image stabilization. *See* M. Oshima

et al., "VHS Camcorder with Electronic Image Stabilizer," IEEE Transactions on Consumer Electronics 749-758 (Nov. 1989) (APL-MAXELL_01451998 to -2007). It describes the use of "compact vibration gyro sensors" that include "thin rectangular piezo-electric bimorph cells" for the detection of motion. *Id.* at 749-51. It also describes two general approaches for motion compensation—the use of mechanical components to stabilize the lens unit (e.g., "a gimbal mechanism and actuators") and the use of "electronic compensation system" that alters the image signal lines transferred from the CCD sensor. *Id.* at 755. The "electronic compensation system" described by Oshima is illustrated in Figure 15, below. *Id.*

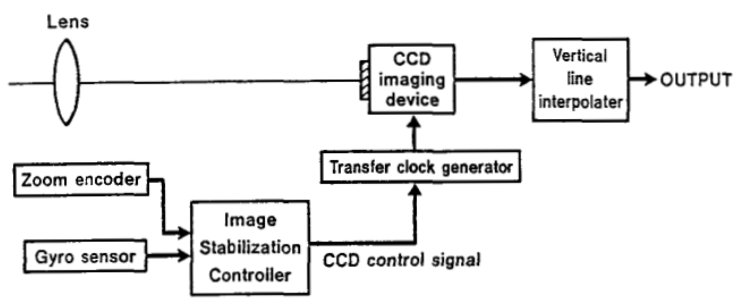


Fig.15 Electronic Compensation System

93. The '493 patent recognizes that image stabilization was well known. The '493 patent's "Background of the Invention" section acknowledges that cameras having "image stabilization" already existed. '493 patent at 1:51-2:9. In cameras having such image stabilization functionality, the image sensor would have "pixels … added to the area of effective pixel area, thus bringing the effective number of vertically arranged pixels to about 480 or more." *Id.* In other words, in order to perform image stabilization, the image sensor would have more pixel lines than the desired output image (e.g., more lines than the 480 output lines for NTSC television) such that, depending on the movement detected, the device can use a different set of 480 lines for each frame in order to compensate for unintended movement of the camera. *See id.*

94. By 1999, the use of electronic image stabilization was common. For example, the October 1999 edition of the Popular Photography magazine contained advertisements for many camera models that included features described as "Digital Electronic Image Stabilization," "Picture Stabilizer," or "Digital Image Stabilization." *See* Popular Photography (October 1999) at 132. Both the benefits of electronic image stabilization and its implementation were well known to those working in the field of digital image processing, including those defined as persons of ordinary skill in the art above.

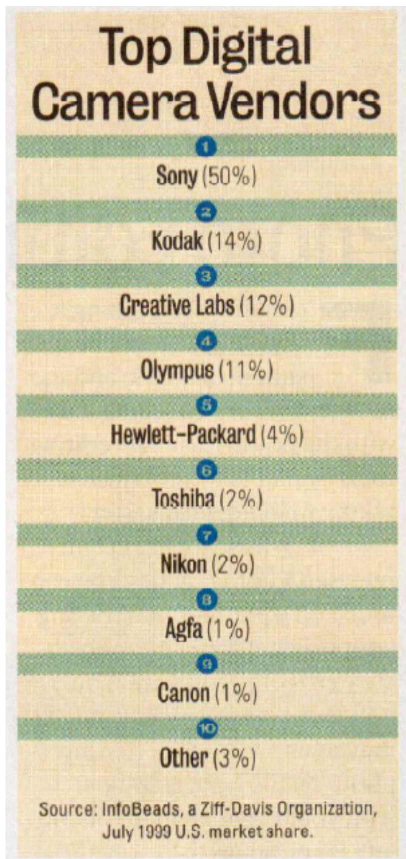
95. While the technology for electronic image stabilization was well known, not all commercially available cameras included stabilization features. Among cameras that included stabilization features, some used electronic stabilization techniques while others used optical stabilization techniques. Camera designers would need to make design decisions to balance between the benefits of image stabilization against the size and cost of additional components. *See, e.g.*, Handbook of Image & Video Processing at 263 (noting that while image stabilization improved image quality, it also adds "bulk and cost" to the camera). But these approaches were well known and represented common design choices available to camera makers.

E. The Digital Cameras Market

96. Around the filing of the '493 patent in early 2000, there was already a robust digital cameras market. Indeed, as discussed above, Apple sold several models of digital

cameras in the 1990s, including the QuickTake 100, QuickTake 150, and QuickTake 200. *See, e.g.*, APL-MAXELL_P08. And the '493 patent also acknowledges that digital camera products already existed. *See* '493 patent at 1:23-29.

97. For example, the November 11, 1999 edition of PC Magazine, a popular magazine for computer and electronic products in the 1990s, listed the top digital camera vendors around July 1999. *See* PC Magazine (Nov. 11, 1999) (APL-MAXELL_01463585 to -601) at 12. It listed Sony as the market leader with approximately 50% market share, followed by Kodak with 14% market share. *See id.* Neither Hitachi nor Maxell was listed. *See id.*



98. The November 11, 1999 edition of PC Magazine also included an article that described and compared the features of 19 models of digital cameras available on the market at the time. *See* PC Magazine (Nov. 11, 1999) at 162-190. A summary of their features are shown in the chart below. *Id.* at 174, 176.

SUMMARY OF FEATURES

Digital Cameras

Continues

■ YES □ NO

Products listed in review order	Agfa ePhoto CL30	Agfa ePhoto CL50	Canon PowerShot A50	Casio QV-2000UX	Casio QV-8000SX	Epson PhotoPC 750Z	Epson PhotoPC 800	Fujifilm MX-2700	Fujifilm MX-2900	HP PhotoSmart C200
Street price	$400	$600	$500	$900	$700	$600	$700	$700	$900	$300
Dimensions (HWD, in inches)	3.2 x 5.1 x 1.5	2.9 x 5.1 x 2.2	2.7 x 4.1 x 1.5	2.9 x 5.1 x 2.4	3.1 x 5.6 x 2.8	3.0 x 5.4 x 2.4	2.7 x 4.4 x 1.6	3.1 x 3.8 x 1.3	2.7 x 5.1 x 2.4	2.1 x 5.0 x 3.1
Weight	9 ounces	11 ounces	9 ounces	11 ounces	11 ounces	11 ounces	8 ounces	9 ounces	12 ounces	11 ounces
Optical/digital zoom level	N/A / 2X	3X / 2X	2.5X / N/A	3X / 2X	8X / 2X–4X	3X / 2X	N/A / 2X	N/A / 2.5X	3X / 2.5X	N/A / 2X
Equivalent 35-mm camera lens	Info not available	34–102 mm	28–70 mm	36–108 mm	40–320 mm	34–102 mm	38 mm	35 mm	35–105 mm	39 mm
LCD viewfinder (diagonal measurement)	2.0 inches	2.0 inches	2.0 inches	1.8 inches	2.5 inches	2.0 inches	1.8 inches	2.0 inches	2.0 inches	1.8 inches
Closest focus (macro mode)	7.8 inches	7.8 inches	6.7 inches	7.8 inches	0.04 inches	8.0 inches	5.9 inches	3.5 inches	9.8 inches	9.5 inches
Best resolution	1,440 x 1,080	1,600 x 1,200	1,280 x 960	1,600 x 1,200	1,280 x 960	1,600 x 1,200	1,984 x 1,488	1,800 x 1,200	1,800 x 1,200	1,152 x 872
Total number of pixels	1.5 million	1.9 million	1.3 million	2.1 million	1.3 million	1.3 million	2.1 million	2.3 million	2.3 million	1.0 million
Compression modes	JPEG	JPEG	JPEG	JPEG	JPEG	JPEG	JPEG	JPEG	JPEG, TIFF	JPEG
Removable memory shipped with camera	4MB CompactFlash	8MB SmartMedia	8MB CompactFlash	8MB CompactFlash	8MB CompactFlash	12MB CompactFlash	8MB CompactFlash	8MB SmartMedia	8MB SmartMedia	8MB CompactFlash
Image capacity: standard/best quality	36 / 6	96 / 12	14 / 8	39 / 8	63 / 13	178 / 16	120 / 10	35 / 8	35 / 8	80 / 17
Video capture	■	■	□	■	■	□	□	■	■	□
Batteries included	4 AA	4 AA	1 lithium ion	4 AA	4 AA	4 nickel hydride	4 nickel hydride	1 lithium ion	1 lithium ion	4 AA
Rechargeable	□	□	■	□	□	■	■	■	■	□
Bundled software	Agfa Photo-Genie, Agfa PhotoWise	Agfa Photo-Genie, Agfa PhotoWise	PowerShot Solutions	Media Center, Panorama Editor	Media Center, Panorama Editor	Image Expert	Image Expert	Adobe Photo-Deluxe Home Edition	Adobe Photo-Deluxe Home Edition	HP Photo Imaging
Companion printer type (and list price)	None	None	Dye sub ($499)	Dye sub ($199)	Dye sub ($199)	Ink jet ($179–$500)	Ink jet ($179–$500)	None	None	Ink jet ($499)
Works directly from camera	N/A	N/A	■	■	■	■	■	N/A	N/A	■

N/A—Not applicable: The product does not have this feature.

SUMMARY OF FEATURES

Digital Cameras

Ends

■ YES □ NO

Products listed in review order	Kodak DC265	Kodak DC280 (PC MAGAZINE EDITORS' CHOICE)	Minolta Dimâge EX Zoom 1500	Nikon Coolpix 950	Olympus C-2000 Zoom (PC MAGAZINE EDITORS' CHOICE)	Panasonic PV-DC2590 PalmCam	Sanyo VPC-Z400	Sony Cyber-shot DSC-F55	Toshiba PDR-M4
Street price	$760	$690	$510	$1,000	$900	$800	$700	$800	$600
Dimensions (HWD, in inches)	4.2 x 4.6 x 2.2	3.0 x 5.2 x 2.0	2.3 x 5.0 x 2.7	5.6 x 3.0 x 1.4	2.9 x 4.2 x 2.6	2.7 x 4.7 x 2.0	2.2 x 5.0 x 2.8	3.1 x 4.1 x 2.0	2.7 x 4.4 x 1.6
Weight	19 ounces	12 ounces	11 ounces	12 ounces	10 ounces	10 ounces	11 ounces	10 ounces	8 ounces
Optical/digital zoom level	3X / 2X	2X / 3X	3X / 2X	3X / 2.5X	3X / 3X	3X / 2X	3X / 6X	N/A / 2.5X	N/A / 2X
Equivalent 35-mm camera lens	30–115 mm	30–60 mm	30–115 mm	30–115 mm	35–105 mm	34–102 mm	34–102 mm	37 mm	34 mm
LCD viewfinder (diagonal measurement)	2.0 inches	1.8 inches	2.0 inches	2.0 inches	1.8 inches	1.8 inches	2.0 inches	2.0 inches	1.8 inches
Closest focus (macro mode)	11.8 inches	9.8 inches	16.0 inches	0.8 inches	8.0 inches	7.9 inches	8.0 inches	1.0 inch	4.0 inches
Best resolution	1,536 x 1,024	1,760 x 1,168	1,344 x 1,008	1,600 x 1,200	1,600 x 1,200	1,280 x 960	1,280 x 960	1,600 x 1,200	1,600 x 1,200
Total number of pixels	1.6 million	2.1 million	1.5 million	2.1 million	2.1 million	1.3 million	1.3 million	2.1 million	2.1 million
Compression modes	JPEG, FlashPix	JPEG	JPEG	JPEG, TIFF	JPEG, TIFF	JPEG	JPEG	JPEG	JPEG
Removable memory shipped with camera	16MB CompactFlash	20MB CompactFlash	8MB CompactFlash	8MB CompactFlash	8MB SmartMedia	8MB CompactFlash	4MB SmartMedia	4MB Memory Stick	8MB SmartMedia
Image capacity: standard/best quality	190 / 28	245 / 32	38 / 3	16 / 1	122 / 7	100 / 15	60 / 0	15 / 0	20 / 0
Video capture	□	□	■	□	□	■	□	■	□
Batteries included	4 AA / 4 nickel hydride	4 AA / 4 nickel hydride	4 AA	4 AA	4 AA	4 AA	4 AA	1 lithium ion	1 lithium ion
Rechargeable	□ ■	□ ■	□	□	□	□	□	■	■
Bundled software	Adobe PageMill, Adobe Photo-Deluxe, Kodak Picture Easy	Adobe PageMill, Adobe Photo-Deluxe, ArcSoft PhotoPrinter	None	Hotshots (PictureWorks), IPIX, NikonView 2	Adobe Photo-Deluxe, QuickStitch	Adobe PhotoDeluxe	MGI PhotoSuite SE	Picture Gear 3.2	Image Expert, Image Shuttle
Companion printer type (and list price)	Ink jet ($149)	Ink jet ($149)	None	None	Dye sub ($449)	Dye sub ($600)	None	Dye sub ($599)	None
Works directly from camera	■	■	N/A	N/A	■	■	N/A	□	N/A

N/A—Not applicable: The product does not have this feature.

99. As shown in the charts above, every model of the digital camera reviewed by PC Magazine had a "LCD viewfinder." *Id.* at 174, 176. About half of the reviewed models—9 out of 19—supported "Video Capture" in addition to the capture of still images. *See id.* For

example, I have used and tested one of the reviewed models, a Casio QV-8000SX. *See* APL-MAXELL_P02. Below are images I took using the Casio QV-8000SX. *See also* Appendix C.

100. I have confirmed that this camera has a built-in LCD viewfinder, captures still images at the 1280 x 960 resolution (at the highest resolution setting), and captures video at the 320 x 240 resolution (in the AVI format). *See id.*; *see also* QV-8000SX User's Guide (APL-MAXELL_01009249 to -9368) at E-31, E-53, E-61, E-76. The User's Guide for this camera also explains that the built-in LCD viewfinder is a "2.5" TFT, low-glare color HAST LCD" with

resolution of 555 x 220 pixels. *See* QV-8000SX User's Guide at E-119. Thus, both the "LCD viewfinder" and "Video Capture" features were well known and prevalent in commercial digital cameras by 1999. *See* PC Magazine (Nov. 11, 1999) at 162-190.

101. The '493 patent purports to address challenges associated with capturing both high-resolution still images and lower-resolution video images using the same device. *See, e.g.*, '493 patent at 2:57-3:7. It appears that this challenge has already been addressed and resolved by the leading digital camera makers by 1999. As the PC Magazine article shows, many of the reviewed camera models supported relatively high still image resolution (such as 1600 x 1200 or 1800 x 1200) and video capture capability. *See* PC Magazine (Nov. 11, 1999) at 162-190.

VII. ANTICIPATION AND OBVIOUSNESS

A. Sony MVC-FD83 and MVC-FD88

1. Overview MVC-FD83 and MVC-FD88

102. The Sony MVC-FD83 and MVC-FD88 are two related models of digital cameras introduced by Sony in 1999. *See* Sony MVC-FD83/FD88 User Manual (APL-MAXELL_00716451 to 582)[1] at Cover. The MVC-FD88 had the capability to capture still photographs with a resolution up to 1280 x 960 pixels, and the MVC-FD83 provided image had the capability to capture still photographs with a resolution up to 1024 x 768 pixels (non-interpolated) or 1216 x 912 pixels (interpolated). *See id.* at 36-37. These two camera models also had the capability to capture moving images in a "MOVIE mode" at the 320 x 240 or 160 x 112 resolutions. *Id.* at 18, 24, 34. Below are photographs of a MVC-FD88 camera.

[redacted]

103. The Sony MVC-FD83 and MVC-FD88 cameras were publicly available in the U.S. at least by June 13, 1999. For example, the following advertisement from the June 13, 1999, edition of the Daily Sentinel (Grand Junction, Colorado) shows that Circuit City offered the MVC-FD83 on sale for $699.99 and the MVC-FD88 on sale for $899.99. *See* APL-MAXELL_00717723. Thus, buyers of these cameras would have known and used the products in the U.S. before the alleged priority date of the '493 patent (i.e., January 11, 2000). *See* Section V.A. I understand that the MVC-FD83 and MVC-FD88 cameras qualify as prior art under at least 35 U.S.C. § 102(a). *See* Section IV.C.

104. In addition, the following advertisement from the November 16, 1999 edition of PC Magazine shows that the MVC-FD83/88 cameras were publicly available through Warehouse.com, an online retailer of computer products. *See* PC Magazine (Nov. 11, 1999) at 233 (APL-MAXELL_01463585 to - 601). Thus, buyers of these cameras would have known and used the products in the U.S. before the alleged priority date of the '493 patent (i.e., January 11, 2000). *See* Section V.A.

105. Similarly, the October 1999 edition of the Popular Photography magazine contained over a dozen advertisements from various retailers for the MVC-FD83/88 cameras. *See* Popular Photography (October 1999) at 110 (advertisement from Abe's of Maine, a camera and electronics store in Brooklyn, NY); 113 (advertisement from Beach Camera, a camera store in New Jersey); 121 (advertisement from Marine Park, a camera and video store in Brooklyn, NY); 128 (advertisement from CameraWorld.com); 136 (advertisement from Family Photo & Video); 136-37 (advertisement from Camera Zone); 148-49 (advertisement from B&H Photo Video); 184-85 (advertisement from CCI Camera City Inc.); 188-89 (advertisement from The Photo Specialists); 194 (advertisement from TriState Camera & Video); 202 (advertisement from Smile Photo); 208 (advertisement from Focus Camera & Video); 212 (advertisement from

Adorama) (APL-MAXELL_01452048 to -065). Thus, buyers of these cameras would have known and used the products in the U.S. before the alleged priority date of the '493 patent (i.e., January 11, 2000). *See* Section V.A.

[redacted]

107. The MVC-FD88 camera allowed for recording of still images in a "STILL mode" at the 1280 x 960, 1024 x 768, and 640 x 480 resolutions. *See* Sony MVC-FD83/FD88 User Manual at 23, 34, 36-37. The recorded images are stored on a 3.5 inch floppy disk. *Id.* at 17. The MVC-FD88 camera also allowed for recording of moving images in a "MOVIE mode" at the 320 x 240 and 160 x 112 resolutions. *Id.* at 18, 24, 34. The recorded images are stored on a 3.5 inch floppy disk. *Id.*

3 Select IMAGE SIZE with the control button, then press ●.

Items for STILL mode
1280 × 960 : Records a 1280 × 960 JPEG file. (FD88 only)
1216 × 912 : Records a 1216 × 912 JPEG file. (FD83 only)
1024 × 768 : Records a 1024 × 768 JPEG file.
640 × 480 : Records a 640 × 480 JPEG file.

Items for MOVIE mode
320 × 240 : Records a 320 × 240 MPEG file.
160 × 112 : Records a 160 × 112 MPEG file.

[redacted]

[redacted]

109. The MVC-FD83/88 cameras each includes an LCD screen that serves as a viewfinder and user interface display. The LCD screen is a 2.5 inch TFT display. *See* Sony MVC-FD83/FD88 User Manual at 65; Sony MVC-FD83/FD88 Service Manual (APL-MAXELL_01147532 to -644)[2] at Cover. The User's Manual explains that the LCD screen has a resolution of approximately 84k pixels. *See* Sony MVC-FD83/FD88 User Manual at 65.

LCD screen	
Screen size	2.5 inch
LCD panel	TFT
Total dot number	84260 dots

[redacted]

111. The service manual of the MVC-FD83/88 camera includes a block diagram illustrating its electronic components. *See* Sony MVC-FD83/FD88 Service Manual at 3-1. The

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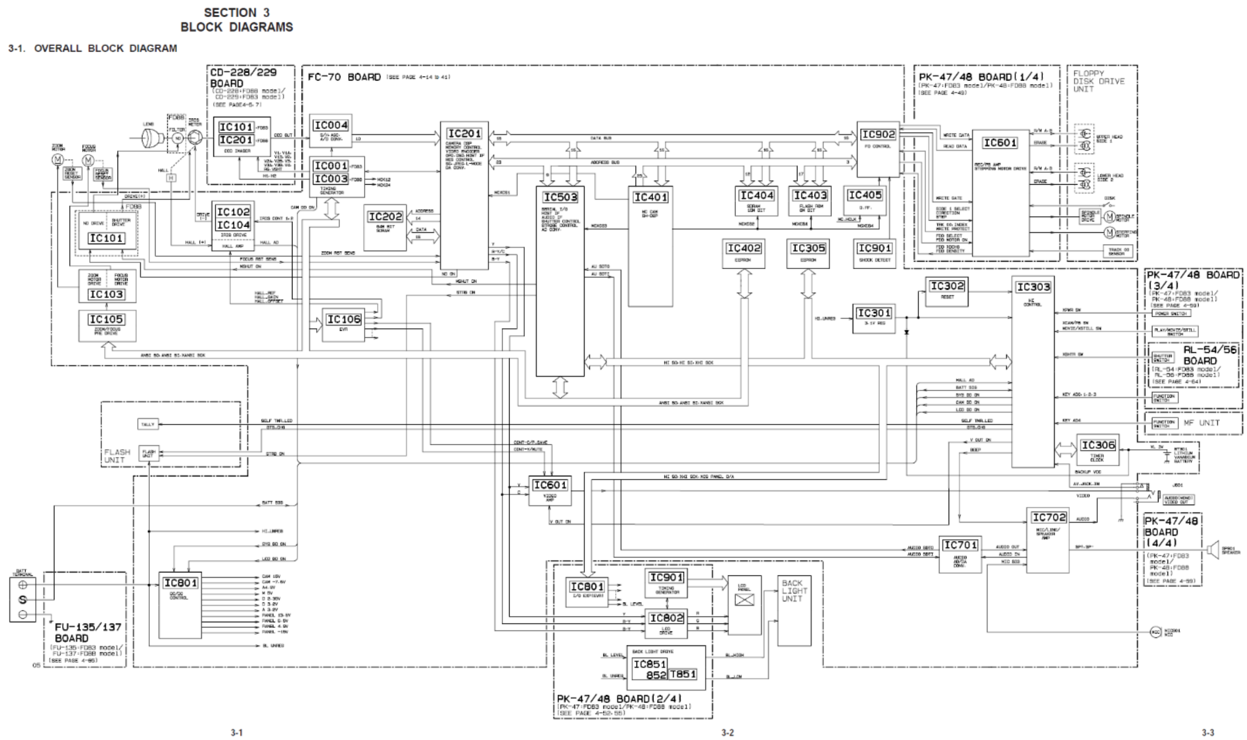
[redacted]

overall diagram is shown below, and various excerpts of the diagram are used in the claim chart below.

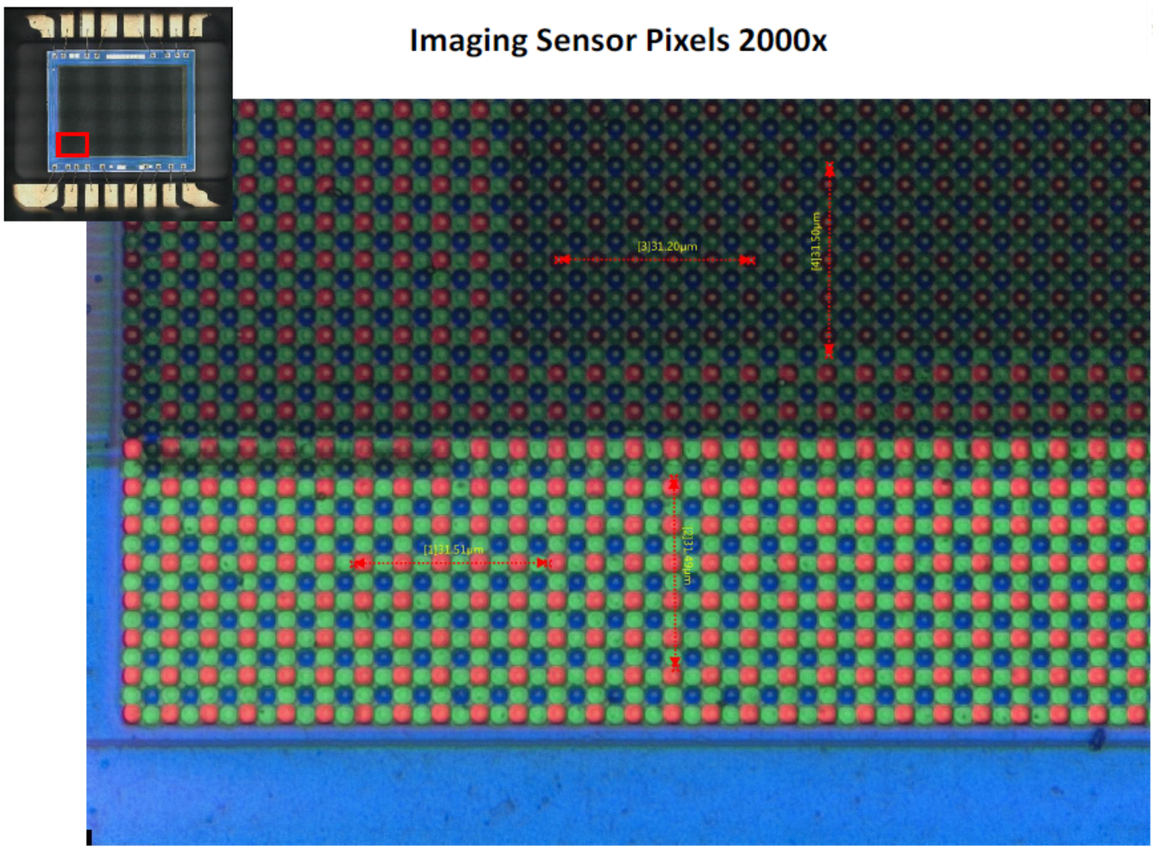


112. I have reviewed a set of tear-down images of a MVC-FD88 camera provided by Sage Analytical Lab, LLC ("Sage"). *See* APL-MAXELL_01099009 to -092. I have spoken to Sage and understand that these images were taken from a disassembled MVC-FD88 device.

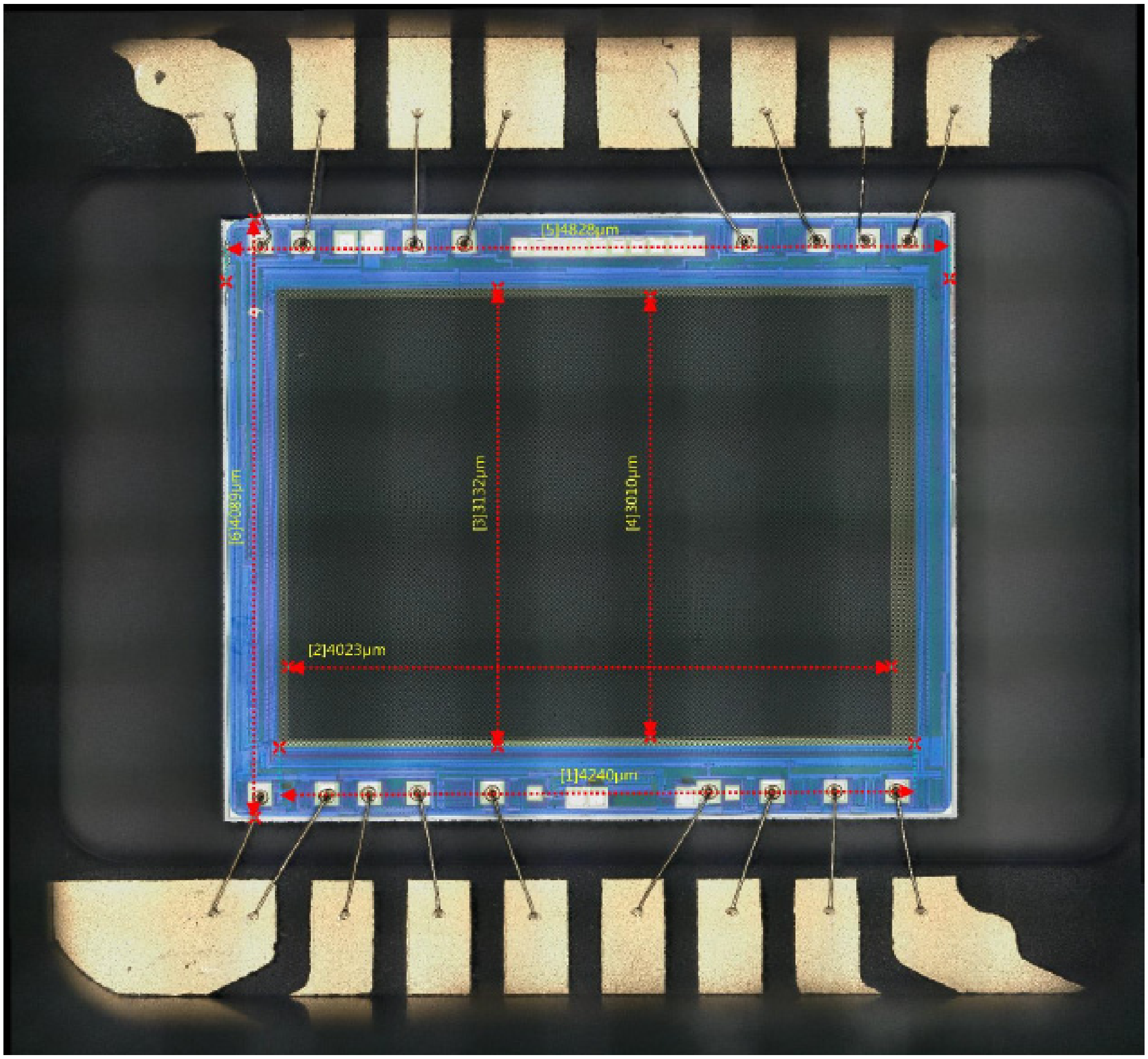
113. I understand that Sage performed a teardown analysis of a MVC-FD88 camera. It took photographs of various components, including the image sensor, LCD screen, and main circuit board. *See* APL-MAXELL_01099009 to -092. It then used an optical microscope to take photographs of the image sensor and LCD screen, and performed measurements on said images. *See id.* at -9022 to -9030; -9069 to -9092.

114. I have spoken to Sage and understand that Sage used the measurements on said images to calculate the resolution of the MVC-FD88 camera's image sensor and LCD screen, which are reported on APL-MAXELL_01099011, -9026, and -9030.

115. I understand that the image below is a microscopic image of a portion of the image sensor. *See id*. at -9025. The image shows the width of ten pixels to be approximately 31.20 µm and the height of ten pixels to be approximately 31.5 µm. *See id*. Each pixel appears to be round, and I have confirmed this during my conversation with Sage. *See id*. Accordingly, the diameter of a single pixel on the image sensor appears to be in the range of approximately 3.12 µm to 3.15 µm (calculated from 31.20 µm / 10 pixels and 31.5 µm / 10 pixels).



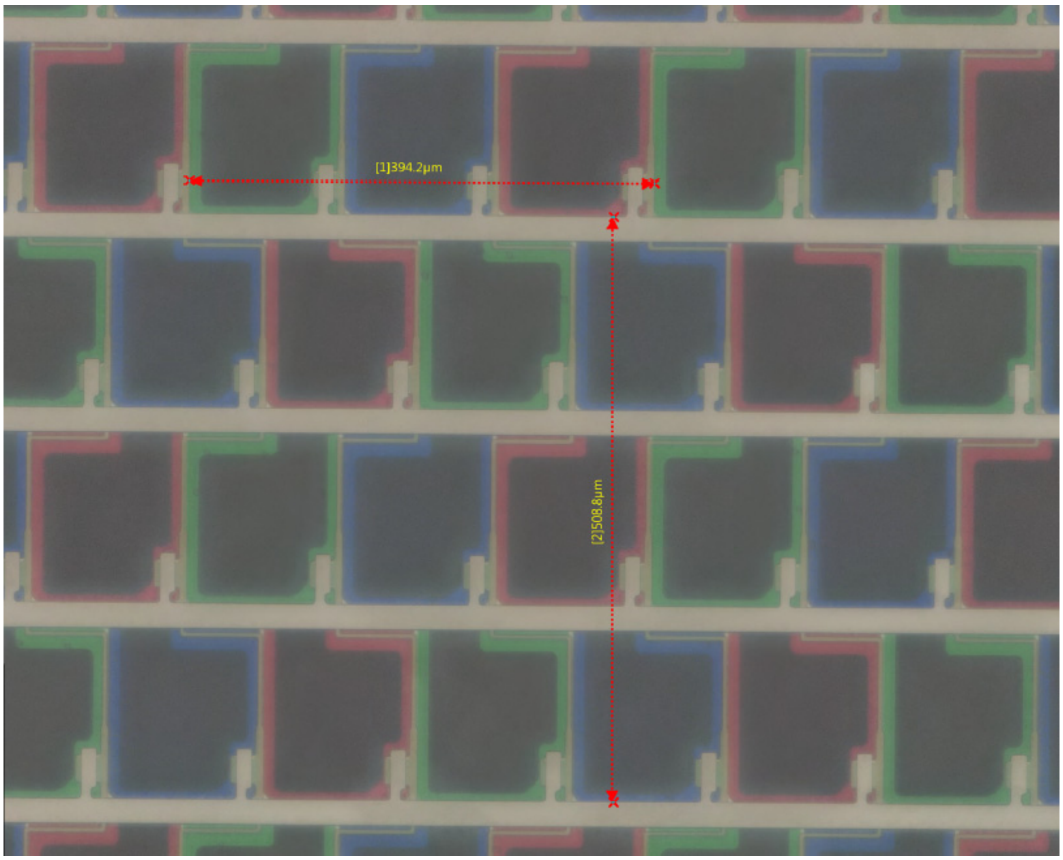
116. I understand that the image below is an image of the image sensor that depicts the active region (i.e., region without non-active pixels) in black and surrounded by a yellow border. *See id*. at -9024. It shows that the width of the image sensor active region is approximately 4023 µm and the height of the image sensor active region is approximately 3010 µm. *See id*.



117. Based on the measurements shown above, the number of pixels width-wise on the image sensor appears to be in the range of approximately 1277 to 1289 pixels (calculated from a width of 4023 µm / 3.12 µm and a width of 4023 µm / 3.15 µm). The number of pixels height-wise on the image sensor appears to be in the range of approximately 956 to 965 pixels (calculated from a height of 3010 µm / 3.12 µm pixel diameter and a height of 3010 µm / 3.15 µm pixel diameter). These measurements are consistent with the maximum resolution of 1280 x

960 as specified in the Sony MVC-FD83/FD88 User Manual. *See* Sony MVC-FD83/FD88 User Manual at 34, 36, 54.[3]

118. I understand that the image below is a microscope image of a portion of the LCD panel. *See* APL-MAXELL_01099009 at -9029; -9074. It shows that the width of three pixels to be approximately 394.2 μm and the height of three pixels to be approximately 508.8 μm.



119. Based on the measurements shown above, the width of a single pixel on the LCD screen is approximately 394.2 μm / 3 = 131.4 μm, and the height of a single pixel on the LCD screen is approximately 508.8 μm / 3 = 169.6 μm. *See id.* APL-MAXELL_01099029; -9074. The overall size of the LCD screen is approximately 50 mm (or 50,000 μm) in width and 37 mm

[3] Sage's report indicates a resolution of 1231 x 997. *See* APL-MAXELL_01099011; -9026. I have spoken to Sage and understand that Sage's calculations were incorrect and that the resolution number reported in Sage's report (1231 x 997) is not accurate.

(or 37,000 μm) in height. *See* APL-MAXELL_01099030; APL-MAXELL_P03; APL-MAXELL_P06. Accordingly, the number of pixels on the LCD is approximate 380 x 218 (calculated from a width of 50,000 μm /131.4 μm and a height of 37,000 μm /169.6 μm).[4]

120. I have used and tested a MVC-FD83 camera and a MVC-FD88 camera. *See* APL-MAXELL_P03; APL-MAXELL_P06; Appendix C.

121. Below are images I took using the MVC-FD83.

[4] Sage's report indicates a resolution of 380 x 281. *See* APL-MAXELL_01099030; -9011. I have confirmed with Sage that this is a typographical error.

122. Below are images I took using the MVC-FD88.

123. Below are images I took of the Casio QV-8000SX, Apple QuickTake 200, Sony MVC-FD83, and Sony MVC-FD88 cameras that I used and tested. *See* Appendix C.

2. U.S. Patent Nos. 5,444,482 ("Misawa")

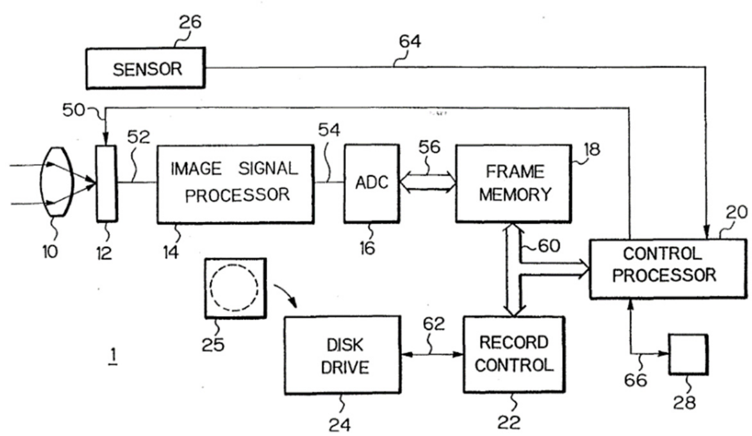
124. Misawa, titled "Digital Electronic Camera for Selectively Recording a Frame of Still Image and Movie Fields of Image in a Recording Medium," was filed on April 28, 1994, and it issued on August 22, 1995. Misawa issued over four years before the alleged priority date for the '493 patent (i.e., January 11, 2000). *See* Section V.A. Misawa names Takashi Misawa and Takeshi Ohta as inventors, and is assigned to Fuji Photo Film Co., Ltd. *See* Misawa at Cover. Misawa was not considered during the original prosecution of the '493 patent. Misawa was presented in an IPR petition filed by Olympus (as discussed above in Section V.C), but the parties settled and dismissed the petition before the PTAB instituted review. I understand that Misawa qualifies as prior art under at least 35 U.S.C. §§ 102(a), (b), and (e). *See* Section IV.C.

125. Misawa discloses "a digital electronic camera for photographing the image of an object, and more particularly to a digital electronic camera for capturing the image of an object

and recording data representative of still and movie images in a single data recording medium." Misawa at 1:9-14.

126. The camera device of Misawa is shown below in Figure 1. *Id.* at Fig. 1. It includes an "optical lens 10," "an image sensor 12," "image signal processor 14," and other components. *Id.* at 2:36-61. Image data captured by the sensor is processed and stored in "disk drive 24." *Id.* at 2:61-3:13.

Fig. 1



127. Misawa discloses a camera device that allowed the user to select capture in a "still picture mode" or a "movie picture mode." *Id.* at Abstract. In the "still picture mode," a still image is captured, processed, and stored in memory when a user presses the shutter. *Id.* at 8:40-9:19. In the "movie picture mode," the device captures, processes, and stores a "sequence of the image data, corresponding to a plurality of movie image frames …." *Id.* at 9:27-10:15

128. The Misawa camera further includes "sensor 26 for sensing movement or viblration [sic]" of the camera. *Id.* at 3:7-13. Misawa explains that "unintentional movement or vibration of the camera body proper which would cause blur in a picture reproduced." *Id.* at 4:62-65. By using "movement signal from sensor 26," the Misawa camera generates "correction values by which [the capture area] is to be shifted in position and which is calculated on the basis

of the moving amount and directional data included in the movement data." *Id.* at 8:7-27. This correction data is "used for compensating for blur due to the movement of" the camera. *Id.* Thus, the Misawa camera improves image quality of the recorded moving video data because "each of the motion picture frames can be recorded without being accompanied by blur which would otherwise be caused by unintentional movements of the digital camera …." *Id.* at 11:23-30.

3. Motivations to Combine Misawa with Sony MVD-FD83/FD88

129. Misawa discloses a digital camera system that is very similar to the Sony MVC-FD83/FD88 cameras. For example, Misawa discloses "a digital electronic camera" that captures and stores "still and movie images in a single data recording medium." Misawa at 1:9-14, 1:54-58. Specifically, Misawa describes storing still images in "JPEG" format and video images in "MPEG" format. *Id.* at 7:59-65. The Sony MVC-FD83/FD88 are digital cameras that capture and store both still and movie images in a single recording medium. *See* Sony MVC-FD83/FD88 User Manual at 34, 36, 65. Moreover, "the still image data is compressed in JPEG format and movie image data is compressed with MPEG-1 format." *Id.* at 25. Accordingly, a person of ordinary skill in the art would have understood that Misawa discloses a digital camera device similar to the Sony MVC-FD83/FD88 cameras, and that the improvements contemplated by Misawa are applicable to the Sony MVC-FD83/FD88 cameras. Thus, applying Misawa to Sony MVC-FD83/FD88 cameras would simply represent the use of a known technique to improve a similar device in the same way with predictable results.

130. For example, a person of ordinary skill in the art would have found it obvious to modify the MVC-FD83/88 to include the electronic image stabilization feature disclosed by Misawa. A skilled person would have been motivated to modify MVC-FD83/88's image processing circuitry to include Misawa's image stabilization features for several reasons.

131. First, Misawa expressly discloses a benefit that would have motivated a person of ordinary skill in the art to modify that the MVC-FD83/88 cameras—to improve image quality and compensate for image blur caused by unintentional movements. *See, e.g.*, Misawa at 4:62-65, 8:7-27, 10:37-57, 11:23-30. As taught by Misawa, a person of ordinary skill in the art would have understood that Misawa's image stabilization features would improve the quality of video images captured by the MVC-FD83/88 cameras by reducing the image blurring caused by unintentional movements of the cameras. A person of ordinary skill in the art would have further recognized the benefits of incorporating Misawa's image stabilization features into the MVC-FD83/88 cameras given that these cameras were designed to be small, portable, consumer-friendly cameras, which are prong to blurring caused by unintentional movements.

132. Second, a person of ordinary skill in the art would have both known the common problem of image blurring due to unintentional camera movement, and that there were a finite number of known solutions to this problem (e.g., optical image stabilization and electronic image stabilization). A person of ordinary skill in the art would have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other known stabilization techniques, such as optical image stabilization. For example, it was well known that optical image stabilization required moving components, adding size and bulk to the device. *See, e.g.*, Handbook of Image & Video Processing at 263-268. The MVC-FD83/88 cameras are designed to be portable consumer cameras. Thus, a person of ordinary skill in the art would have understood that Misawa's teachings could have improved functionality without adding size and bulk to the device. *See, e.g.*, Misawa at 1:42-46 (recognizing the importance of "portability"). Accordingly, the combination represents the selection of a solution from among a finite number of identified, predictable potential solutions to a recognized need or problem.

133. Third, a person of ordinary skill in the art would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, there would have been an expectation of success from the combination or, at a minimum, it would have been obvious to try to apply Misawa's teachings to the MVC-FD83/88 cameras. Accordingly, applying the teachings of Misawa to the MVC-FD83/88 cameras would have been a combination of prior art elements according to known methods that would have yielded predictable results with a reasonable expectation of success.

4. Claim 5

134. As explained in the chart below, each of the Sony MVC-FD83 and MVD-FD88 cameras anticipates or renders obvious claim 5.

Claim Element	Sony MVC-FD83/88
5. An electric camera comprising:	The Sony MVC-FD83 and FD88 devices are "electric cameras." *See* Sony MVC-FD83/FD88 User Manual at Cover. *See also* APL-MAXELL_P03 (MVC-FD83). 

Claim Element	Sony MVC-FD83/88
	  *See also* APL-MAXELL_P06 (MVC-FD88). 

Claim Element	Sony MVC-FD83/88
	 
[a] an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines;	The Sony MVC-FD83/FD88 camera includes an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines. For example, the image sensing device allows the camera to capture images at different resolutions:

Claim Element	Sony MVC-FD83/88

3 Select IMAGE SIZE with the control button, then press ●.

Items for STILL mode

1280 × 960 : Records a 1280 × 960 JPEG file. (FD88 only)
1216 × 912 : Records a 1216 × 912 JPEG file. (FD83 only)
1024 × 768 : Records a 1024 × 768 JPEG file.
640 × 480 : Records a 640 × 480 JPEG file.

Items for MOVIE mode

320 × 240 : Records a 320 × 240 MPEG file.
160 × 112 : Records a 160 × 112 MPEG file.

See Sony MVC-FD83/FD88 User Manual at 34, 36, 65. The maximum resolution of the MVC-FD88 is 1280 x 960, and the maximum, non-interpolated resolution of the MVC-FD83 is 1024 x 768. Thus, the Sony MVC-FD88 camera has an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, with at least 1280 number of pixels in the horizontal direction and 960 number of pixels in the vertical direction. *See id.* The Sony MVC-FD83 camera has an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, with at least 1024 pixels in the horizontal direction and 768 pixels in the vertical direction. *See id.*

The Sony MVD-FD83 includes a "1/3-inch CCD" image sensor, and the Sony-FD88 includes a "1/3.6-inch CCD" image sensor. A person of ordinary skill in the art would have understood that a CCD, or a charge-coupled device, is a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern.

Table for differences of function

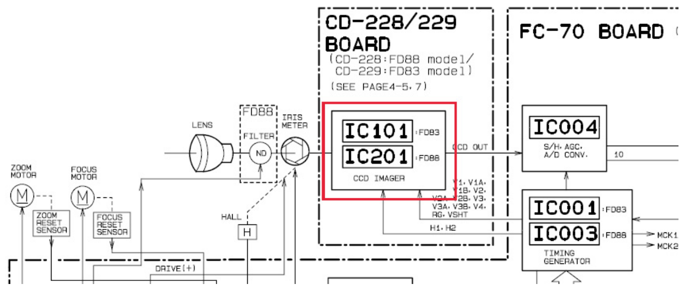
Model	MVC-FD83	MVC-FD88	MVC-FD83K	MVC-FD88K
Destination	US, CND, AEP, UK, E, AUS, HK, CH, KR	US, CND, AEP, UK, E, AUS, HK, CH, KR, JE	J	J
Image device	1/3-inch CCD	1/3.6-inch CCD	1/3-inch CCD	1/3.6-inch CCD
Lens	3 ×	8 ×	3 ×	8 ×
Digital zoom	6 ×	16 ×	6 ×	16 ×
CD board	CD-229	CD-228	CD-229	CD-228
FU board	FU-135	FU-137	FU-135	FU-137
PK board	PK-47	PK-48	PK-47	PK-48
RL board	RL-54	RL-56	RL-54	RL-56

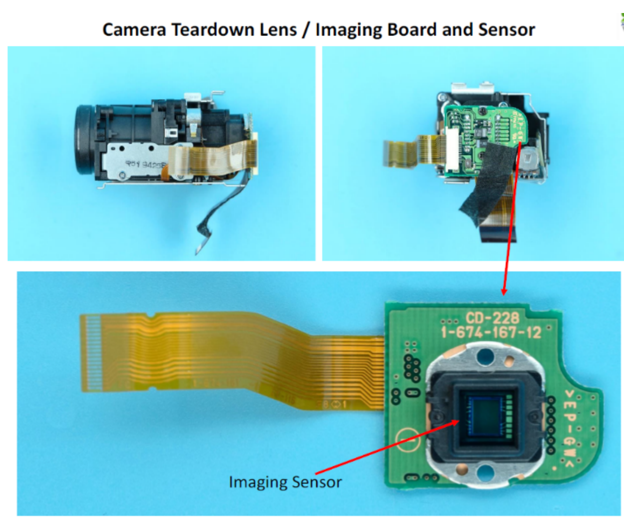
Note: MVC-FD83K/FD88K are the same as MVC-FD83/FD88 except accessories and packing materials.

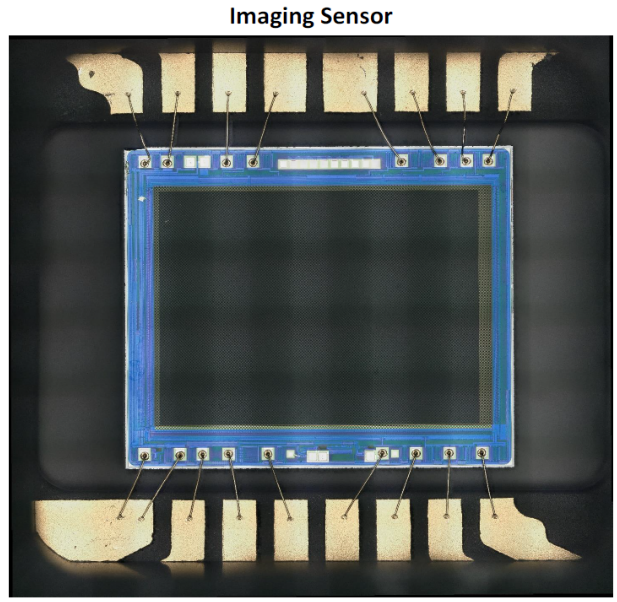
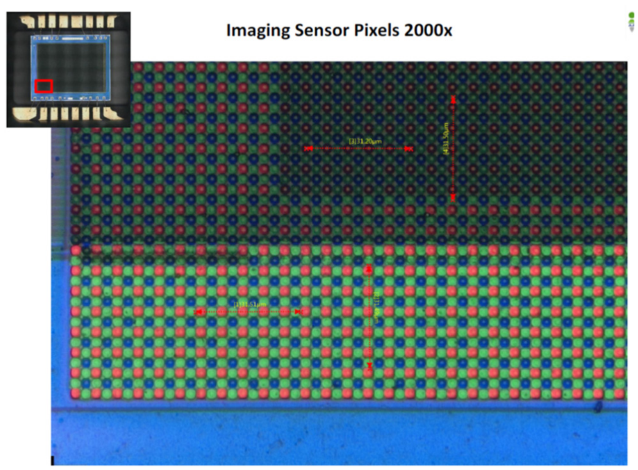
MVC-FD83K : MVC-FD83 + Accessory kit
MVC-FD88K : MVC-FD88 + Accessory kit

• Abbreviation
AUS : Australian model
CH : Chinese model
CND : Canadian model
J : Japanese model
HK : Hong Kong model
KR : Korea model
JE : Tourist model

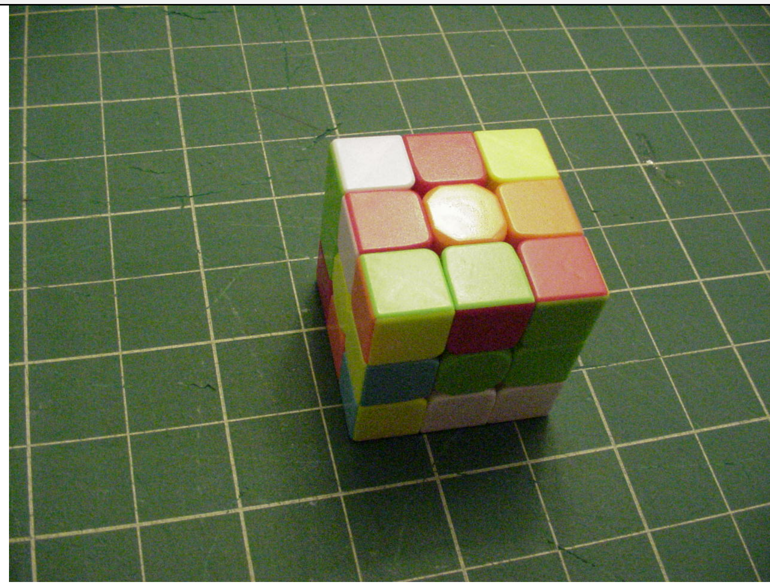
See Sony MVC-FD83/FD88 Service Manual at 2; *see also id.* at 2-2.

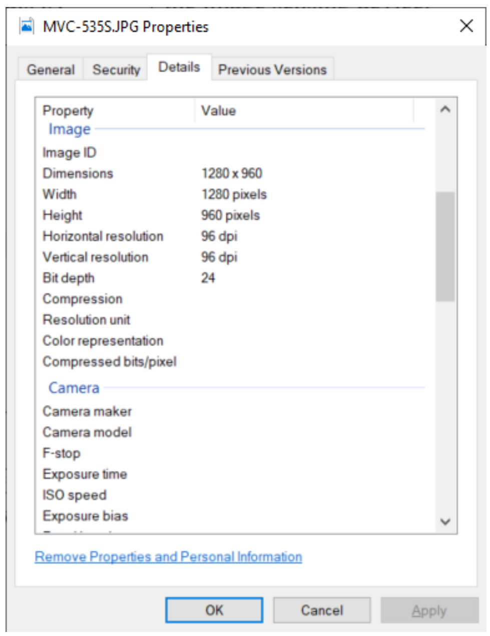
Claim Element	Sony MVC-FD83/88
	The following is an excerpt of the "Overall Block Diagram" of the Sony MVD-FD83/FD88, which shows "CCD Imager" identified as "IC101" for FD83 and "IC201" for FD88. SECTION 3 BLOCK DIAGRAMS 3-1. OVERALL BLOCK DIAGRAM  *Id.* at 3-1. [redacted] [redacted]

Claim Element	Sony MVC-FD83/88
	[redacted] A person of ordinary skill in the art would have understood that the CCD image sensor in each of MVC-FD83 and MVC-FD88 is an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines. A teardown analysis of the image sensor for a MVC-FD88 device shows that the image sensing device include a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines. 

Claim Element	Sony MVC-FD83/88
	  *See* APL-MAXELL_01099009 to -030 at -022, -023, -025. The existence of an image sensor is further confirmed by testing of the devices. *See also* APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the following is a 1280 x 960 (i.e., 1280 pixels in the horizontal direction and 960 pixels in the vertical direction) still image taken by the MVC-FD88 device, demonstrating that the device includes an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines.

Claim Element	Sony MVC-FD83/88

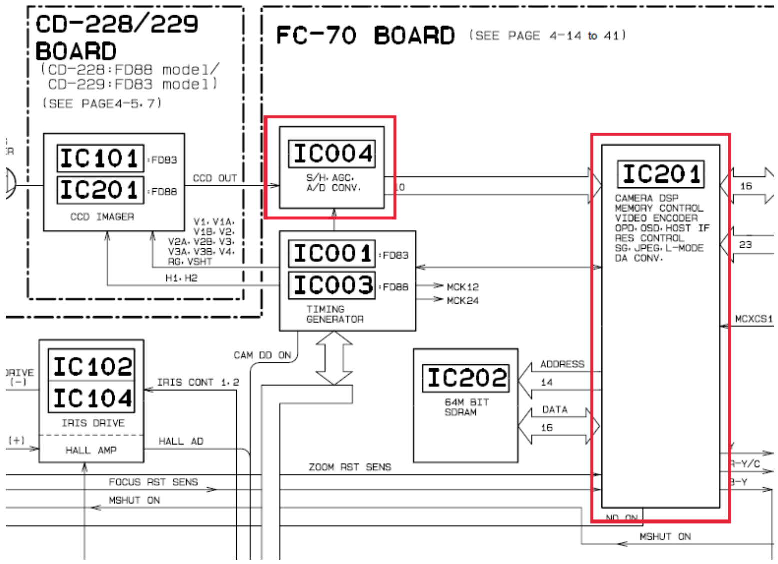


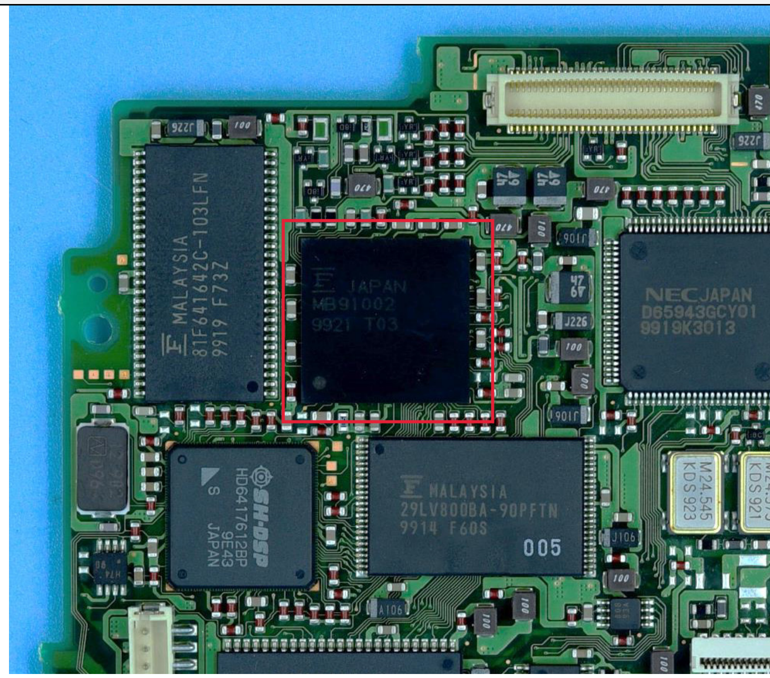
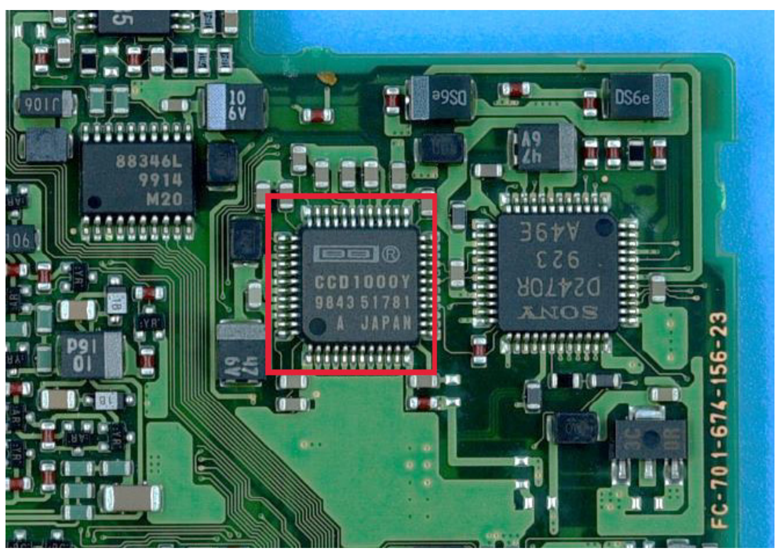


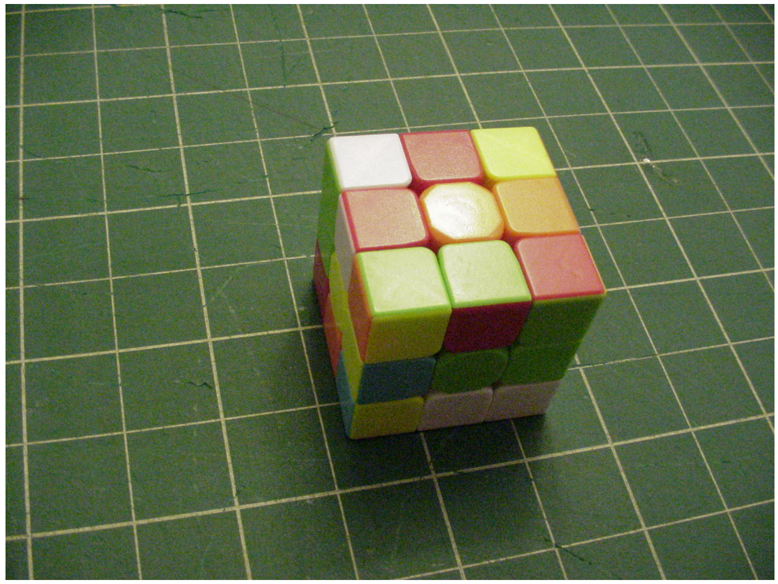
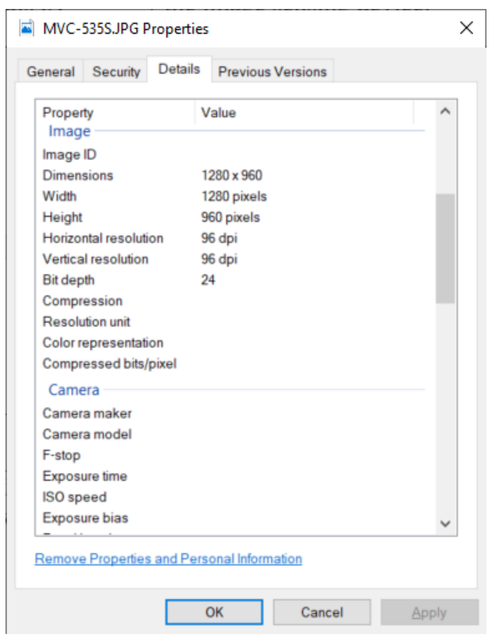
As explained in paragraphs 115 - 117 above, analysis of the image sensor of a MVC-FD88 camera shows that the active region of the image sensor includes approximately 1280 pixels in the horizontal direction and 960 pixels in the vertical direction.

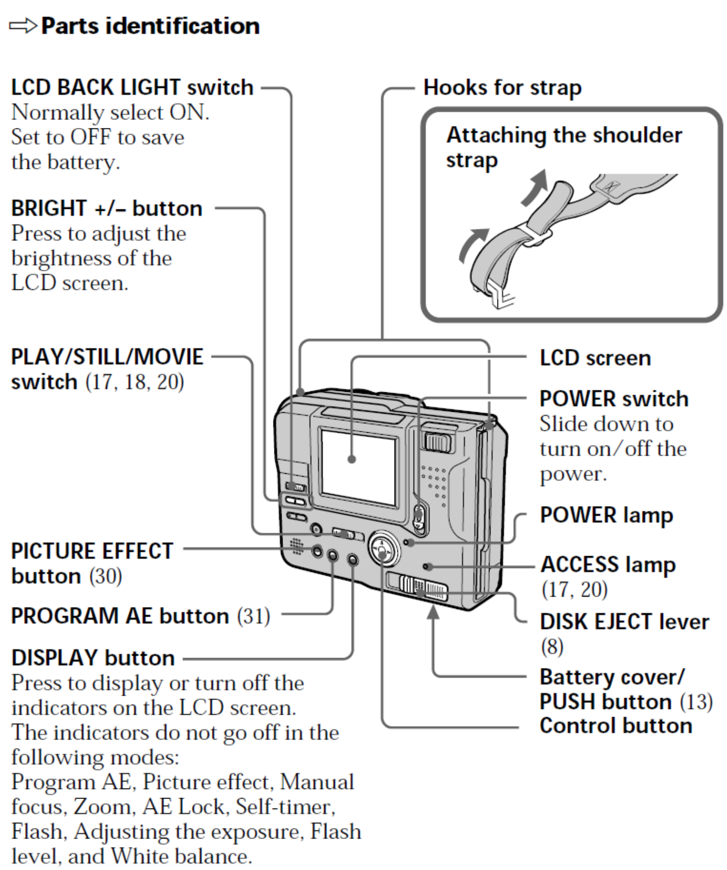
Thus, each of the Sony MVC-FD83 and MVC-FD88 cameras includes an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines.

Claim Element	Sony MVC-FD83/88
[b] a signal processing unit that generates image signals by processing the output signals of the image sensing device; and	The Sony MVC-FD83/FD88 camera includes a signal processing unit that generates image signals by processing the output signals of the image sensing device. The existence of a signal processing unit is evident from the camera's capability to produce still images compressed in the JPEG format and video images compressed in the MPEG format: **3 Select IMAGE SIZE with the control button, then press ●.** **Items for STILL mode** 1280 × 960 : Records a 1280 × 960 JPEG file. (FD88 only) 1216 × 912 : Records a 1216 × 912 JPEG file. (FD83 only) 1024 × 768 : Records a 1024 × 768 JPEG file. 640 × 480 : Records a 640 × 480 JPEG file. **Items for MOVIE mode** 320 × 240 : Records a 320 × 240 MPEG file. 160 × 112 : Records a 160 × 112 MPEG file. *See* Sony MVC-FD83/FD88 User Manual at 34, 36, 56, 65. The following is an excerpt of the "Overall Block Diagram" of the Sony MVD-FD83/FD88 camera's service manual, which shows that image data from the "CCD Imager" is transmitted to an "IC004" chip for "S/H, AGC, A/D CONV" (i.e., sample/hold, automatic gain control, and analog/digital conversion") and then to an "IC201" chip that is described as an "Camera DSP." The "Camera DSP" (camera digital signal processor) chip performs functions such as "Memory Control," "Video Encoder," and "Res Control" (resolution control).

Claim Element	Sony MVC-FD83/88
	 *See* Sony MVC-FD83/FD88 Service Manual at 3-1; *see also id.* at 3-18E, 4-6, 4-17 to 4-18. The service manual describes "IC004" with part number "CCD1000Y-1/2K," and "IC201" with the part number "MB91002LGA-G." *Id.* at 6-8. Teardown images of a MVC-FD88 camera confirms that a "MB91002" chip is on the front side of the camera's main circuit board.

Claim Element	Sony MVC-FD83/88
	 *See* APL-MAXELL_01099009 to -030 at -018. Teardown images of a MVC-FD88 camera confirms that a "CCD1000Y" chip is on the back side of the camera's main circuit board.  *See* APL-MAXELL_01099009 to -030 at -019. The existence of a signal processing unit is further confirmed by testing of the devices. *See also* APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the following is a 1280 x 960 still image taken by the MVC-FD88 device. It is stored

Claim Element	Sony MVC-FD83/88
	in JPEG format, which demonstrates that the device includes a signal processing unit that generates image signals by processing the output signals of the image sensing device.   Thus, each of MVC-FD83 and MVC-FD88 includes a signal processing unit that generates image signals by processing the output signals of the image sensing device.
[c] a display unit with a display screen, that displays an image	The Sony MVC-FD83/FD88 camera includes a display unit with a display screen (an LCD screen) that displays an image corresponding to the image signals.

Claim Element	Sony MVC-FD83/88
corresponding to the image signals;	 The MVC-FD83/FD88 cameras each includes an LCD screen that serves as a viewfinder and displayed menu options to the user. The LCD screen is a 2.5 inch TFT screen. Sony MVC-FD83/FD88 User Manual at 65. The LCD screen is shown below:  *Id.* at 10; *see also id.* at 34, 36.

<table>
<tr><th>Claim Element</th><th>Sony MVC-FD83/88</th></tr>
<tr><td></td><td>

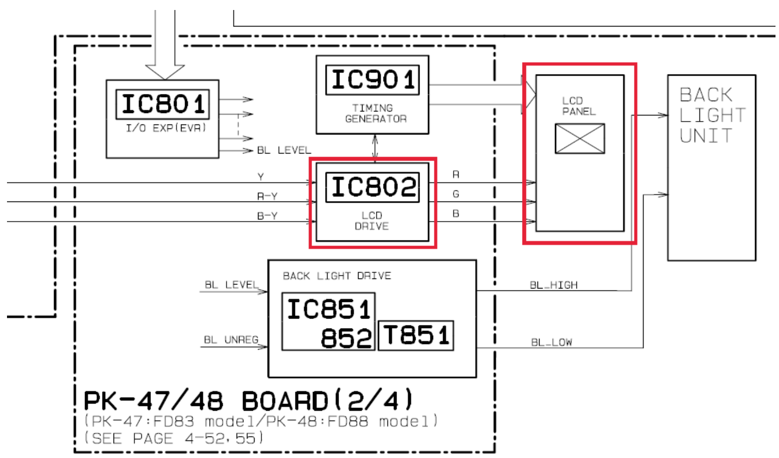
The User's Manual further describes the LCD as a 2.5 inch TFT type display with 84,260 pixels.

LCD screen

Screen size	2.5 inch
LCD panel	TFT
Total dot number	84260 dots

Id. at 65.

As shown in the excerpt below, the system block diagram for MVC-FD83/FD88 shows that the display unit receives signals (Y, R-Y, B-Y) from the Camera DSP, converts the signals to R-G-B using "IC 802, LCD Drive" for display on the LCD Panel:

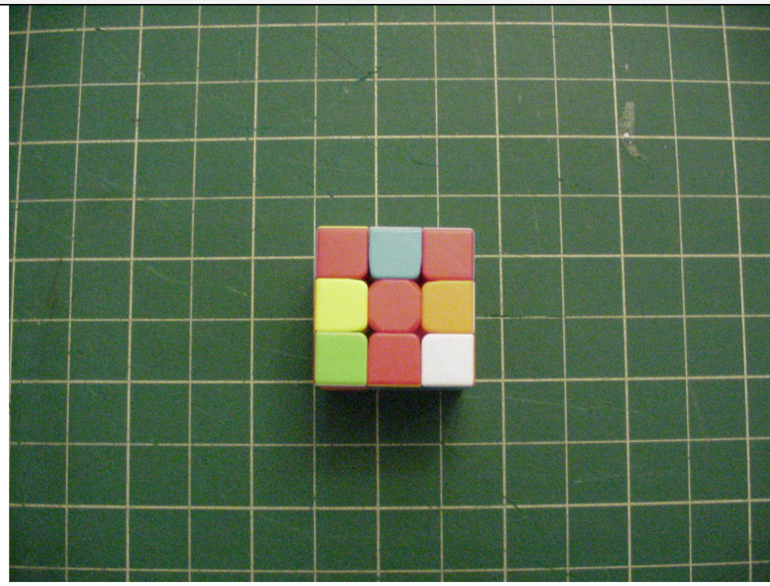


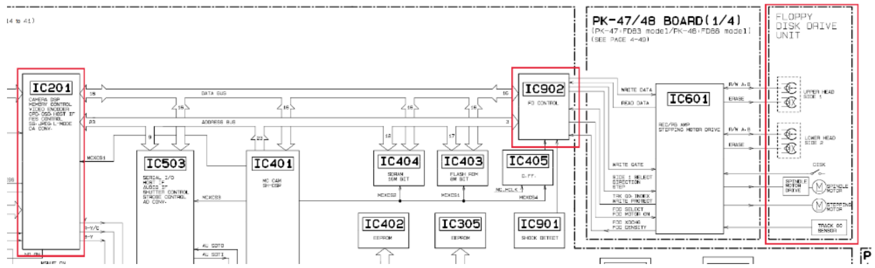
Sony MVC-FD83/FD88 Service Manual at 3-2.

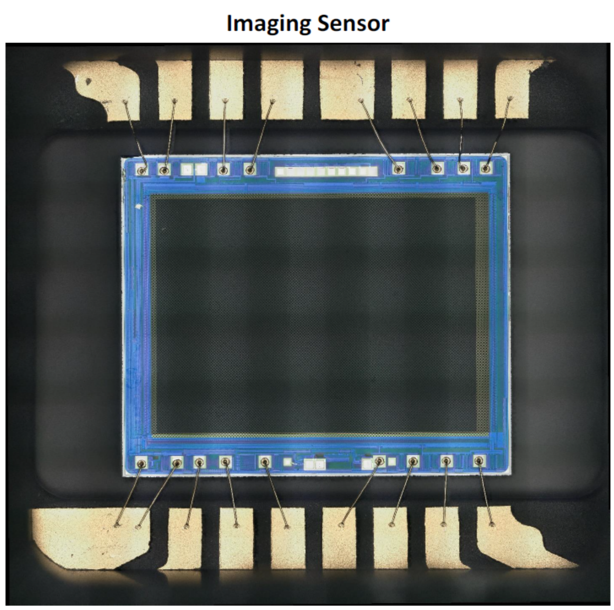
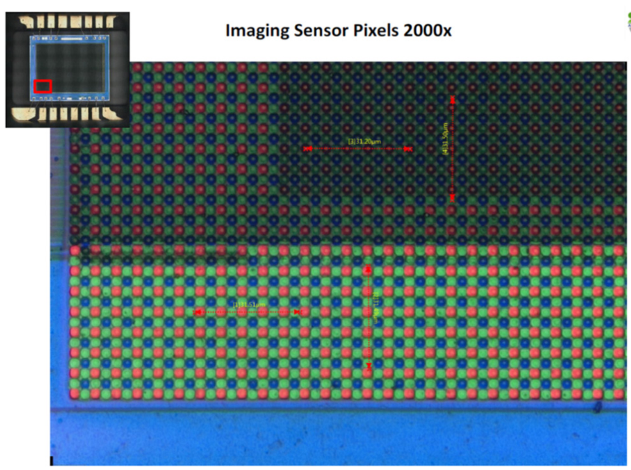
Teardown images of a MVC-FD88 camera show the LCD panel:

</td></tr>
</table>

Claim Element	Sony MVC-FD83/88
	 *See* APL-MAXELL_01099009 to -030 at -030. Testing of the MVC-FD83/FD88 cameras confirms the existence of a display unit with a display screen that displays an image corresponding to the image signals. *See also* APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the following photo shows that the MVC-FD88's LCD view finder displays the object being captured.  The following image is the photograph captured by the MVC-FD88 camera. Thus, the MVC-FD88 includes a display unit with a display screen that displays an image corresponding to the image signals.

Claim Element	Sony MVC-FD83/88
	 Thus, each of Sony MVC-FD83 and MVC-FD88 includes a display unit with a display screen, that displays an image corresponding to the image signals.
[d] wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines;	The Sony MVC-FD83/FD88 camera discloses or renders obvious wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines. For example, the Sony MVC-FD88 camera includes a "STILL mode" that captures still images at a resolution up to 1280 x 960 for storage on a 3.5 inch floppy disk. **3 Select IMAGE SIZE with the control button, then press ●.** **Items for STILL mode** 1280 × 960 : Records a 1280 × 960 JPEG file. (FD88 only) 1216 × 912 : Records a 1216 × 912 JPEG file. (FD83 only) 1024 × 768 : Records a 1024 × 768 JPEG file. 640 × 480 : Records a 640 × 480 JPEG file. **Items for MOVIE mode** 320 × 240 : Records a 320 × 240 MPEG file. 160 × 112 : Records a 160 × 112 MPEG file. *See* Sony MVC-FD83/FD88 User Manual at 34; *see also id.* at 36, 46, 54, 56, 65. The service manual for the MVC-FD83/FD88 shows that image data processed by the "Camera DSP" is transmitted via a 16-bit Data Bus

Claim Element	Sony MVC-FD83/88
	to a disk drive controller ("IC902, FD Control") for recording on a Floppy Disk:  Sony MVC-FD83/FD88 Service Manual at 3-2. [redacted]

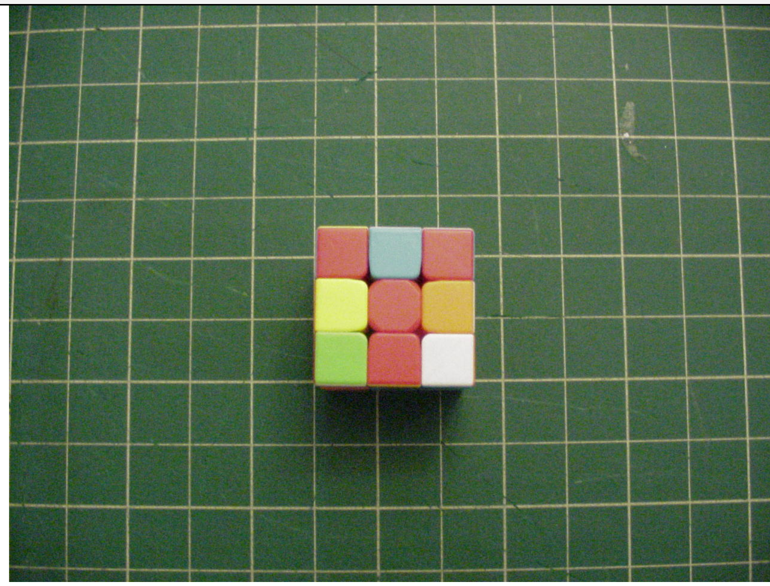
Claim Element	Sony MVC-FD83/88
	Teardown analysis of a MVC-FD88 camera shows that the image sensor has pixel resolution between approximately 1289 x 965 pixels to 1277 x 956 pixels:   *See* APL-MAXELL_01099009 to -030 at -022, -023, -025. Operation of "recording an image in a static image mode" is also confirmed by testing of the devices. *See also* APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the back of the MVC-FD88 camera includes a lever that allows the user to select "STILL" capture mode.

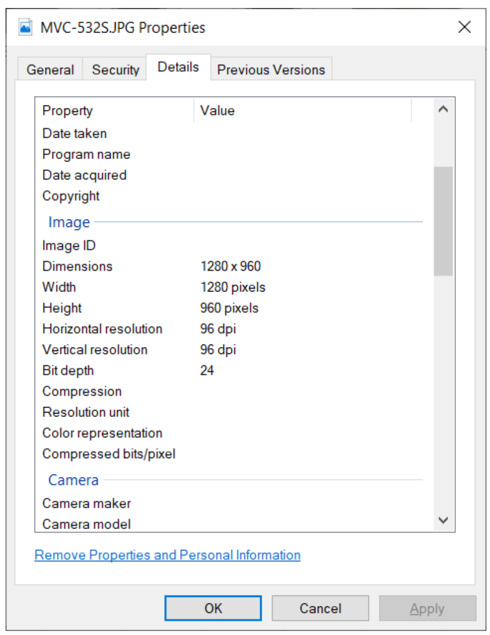
<table>
<tr><th>Claim Element</th><th>Sony MVC-FD83/88</th></tr>
<tr><td></td><td>


The following photo shows that the MVC-FD88's LCD view finder displays the object being captured in the "STILL" capture mode.

The following image is the photograph captured by the MVC-FD88 camera in the "STILL" capture mode.
</td></tr>
</table>

Claim Element	Sony MVC-FD83/88



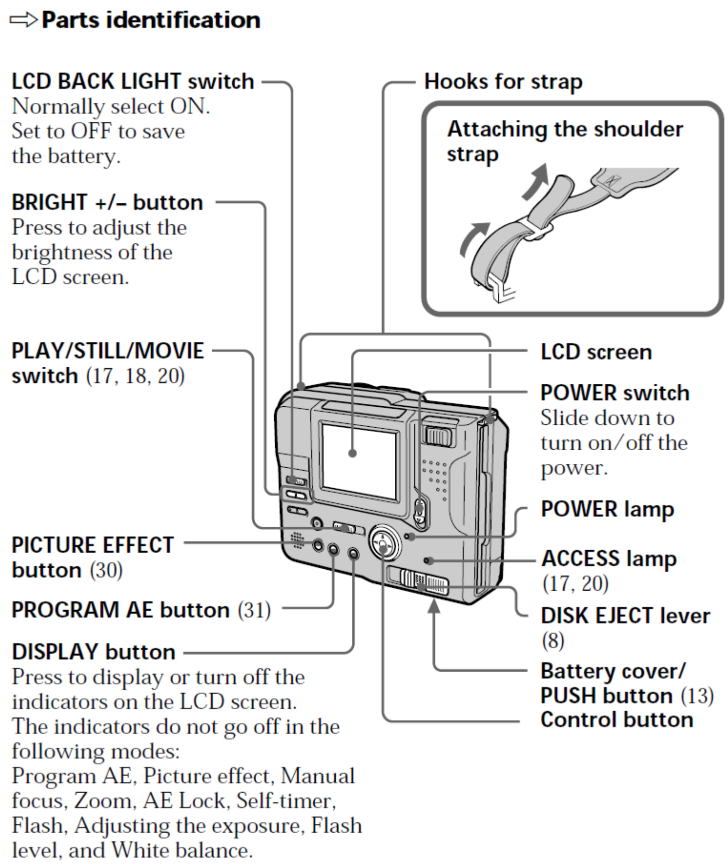


I understand that Maxell contends that this claim element is met by the accused Apple iPhone and iPad products because they capture still images at the maximum resolution supported by the accused devices. *See, e.g.*, Maxell's Second Supplemental Infringement Contentions, Appendix 3 ('493 patent) at 106-118. Moreover, I understand Maxell argues that the claim limitation of "using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines" is met even when a device captures still images using fewer rows and columns of pixels compared to the total number of pixels on its image sensor. *See id.* at 181 (identifying a Sony image sensor

Claim Element	Sony MVC-FD83/88
	allegedly having "4224 total horizontal pixels (4208 active pixels) and 3192 vertical pixels (3120 active pixels)"); at 183 (identifying a Sony image sensor having "3288 total horizontal pixels (3280 'effective' pixels) and 2512 vertical pixels (2464 'effective' pixels)"). Thus, under Maxell's infringement theory, the Sony MVC-FD83/FD-88 cameras each satisfies the claim element of "wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines." For example, as explained above, the MVC-FD88 camera supports still image capture up to 1280 x 960 and is capable of capturing still images having 1280 vertical pixel lines and 960 horizontal pixel lines. The MVC-FD83 camera supports non-interpolated still image capture at 1024 x 768 and is capable of capturing still images having 1024 vertical pixel lines and 768 horizontal pixel lines. Thus, to the extent any of the accused products is found to infringe, the Sony MVC-FD83/88 discloses wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines. Like the accused Sony image sensors identified in Maxell's Infringement Contentions, the Sony MVC-FD83/FD-88 cameras each uses an image sensor having a larger number of total pixels compared to the highest resolution, non-interpolated still image resolution captured by the device. For example, as discussed above, the Sony MVC-FD88 camera includes a 1.3 million pixel image sensor while it captures still images up to 1280 x 960 (or approximately 1.23 million pixels), and the Sony MVC-FD83 camera includes a 850k pixel image sensor while it captures non-interpolated still images up to 1024 x 768 (or approximately 786k pixels). *See* [redacted] Sony MVC-FD83/FD88 User Manual at 34, 36, 65. If Maxell argues that the MVC-FD83/FD88 cameras do not explicitly disclose this claim element, it would have been obvious to a person of ordinary skill in the art. A person of ordinary skill in the art would have found it obvious to record still images using all of the vertically arranged pixel lines on the image sensor (*e.g.*, by capturing an image using all 1.3 million pixels for the MVC-FD88 or 850 pixels for the MVC-FD83). A person of ordinary skill in the art would have been motivated by the capability to produce a higher resolution image. Making this modification would have been well within the level of skill of a person of

Claim Element	Sony MVC-FD83/88
	ordinary skill in the art, and it would have been a simple design choice requiring the balance between the benefit of higher resolution compared to the need for increased storage space of captured images.
[e] wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance; and	**<u>Claim Construction:</u>** The Court construed "mixing . . . signal charges" and "mixed" means "combining signal charges from multiple pixels" and "combined," and "culling signal charges" and "culled" as "reading out only one line of signal charges of pixels for every predetermined number of lines" and "only one line of signal charges of pixels is read out for every predetermined number of lines" **<u>Analysis:</u>** The Sony MVC-FD83/FD88 camera discloses or renders obvious wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance. The MVC-FD83/FD88 cameras each includes an LCD screen that serves as a viewfinder:

Claim Element	Sony MVC-FD83/88
	(see below)



Id. at 10; *see also id.* at 34, 36.

The User's Manual indicates that the LCD display has a resolution of approximately 84k pixels.

LCD screen

Screen size	2.5 inch
LCD panel	TFT
Total dot number	84260 dots

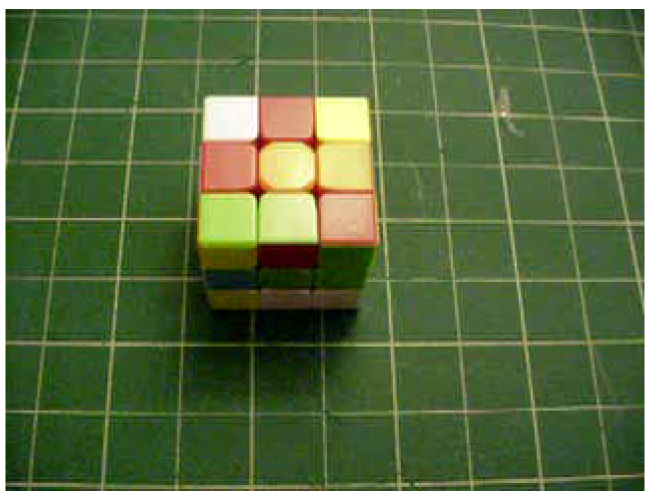
Id. at 65.

[redacted]

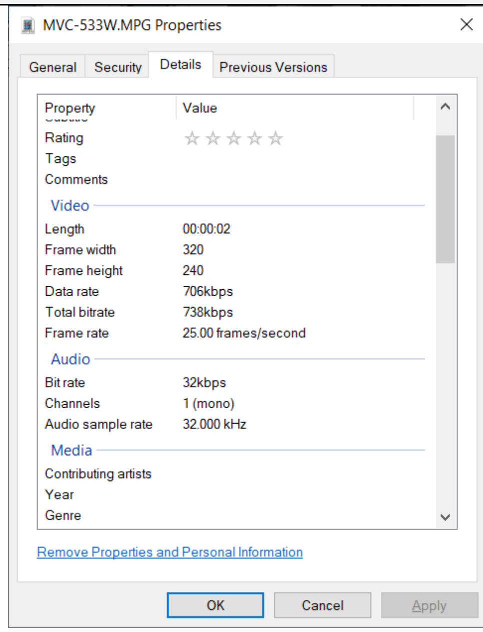
Claim Element	Sony MVC-FD83/88
	[redacted] Teardown images of a MVC-FD88 camera show the LCD panel:  *See* APL-MAXELL_01099009 to -030 at -030. As explained in Paragraph 113-119, microscope measurements on the LCD screen show that it has a pixel resolution of approximately 380 x 218. The "monitoring the image in the static image mode" is further confirmed by operation of the MVC-FD83/FD88 devices. *See also* APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the following photo shows that the MVC-FD88's LCD view finder displays the object being captured in "STILL" capture mode.

Claim Element	Sony MVC-FD83/88
	 Accordingly, when using the MVC-FD88 camera in "STILL" capture mode, image data from the image sensor is down-sampled from the maximum resolution of 1280 x 960 to approximately 84k pixels (or approximately 380 x 218) for display on the LCD screen. Thus, the camera's image signal unit has reduced the captured image signal from approximately 1280 vertical lines to approximately 380 vertical lines, and approximately 960 horizontal lines to approximately 218 horizontal lines. Thus, this down-sampling represents output pixel lines of a first interval compared to that of the original image signal. I understand that Maxell has accused Apple's iPhones of satisfying the "mixed or culled" limitation because they "downsample" image data from a higher resolution to a lower resolution. *See* Maxell's Second Supplemental Infringement Contentions, Appendix 3 ('493 patent) at 80-87. Thus, to the extent the accused products is found to infringe, the Sony MVC-FD88 also discloses this limitation. Alternatively, a person of ordinary skill in the art would have found it obvious to use the claimed "mixing or culling" method for image down sampling. For example, the '493 patent itself admits that the use of mixing and culling to downscale image resolution was well known in the art. *See* '493 patent at 2:44-53. As evident from the Handbook of Image & Video Processing and the references cited by the '493 patent discussed in Section VI.B above, the technique of down-sampling by simply skipping lines of pixels was well known. Compared to other techniques for down-sampling, a skilled person would have recognized that skipping lines of pixels at a predetermined interval would achieve the result of down-sampling without requiring significant additional circuitry for calculation of pixel values. Moreover, Maxell's expert, Dr. Vijay Madisetti,

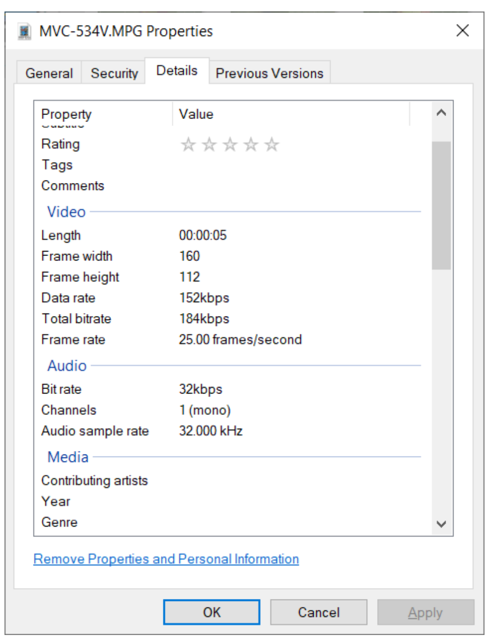
Claim Element	Sony MVC-FD83/88
	testified in deposition that he expects a person of ordinary skill in the art to know about image processing techniques including "decimation." *See* 10/22/19 Madisetti Dep. Tr. at 41:16-42:2. Thus, to the extent Maxell argues that it is not apparent from the operation of the Sony MVC-FD83/FD88 camera how it performs downscaling of the captured image data to match the resolution of the LCD screen, the use of "mixing or culling" would have been an obvious design choice to a person of ordinary skill in the art in view of his or her knowledge.
[f] wherein when recording the image in a moving video mode, the signal processing unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance, where the second distance is different from the first distance.	**<u>Claim Construction:</u>** The Court construed "mixing . . . signal charges" and "mixed" means "combining signal charges from multiple pixels" and "combined," and "culling signal charges" and "culled" as "reading out only one line of signal charges of pixels for every predetermined number of lines" and "only one line of signal charges of pixels is read out for every predetermined number of lines" **<u>Analysis:</u>** The Sony MVC-FD83/FD88 camera discloses or renders obvious wherein when recording the image in a moving video mode, the signal processing unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance, where the second distance is different from the first distance. The Sony MVC-FD83/FD88 cameras each allows for a "MOVIE mode" that records moving video files at either the 320x240 or 116x112 resolutions. **3 Select IMAGE SIZE with the control button, then press ●.** **Items for STILL mode** 1280 × 960 : Records a 1280 × 960 JPEG file. (FD88 only) 1216 × 912 : Records a 1216 × 912 JPEG file. (FD83 only) 1024 × 768 : Records a 1024 × 768 JPEG file. 640 × 480 : Records a 640 × 480 JPEG file. **Items for MOVIE mode** 320 × 240 : Records a 320 × 240 MPEG file. 160 × 112 : Records a 160 × 112 MPEG file. *See* Sony MVC-FD83/FD88 User Manual at 34; *see id.* at 10, 18, 24.

Claim Element	Sony MVC-FD83/88
	See also APL-MAXELL_P03 (MVC-FD83); APL-MAXELL_P06 (MVC-FD88). For example, the back of the MVC-FD88 camera includes a lever that allows the user to select "MOVIE" capture mode.  When in "MOVIE" mode, the user can select between resolutions of 320 x 240 or 160 x 112. Below is a screenshot of a video taken at the 320 x 240 resolution. 

Claim Element	Sony MVC-FD83/88



Below is a screenshot of a video taken at the 160 x 120 resolution.

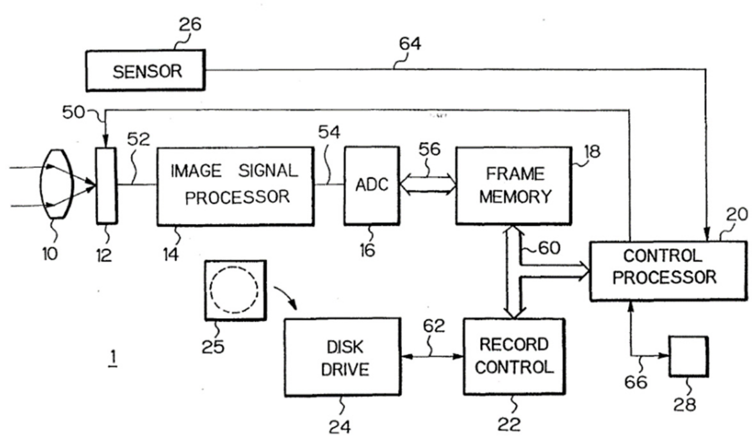


Claim Element	Sony MVC-FD83/88
	Accordingly, when using the MVC-FD83/FD88 camera in "MOVIE" mode, image data from the image sensor is down-sampled from 1280 x 960 to either 320 x 240 or 160 x 112 for recording. When capturing 160 x 112 resolution video, the camera's image signal unit has reduced the captured image signal from approximately 1280 vertical lines to 160 vertical lines, and approximately 960 horizontal lines to 112 horizontal lines. This down-sampling represents output pixel lines of a second interval compared to that of the original image signal. This second interval is different from the first interval, as explained above for claim element 5[e]. Similarly, when capturing 320 x 240 resolution video, the camera's image signal unit has reduced the captured image signal from approximately 1280 vertical lines to 320 vertical lines, and approximately 960 horizontal lines to 240 horizontal lines. This down-sampling represents output pixel lines of a second interval compared to that of the original image signal. This second interval is different from the first interval, as explained above for claim element 5[e]. I understand that Maxell has accused Apple's iPhones of satisfying the "mixed or culled" limitation because they "downsample" image data from a higher resolution to a lower resolution. *See* Maxell's Second Supplemental Infringement Contentions, Appendix 3 ('493 patent) at 80-87. Thus, to the extent any of the accused products is found to infringe, the Sony MVC-FD83/FD88 discloses this limitation. Alternatively, a person of ordinary skill in the art would have found it obvious to use the claimed "mixing or culling" method for image downsampling. For example, the '493 patent itself admits that the use of mixing and culling to downscale image resolution was well known in the art. *See* '493 patent at 2:44-53. As evident from the Handbook of Image & Video Processing and the references cited by the '493 patent discussed in Section VI.B above, the technique of down-sampling by simply skipping lines of pixels was well known. Compared to other techniques for down-sampling, a skilled person would have recognized that skipping lines of pixels at a predetermined interval would achieve the result of down-sampling without requiring significant additional circuitry for calculation of pixel values. Moreover, Maxell's expert, Dr. Vijay Madisetti, testified in deposition that he expects a person of ordinary skill in the art to know about image processing techniques including "decimation." *See* 10/22/19 Madisetti Dep. Tr. at 41:16-42:2. Thus, to the extent Maxell argues that it is not apparent from the operation of the Sony MVC-FD83/FD88 camera how it performs downscaling of the captured image data to match the resolution of the LCD

Claim Element	Sony MVC-FD83/88
	screen, the use of "mixing or culling" would have been obvious to a person of ordinary skill in the art in view of his or her knowledge.

5. Claim 6

135. As explained in the chart below, the Sony MVC-FD83/88 alone or combined with Misawa renders obvious claim 6.

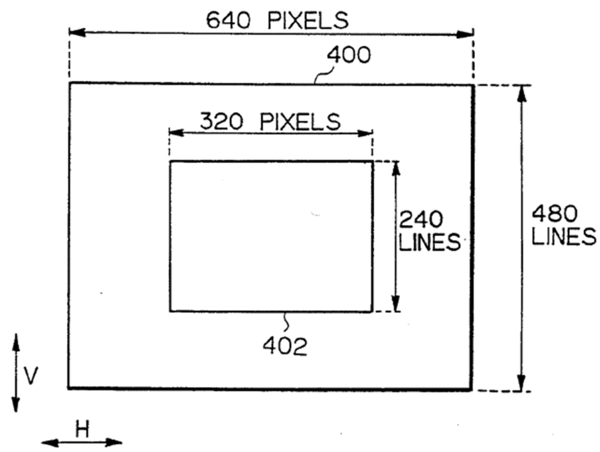
Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
6. An electric camera according to the claim 5, further comprising:	The Sony MVC-FD83 and MVC-FD88 devices are "electric cameras." *See* Claim 5, preamble. Misawa discloses an electric camera. *See* Misawa at Abstract, 2:36-3:13, Figs. 1-4. *Fig. 1* 
[a] an image-instability detector which detects an image-instability of the electric camera; and	**Claim Construction:** The parties agreed to construe "an image-instability detector" as "a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera." **Analysis:** A person of ordinary skill in the art would have found it obvious to add "an image-instability detector which detects an image-instability of the electric camera" to the MVC-FD83/88 camera. As explained

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	in Section VI.D above, the use of detectors in digital cameras for image stabilization was well known, and the inclusion of such a device was well within the level of skill and knowledge of a person of ordinary skill in the art. A person of ordinary skill in the art would have recognized the benefits of including an image-instability detector, such as the ability to perform image stabilization. For example, the '493 patent's "Background of the Invention" section describes that cameras having "image stabilization" was well known. '493 patent at 1:51-2:9. In camera devices having image stabilization functionality, a person of ordinary skill in the art would have known that such a device necessarily includes a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera. Thus, the '493 patent itself recognizes that the inclusion of an image-instability detector was well known and within the level of ordinary skill in the art. Alternatively, Misawa discloses an image-instability detector which detects an image-instability of the electric camera. Misawa discloses "a sensor 26 for sensing movement or viblation [sic] of the camera," and the sensor may be a "piezoelectric gyroscopic transducer … adapted to sense any mechanical movement." Misawa at 3:7-9, 4:60–5:8, Fig. 1. Thus, under the parties' agreed construction, Misawa's "piezoelectric gyroscopic transducer" is a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera. Misawa further discloses that "Sensor 26 serves to sense how digital camera 1 physically moves and produce corresponding electric signals over a connection 64. The electric signals represent an unintentional movement or vibration of the camera body proper which would cause blur in a picture reproduced." *Id.* at 4:60-5:8. Misawa explains that "movement detector 314 receives a movement signal from sensor 26" and "generates movement data representing how digital camera moves or vibrates," which is "delivered to correction processor 316." *Id.* at 8:7-16, 7:30-33. Thus, Misawa's "piezoelectric gyroscopic transducer" detects an image-instability of the electric camera. *Id. See also id.* at Abstract, 1:10-15, Figs. 1, 3. A person of ordinary skill in the art would have found it obvious to modify the MVC-FD83/88 to have an image-instability detector that detects an image-instability of the electric camera, as taught by Misawa for the reasons stated above in Section VII.A.3. Like Misawa, MVC-FD83/88 teaches a similar electronic camera that can capture both still images and video images. A skilled

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	person would have been motivated to modify MVC-FD83/88's image processing circuitry to further include an image-instability detector, as taught by Misawa, thereby improving similar devices in the same way. A skilled person would have been motivated by the benefits taught by Misawa, including improving image quality and compensating for image blur caused by unintentional movements. *See* Misawa at 4:62-65, 8:7-27, 11:23-30. A skilled person would also have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other stabilization techniques, such as optical image stabilization, including smaller size and not requiring moving components. *See, e.g.*, Handbook of Image & Video Processing at 263-268. A skilled person would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, such a combination of prior art elements according to known methods would have yielded predictable results with a reasonable expectation of success.
[b] wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector.	**Claim Construction:** The parties agreed to construe "an image-instability of the electric camera" as "instability caused by vertical and/or horizontal movement of the electric camera." **Analysis:** A person of ordinary skill in the art would have found it obvious to modify the MVC-FD83/88 camera such that wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector. *See* claim element 6[a]. For reasons explained above, this limitation was well within the level of skill and knowledge of a person of ordinary skill in the art. A person of ordinary skill in the art would have recognized the benefits of performing image stabilization, and thus would have found this limitation obvious. The '493 patent specification admits that this limitation was known and obvious to those of ordinary skill in the art. For example, the '493 patent's "Background of the Invention" section explains that cameras having "image stabilization" was well known. '493 patent at 1:51-2:9. In camera devices having image stabilization

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	functionality, the image sensor would have "pixels … added to the area of effective pixel area, thus bringing the effective number of vertically arranged pixels to about 480 or more." *Id.* In other words, in order to perform image stabilization, the image sensor has more pixel lines than the output image (480 lines) such that, depending on the movement detected, the image signal processing unit generates the output by changing the pixel lines used, and the portion of the pixel lines used, according to the movement detected by the instability detector, such as the instability caused by vertical and/or horizontal movement of the electric camera. Alternatively, Misawa discloses wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector. Misawa discloses an "image sensor 12 for producing pixel signals associated with the optical image thus formed." Misawa at 2:55-59. It teaches "an image signal processor 14 for processing the pixel signals produced to develop image signals representative of the optical image captured." *Id.* at 2:55-61, 3:14-48, 6:32-37. Therefore, Misawa teaches when recording in the moving video mode, generating image signals. Misawa further discloses: "Sensor 26 serves to sense how digital camera 1 physically moves and produce corresponding electric signals over a connection 64. The electric signals represent an unintentional movement or vibration of the camera body proper which would cause blur in a picture reproduced." *Id.* at 4:60-5:8. Thus, Misawa discloses detecting instability caused by vertical and/or horizontal movement of the electric camera, such as an unintentional movement or vibration of the camera body. Misawa further discloses: "Movement detector 314 receives a movement signal from sensor 26 on connection 64 and generates movement data representing how digital camera moves or vibrates to cause blur to be involved in a picture. The movement data includes moving amount data representing an angular velocity at which digital camera 1 rotates, and directional data representing the direction in which camera 1 moves by the hirizontal [sic] and vertical components. The movement data thus generated is delivered to correction processor 316." *Id.* at 8:7-16. Thus, Misawa discloses detecting "movement data," including "moving amount data," that

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	reflects an amount of instability caused by vertical and/or horizontal movement of the electric camera. Misawa further discloses: "Correction processor 316 is responsive to the movement data provided by movement detector 314 to form correction data used for compensating for blur due to the movement of camera 1 in movie pictures taken by camera 1. Correction data includes correction values by which area 402 is to be shifted in position and which is calculated on the basis of the moving amount and directional data included in the movement data. While the movie mode is selected by mode selector 302, correction processor 316 supplies read-out processor 308 with the correction data thus calculated." *Id.* at 8:17-27. Thus, Misawa discloses changing the pixel lines used, and the portion of the pixel lines used, by shifting the position of area 402 within area 400 (see Fig. 4B below) according to an amount of image-instability detected by the instability detector to correct for motion-induced blur. Misawa discloses that its "[r]ead-out processor 308 is also adapted to compensate for blur which would otherwise be caused by unintentional movement of camera 1" and "responds to correction data provided from correction processor 316." *Id.* at 7:30-35, 9:49-56. As shown in Figure 4B, "[r]ead-out processor 308 changes in response to the correction signal the position of area 402 within the imaging field 400 and generates the address representing the altered position of area 402. Image data corresponding to the altered area will be read out from frame memory 18 in response to the new address. The image data read out from frame memory 18 is in turn transferred to data compressing processor 310 under the control of read-out processor 308." *Id.* at 7:40-48, 9:52-61. Thus, Misawa teaches changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector to correct for motion-induced blur.

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	Fig. 4B  With reference to Figure 4B, Misawa explains: "Area 402 is smaller than the entire frame 400, thus utilizing portions of the image data associated with a peripheral portion adjacent to and surrounding area 402 for the purpose of compensating for blur." *Id.* at 10:39-51; *see also id.* at 10:8-15 (teaching compressing and recording to memory the movie image frames); 2:9-15. Thus, Misawa teaches using the pixel lines, or portions of pixels lines, in the regions adjacent to and surrounding area 402 for the purpose of compensating for motion-induced blur. Accordingly, Misawa teaches that when recording in the movie image mode and to correct image-instability (e.g., blur), the image signals are generated by changing the part of pixels lines used from the image data (field 400) and a portion of the pixel lines is used (area 402) according to the correction data indicative of an amount of instability caused by vertical and/or horizontal movement of the electric camera detected by sensor 26. A person of ordinary skill in the art would have found it obvious to modify the MVC-FD83/88 to have the image-instability correction technique taught by Misawa for the reasons stated above in Section VII.A.3. Like Misawa, MVC-FD83/88 teaches a similar electronic camera that can capture both still images and video images. A skilled person would have been motivated to modify the MVD-FC83/88 by the teachings of Misawa to improve similar devices in the same way. A skilled person would have been motivated by the benefits

Claim Element	Sony MVC-FD83/88, alone or combined with Misawa
	taught by Misawa, including improving image quality and compensating for image blur caused by unintentional movements. *See* Misawa at 4:62-65, 8:7-27, 11:23-30. A skilled person would also have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other stabilization techniques, such as optical image stabilization, including smaller size and not requiring moving components. *See, e.g.*, Handbook of Image & Video Processing at 263-268. A skilled person would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, such a combination of prior art elements according to known methods would have yielded predictable results with a reasonable expectation of success.

B. U.S. Patent Nos. 7,903,162 ("Juen") and 6,563,535 ("Anderson")

1. U.S. Patent Nos. 7,903,162 ("Juen")

136. Juen was filed on March 9, 2005, and issued on March 8, 2011. *See* Juen at Cover. Juen lists on its cover Nikon Corporation as its assignee. *See id.* Juen was filed as a continuation of an abandoned application No. 09/951,417 filed on September 14, 2001, which itself was a continuation of an abandoned application No. 08/937,805 filed on September 25, 1997. *See id.* Juen also claims priority to Japanese Application No. H8-253343 filed on September 25, 1996. *See id.* I understand that Juen's earliest U.S. filing date predates the alleged priority date of the '493 patent (i.e., January 11, 2000) by over two years. *See* Section V.A. Juen is not cited on the face of the '493 patent or in its prosecution history. *See* '493 patent at Cover. I understand that Juen qualifies as prior art under at least 35 U.S.C. § 102(e). *See* Section IV.C.

137. I have also reviewed a certified translation of Japanese Patent Application Publication No. H10-108121 ("JP'121"), published on April 24, 1998, from Japanese Application No. H8-253343 identified on the cover of Juen. *See* APL-MAXELL_01089218 to -

251. JP'121 was published over a year before the alleged priority date of the '493 patent (i.e., January 11, 2000). *See* Section V.A. JP'121 contains substantially the same disclosure as Juen. Thus, my analysis below to Juen applies equally to the corresponding disclosures and figures of JP'121. I understand that JP'121 qualifies as prior art under at least 35 U.S.C. §§ 102(a) and (b). *See* Section IV.C.

138. Juen discloses an "electronic camera" that includes "a display screen and … an imaging device, a pixel density converter, a moving image recording device and a still image recording device." Juen at Abstract. "The still image recording device retrieves the image information converted by the imaging device and records the image information in the recording medium as a still image." *Id.* "The moving image recording device successively retrieves the image information from the pixel density converter and records the image information in the recording medium as a series of moving images." *Id.* The disclosed camera, as illustrated below in Figure 8, also includes a display screen 25.

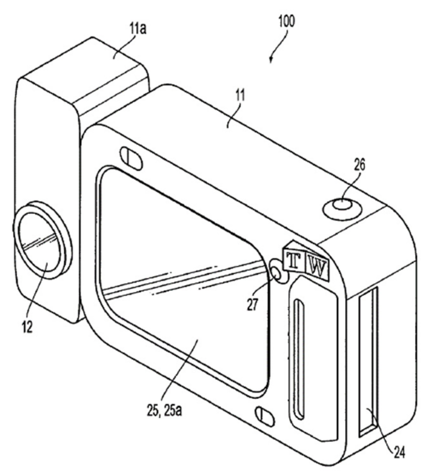


FIG. 8

139. As shown below in Figure 1, when the device records a still image, it "retrieves image information converted by the imaging means 1 to record it in the recording medium R" without any signal conversion. *Id.* at Fig. 1; 3:41-44. When recording moving images, "the

image information from the imaging means 1 is converted via the pixel density conversion means 2 to a pixel density that is compatible with a scan format of a display screen 25" and then recorded "in the recording medium R." *Id.* at Fig. 1; 3:45-63. Juen explains that "[t]he imaging means 1 has a pixel number that is larger than the pixel number of the scan format" and therefore "the pixel density conversion means 2 reduces the image information converted by the imaging means 1 to a pixel density that is suitable for the scan format." *Id.* at 3:64-4:3.

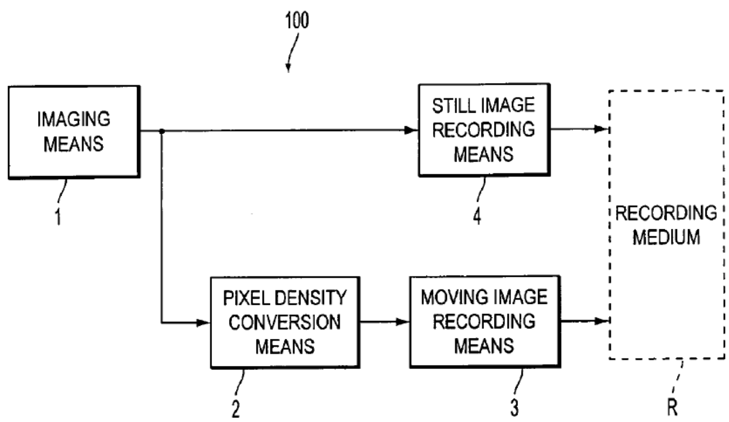


FIG. 1

140. For its image sensor, Juen describes "an imaging element 13, which is composed of a CCD image sensor" that has pixels of "960 in length x 1280 in width." *Id.* at 5:63-6:2. For the scan format of its output, Juen describes NTSC as an example. *See id.; see also* 7:51-58.

141. Juen also discloses a display screen, such as a liquid crystal display, that serves as "an electronic viewfinder." *Id.* at 3:49-55, 6:23-25, 7:36-40, Figs. 7-8. It discloses using the display as a viewfinder when taking still images. *Id.* at 11:3-10, Fig. 17.

2. U.S. Patent No. 6,563,535 ("Anderson")

142. Anderson was filed on May 19, 1998, and issued on May 13, 2003. Thus, I understand that Anderson's filing date predates the alleged priority date of the '493 patent (i.e., January 11, 2000) by over a year. *See* Section V.A; Anderson at Cover. Anderson is not cited

on the face of the '493 patent or in its prosecution history. *See* Anderson at Cover. I understand that Anderson qualifies as prior art under at least 35 U.S.C. § 102(e). *See* Section IV.C.

143. Anderson is assigned to a company called FlashPoint Technology, Inc. *See* Anderson at Cover. I understand that FlashPoint Technology was spun out of Apple's Imaging Division in the mid-1990s. *See FlashPoint Technology, Inc. v. Aiptek, Inc.*, No. 1:09-cv-00106-GMS, Dkt. No. 1 (D. Del. Feb. 19, 2009) at ¶ 30 ("In 1996, FlashPoint was founded as a spin-off of the Imaging Division of Apple Computer, Inc. ('Apple'). FlashPoint continued the research and development of the core technologies started at Apple, and perfected such technologies.").

144. Anderson discloses a digital camera that supports "at least four modes of operation": "live view, capture, instant review, and play mode." *See* Anderson at Abstract, 2:48-67. A block diagram of the Anderson camera is shown below in Figure 1.

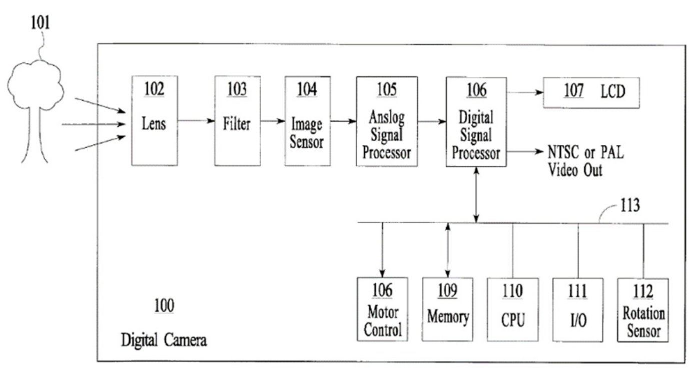


FIG. 1

145. Anderson discloses reducing the resolution of image data from the image sensor for "capture" and "live view" using various techniques, such as "line averaging" and "line skipping." *See id.* at 10:9-20. For example, Anderson teaches that "[t]he captured images may be captured in full, quarter, or one-sixteenth size." *Id.* at 6:16-18.

146. Anderson discloses that, for "CCD's 1152 and larger, 1/16 mode is used for live view." *Id.* at 10:20-22. Anderson explains that 1/16 image resolution reduction is necessary for higher-resolution image sensors in order "to provide sufficient read-out speed for large CCD's,

as well as keeping the bus bandwidth low enough during live view." *Id.* at 10:23-27. Table 1 of Anderson, reproduced below, shows possible "live view" resolutions for different resolution CCD sensors, with the recommended resolutions underlined. *Id.* at 10:29-44. For example, for a CCD sensor having 1280 x 960 pixels, Anderson teaches that 1/16 scaling should be used for "live view," which results in an image size of 320 x 240. *See id.* (highlighting added).

TABLE 1

CCD Size and Live View Size Table

Image Size		¼ Image Size		1/16 Image Size		M Pixels
640	480	320	240	160	120	0.31
768	576	384	288	192	144	0.45
896	672	448	336	224	168	0.61
1024	768	512	384	256	192	0.79
1152	864	576	432	288	216	1.00
1280	960	640	480	320	240	1.23
1536	1024	768	512	384	256	1.58
1536	1152	768	576	384	288	1.77
1792	1344	896	672	448	336	2.41
2048	1536	1024	768	512	384	3.15

*Live view sizes to resizer are shown underlined

3. Motivations to Combine Juen and Anderson:

147. It would have been obvious to a person of ordinary skill in the art to combine Juen and Anderson. Both references are in the same field of digital cameras, both disclose digital cameras that operate in multiple modes (including still and "live view" modes), and both describe down-sampling image resolution for display and/or capture using similar techniques. *See* Juen at Abstract, 1:34-63, 3:64-4:3; Anderson at Abstract, 10:20-44. Accordingly, a person of ordinary skill in the art would have understood that Juen and Anderson disclose similar digital camera devices, and that the improvements contemplated by Juen and Anderson are applicable to each other. Thus, combining Juen and Anderson would simply be the application of a known method of solving a problem to a similar device to yield predictable results.

148. For example, Anderson discloses reasons that would have motivated a person of ordinary skill in the art to combine its teachings with other references, such as Juen. Anderson explains that "there is a need for an advanced architecture which facilitates high-speed image processing, offers advanced features, and yet is cost-effective." Anderson at 2:11-13; *see also id.* at 1:12-2:10. Anderson further explains that its disclosed invention provides improved performance at a lower cost, and "is adaptable to be used in virtually any type of digital camera and CCD array." *Id.* at 2:13-21. Thus, a person of ordinary skill in the art would been motivated by the benefit of improved performance at lower cost to apply the teachings of Anderson to Juen. *Id.* A person of ordinary skill in the art would have also expected success given Anderson's teaching that its disclosed invention is applicable to "virtually any type of digital camera and CCD array." *See id.*; *see also* Juen at 5:63-6:2 (describing digital camera with CCD array).

149. Specifically, Anderson explains that "modern digital cameras were typically designed using specialized circuitry to handle [its] advanced features," such as real-time image preview, image scaling, and other image processing features. Anderson at 1:26-53. While "this approach makes digital cameras relatively fast," it also "dramatically increases the overall cost, size, battery consumption, and weight of the digital cameras." *Id*. at 1:53-58. Another conventional approach—using "a generic processor" that is "programmed to perform all of the enhanced functionality's [sic]" by software—suffers the drawback of being slow in performance. *Id*. at 1:59-2:10. To address these issues, Anderson discloses a solution that uses "a special hardware configuration which has been optimized for increased speed" such that "[c]ertain parts and paths of the circuit are reused and shared so as to leverage existing resources with minimal impact on its speed and functionality," resulting in improved performance at a decreased cost. *Id*. at 2:11-21; *see also id*. at 5:52-6:65 (describing numerous performance and functional advantages of the disclosed design). Juen discloses a device that uses specialized circuitry for

image processing, such as a "pixel density conversion means 2," "moving image recording means 3," and "still image recording means 4." Juen at 7:14-32, Figs. 1-7. Accordingly, a person of ordinary skill in the art would have understood that Juen could be improved using the techniques described in Anderson, and would have been motivated to do so by the benefits taught by Anderson such as improved performance, enhanced functionality, and decreased costs. *See, e.g.*, Anderson at 2:11-21 and 5:52-6:65.

150. Juen also discloses reasons that would have motivated a person of ordinary skill in the art to combine its teachings with Anderson. For example, Juen explains that its objectives are to provide "an electronic camera that can record a still image at a high image quality," enable the capture of "still objects or subjects at will, even while recording a moving object or subject," and to "enhance the operational quality relating to recording changeover between still images and moving images." Juen at 1:46-67. A person of ordinary skill in the art would have found these benefits to be applicable to digital cameras such as those disclosed in Anderson.

151. For example, it would have been obvious to apply Anderson's teaching relating to its "live view" mode to Juen. Juen discloses an image sensor having a resolution of 1280 x 960 pixels. *See* Juen at 5:63-6:2. As shown in Table 1 of Anderson above, Anderson teaches that, for this image sensor resolution, a "live view" output of 320 x 240 would be beneficial. *See* Anderson at 10:20-44. Anderson describes the performance benefits of using this "live view" resolution, such as "to provide sufficient read-out speed for large CCD's, as well as keeping the bus bandwidth low enough during live view." *Id*. at 10:23-27. Anderson further teaches that its disclosed invention allows for "high-speed image processing" and "is cost effective," and is applicable to "virtually any type of digital camera and CCD array." *Id.* at 2:11-21. Thus, a person of ordinary skill in the art would have been motivated by these performance benefits expressly disclosed by Anderson, including higher read-out speed and low bus bandwidth

requirements, to apply Anderson's teaching of selecting a "live view" resolution of 320 x 240 to apply to Juen's 1280 x 960 image sensor output.

152. As another example, Anderson discloses outputting an "NTSC or PAL format" video stream but does not explicitly disclose recording that video stream in memory. *See* Anderson at 4:9-34, Fig. 1. Juen discloses a "moving image recording means" that stores video data in a "recording medium." *See* Juen at 3:32-44. Juen further discloses that electronic cameras on the market had video recording capability. *See id*. at 1:25-42. Anderson similarly discloses video recording devices. Anderson at 3:62-4:8. Thus, a person of ordinary skill in the art would have recognized the benefits of improved functionality, and would have been motivated by such benefits to add video recording capability to Anderson. Thus, applying Juen's teaching of video recording to Anderson would have been obvious.

153. Both Juen and Anderson disclose similar digital camera devices, and there were a finite number of known solutions to the problems of image processing and recording addressed by both patents. Accordingly, combining the teachings of Juen and Anderson would have been a combination of prior art elements according to known methods that would have yielded predictable results with a reasonable expectation of success.

4. Motivations to Combine Misawa with Juen/Anderson

154. Misawa discloses a digital camera system that is very similar to the cameras disclosed by Juen and Anderson. For example, Misawa discloses "a digital electronic camera" that captures and stores "still and movie images in a single data recording medium." Misawa at 1:9-14, 1:54-58. Similarly, each of Juen and Anderson disclose cameras that provide both still and moving images. *See, e.g.*, Juen at 9:11-25; Anderson at 4:33-34. Thus, a person of ordinary skill in the art would have found it obvious to apply the teachings of Misawa to Juen/Anderson.

155. For example, a person of ordinary skill in the art would have found it obvious to modify Juen/Anderson to include the electronic image stabilization feature disclosed by Misawa. A skilled person would have been motivated to modify Juen/Anderson's image processing circuitry to include Misawa's image stabilization features for several reasons.

156. First, Misawa expressly discloses a benefit that would have motivated a person of ordinary skill in the art to modify Juen/Anderson—to improve image quality and compensate for image blur caused by unintentional movements. *See, e.g.*, Misawa at 4:62-65, 8:7-27, 11:23-30. As taught by Misawa, a person of ordinary skill in the art would have understood that Misawa's image stabilization features would improve the quality of video images captured by Juen/Anderson by reducing the image blurring caused by unintentional movements of the cameras.

157. Second, a person of ordinary skill in the art would have both known the common problem of image blurring due to unintentional camera movement, and that there were a finite number of known solutions to this problem (e.g., optical image stabilization and electronic image stabilization). A person of ordinary skill in the art would have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other known stabilization techniques, such as optical image stabilization. For example, it was well known that optical image stabilization required moving components, adding size and bulk to the device. *See, e.g.*, Handbook of Image & Video Processing at 263-268. A person of ordinary skill in the art would have recognized the importance of size and weight to a digital camera. Thus, a person of ordinary skill in the art would have understood that Misawa's teachings could have improved functionality without adding size and bulk to the device. *See, e.g.*, Misawa at 1:46 (recognizing the importance of "portability"). Accordingly, the combination represents the

selection of a solution from a finite number of identified, predictable potential solutions to a recognized need or problem.

158. Third, a person of ordinary skill in the art would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, there would have been an expectation of success from the combination. Accordingly, applying the teachings of Misawa to Juen/Anderson would have been a combination of prior art elements according to known methods that would have yielded predictable results with a reasonable expectation of success.

159. Juen, Anderson, and Misawa all disclose similar digital camera devices, and there were a finite number of known solutions to the problems of image processing and recording addressed by these patents. Accordingly, combining the teachings of Juen, Anderson, and Misawa would have been a combination of prior art elements using known methods to yield predictable results.

5. Claim 5

160. As explained in the chart below, Juen and Anderson disclose all elements of claim 5 and therefore render obvious claim 5.

Claim Element	Juen and Anderson
5. An electric camera comprising:	Each of Juen and Anderson discloses an "electric camera." **<u>Juen:</u>** Juen discloses an "electronic camera." *See* Juen at Abstract, 1:22-23, 1:46-2:15, 3:32-44, Figs. 1-17. **<u>Anderson:</u>** Anderson discloses a "digital camera." *See* Anderson at Abstract, 1:6-9, 2:24-47, Figs. 1-4.

Claim Element	Juen and Anderson
[a] an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines;	Each of Juen and Anderson discloses an image sensing device with a light receiving sensor having an array of pixels arranged vertically and horizontally in a grid pattern, in an N number of vertically arranged pixel lines. **<u>Juen:</u>** Juen discloses: "Light passing through the photographic lens 12 is refracted within the camera part 11a, and received by a photoreceptor surface of an ***imaging element 13***, which is composed of ***CCD image sensor***. For example, the number of pixels of the imaging element 13 is 960 in length x 1280 in width, which is twice the degrees in both length and width of the effective resolution in a NTSC method." Juen at 5:63-6:2; *see also* 3:32-44, 6:3-28. Thus, Juen discloses an image sensing device ("imaging element 13") with a light receiving sensor ("CCD image sensor") having an array of pixels arranged vertically and horizontally in a grid pattern (1280 horizontal x 960 vertical pixels), in an N number of vertically arranged pixel lines. **<u>Anderson</u>** Anderson discloses: "An image processing system for high performance digital imaging in a digital camera. The reflected light from an image is focused through a lens and optically filtered. A ***CCD array*** converts this image into an electrical signal. This electrical signal is processed and then converted into an equivalent digital signal." Anderson at Abstract (emphasis added); *see also* 2:24-28, 2:11-21, 9:66-10:3, Figs. 1, 2A-2B, and 4. In Table 1, Anderson discloses various "CCD Size[s]," including, for example, a CCD size of 1280 x 960 pixels. *Id.* at 10:28-44.

TABLE 1

CCD Size and Live View Size Table

Image Size		¼ Image Size		1/16 Image Size		M Pixels
640	480	320	240	160	120	0.31
768	576	384	288	192	144	0.45
896	672	448	336	224	168	0.61
1024	768	512	384	256	192	0.79
1152	864	576	432	288	216	1.00
1280	960	640	480	320	240	1.23
1536	1024	768	512	384	256	1.58
1536	1152	768	576	384	288	1.77
1792	1344	896	672	448	336	2.41
2048	1536	1024	768	512	384	3.15

*Live view sizes to resizer are shown underlined

Claim Element	Juen and Anderson
	Thus, Anderson discloses an image sensing device ("digital camera") with a light receiving sensor ("CCD array") having an array of pixels arranged vertically and horizontally in a grid pattern (e.g., 1280 horizontal x 960 vertical pixels), in an N number of vertically arranged pixel lines.
[b] a signal processing unit that generates image signals by processing the output signals of the image sensing device; and	Each of Juen and Anderson discloses a signal processing unit that generates image signals by processing the output signals of the image sensing device. **<u>Juen:</u>** Juen discloses: "The photoelectric output of the imaging element 13 is connected to a picture ***image signal processor 15*** that performs white balance adjustment, gamma correction, or the like via an A/D converter 14. The image information of the picture image signal processor 15 is input to an ***image density converter 16*** and a memory I/O component 17. The image density converter 16 performs conversion of the pixel density by executing interpolation, dividing into identical blocks, thinning, and the like, to the pixel value of the image information. The memory I/O component 17 controls input and output of the image information to a system bus 19 of a microprocessor 18. The output of the image density converter 16 and the memory I/O component 17 is input to a coding conversion component 21 via an interface component 20. The interface component 20 communicates with the microprocessor 18 via the system bus 19. To the system bus 19, a memory 22, disk drive part 23, the liquid crystal display screen 25, and a touch panel 25a are respectively connected." Juen at 6:3-28. *See also* Juen at 3:32-44 ("A pixel density conversion means 2 converts the image information converted by the imaging means 1 to a pixel density suitable for a scan format of a display screen."); 7:14-32 (describing image processing circuitry including "A/D converter 14," "pixel density conversion means 2," "moving image recording means 3," "still image recording means 4," "buffer means 5," and "coding conversion component 21"); Figs. 1-7.

<table>
<tr><th>Claim Element</th><th>Juen and Anderson</th></tr>
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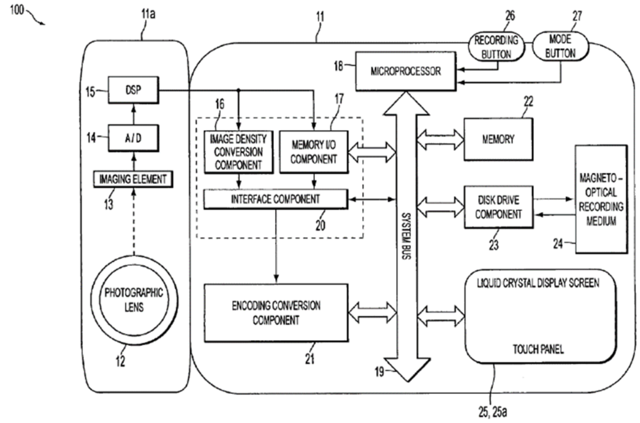

FIG. 7

Thus, Juen's "A/D converter 14," "image signal processor 15," "image density converter 16," "encoding conversion component 21," and other components (e.g., "pixel density conversion means 2," "moving image recording means 3," "still image recording means 4," and "buffer means 5") that generate image signals by processing the output signals of the image sensing device constitute a "signal processing unit."

<u>Anderson:</u>

Anderson discloses: "A ***digital signal processor*** is then used to process the raw digital signal. The DSP includes a capture data path, a data flow control, an image processing data path, a compression/decompression engine, a resize circuit, a display processing circuit, and a rotation circuit. Data is routed between the DSP and memory via a bus." Anderson at Abstract.

Anderson further discloses: "The raw CCD image data is then passed on to the Digital Signal processor (DSP) 106. The DSP ASIC chip 106 combines the following related functions: front-end pixel data path to a frame buffer, statistics generation, image processing, compression/decompression, live view generation, rotation, resize, video generation, and timing generation. The processed image from DSP 106 is displayed onto a built-in LCD 107. LCD 107 can act as a viewfinder and as a display for captured images. The image signal can also be output from DSP 106 in either an NTSC or PAL format." *Id.* at 4:24-34; *see also* 4:62-5:51 (describing "DSP 106" with respect to the block diagram shown in Figure 2a); 6:66-67 (describing an "alternative embodiment of the DSP" shown in Figure 2b) 9:66-10:3; Figs. 1, 2a-2b, 4.

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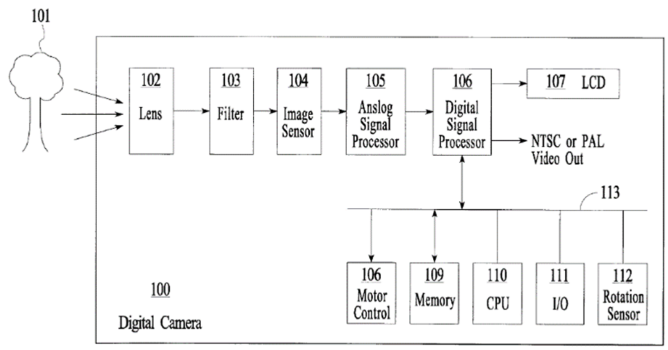
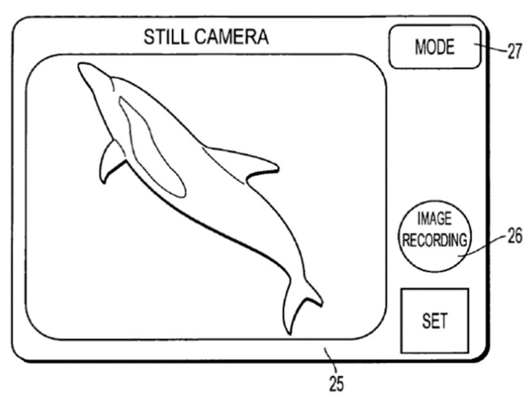
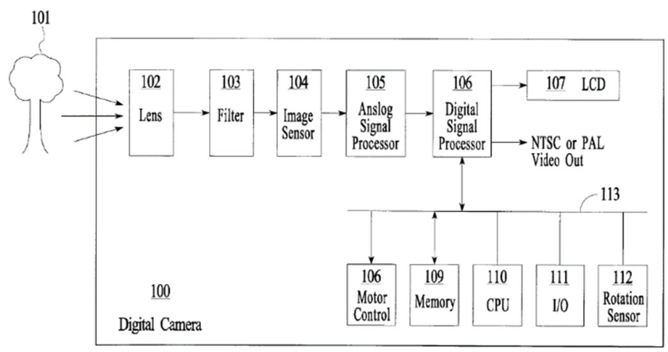
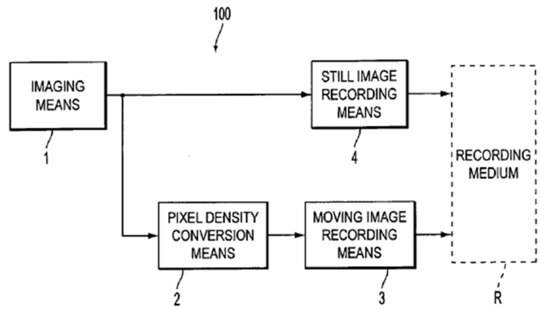
</table>

Claim Element	Juen and Anderson
	 FIG. 1 Thus, Anderson's "Digital Signal processor (DSP)" and other components that generate image signals by processing the output signals of the image sensing device constitute a "signal processing unit."
[c] a display unit with a display screen, that displays an image corresponding to the image signals;	Each of Juen and Anderson discloses a display unit with a display screen, that displays an image corresponding to the image signals. **<u>Juen:</u>** Juen discloses a "liquid crystal display screen 25." *See* Juen at 6:32-35. Juen further discloses that the "***display screen 25 can be an electronic viewfinder***." *Id.* at 3:45-55 (emphasis added); *see also* Abstract, 3:32-44, 2;1-8, 6:23-35, 7:36-40; Figs. 15-17. As shown below in Fig. 17, Andersons' display 25 is a display unit with a display screen that displays an image corresponding to the image signals.  **FIG. 17**

Claim Element	Juen and Anderson
	<u>Anderson:</u> Anderson discloses: "FIG. 1 shows the block diagram of a digital camera upon which the present invention may be practiced. … The processed image from DSP 106 is displayed onto a built-in LCD 107. ***LCD 107 can act as a viewfinder and as a display for captured images***. The image signal can also be output from DSP 106 in either an NTSC or PAL format." Anderson at 4:9-34; *see also* Abstract, 1:29-35, 5:17-33, 6:3-18, 7:1-24, 8:40-53, 8:66-9:3, 9:1-3, Figs. 1-2 and 4.  FIG. 1
[d] wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines;	Each of Juen and Anderson discloses wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines. **<u>Juen:</u>** As shown below in Figure 1, the recording path of still images bypasses the "pixel density conversion means," which performs image resolution conversion. Thus, the image data is recorded without any change to its resolution from the image sensor. This indicates that still images are captured by having the signal processing unit generate the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines. *See* Juen at Fig. 1; *see also* Figs. 2-3 and 6.

Claim Element	Juen and Anderson
	 FIG. 1 Juen discloses: "In FIG. 1, an electronic camera 100 includes an imaging means 1 that images an object or living subject (hereinafter referred to as 'object') and converts an image thereof to image information. … ***A still image recording means 4 retrieves image information converted by the imaging means 1 to record it in the recording medium R as a still image.***" *Id.* at 3:32-44 (emphasis added). *See also id.* at 9:11-25 ("stores the ***entire still image*** that has a high pixel density") (emphasis added); 7:36-40; 9:55-59; 11:36-40; Figs. 6, 11. Thus, Juen teaches generating a high pixel density still image by using the entire still image data from the image sensor. Thus, Juen discloses wherein when recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines. **<u>Anderson:</u>** Anderson discloses: "The captured images may be captured in ***full***, quarter, or one sixteenth size." *See* Anderson at 5:66-6:18 (emphasis added); *see also* Abstract, 2:49-59, 2:24-28, 7:25-59, 12:11-16; Figs. 3B-3C. Anderson further discloses: "Starting with the raw CCD data generated by the CCD array (or some other equivalent image capture head), this data is input to the pixel average block 403. The pixel average block 403 performs pixel averaging to reduce lines to half and quarter length. The averaging is performed by adding values and shifting as follows: ***Full Output: Ra, Ga, Rb, Gb, Rc, Gc, Rd, Gd*** Half Output: (Ra+Rb)/2, (Ga+Gb)/2, (Rc+Rd)/2, (Gc+Gd)/2 Quarter Output: (Ra+Rb+Rc+Rd)/4, (Ga+Gb+Gc+Gd)/4." *Id.* at 9:66-10:8 (emphasis added).

Claim Element	Juen and Anderson
	Thus, by using the "Full Output," Anderson discloses recording an image in a static image mode, the signal processing unit generates the image signals by using all signal charges accumulated in all N number of vertically arranged pixel lines of the image sensing device, to provide N pixel lines.
[e] wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance; and	**Claim Construction:** The Court construed "mixing . . . signal charges" and "mixed" means "combining signal charges from multiple pixels" and "combined," and "culling signal charges" and "culled" as "reading out only one line of signal charges of pixels for every predetermined number of lines" and "only one line of signal charges of pixels is read out for every predetermined number of lines." **Analysis:** Juen and Anderson disclose or render obvious wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance. **Juen:** Juen discloses: "On the other hand, when the still image is shown on the display screen, ***a still image of a high pixel density may be converted to a pixel density matching the scan format of the display screen*** by appropriating the pixel density conversion means 2 used during recording for use during playback. …" Juen at 11:1-10 (emphasis added). Juen further discloses: "The pixel density conversion means 2 includes the image density converter 16." *Id.* at 7:16-18. "The image density converter 16 divides the image information into 2x2 pixel blocks, respectively, and reduces the density to a pixel density of 480x640 pixels (FIG. 10 S5). At this time, the pixel density in the vertical direction becomes equivalent to 480, after excluding the retrace time, from the number of Scanning lines, 525, in the vertical direction in the NTSC method." *Id.* at 7:53-58. Thus, Juen discloses down-sampling the pixel density from the image sensor resolution of 960 x 1280 pixels to 480 x 640 pixels by dividing image data into 2 x 2 blocks. *See id.* Under Maxell's apparent interpretation of "mixing" and "culling" (as reflected in its Infringement Contentions), this operation qualifies as "mixing" or

Claim Element	Juen and Anderson
	"culling" with an interval of one of every two pixels. Alternatively, a person of ordinary skill in the art would have found the use of "mixing" or "culling" to be obvious because these were common and known methods of reducing image resolution. *See, e.g.*, '493 patent at 2:44-63.

<u>Anderson:</u>

Anderson discloses a "live view" mode. *See* Anderson at 2:48-55. In this mode, the LCD display "can act as a viewfinder and as a display for captured images." *Id.* at 4:30-33; *see also* 2:49-59, 5:66-6:4, 7:1-10.

Anderson further discloses: "During live view mode, typically the CCD is being scanned using line skipping, for 50% vertical resolution, reduced bus bandwidth, and faster frame rate." *Id.* at 10:17-20. It also describes "line averaging" as an alternative method to reduce resolution. *See id.* at 9:66-10:17.

Anderson includes a table that shows image resolution output for "1/4 Image Size" (interval of one of every two pixels in each of the horizontal and vertical direction) or "1/16 Image Size" (interval of one of every four pixels in each of the horizontal and vertical direction). *Id.* at 10:28-44.

TABLE 1

CCD Size and Live View Size Table

Image Size		¼ Image Size		1/16 Image Size		M Pixels
640	480	320	240	160	120	0.31
768	576	384	288	192	144	0.45
896	672	448	336	224	168	0.61
1024	768	512	384	256	192	0.79
1152	864	576	432	288	216	1.00
1280	960	640	480	320	240	1.23
1536	1024	768	512	384	256	1.58
1536	1152	768	576	384	288	1.77
1792	1344	896	672	448	336	2.41
2048	1536	1024	768	512	384	3.15

*Live view sizes to resizer are shown underlined

For example, Anderson discloses: "As can be seen from Table 1 below, for CCD's 1152 and larger, 1/16 mode is used for live view. To accomplish this, a combination of 2 out of 8 line skipping and Quarter Output is used." *Id.* at 10:20-23. *See also id.* at 10:15-20, 10:48-52, 11:26-29, 12:19-26.

The '493 patent describes the "culling operation" as follows: "The number of lines of output signals can also be reduced by a so-called

Claim Element	Juen and Anderson
	culling operation, by which only one line of signal charges of pixels is read out for every predetermined number of lines." '493 patent at 10:9-12. Thus, Anderson's "line skipping" approach to down-sample image resolution qualifies as a "culling operation" because only one line of signal output is read out for every 2 lines (in 1/4 mode) or every 4 lines (in 1/16 mode). Accordingly, Anderson discloses wherein when monitoring the image in the static image mode, the signal processing unit generates the image signals by using pixel lines that have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a first distance. **<u>Juen and Anderson:</u>** A person of ordinary skill in the art would have found it obvious to apply the teachings of Anderson to Juen for reasons stated above in Section VII.B.3. For example, Juen discloses an image sensor having a resolution of 1280 x 960 pixels. *See* Juen at 5:63-6:2. As shown in Table 1 of Anderson above, Anderson teaches that, for this image sensor resolution, a "live view" output of 320 x 240 should be used. Anderson at 10:20-44. Anderson describes the performance benefits of using his "live view" resolution, such as "to provide sufficient read-out speed for large CCD's, as well as keeping the bus bandwidth low enough during live view." *Id.* at 10:23-27. Thus, a person of ordinary skill in the art would have been motivated by these performance benefits, such as higher read-out speed and low bus bandwidth requirements, to apply Anderson's teaching of using a "1/16 mode" output (i.e., outputting one out of every four lines using "line skipping") for "live view" to Juen.
[f] wherein when recording the image in a moving video mode, the signal processing unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to	**<u>Claim Construction:</u>** The Court construed "mixing . . . signal charges" and "mixed" means "combining signal charges from multiple pixels" and "combined," and "culling signal charges" and "culled" as "reading out only one line of signal charges of pixels for every predetermined number of lines" and "only one line of signal charges of pixels is read out for every predetermined number of lines." **<u>Analysis:</u>** Juen and Anderson disclose or render obvious wherein when recording the image in a moving video mode, the signal processing

Claim Element	Juen and Anderson
only include pixel lines separated from one another by intervals of a second distance, where the second distance is different from the first distance.	unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance, where the second distance is different from the first distance. **<u>Juen:</u>** Juen discloses a moving video mode that records image data at a reduced resolution: "In FIG. 1, an electronic camera 100 includes an imaging means 1 that images an object or living subject (hereinafter referred to as 'object') and converts an image thereof to image information. A pixel density conversion means 2 converts the image information converted by the imaging means 1 to a pixel density suitable for a scan format of a display screen. ***A moving image recording means 3 successively retrieves the image information in which the pixel density has been converted by the pixel density conversion means 2 and records it in a recording medium R as a series of moving images***." Juen at 3:32-44 (emphasis added); *see also* 8:38-41. *See* Element 5[e]. Juen discloses using a 960 x 1280 pixel image sensor that is "twice the degrees in both length and width of the effective resolution in a NTSC method." *Id.* at 5:63-6:2. Juen further discloses reducing the resolution of the image sensor data to 480x640: "At this time, the image density converter 16 successively retrieves image information, that has been digitized, from the camera part 11 a (FIG. 10 S4). The image density converter 16 divides the image information into 2×2 pixel blocks, respectively, and reduces the density to a pixel density of 480×640 pixels (FIG. 10 S5). At this time, the pixel density in the vertical direction becomes equivalent to 480, after excluding the retrace time, from the number of scanning lines, 525, in the vertical direction in the NTSC method." *Id.* at 7:51-58. Thus, Juen discloses a moving video mode in which the signal processing unit generates the image signals by using a portion of, or the entirety of, pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance (i.e., one of two pixel lines). A person of ordinary skill in the art would have recognized the importance of recording video data in the NTSC format. Around the date of Juen (and of Anderson and the '493 patent), NTSC was the television standard in North America, as it has been since the early

<table>
<tr><th>Claim Element</th><th>Juen and Anderson</th></tr>
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1950s. Thus, recording videos in NTSC format would allow the video to be played back on a standard television set.

<u>Anderson:</u>

Similarly, Anderson discloses outputting image data in the NTSC format. *See* Anderson at 4:33-34 ("The image signal can also be output from DSP 106 in either an NTSC or PAL format."); *see also* 3:62-4:8, 14:44-45, 15:64-16:18. Anderson discloses various techniques for downsampling image data, such as "line skipping" and "line averaging." *See* Element 5[e]. As explained above, one or more of these techniques qualify as "mixing" or "culling." *See id.*

For example, Figure 1 of Anderson illustrates that "Digital Signal Processor 106" can output a signal for "NTSC or PAL Video Out." *Id.* at Fig. 1; *see also* Fig. 4.

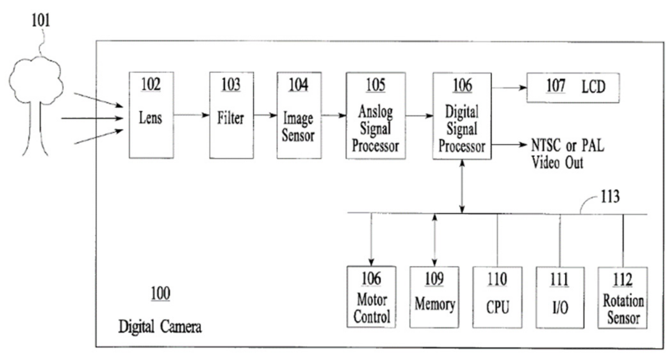

FIG. 1

As described above for element 5[e], Anderson describes using "line skipping" to downscale resolution. *See, e.g., id.* at 10:15-23, 10:48-52, 11:26-29, 12:19-26. A person of ordinary skill in the art would have recognized that the resolutions for NTSC (e.g., 480x640) or PAL would require downscaling at a different interval compared to that described for the LCD viewfinder. Moreover, a person of ordinary skill in the art would have recognized that it would be obvious to record the output of the NTSC or PAL video data. Indeed, Anderson explicitly teaches that its disclosed invention is applicable to video recording devices such as "digital VCRs, digital camcorders and recorders." *Id.* at 3:62-4:8.

<u>Juen and Anderson:</u>

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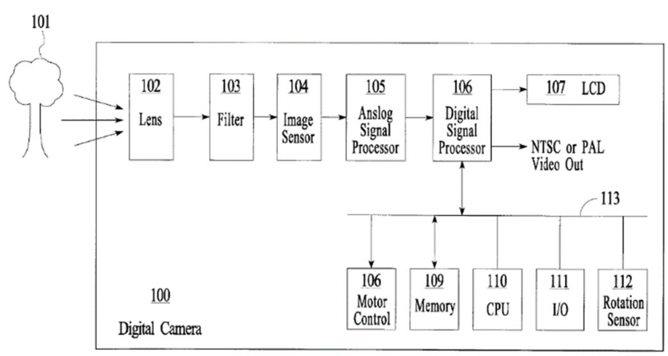
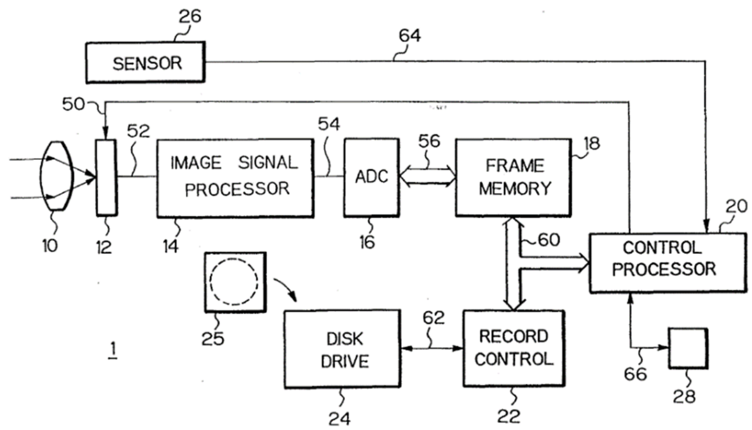
Claim Element	Juen and Anderson
	A person of ordinary skill in the art would have found it obvious to combine Juen and Anderson for reasons stated above in Section VII.B.3 and for claim element 5[e]. As combined, the modified system could use Juen's 1280 x 960 pixels image sensor (*see* Juen at 5:63-6:2) to generate a "live view" output of 320 x 240 pixels in a monitoring mode by using the "line skipping" technique as taught by Anderson (*see* Anderson at 10:20-44). *See* claim element 5[e]. The modified system would also record video using the NTSC format (at 640 x 480) as taught by both Juen and Anderson. *See* Juen at 7:51-58; Anderson at 4:33-34. Thus, the modified system discloses a moving video mode that records pixel lines pixel lines which have been mixed or culled from the N number of vertically arranged pixel lines to only include pixel lines separated from one another by intervals of a second distance (i.e., one of every two lines), and a "live view" monitoring mode that uses pixel lines separated from one another by intervals of a first distance (i.e., one of every four lines). The modified system would have the benefit of improved performance during "live view" monitoring, as taught by Anderson, while retaining NTSC compatibility for video recording. As shown in Anderson's Figure 1, its "Digital Signal Processor 106" has the capability to output both to a viewfinder ("LCD 107") and to provide a "NTSC … Video Out." *Id.* at Fig. 1; *see also* 4:24-34, Fig. 4.  FIG. 1 Alternatively, Anderson discloses outputting a NTSC video signal but does not explicitly teach recording that video. *See, e.g.*, Anderson at Fig. 1, 4:24-34. A person of ordinary skill in the art would have found it obvious to modify Anderson to include a video recording capability, as taught by Juen. *See, e.g.*, Juen at 3:32-44, 5:63-6:2, 7:51-58, 8:38-41. Indeed, Anderson already teaches that

Claim Element	Juen and Anderson
	its disclosed invention is applicable to video recording devices such as "digital VCRs, digital camcorders and recorders." Anderson at 3:62-4:8. For a device that uses an 1280 x 960 image sensor (as taught by Anderson at 10:38), the modified system discloses a moving video mode that records pixel lines separated from one another by intervals of a second distance (i.e., one of every two lines) to provide an NTSC output, and a "live view" monitoring mode that uses pixel lines separated from one another by intervals of a first distance (i.e., one of every four lines) to generate a preview image at the 320 x 240 resolution. *See* Anderson at 4:30-34, 10:28-44, Fig. 1. A person of ordinary skill in the art would have understood the benefits of including a video recording mode to record videos on the same recording medium as still images (as taught by Juen) because it would improve the functionality of the device. Adding Juen's "moving image recording means 3" (Juen at Fig. 1) to Anderson to capture "NTSC or PAL Video Out" (Anderson at Fig. 1) is simply the application of a known method of solving a problem to a similar device to yield predictable results.

6. Claim 6

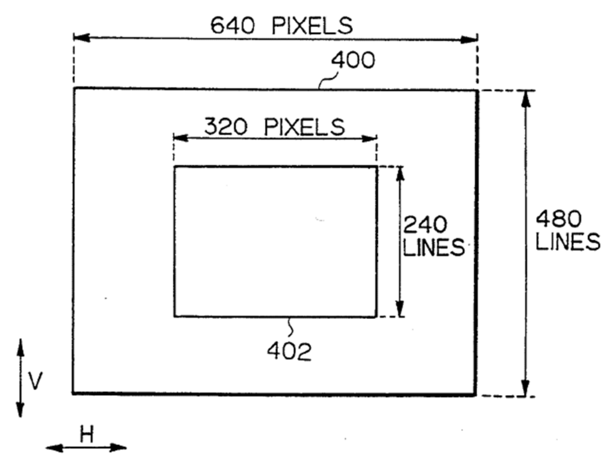
161. As explained in the chart below, the combination of Juen and Anderson, further in view of Misawa, renders obvious claim 6.

Claim Element	Juen, Anderson, and Misawa
6. An electric camera according to the claim 5, further comprising:	Juen and Anderson each discloses an electric camera. *See* Claim 5, preamble. Misawa also discloses an electric camera. *See* Misawa at Abstract, 2:36-3:13, Figs. 1-4.

Claim Element	Juen, Anderson, and Misawa
	Fig. 1 
[a] an image-instability detector which detects an image-instability of the electric camera; and	<u>**Claim Construction:**</u> The parties agreed to construe "an image-instability detector" as "a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera." <u>**Analysis:**</u> Misawa discloses an image-instability detector which detects an image-instability of the electric camera. Misawa discloses "a sensor 26 for sensing movement or viblation [sic] of the camera," and the sensor may be a "piezoelectric gyroscopic transducer…adapted to sense any mechanical movement." Misawa at 3:7-9, 4:60–5:8, Fig. 1. Thus, under the parties' agreed construction, Misawa's "piezoelectric gyroscopic transducer" is a detector, such as a gyroscopic sensor or the like, capable of detecting an image instability of the electric camera. Misawa further discloses that "Sensor 26 serves to sense how digital camera 1 physically moves and produce corresponding electric signals over a connection 64. The electric signals represent an unintentional movement or vibration of the camera body proper which would cause blur in a picture reproduced." *Id.* at 4:60-5:8. Misawa explains that "movement detector 314 receives a movement signal from sensor 26" and "generates movement data representing how digital camera moves or vibrates," which is "delivered to correction processor 316." *Id.* at 8:7-16, 7:30-33. Thus, Misawa's "piezoelectric gyroscopic transducer" detects an image-instability of the electric camera. *Id.* *See also id.* at Abstract, 1:10-15, Figs. 1, 3.

Claim Element	Juen, Anderson, and Misawa
	A person of ordinary skill in the art would have found it obvious to modify Juen/Anderson to have an image-instability detector that detects an image-instability of the electric camera, as taught by Misawa for reasons stated above in Section VII.B.4. Each of Juen, Anderson, and Misawa teaches an electronic camera that operates in multiple modes. A skilled person would have been motivated to modify Juen/Anderson to further include an image-instability detector, as taught by Misawa, thereby improving the camera to have image stabilization functionality. The inclusion of image stabilization functionality was well within the skill level of a person of ordinary skill in the art, and merely represent an obvious design choice to include a known functionality. A skilled person would have been motivated by the benefits taught by Misawa, including improving image quality and compensating for image blur caused by unintentional movements. *See* Misawa at 4:62-65, 8:7-27, 11:23-30. A skilled person would also have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other stabilization techniques, such as optical image stabilization, including smaller size and not requiring moving components. *See, e.g.*, Handbook of Image & Video Processing at 263-268. A skilled person would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, such a combination of prior art elements according to known methods would have yielded predictable results with a reasonable expectation of success.
[b] wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector.	**<u>Claim Construction:</u>** The parties agreed to construe "an image-instability of the electric camera" as "instability caused by vertical and/or horizontal movement of the electric camera." **<u>Analysis:</u>** Misawa discloses wherein when recording in the moving video mode, in order to correct the image-instability, the signal processing unit generates the image signals by changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector. Misawa discloses an "image sensor 12 for producing pixel signals associated with the optical image thus formed." Misawa at 2:55-59. It teaches "an image signal processor 14 for processing the pixel

Claim Element	Juen, Anderson, and Misawa
	signals produced to develop image signals representative of the optical image captured." *Id.* at 2:55-61, 3:14-48, 6:32-37. Therefore, Misawa teaches when recording in the moving video mode, generating image signals. Misawa further discloses: "Sensor 26 serves to sense how digital camera 1 physically moves and produce corresponding electric signals over a connection 64. The electric signals represent an unintentional movement or vibration of the camera body proper which would cause blur in a picture reproduced." *Id.* at 4:60-5:8. Thus, Misawa discloses detecting instability caused by vertical and/or horizontal movement of the electric camera, such as an unintentional movement or vibration of the camera body. Misawa further discloses: "Movement detector 314 receives a movement signal from sensor 26 on connection 64 and generates movement data representing how digital camera moves or vibrates to cause blur to be involved in a picture. The movement data includes moving amount data representing an angular velocity at which digital camera 1 rotates, and directional data representing the direction in which camera 1 moves by the hirizontal [sic] and vertical components. The movement data thus generated is delivered to correction processor 316." *Id.* at 8:7-16. Thus, Misawa discloses detecting "movement data," including "moving amount data," that reflects an amount of instability caused by vertical and/or horizontal movement of the electric camera. Misawa further discloses: "Correction processor 316 is responsive to the movement data provided by movement detector 314 to form correction data used for compensating for blur due to the movement of camera 1 in movie pictures taken by camera 1. Correction data includes correction values by which area 402 is to be shifted in position and which is calculated on the basis of the moving amount and directional data included in the movement data. While the movie mode is selected by mode selector 302, correction processor 316 supplies read-out processor 308 with the correction data thus calculated." *Id.* at 8:17-27. Thus, Misawa discloses changing the pixel lines used, and the portion of the pixel lines used, by shifting the position of area 402 within area 400 (see Fig. 4B below) according to an amount of image-instability detected by the instability detector to correct for motion-induced blur. Misawa discloses that its "[r]ead-out processor 308 is also adapted to compensate for blur which would otherwise be caused by unintentional movement of camera 1" and "responds to correction data provided from correction processor 316." *Id.* at 7:30-35, 9:49-

Claim Element	Juen, Anderson, and Misawa
	56. As shown in Figure 4B, "[r]ead-out processor 308 changes in response to the correction signal the position of area 402 within the imaging field 400 and generates the address representing the altered position of area 402. Image data corresponding to the altered area will be read out from frame memory 18 in response to the new address. The image data read out from frame memory 18 is in turn transferred to data compressing processor 310 under the control of read-out processor 308." *Id.* at 7:40-48, 9:52-61. Thus, Misawa teaches changing the pixel lines used, and the portion of the pixel lines used, according to an amount of image-instability detected by the instability detector to correct for motion-induced blur. Fig. 4B  With reference to Figure 4B, Misawa explains: "Area 402 is smaller than the entire frame 400, thus utilizing portions of the image data associated with a peripheral portion adjacent to and surrounding area 402 for the purpose of compensating for blur." *Id.* at 10:39-51; *see also id.* at 10:8-15 (teaching compressing and recording to memory the movie image frames); 2:9-15. Thus, Misawa teaches using the pixel lines, or portions of pixels lines, in the regions adjacent to and surrounding area 402 for the purpose of compensating for motion-induced blur. Accordingly, Misawa teaches that when recording in the movie image mode and to correct image-instability (e.g., blur), the image signals are generated by changing the part of pixels lines used from the image data (field 400) and a portion of the pixel lines is used (area 402) according to the correction data indicative of an amount of instability caused by vertical and/or horizontal movement of the electric camera detected by sensor 26.

Claim Element	Juen, Anderson, and Misawa
	A person of ordinary skill in the art would have found it obvious to modify Juen/Anderson to have the image-instability correction technique taught by Misawa for reasons stated above in Section VII.B.4. Each of Juen, Anderson, and Misawa teaches an electronic camera that operates in multiple modes. A skilled person would have been motivated to modify Juen/Anderson to further include image stabilization correction, as taught by Misawa, thereby improving the camera's video capturing functionality. The inclusion of image stabilization functionality was well within the skill level of a person of ordinary skill in the art, and merely represent an obvious design choice to include a known functionality. A skilled person would have been motivated by the benefits taught by Misawa, including improving image quality and compensating for image blur caused by unintentional movements. *See* Misawa at 4:62-65, 8:7-27, 11:23-30. A skilled person would also have been motivated to include the electronic stabilization feature disclosed by Misawa because of its known benefits over other stabilization techniques, such as optical image stabilization, including smaller size and not requiring moving components. *See, e.g.*, Handbook of Image & Video Processing at 263-268. A skilled person would have expected success from such a modification because many commercial cameras existing before the priority date of the '493 patent already included electronic stabilization features for video capture. *See, e.g.*, Popular Photography (October 1999) at 132. Thus, such a combination of prior art elements according to known methods would have yielded predictable results with a reasonable expectation of success.

VIII. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

162. As set forth below, I am not aware of any secondary considerations that support a showing that the asserted claims of the '493 patent are non-obvious.

[redacted]

[redacted]

A. Commercial Success

164. I am not aware of any evidence of commercial success that can be attributed to the utilization of the invention claimed in the '493 patent. As explained above in Section IV.D, I understand that a strong showing of commercial success of a product that has a nexus with the claimed limitations of the asserted patent should be considered an indication of non-obviousness. I am not aware, however, of any evidence of commercial success of any product embodying the Asserted Patents having a nexus with a patented feature.

165. For example, I understand that Sony's prior art digital camera products, such as the MVC-FD83 and MVC-FD88, were already commercially successful. [redacted] Indeed, prior to the filing of the '493 patent, Sony already had approximately 50% market share in the digital camera market. *See* PC Magazine (Nov. 11, 1999) at 12. Thus, Sony enjoyed commercial success before the filing '493 patent (*see id.*), and it continues to enjoy success in the digital camera market. To the extent that Maxell contends that claims 5-6 of the '493 patent claim features not found in the prior art, such as the Sony MVC-FD83 and MVC-FD88 cameras, I am not aware of any evidence that those claimed

features resulted in commercial success for Hitachi, Maxell, or anyone else utilizing the claimed inventions.

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

B. Copying

173. I am unaware of any evidence that any person or entity copied the invention claimed in the '493 patent. To the contrary, the publications, books, prior art patents, references, and products identified in this report demonstrate that the ideas claimed by claims 5-6 of the '493 patent were already well known to other companies, such as Sony, Nikon, Kodak, Fuji, FlashPoint Technology (a company that spun off from Apple's Imaging Division[5]), and others,

[5] *See FlashPoint Technology, Inc. v. Aiptek, Inc.*, No. 1:09-cv-00106-GMS, Dkt. No. 1 (D. Del. Feb. 19, 2009) at ¶ 30 ("In 1996, FlashPoint was founded as a spin-off of the Imaging Division

long before the filing of the '493 patent. *See* Sections VI-VII. Indeed, Sony (which I understand to be Apple's image sensor vendor) developed prior art cameras before the filing of the '493 patent. *See id.*

174. In addition, I understand the evidence in this case demonstrates that Apple did not copy the '493 patent. [redacted]. I am not aware of any evidence or allegation that Apple knew about the '493 patent before June 25, 2013. Apple released the original iPhone in June 2007. *See* Steve Jobs Introducing The iPhone At MacWorld 2007 at https://www.youtube.com/watch?v=x7qPAY9JqE4. The original iPhone includes a built-in camera and had the capability to capture still and video images. *Id.* at 11:39. Apple released the iPhone 3G in 2008, iPhone 3GS in 2009, iPhone 4 in 2010, iPhone 4S in 2011, and iPhone 5 in 2012. *See* The WIRED Guide to the iPhone, at https://www.wired.com/story/guide-iphone/. By June 2013, there were already many generations of iPhones that provide still and video capture capability. *See id.* Documents produced by Apple also show that several of these iPhone models, designed and produced by Apple before Maxell's alleged notice date of June 25, 2013, already had video stabilization features. *See, e.g.*, APL-MAXELL_01419575 (showing that iPhone 4S and iPhone 5 both had "GyroVideoStabilization"). There is no evidence that any of those products were "copied" from the '493 patent.

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of Apple Computer, Inc. ('Apple'). FlashPoint continued the research and development of the core technologies started at Apple, and perfected such technologies.")

C. Simultaneous Invention

175. The prior art references and products described above show that others had independently developed the claimed invention before or around the same time as the filing of the '493 patent. For example, many companies independently developed products having both still and video image capture features, as well as electronic image stabilization features, before the filing of the '493 patent. *See* Sections VI-VII.

176. For example, of the 19 camera models reviewed in the November 11, 1999 edition of PC Magazine, 9 models included both still and video capture capability. *See* PC Magazine (Nov. 11, 1999) at 162-190. These cameras were made by many different companies, including Agfa, Casio, Fujifilm, Minolta, Panasonic, and Sony. *See id.* And the October 1999 edition of the Popular Photography magazine contained advertisements for many camera models from companies like Panasonic and Sharp that included features described as "Digital Electronic Image Stabilization," "Picture Stabilizer," or "Digital Image Stabilization." *See* Popular Photography (October 1999) at 132. In addition, the prior art cited in Section VII above from companies such as Sony, Fuji, Nikon, and FlashPoint (which spun out of Apple's Imaging Division) further demonstrate that many companies arrived at the claimed invention within a relatively short span of time.

D. Long-Standing Problem Or Need

177. I am not aware of evidence that the patented invention resolved any long-standing problem or need. For example, I understand that Sony's digital camera products, such as the MVC-FD83 and MVC-FD88, were already commercially successful. To the extent that Maxell contends that claims 5-6 of the '493 patent include features not found in the MVC-FD83 and MVC-FD88 products, I am not aware of any evidence that those features addressed any long-

standing problem or need that was not otherwise solved by these prior art products. *See supra,* Sections VII.A.

178. For example, the idea of having a camera capable of recording images in "static image mode" and "moving video mode," while allowing for "monitoring the image in the static image mode," was common place and implemented in many commercially-available cameras. *See* PC Magazine (Nov. 11, 1999) at 162-190 (reviewing 9 models of digital cameras that had still and video capture capability and built-in viewfinder).

179. As another example, the problem of image stabilization was already discussed and addressed by prior art in patents, journal articles, and text books, and it was addressed by the use of electronic image stabilization techniques in products. *See, e.g.*, Handbook of Image & Video Processing at § 3.13; U.S. Patent No. 4,612,575; Popular Photography (October 1999) at 132. Because prior art products, patents, and publications successfully addressed the problems purportedly addressed by the '493 patent, there was no long-standing problem to resolve. The '493 patent merely uses known solutions to address known problems.

E. Prior Failures

180. I am not aware of any evidence that others tried and failed to solve the alleged problems or provide the alleged need resolved by the claimed invention, if any exists. To the contrary, there were already many prior art products on the market by the filing of the '493 patent, including, for example, the Apple QuickTake camera products and the Sony MVC-FD83 and MVC-FD88 camera products discussed above. The '493 patent purports to address challenges associated with capturing both high-resolution still images and lower-resolution video images using the same device. *See, e.g.*, '493 patent at 2:57-3:7. But it appears that this challenge had already been successfully resolved by the leading digital camera makers by 1999.

See PC Magazine (Nov. 11, 1999) at 162-190 (reviewing 9 models of digital cameras that had both still and video capture capability).

F. Skepticism

181. I am not aware of any evidence that those of ordinary skill in the art were skeptical as to the merits of the invention claimed by the '493 patent or taught away from that invention. To the contrary, as discussed above, the '493 patent describes and claims features that are well known to those of ordinary skill in the art, and use these features for their expected purpose.

G. Unexpected results

182. Those of ordinary skill in the art, at the time of the invention of the subject matter claimed in the '493 patent, would not have been surprised by the capabilities of the claimed invention. To the contrary, as discussed above, the '493 patent describes and claims features that are well known to those of ordinary skill in the art, and use these features for their expected purpose.

H. Industry praise

183. I am not aware of any evidence that any person or entity outside of Hitachi or Maxell has praised the alleged invention claimed by the '493 patent. To the contrary, Hitachi was not (and is not) known as a leading innovator in the field of digital photography, and I'm not aware of any technical or industry award given to Hitachi relating to the '493 patent.

184. For example, Apple has been praised by Time Magazine for producing "the first consumer digital camera." *See* Peter Ha, "Apple QuickTake 100," Time.com (Oct. 25, 2010) (http://content.time.com/time/specials/packages/article/0,28804,2023689_2023773_2023615,00.html). Sony has been praised by PC Magazine for being the market leader in the digital camera market, and for making cameras that "produced extremely clear images with good detail and color fidelity." *See* PC Magazine (Nov. 11, 1999) at 12, 190. I am not aware of any similar

praise received by Hitachi or Maxell for the alleged inventions claimed by the '493 patent, nor for any commercial product that purports to practice such inventions.

IX. OTHER TOPICS

185. If asked to more fully explain my opinions as expressed in this report, I reserve the right to rely on various portions of the references that I have discussed in this report that I have not already explicitly cited to in this report.

186. I reserve the right to supplement my report in light of any additional fact discovery, opinions by Plaintiff's experts, and/or trial testimony. I also reserve the right to provide rebuttal opinions and testimony in response to Plaintiff's experts, and rebuttal testimony in response to any of Plaintiff's fact witnesses. Further, I reserve the right to use animations, demonstratives, enlargements of actual exhibits, and other information in order to illustrate my opinions.

187. When called upon to do so, I will offer testimony at trial or otherwise regarding these opinions and will offer rebuttal testimony as appropriate throughout the remainder of this proceeding.

Executed on 7th day of May, 2020,

Alan C. Bovik

CERTIFICATE OF SERVICE

I hereby certify that all counsel of record who are deemed to have consented to electronic service are being served this 7th day of May, 2020 with a copy of this document via electronic mail.

Dated: May 7, 2020

/s/ Kristin Godfrey
Kristin Godfrey