

Declaration of R. Jacob Baker in Support of
Petition for *Inter Partes* Review of
U.S. Patent No. 8,223,117 B2

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NINTENDO CO., LTD., and
NINTENDO OF AMERICA INC.
Petitioners

v.

POLARIS POWERLED TECHNOLOGIES, LLC
Patent Owner

Case IPR 2023-00778
U.S. Patent No. 8,223,117 B2
Issue Date: July 27, 2012

Title: METHOD AND APPARATUS TO CONTROL DISPLAY BRIGHTNESS
WITH AMBIENT LIGHT CORRECTION

DECLARATION OF R. JACOB BAKER, PH.D., P.E.

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I, R. Jacob Baker, declare as follows:

I. INTRODUCTION AND QUALIFICATIONS

1. My name is R. Jacob Baker Ph.D., P.E., and I am a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas. I have prepared this declaration as an expert witness on behalf of Petitioner Nintendo Co., Ltd., and Nintendo of America Inc. In this declaration, I will give my opinion as to whether claims 1, 2, 7, 9, 15, and 16 of U.S. Patent No. 8,223,117 (“the ’117 patent”) (**EX1001**) are valid. I also provide herein the technical bases for these opinions, as appropriate.

2. This declaration contains statements of my opinions formed to date, and the bases and rationale for these opinions. I may offer additional opinions based on further review of materials in this case, including opinions and/or testimony of other expert witnesses.

3. For my efforts in connection with the preparation of this declaration, I have been compensated at my usual and customary rate for this type of consulting activity. My compensation is in no way contingent on the results of these or any other proceedings related to the ’117 patent.

A. Qualifications / Professional Background

4. My qualifications generally are set forth in my Curriculum Vitae, which

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is attached as **Appendix A**. Appendix A also includes a list of the publications I have authored and a list of the other cases in which I have testified during the last five years.

5. I have been working as an Engineer since 1985 and I have been teaching Electrical and Computer Engineering courses since 1991. I am currently a Professor of Electrical and Computer Engineering at the University of Nevada, Las Vegas (“UNLV”).

6. I received B.S. and M.S. degrees in Electrical Engineering from UNLV in 1986 and 1988, respectively. I received my Ph.D. in Electrical Engineering from the University of Nevada, Reno, in 1993.

7. My doctoral research, culminating in the award of a Ph.D., investigated the use of power MOSFETs in the design of very high peak power, and high-speed, instrumentation. I developed techniques to reliably stack power MOSFETs to switch higher voltages, that is, greater than 1,000 V and 100 Amps of current with nanosecond switching times. This work was reported in the paper entitled “Transformerless Capacitive Coupling of Gate Signals for Series Operation of Power MOSFET Devices,” published in the IEEE Transactions on Power Electronics. The paper received the Best Paper Award in 2000.

B. Industry Experience

8. I have done technical and expert witness consulting for over 200 companies and their subsidiaries since I started working as an engineer in 1985. From 1985 to 1993, I worked for EG&G Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapon tests at the Nevada test site. During this time, I designed, and oversaw the fabrication of, over 30 electronic and electro-optic instruments, including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame and bit-syncs, data converters, streak-camera sweep circuits, Pockel's cell drivers, micro-channel plate gating circuits, charging circuits for battery backup of equipment for recording test data, and analog oscilloscope electronics.

9. My work during this time, as one example, had a direct impact on my doctoral research work using power MOSFETs, subsequent publishing efforts, and industry designs. In addition to the 2000 Best Paper Award from the IEEE Power Electronics Society, I published several other papers in related areas while working in industry. I hold a patent, Patent No. 5,874,830, in the area of power supply design, titled, "Adaptively biased voltage regulator and operating method," which was issued on February 23, 1999. I have designed dozens of linear and switching power supplies for commercial products and scientific instrumentation.

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10. I am a licensed Professional Engineer and have extensive industry experience in circuit design, fabrication, and manufacture of Dynamic Random Access Memory (DRAM) semiconductor integrated circuit chips, Phase-Change Random Access Memory (PCRAM) chips, displays, and CMOS Image Sensors (CISs) at Micron Technology, Inc. (“MTI”) in Boise, Idaho. I spent considerable time working on the development of flash memory chips while at MTI. My efforts resulted in more than a dozen patents relating to flash memory. One of my projects at MTI included the development, design, and testing of circuit design techniques for a multi-level cell (MLC) flash memory using signal processing. This effort resulted in higher-density memories for use in solid-state drives and flash memory cards having an ATA interface that are ubiquitous in consumer electronics, including cameras and data storage systems. Further, the use of higher-density memory can result in fewer changes in the flash translation layer for logical-to-physical addressing, less need for garbage collection, and larger data segments that can improve a computing system’s performance. I also worked on the design of flat panel displays, which resulted in a half-dozen U.S. patents. Another project I worked on at MTI focused on the design of buffers for high-speed double-data rate DRAM, which resulted in around 10 U.S. patents in buffer design. Among many other experiences, I led the development of the delay locked loop (DLL) in the late

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1990s so that MTI DRAM products could transition to the DDR memory protocol, used in mobile and non-mobile (server, desktop, cell phones, tablets, etc.) computing systems as main computer memory, for addressing and controlling accesses to memory via interprocess communications (IPC) with the memory controller (MC). I provided technical assistance with MTI's acquisition of Photobit during 2001 and 2002, including transitioning the manufacture of CIS products into MTI's process technology. Further, I did consulting work at Sun Microsystems and then Oracle on the design of memory modules during 2009 and 2010. This work entailed the design of low-power, high-speed, and wide interconnection methods with the goal of transmitting data to/from the memory module and the MC at higher speeds.

11. I have extensive experience in the development of instrumentation and commercial products in a multitude of areas including: integrated electrical/biological circuits and systems, array (memory, imagers, and displays) circuit design, CMOS analog and digital circuit design, diagnostic electrical and electro-optic instrumentation for scientific research, CAD tool development and online tutorials, low-power interconnect and packaging techniques, design of communication/interface circuits (to meet commercial standards such as USB, firewire, DDR, PCIe, SPI, etc.), circuit design for the use and storage of renewable energy, and power electronics. For example, a part of my research at Boise State,

for many years, focused on the use of Thru-Silicon-Vias (TSVs), aka Thru-Wafer Vias (TWVs), for high-density packaging. These packaging techniques were utilized in the memory module development work I did with Sun Microsystems and Oracle. As another example, I designed circuitry for use in implementing Universal Serial Bus (USB) interface circuits while I did consulting at Tower Semiconductor. I designed PCI communication circuits for IPC between a Graphics Processor Unit (GPU) and memory while consulting for Rendition, Inc.

12. My current research work is focused in part on the design of integrated circuits for wireless sensing using LIDAR (Light Detection And Ranging). I have worked with several companies in the development of these circuits and systems including Freedom Photonics, Aerius Photonics, and FLIR. In the early 1990s, I worked on wireless systems for wideband impulse radar while at Lawrence Livermore Laboratory. Further, part of my research for several years focused on the digitization of IQ channels using delta-sigma modulation. The knowledge and experience gained from this effort are reflected in my textbook CMOS Mixed-Signal Circuit Design and a presentation, which I have presented at several universities and companies, http://cmosedu.com/jbaker/papers/talks/BP_DSM_talk.pdf.

C. Academic Experience

13. I was an adjunct faculty member in the Electrical Engineering

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departments of UNLV and from 1991-1993. From 1993 to 2000, I served on the faculty at the University of Idaho as an Assistant Professor and then as a tenured Associate Professor of Electrical Engineering. In 2000, I joined a new Electrical and Computer Engineering program at Boise State University (“BSU”), where I served as department chair from 2004 to 2007. At BSU, I helped establish graduate programs in Electrical and Computer Engineering including, in 2006, the university’s second Ph.D. degree. In 2012, I re-joined the faculty at UNLV. Over the course of my career as a professor, I have advised more than 100 masters and doctoral students.

14. I have been recognized for my contributions as an educator in the field. While at Boise State University, I received the President’s Research and Scholarship Award (2005), Honored Faculty Member recognition (2003), and Outstanding Department of Electrical Engineering Faculty recognition (2001). In 2007, I received the Frederick Emmons Terman Award (the “Father of Silicon Valley”). The Terman Award is bestowed annually upon an outstanding young electrical/computer engineering educator in recognition of the educator’s contributions to the profession. In 2011, I received the IEEE Circuits and Systems Education Award. I received the Tau Beta Pi Outstanding Electrical and Computer Engineering Professor Award every year it was awarded while I have been back at

UNLV.

15. I have authored several books and papers in the electrical and computer engineering area. My published books include CMOS Circuit Design, Layout, and Simulation (Baker, R.J., Wiley-IEEE, ISBN: 9781119481515 (4th ed., 2019)) and CMOS Mixed-Signal Circuit Design (Baker, R.J., Wiley-IEEE, ISBN: 9780470290262 (2nd ed., 2009) and ISBN: 9780471227540 (1st ed., 2002)). I co-authored DRAM Circuit Design: Fundamental and High-Speed Topics (Keeth, B., Baker, R.J., Johnson, B., and Lin, F., Wiley-IEEE, ISBN: 9780470184752 (2008)), DRAM Circuit Design: A Tutorial (Keeth, B. and Baker, R.J., Wiley-IEEE, ISBN: 0-7803-6014-1 (2001)), and CMOS Circuit Design, Layout and Simulation (Baker, R.J., Li, H.W., and Boyce, D.E., Wiley - IEEE, ISBN: 9780780334168 (1998)). I contributed as an editor and co-author on several other electrical and computer engineering books.

D. Other Relevant Experience

16. I have performed technical and expert witness consulting for more than 200 companies and their subsidiaries and given more than 50 invited talks at conferences, companies, and universities. Further, I am the author or co-author of more than 100 papers and presentations in the areas of electrical and computer engineering design, fabrication, and packaging.

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17. I currently serve, or have served, as a volunteer on the IEEE Press Editorial Board (1999-2004); as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018); as the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015); on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016); as a Distinguished Lecturer for the SSCS (2012-2015); the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for IEEE Solid-State Circuits Magazine; IEEE Kirchhoff Award Committee (2020-2023); and advisor for the student branch of the IEEE at UNLV (2013-present). These meetings, groups, and publications are intended to allow researchers to share and coordinate research. My active participation in these meetings, groups, and publications allowed me to see what other researchers in the field have been doing.

18. In addition to the above, I am an IEEE Fellow for contributions to semiconductor memory design and a member of the honor societies Eta Kappa Nu and Tau Beta Pi.

19. I have been retained by counsel for Petitioners to provide my expert opinion in connection with the above-captioned proceeding as set forth herein.

E. Materials Considered

20. The analysis that I provide in this Declaration is based on my education,

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research, and experience, as well as the documents I have considered. In forming my opinions, I have read and considered U.S. Patent No. 8,223,117 B2 (**EX1001**) and its prosecution history. I have cited to the following documents in my analysis below:

Exhibit No.	Description of Document
1001	U.S. Patent No. 8,223,117 B2 to Bruce R. Ferguson (filed Dec. 17, 2008, issued Jul. 17, 2012) (“117” or “117 patent”)
1003	U.S. Patent No. 4,769,708 to John W. Stoughton (filed Apr. 23, 1987, issued Sep. 6, 1988) (“Stoughton”)
1004	U.S. Patent No. 3,813,686 to Eugene Peter Mierzwinski (filed April 13, 1973, issued May 28, 1974) (“Mierzwinski”)
1005	U.S. Patent No. 3,983,575 to Nagai, et al. (filed May 12, 1975, issued Sept. 28, 1976) (“Nagai”)
1006	Japanese Patent Application Publication No. H6[1994]-308891 to Yoko Shimomura (filed Apr. 23, 1993, published Nov. 4, 1994) (“Shimomura”)
1007	Certified Translation of Shimomura, including certification of Tonja Shepard
1008	Excerpts from Donald G. Fink, Television Engineering Handbook, First Edition, McGraw-Hill Book Company (1957) (“Fink”)
1009	U.S. Patent No. 3,096,399 to L.P. Thomas, Jr. (filed December 30, 1960, issued July 2, 1963) (“Thomas”)

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Exhibit No.	Description of Document
1010	Gildo Cecchin, <i>One Knob Picture Control</i> , published in IEEE Transactions on Broadcast and Television Receivers, No. 3, pp.179-184 (August 1974) (“Cecchin”)
1011	U.S. Patent No. 4,511,921 to Wayne E. Harlan et al. (filed June 16, 1982, issued April 16, 1985) (“Harlan”)
1012	U.S. Patent No. 6,798,395 to Atsushi Yamauchi et al. (filed June 19, 2000, issued September 28, 2004) (“Yamauchi”)
1013	U.S. Patent No. 6,947,017 B1 to Shawn R. Gettemy (filed August 29, 2001, issued September 20, 2005) (“Gettemy”)
1014	Excerpts from Philip Kerman, <i>ActionScripting in FLASH</i> (2001) (“Kerman”)
1015	Excerpts from Gary Rosenzweig, <i>Using Macromedia Director 8</i> (2000) (“Rosenzweig”)
1016	U.S. Patent No. 7,110,062 B1 to J. Turner Whitted et al. (filed April 26, 1999, issued September 19, 2006) (“Whitted”)
1017	U.S. Patent No. 7,928,955 B1 to Cynthia S. Bell (filed March 13, 2000, issued April 19, 2011) (“Bell”)
1018	Excerpts from Eugene D. Nichols et al., <i>Mathematics Dictionary and Handbook</i> (1993)
1019	U.S. Patent No. 6,207,943 B1 to Thomas C. Smelker (filed October 30, 1998, issued March 27, 2001 (“Smelker”)
1020	U.S. Patent Application Pub. No. 2002/0167637 A1 (filed February 21, 2002, published November 14, 2002) (“Burke”)
1021	U.S. Patent No. 6,618,042 B1 to John P. Powell (filed October 28, 1999, issued September 9, 2003 (“Powell”)

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Exhibit No.	Description of Document
1022	Don A. Gregory, et al., <i>Full Complex Modulation Using Liquid-Crystal Televisions</i> , Applied Optics, Vol. 31, No. 2, pp. 163-165 (1992)
1023	Hee-Chul Kim, et al., <i>An Image Interpolator with Image Improvement for LCD Controller</i> , IEEE Transactions on Consumer Electronics, Vol. 47, No. 2, pp. 263-271 (May 2001)
1024	U.S. Patent No. 5,825,408 to Masami Yuyama et al. (filed January 11, 1996, issued October 20, 1998) (“Yuyama”)
1025	Office Action Summary and Detailed Action from ’117 Patent (filing 12/17/2008, notification date 11/07/2011)
1026	Expert Report of Dr. Ravin Balakrishnan dated January 25, 2023, served in <i>Polaris PowerLED Technologies, LLC v. Nintendo Co., Ltd., et al</i> , Case No. 2:22-cv-00386-JLR (W.D. Wash.)
1027	Claim construction order entered on January 7, 2019, in <i>Polaris PowerLED Tech., LLC v. Samsung Elecs. Am., Inc.</i> , Case. No. 2:17-cv-00715 (E.D. Tex.)
1028	Claim construction order entered on November 26, 2019, in <i>Polaris PowerLED Tech., LLC v. VIZIO, Inc.</i> , No. 8:18-cv-01571 (C.D. Cal.)
1033	Claim construction order entered on December 23, 2019, in <i>Polaris PowerLED Tech., LLC v. VIZIO, Inc.</i> , No. 8:18-cv-01571 (C.D. Cal.)

II. PERSON OF ORDINARY SKILL IN THE ART

21. I understand that, under the patent laws in effect before the America Invents Act (“AIA”) of 2011, an assessment of claims of a patent filed before the AIA took effect should be undertaken from the perspective of a person of ordinary

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skill in the art as of the earliest claimed priority date (i.e., the “time the invention was made”). I have preliminarily for purposes of my Declaration only assumed that date to be March 28, 2003, the priority date Polaris is asserting in the district court litigation.¹

22. I have also been advised that to determine the appropriate level of a person having ordinary skill in the art, the following factors may be considered: (1) the types of problems encountered by those working in the field and prior art solutions thereto; (2) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (3) the educational level of active workers in the field; and (4) the educational level of the inventor.

23. The '117 patent states that it relates to “brightness control in a visual

¹ I express no opinion on whether the '117 patent is actually entitled to the benefit of the March 28, 2003 priority date. This issue is not relevant here because all the prior art references relied upon predate that date. In the event entitlement to the provisional filing date may later become relevant, for example based on arguments later presented by Patent Owner, I reserve my right to provide opinions on that issue at that time.

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information display system, and more particularly ... to adjusting the brightness level to compensate for changes in ambient lighting.” (’117, 1:19-22.)

24. I understand that the Board in prior IPR petition proceedings adopted LG’s and Hisense’s unopposed definition as follows:

Petitioner asserts a person of ordinary skill in the art “would have had at least a bachelor’s degree in electrical engineering, physics, optics or a related field, and approximately three years of experience with field of visual displays, circuit design, and related technologies.” Pet. 21 (citing Ex. 1102 ¶¶ 19–20).

Patent Owner does not propose a level of ordinary skill in the art or oppose Petitioner’s proposed level of ordinary skill in the art. *See generally* Prelim. Resp.

We, therefore, adopt Petitioner’s level of ordinary skill in the art for purposes of this Decision.

(*LG Electronics v. Polaris PowerLED Technologies, LLC*, IPR2020-01337, (Paper 11, March 9, 2021, p.10 (emphasis added)); *LG Electronics v. Polaris PowerLED Technologies*, IPR2020-01283, (Paper 9, March 9, 2021, pp.8-9).)

25. I have analyzed the Board’s determination and concluded that it is an appropriate formulation of the qualifications of a person of ordinary skill in the art for the ’117 patent. Accordingly, in my opinion, a person of ordinary skill (“POSITA” or “reasonably skilled artisan”) as of March 28, 2003 would have

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possessed at least a bachelor's degree in electrical engineering, physics, optics or a related field, and approximately three years of experience in the fields of visual displays, circuit design, and related technologies.

26. My opinions regarding the level of ordinary skill in the art are based on, among other things, my almost 40 years of experience in the field of electronics, electro optics, imaging, and display design, my understanding of the basic qualifications that would be relevant to an engineer or scientist tasked with investigating methods and systems in the relevant area, and my familiarity with the backgrounds of colleagues, co-workers, and employees, both past and present.

27. Although my qualifications and experience exceed those of the hypothetical person having ordinary skill in the art defined above, my analysis and opinions regarding the '117 patent have been based on the perspective of a person of ordinary skill in the art as of March 2003.

28. I understand that in the district court litigation, Dr. Mark Horenstein, opined that a POSITA have been someone with a Bachelor of Science degree in electrical engineering, physics, or a similar field; and three years of industry experience designing analog electronics; or equivalent background and experience. Alternatively, a POSITA would have been someone with a Master of Science or Master of Engineering degree in electrical engineering, physics, or a similar field;

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and one year of industry experience designing analog electronics; or equivalent background and experience.

29. I understand that in the district court litigation, Patent Owner's expert, Dr. Ravin Balakrishnan, opined that "the person of ordinary skill in the art with respect to the '117 patent at the time of the alleged invention would have had at least a bachelor's degree in electrical engineering, physics, or computer science, and 2-4 years of experience in the field of visual displays and related technologies." (EX1026, 1/25/23 Balakrishnan Rpt., ¶15.)

30. I also understand that in the Samsung district court litigation, in the claim construction order, the district court stated:

Defendants submit:

[A] person of ordinary skill in the art at the time of filing (March 2003) would have at least a bachelor's degree in electrical engineering, physics, or optics, and at least three (3) years of experience with analog circuit design and optical sensors.

ECF No. 121 at 6. Plaintiff submits:

A person of ordinary skill in the art at the time of the invention of the '117 patent would have at least a bachelor's degree in electrical engineering, physics, or computer science, or 2-4 years of experience in the field of visual displays and related technologies.

ECF No. 123 at 5 n.2.

The Court understands that these two proposals regarding one of ordinary skill in the art differ. That said, for the purpose of resolving the claim-construction disputes presented to the Court, there is no meaningful difference between the parties competing proposals.

(EX1027, p.10.)

31. My opinions and analysis in this Declaration would not change if I were to apply either Dr. Horenstein's articulation, Dr. Balakrishnan's articulation, or Samsung's articulation. The differences in these articulations are not material to my analysis and opinions in this Declaration.

III. STATEMENT OF LEGAL PRINCIPLES

A. Claim Construction

32. I understand that a purpose of claim construction is to determine what a person of ordinary skill in the art would have understood the claim terms to mean. Claim terms are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question as of the effective filing date.

33. I understand that the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. I understand that the patent specification, under the legal principles, has been described as the single best guide to the meaning of a claim term, and is thus highly relevant to the interpretation of claim terms. And I understand for terms that do not have a customary meaning within the art, the specification usually supplies the best context of understanding the meaning of those terms.

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34. I further understand that other claims of the patent in question, both asserted and unasserted, can be valuable sources of information as to the meaning of a claim term. Because the claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

35. I understand that the prosecution history can further inform the meaning of the claim language by demonstrating how the inventors understood the invention and whether the inventors limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be. Extrinsic evidence, such as dictionaries, may also be consulted in construing the claim terms.

36. I understand that, in *Inter Partes* Review (IPR) proceedings, a claim of a patent shall be construed using the same claim construction standard that would be used to construe the claim in a civil action filed in a U.S. district court (which I understand is called the “*Phillips*” claim construction standard), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37. I have been instructed by counsel to apply the “*Phillips*” claim

construction standard for purposes of interpreting the claims in this proceeding, to the extent they require an explicit construction. The description of the legal principles set forth above thus provides my understanding of the “*Phillips*” standard as provided to me by counsel.

38. I understand that certain terms appearing in the challenged claims have been the subject of dispute in the district court litigation. For purposes of my analysis here, I do not believe express claim constructions are necessary because the prior art renders the claim obvious under the claim constructions proposed by either party in the district court litigation.

B. Obviousness

39. I understand that a patent claim is obvious if, as of the effective filing date, it would have been obvious to a person having ordinary skill in the field of the technology (the “art”) to which the claimed subject matter belongs.

40. I understand that the following factors should be considered in analyzing obviousness: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims; and (3) the level of ordinary skill in the pertinent art. I also understand that certain other facts known as “secondary considerations” such as commercial success, unexplained results, long felt but unsolved need, industry acclaim, simultaneous invention, copying by others, skepticism by experts

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in the field, and failure of others may be utilized as indicia of nonobviousness. I understand, however, that secondary considerations should be connected, or have a “nexus,” with the invention claimed in the patent at issue.

41. I understand that a reference qualifies as prior art for obviousness purposes when it is analogous to the claimed invention. The test for determining what art is analogous is: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the field of the inventor’s endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

42. I understand that a person of ordinary skill in the art is assumed to have knowledge of all prior art. I understand that one skilled in the art can combine various prior art references based on the teachings of those prior art references, the general knowledge present in the art, or common sense. I understand that a motivation to combine references may be implicit in the prior art, and there is no requirement that there be an actual or explicit teaching to combine two references. Thus, one may take into account the inferences and creative steps that a person of ordinary skill in the art would employ to combine the known elements in the prior art in the manner claimed by the patent at issue. I understand that one should avoid “hindsight bias” and ex post reasoning in performing an obviousness analysis. But

this does not mean that a person of ordinary skill in the art for purposes of the obviousness inquiry does not have recourse to common sense.

43. I understand that when determining whether a patent claim is obvious in light of the prior art, neither the particular motivation for the patent nor the stated purpose of the patentee is controlling. The primary inquiry has to do with the objective reach of the claims, and that if those claims extend to something that is obvious, then the entire patent claim is invalid.

44. I understand one way that a patent can be found obvious is if there existed at the time of the invention a known problem for which there was an obvious solution encompassed by the patent's claims. I understand that a motivation to combine various prior art references to solve a particular problem may come from a variety of sources, including market demand or scientific literature. I understand that a need or problem known in the field at the time of the invention can also provide a reason to combine prior art references and render a patent claim invalid for obviousness. I understand that familiar items may have obvious uses beyond their primary purpose, and that a person of ordinary skill in the art will be able to fit the teachings of multiple prior art references together like the pieces of a puzzle. I understand that a person of ordinary skill is also a person of at least ordinary creativity. I understand when there is a design need or market pressure to solve a

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problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good reason to pursue the known options within his or her technical grasp. If this finite number of predictable solutions leads to the anticipated success, I understand that the invention is likely the product of ordinary skill and common sense, and not of any sort of innovation. I understand that the fact that a combination was obvious to try might also show that it was obvious, and hence invalid, under the patent laws. I understand that if a patent claims a combination of familiar elements according to known methods, the combination is likely to be obvious when it does not more than yield predictable results. Thus, if a person of ordinary skill in the art can implement a predictable variation, an invention is likely obvious. I understand that combining embodiments disclosed near each other in a prior art reference would not ordinarily require a leap of inventiveness.

45. I understand that obviousness may be shown by demonstrating that it would have been obvious to modify what is taught in a single piece of prior art to create the patented invention. Obviousness may also be shown by demonstrating that it would have been obvious to combine the teachings of more than one item of prior art. I understand that a claimed invention may be obvious if some teaching, suggestion, or motivation exists that would have led a person of ordinary skill in the art to combine the invalidating references. I also understand that this suggestion or

motivation may come from the knowledge of a person having ordinary skill in the art, or from sources such as explicit statements in the prior art. I understand that when there is a design need or market pressure, and there are a finite number of predictable solutions, a person of ordinary skill may be motivated to apply common sense and his skill to combine the known options in order to solve the problem.

46. I understand the following are examples of approaches and rationales that may be considered in determining whether a piece of prior art could have been combined with other prior art or with other information within the knowledge of a person having ordinary skill in the art:

- (1) Some teaching, motivation, or suggestion in the prior art that would have led a person of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
- (2) Known work in one field of endeavor may prompt variations of it for use in the same field or a different field based on design incentives or other market forces if the variations would have been predictable to a person of ordinary skill in the art;
- (3) Combining prior art elements according to known methods to yield predictable results;

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- (4) Applying a known technique to a known device, method, or product ready for improvement to yield predictable results;
- (5) Applying a technique or approach that would have been “obvious to try” (choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success);
- (6) Simple substitution of one known element for another to obtain predictable results; or
- (7) Use of a known technique to improve similar products, devices, or methods in the same way.

47. I understand that, when determining whether a claimed combination is obvious, the correct analysis is not whether one of ordinary skill in the art, writing on a blank slate, would have chosen the particular combination of elements described in the claim. Instead, I understand the correct analysis considers whether one of ordinary skill, facing the wide range of needs created by developments in the field of endeavor, would have seen a benefit to selecting the combination claimed.

48. I understand that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference. The test for obviousness, in other words, is not whether the references could be physically combined but whether the claimed inventions are rendered

obvious by the teachings of the prior art as a whole.

IV. THE '117 PATENT

A. Overview of the Specification

49. The '117 patent is directed to systems and methods for controlling the brightness of a visual display, including “adjusting the brightness level to compensate for changes in ambient lighting.” (**EX1001**, '117, 1:19–22.) The '117 patent discloses systems and methods for adjusting the brightness of a visual display based on a user input preferences and ambient lighting conditions, including by taking “the mathematical product of a light sensor output and user selectable brightness control” to “vary backlight intensity in LCD applications.” (*Id.*, 1:60–67.)

50. The '117 patent acknowledges prior art systems where “an ambient light sensor is used in a closed-loop configuration to adjust the backlight level in response to the ambient light level.” (*Id.*, 1:51–53.) The '117 patent further acknowledges that some of these systems take user preferences into account, but not “usually.” (*Id.*, 1:53–54.)

B. The Challenged Claims

51. This Declaration addresses claims 1, 2, 7, 9, 15, and 16 of the '117 patent. Independent claim 1 is representative and recites:

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1. A brightness control circuit with selective ambient light correction comprising:
 - [a] a first input configured to receive a user signal indicative of a user selectable brightness setting;
 - [b] a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level;
 - [c] a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal; and
 - [d] a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.

('117, 12:28-43 (Claim 1; bracketed notation (e.g., [a]) added).)

52. Claim 2 recites:

The brightness control circuit of claim 1, wherein the dark level bias is provided to the multiplier such that the amount of adjustment to the combined signal is dependent on the user selectable brightness setting.

53. Claim 7 recites:

The brightness control circuit of claim 1, wherein the brightness control

signal is provided to a display driver to control backlight illumination of a liquid crystal display.

54. Claim 9 recites:

The brightness control circuit of claim 1, further comprising a second input configured to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode, wherein the selection signal enables the light sensor in the auto mode and disables the light sensor in the manual mode.

55. Independent claim 15 recites:

15. A method to selectively provide ambient light correction, said method comprising:

- [a] receiving a user input signal indicative of a user selectable brightness setting;
- [b] selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level; and
- [c] adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a

predetermined level when the ambient light level decreases to approximately zero.

56. Claim 16 recites:

The method of claim 15, wherein the step of selectively multiplying the input signal with the sense signal is performed by a software algorithm, an analog circuit, or a mixed-signal circuit.

57. I address the claims further in my detailed analysis in **Part V** below.

C. Claim Constructions from Prior Samsung and Vizio District Court Litigations

58. I understand that district court judges in two prior litigations between Patent Owner and Samsung and Vizio construed a number of claim terms of the '117 patent, summarized as follows:

Claim Term	Samsung and Vizio District Court Constructions
“ambient light” (claim 1, 15)	No construction (<i>Vizio</i> Litigation)
“a first input configured to receive a user signal indicative of a user selectable brightness setting” (claim 1)	“first input actually programmed or implemented with hardware or software to receive a user signal indicative of a user selectable brightness setting” (<i>Vizio</i> Litigation)

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Claim Term	Samsung and Vizio District Court Constructions
“a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal” (claim 1) “selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level” (claim 15)	• “a multiplier actually programmed or implemented with hardware or software to selectively generate a combined signal based on both the user signal and the sensing signal” (<i>Vizio</i> Litigation) ○ “multiplier configured to” means the multiplier must be “actually programmed or implemented with hardware or software” (<i>Vizio</i> Litigation) • “combined signal includes, but is not necessarily limited to, the product of the user signal and the sensing signal” (<i>Samsung</i> Litigation)
“a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display” (claim 1) “adjusting the combined signal with a dark level bias” (claim 15)	• “dark level bias” means “a value that causes a deviation from the combined signal, where the value is a voltage value of an electrical signal or value of a software variable” (<i>Vizio</i> Litigation) ○ “a dark level bias actually programmed or implemented with hardware or software to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display” (<i>Vizio</i> Litigation) • “dark level bias” terms have their “plain and ordinary meaning without the need for further construction” (<i>Samsung</i> Litigation)
“approximately zero” (claims 1, 15)	“zero or a level close enough to zero that a light sensor would measure zero or a corresponding sensing signal would round to zero” (<i>Vizio</i> Litigation)

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Claim Term	Samsung and Vizio District Court Constructions
“second input configured to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode” (claim 9)	“second input actually programmed or implemented with hardware or software to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode” (<i>Vizio</i> Litigation)

(EX1027, EX1028.) As I will demonstrate below, it is unnecessary for me to separately construe terms from the ’117 patent or opine on whether or not the prior district court constructions are correct. Although I understand that Petitioners and Patent Owner have proposed competing constructions for certain terms in the ’117 patent in pending litigation, those disputes do not materially impact how the prior art discussed in my Declaration applies to the challenged claims. As I will demonstrate below, the prior art renders the challenged claims obvious under the prior district court constructions, and constructions proposed by Petitioners or Patent Owner in the pending litigation.

V. APPLICATION OF THE PRIOR ART TO CHALLENGED CLAIMS

59. I have reviewed and analyzed the prior art references and materials listed in **Part I.E** above. In my opinion the claims of the ’117 patent would have been obvious to a person of ordinary skill in the art based on the following combinations of the prior art.

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Ground	Claims	Basis for Challenge Under § 103
1	1, 2, 9, 15, 16	Stoughton, Mierzwinski, Nagai
2	7	Stoughton, Mierzwinski, Nagai, Shimomura
3	1, 2, 7, 9, 15, 16	Gettemy, Kerman, Rosenzweig, Whitted, Bell

60. I am informed by counsel that each of the references cited in the grounds above qualifies as prior art to the challenged claims because each reference was filed and/or published before the priority date Patent Owner is asserting in the district court litigation (March 28, 2003).

A. Brief Summary and Overview of the Prior Art

61. The challenged claims of the '117 patent attempt to lay claim to techniques for adjusting the brightness of a display based on both user input and current ambient lighting conditions. But these techniques were well-known long before the '117 patent.

62. My Declaration presents two separate and independent base grounds for demonstrating the obviousness of the challenged claims. I understand that before the district court case against Petitioner was stayed, the parties were in the middle of exchanging proposed claim construction materials. The case was stayed before the parties filed any briefing with the district court, and before any claim construction

rulings. I therefore provide Grounds 1 and 2, which illustrate the challenged claims are invalid, even if the claims are construed more narrowly. As explained below, I understand that Patent Owner has taken broad claim construction positions in district court in order to read its claims onto software implementations. When those broad claim constructions by Patent Owner are applied, the challenged claims are clearly invalid under Grounds 1, 2, and 3. In short, when narrower constructions are applied, Grounds 1 and 2 clearly invalidate the challenged claims. When Patent Owner's constructions are applied, Grounds 1, 2, and 3 clearly invalidate the challenged claims.

63. **Grounds 1 and 2** rely on references that use conventional hardware-based componentry, whereas **Ground 3** presents prior art that discloses a brightness control system that relies on software executing on a processor. With respect to **Ground 1**, it relies on a combination of Stoughton (EX1003), Mierzwinski (EX1004), and Nagai (EX1005). Stoughton serves as the base reference for **Ground 1**. As demonstrated below, the system of Stoughton changes the contrast of a display based on a signal from ambient light sensor circuitry and a signal from a binary rate multiplier representative of a user contrast setting—leading to an output signal reflecting the product of the two signals that the Stoughton circuit maintains above a minimum threshold using a limiter circuit. **Ground 1** relies on Mierzwinski

for the simple point that it would have been obvious to a POSITA to use Stoughton's circuit to control both the brightness and the contrast of a display. **Ground 1** then relies on Stoughton in combination with **Nagai** to show that it would have been obvious to operate Stoughton's system in such a way that a user could toggle the system between auto and manual modes.

64. **Ground 2** is directed to dependent claim 7, which recites: "... display driver to control backlight illumination of a liquid crystal display." Ground 2 relies on Ground 1, but adds **Shimomura** (EX1006, EX1007), which teaches a "Liquid Crystal Display drive unit" and "Backlight power supply unit."

65. With respect to **Ground 3**, it relies on a combination of **Gettemy** (EX1013), **Kerman** (EX1014), **Rosenzweig** (EX1015), **Whitted** (EX1016), and **Bell** (EX1017). Gettemy serves as the base reference for **Ground 3** that discloses the majority of the claim limitations, including adjusting the brightness of a display based on both user input and current ambient lighting conditions. As demonstrated below, the system of Gettemy discloses software that allows the user to specify a display brightness using a conventional "slider" user interface control, which the system can further increase or decrease based on current ambient lighting levels detected by ambient light sensors. **Ground 3** relies on Gettemy in combination with **Kerman** and **Rosenzweig**, which provide more detail about the user interface slider

controls used throughout Gettemy, and how the values associated with a slider position are calculated. These references, as demonstrated below, confirm that the brightness adjustments disclosed in Gettemy, including all of the specific examples in its figures, operate by multiplying information that fully discloses the claimed “user signal” and “sensing signal.” Finally, **Ground 3** further combines with **Whitted** and **Bell** to show that it would have been obvious to include the claimed “dark level bias” feature to ensure that the display brightness never drops below a desired predetermined minimum level.

1. Brief Summary of References For Grounds 1 and 2

(a) Stoughton (EX1003)

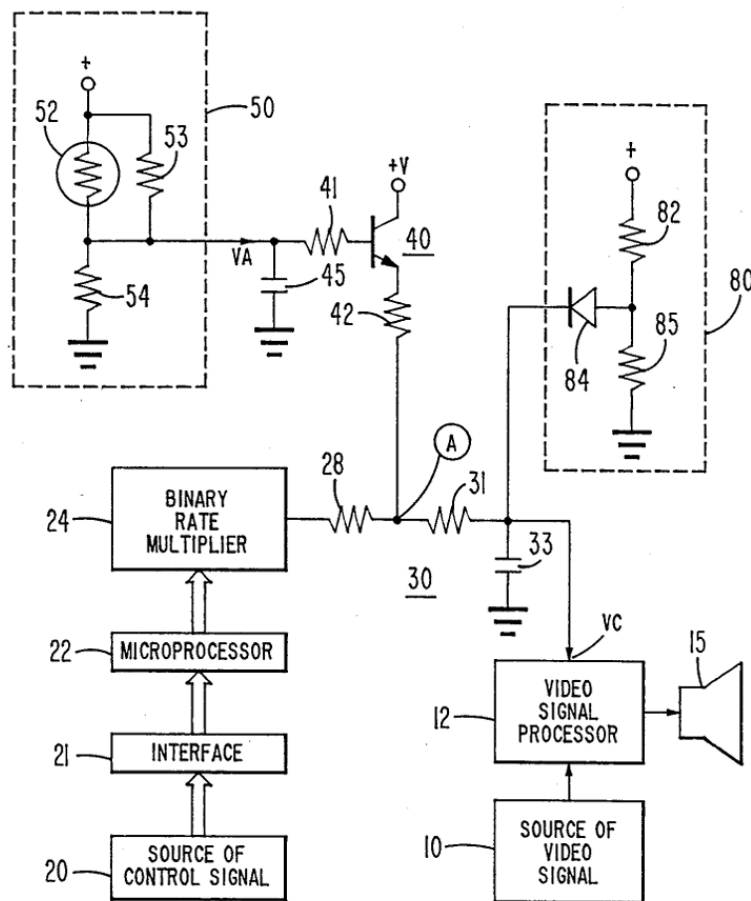
66. **Stoughton**, U.S. Patent No. 4,769,708, is titled “Manual and automatic ambient light sensitive picture control for a television received.” Stoughton describes a video signal processing system that “control[s] the amplitude of a video signal” using a “contrast control signal” that is a “function of a manual contrast control component provided by a viewer, and an automatic contrast control component provided by a light sensitive circuit responsive to ambient light conditions.” (Stoughton, Abstract.) Stoughton’s system includes a limiter circuit that prevents the video signal from being “extinguished due to excessive video signal attenuation in response to the control signal.” (Stoughton, Abstract.) I am informed

that Stoughton qualifies as prior art because it was published September 6, 1988, before the earliest date to which the '117 Patent claims priority.

Overview of Control System

67. Stoughton discloses that in a contrast control system, “circumstances can be such that the coaction of the manual contrast control setting and contrast control as a function of ambient light will attenuate the video signal so as to almost or completely extinguish a displayed image.” (Stoughton, 1:61–65.) Stoughton discloses that “[t]his situation is disturbing and may lead a viewer to believe that the receiver is inoperative, leading to an unnecessary service call.” (Stoughton , 1:68–2:2.) Stoughton’s system prevents this situation using the limiter circuit, which acts to “limit[] a contrast control voltage to prevent a displayed image from being extinguished due to excessive video signal attenuation.” (Stoughton, 2:14-20.)

68. Figure of Stoughton 1 provides an exemplary circuit diagram of the disclosed contrast control system:



(Stoughton, Fig. 1.) Figure 1 above shows a video signal connected from a source **10** to a video signal processor **12**, “which amplifies the video signal to a magnitude suitable for driving an image displaying kinescope **15**.” (Stoughton, 2:34-37.) A POSITA would have understood that a kinescope is a cathode ray tube (CRT) display. Stoughton indicates that the video signal magnitude is the “peak-to-peak amplitude of the video signal, and hence the contrast of a displayed image[.]” (Stoughton, 2:37-40.) Similar to the techniques described in Gettemy and Whitted

below, amplification of the video signal (and thus its brightness) is controlled in response to both **(1)** a control signal from a source **20**, which “constitutes part of a viewer operated remote control unit,” and **(2)** a signal from an “ambient light responsive light dependent resistor (LDR) **52**.” (Stoughton, 3:22-26.) Stoughton describes both in detail, as outlined below.

User-Provided Control Signal

69. For the user-provided control signal, the signal originates from source **20** (such as a remote control) as a “binary infrared signal,” which interface unit **21** receives and translates into a binary electrical signal “suitable for processing” by microprocessor **22**. (Stoughton, 2:41-48.) Specifically, interface unit **21** “formats the received binary signal into a serial or parallel binary signal containing coded information which provides microprocessor **22** with suitable instructions for incrementing or decrementing the digital word stored in memory associated with the contrast function.” (Stoughton, 2:48–53.)

70. Microprocessor **22** outputs a binary signal to binary rate multiplier (BRM) **24**, which outputs a signal with a pulse width or duty factor determined by the processor output signal. (Stoughton, 2:54–63.) Figure 2 of Stoughton provides more detail on generating this signal:

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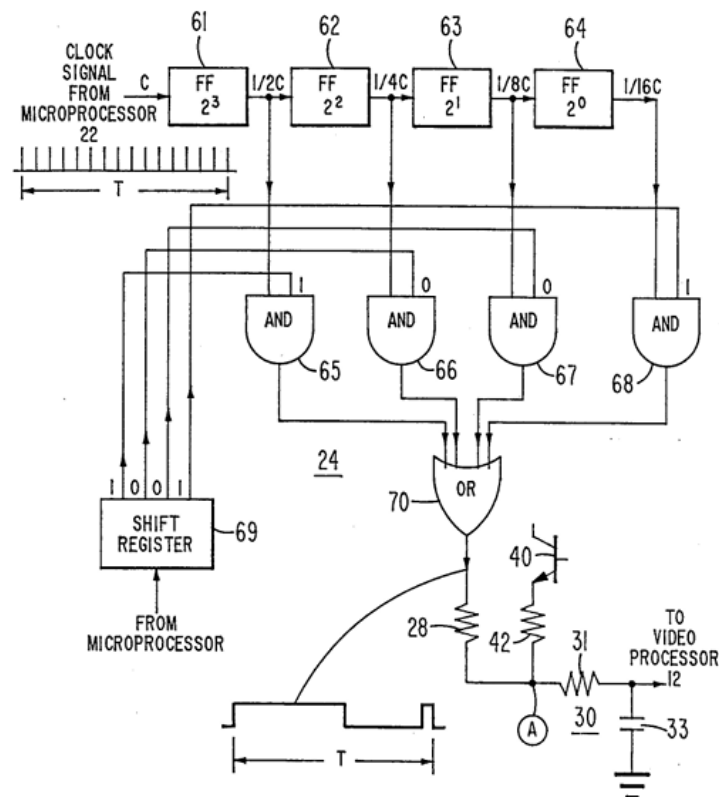


Fig. 2

(Stoughton, Fig. 2.) The microprocessor outputs a binary signal to shift register, which leads to a signal at the output of OR-gate 70 to be high for a fraction of time equal to the binary number in the shift register divided by 2^n . (Stoughton, 4:30-35.) For example, for four-bit binary output signal “1001,” which equals 9 in decimal, the signal at the output of OR-gate 70 will be high 9/16 of the time—where 16 is equal to 2^4 . The numerator value (9 in the 1001 example) can vary between 0 and 2^n (16 for a four-bit binary signal). (Stoughton, 4:31-32.)

Ambient Light-Dependent Signal

71. The output of OR-gate **70** is combined at node A with a voltage signal originating from source **50**, which generates a voltage that changes in magnitude as light responsive light dependent resistor (LDR) **52** changes in impedance in response to a change in the intensity of detected light. (Stoughton, 3:31-36.) Stoughton indicates that LDR **52** is “positioned close to the display screen of kinescope 15 so that the amount of ambient light striking LDR **52** is proportional to the amount of light striking the kinescope display screen.” (Stoughton, 3:26-30.)

**Combination of User-Provided Control Signal and
Ambient Light-Dependent Signal**

72. Control voltage V_A from source **50** “modifies the DC value associated with the BRM output signal at node A in response to ambient lighting conditions, thereby providing an auxiliary means of controlling the contrast of a displayed image in response to ambient lighting conditions.” (Stoughton, 3:36-41.) This results in a DC voltage across capacitor **33** equal to the fractional on-time of the binary signal at the output of OR-gate **70** ($N \div 2^n$) multiplied by the voltage at the emitter of transistor **40** (V_P), yielding the following expression disclosed by Stoughton:

$$\frac{N}{2^n} \times V_P$$

(Stoughton, 4:25.) As I will explain in more detail below, the first factor ($N \div 2^n$) above represents the user-provided control signal and the second factor (VP) is representative of the ambient light-dependent signal – and as shown above, they are multiplied together. As indicated by Figure 1, the resulting voltage signal is then input to video signal processor **12**, where the processor controls the video signal amplitude output to kinescope **15** based on the input voltage signal.

Minimum Contrast Control Voltage

73. Stoughton’s Figure 1 circuit also includes limiter circuit **80**, which “assures that the minimum contrast control voltage ... remains sufficiently greater than a voltage ... which would otherwise attenuate the video signal sufficiently to virtually extinguish a displayed image, particularly under low ambient light conditions.” (Stoughton, 5:38-42.) Diode **84**² in limiter circuit is “rendered conductive when the voltage across capacitor **33** decreases sufficiently in a direction

² It would have been obvious to a POSITA that **84** in Figure 1 is a diode and **85** is a resistor, based on standard circuit diagram symbols that a POSITA would have recognized. Thus, “**84**” refers to the diode in limiter circuit **80** and “**85**” refers to the resistor in limiter circuit **80**, as shown in Figure 1.

related to reduced image contrast,” causing the voltage across capacitor **33** to be limited to “a value related to the DC voltage appearing at the junction of resistor **82** and **[85]** less the offset voltage drop across diode **[84]**[.]” As a result, limiter circuit serves to maintain the voltage across capacitor **33** (and therefore the magnitude of the video signal transmitted to kinescope **15**) above a certain value even under low ambient light conditions—leading to a minimum brightness level of the video signal on kinescope **15**. (Stoughton, 5:38-43.)

74. Figure 3 of Stoughton demonstrates the impact of limiter circuit **80**:

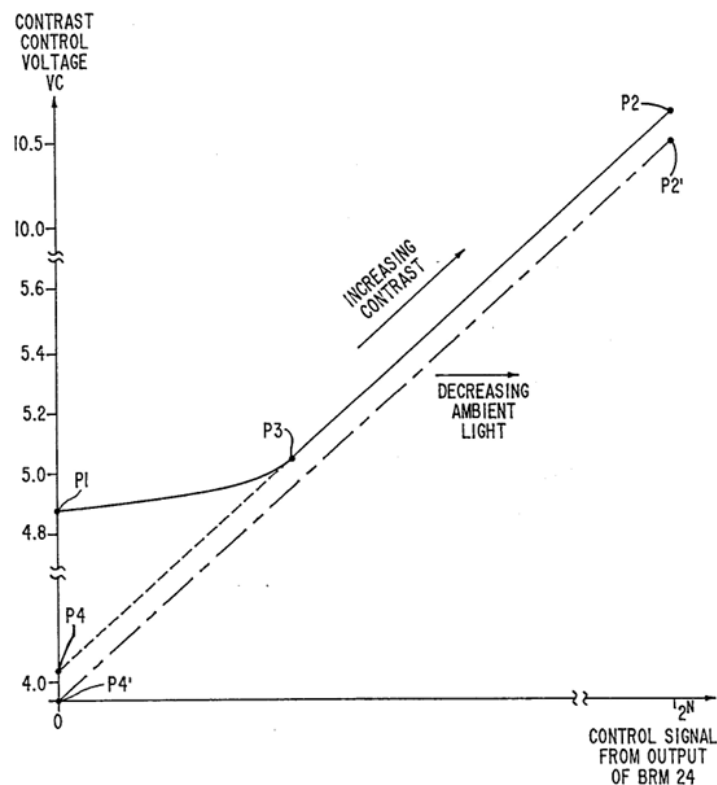


Fig. 3

(Stoughton, Fig. 3.) The x-axis of Figure 3 represents the magnitude of the user-adjustable signal output by BRM 24. This value represents the portion of time the output signal of BRM 24 spends in a high state—which can be anywhere from 0 to 2^n , where “n” is the number of digits in shift register 69 in BRM 24. Figure 3 shows the relationship between the magnitude of the control signal at the output of BRM 24 (from 0 to 2^n) and the control voltage VC applied to the video signal processor 12. (Stoughton, 5:11–14.) The line from P2 to P3 represents the substantially linearly decreasing value of VC as ambient light level is held constant and the magnitude of the control signal output by BRM 24 (from 2^n to 0) decreases to zero. (Stoughton, 5:22–25.) If limiter circuit 80 were not present in the Figure 1 circuit, then as the control signal output by BRM 24 decreased to zero, VC would continue to decrease substantially linearly from P3 to P4. (Stoughton, 5:33–37.) But due to the impact of limiting circuit 80, VC instead begins to decrease more slowly as shown in the line from P3 to P1—ultimately reaching a minimum voltage indicated by P1 between 4.8 and 5.0 V. (Stoughton, 5:50–54, 5:38–50.) I will provide more information about Stoughton in my discussion of the claim limitations below.

(b) Mierzwinski (EX1004)

75. **Mierzwinski**, U.S. Patent No. 3,813,686 is titled “Ambient Light Responsive Control of Brightness, Contrast and Color Saturation.” I am informed

that Mierzwinski qualifies as prior art because it issued on May 28, 1974, before the earliest priority date of the '117 patent.

76. My Declaration relies on Mierzwinski for a limited purpose – for its disclosures of a circuit that adjusts both brightness and contrast based on the ambient light level and user input.

77. Mierzwinski discloses “[a] circuit deployed in a color television receiver for varying the brightness, contrast and color saturation of a displayed picture in accordance with variations in ambient light in the vicinity of a receiver screen[.]” (Mierzwinski, Abstract.)

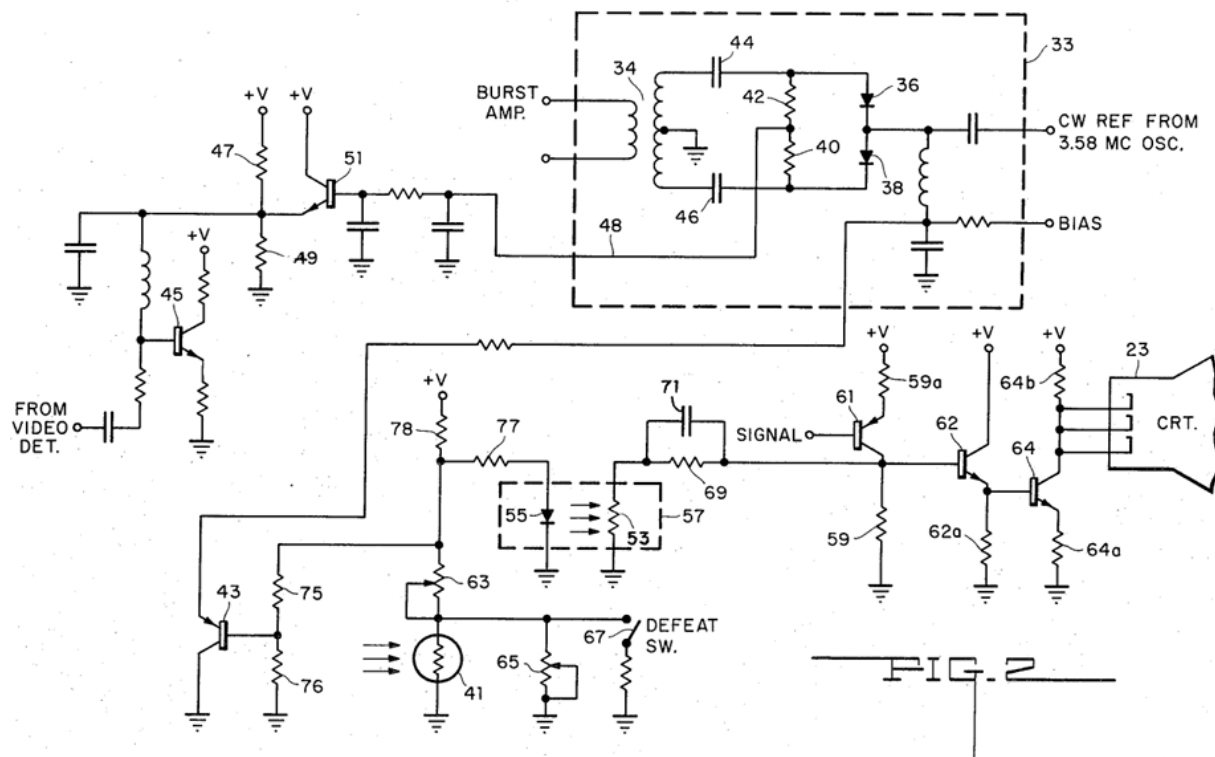
78. Mierzwinski teaches that “[c]onventional television receivers ... have manually operable controls by means of which a viewer may set the level of contrast, intensity, and chroma signal strength to what he feels to be an optimum level for given room lighting conditions. Under changed room lighting conditions, the viewer will obtain the optimum viewing situation by changing these manual controls to a new preferred level.” (Mierzwinski, 1:21-29.)

79. Mierzwinski discloses that it is “an object of the present invention to provide an automatic color saturation control for a color television receiver by providing separate, predetermined gains for the luminance and chroma for a given change in ambient light.” (Mierzwinski, 1:35-44.) Mierzwinski further discloses

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that “[t]he foregoing as well as numerous other objects and advantages of the present invention are achieved by providing a light sensitive element in a television receiver exposed to ambient light in the vicinity of the receiver for separately controlling brightness, contrast, and chroma signal strength of the displayed picture in accordance with the level of ambient light.” (Mierzwinski, 1:47-53.)

80. Mierzwinski discloses the below circuit:



(Mierzwinski, Fig. 2.)

81. Mierzwinski's circuit includes light dependent resistor 41, for which “[t]he resistance of this device is inversely proportional to the intensity of light

incident thereon.” (Mierzwinski, 3:15-17.)

82. Mierzwinski discloses that “[t]he control of brightness (intensity) and contrast is achieved in the present invention by a second light dependent resistor 53 which is optically coupled to a light emitting diode 55. Light emitting diode 55 and light dependent resistor 53 are encapsulated in a light impervious housing illustrated by the dotted line 57. As the room ambient light changes, the change in the resistance of light dependent resistor 41 causes a change in the current through light emitting diode 55. Variations in the current through the light emitting diode cause corresponding variations in the light emitted thereby which in turn cause variations in the resistance of the light dependent resistor 53. The luminance or video amplifier is here illustrated as a three transistor amplifier with the output of the first amplifier stage being across resistor 59. A diminution in the resistance of light dependent resistor 53 causes a lowering of this output impedance and thus a diminution in the gain of the luminance amplifier.” (Mierzwinski, 4:65-5:16.)

83. Mierzwinski further discloses that “[v]ariable resistor 63 being effectively in series with the light dependent resistor 41 may be varied to compensate for differences in specific light dependent resistors so as to establish a desired level of picture brightness, contrast and color saturation for a given level of ambient light. Variable resistance 65 which is in parallel with the light dependent resistor 41 may

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be varied so as to effectively change the range of variation in brightness, contrast and color saturation for a specific range of variations in the ambient light conditions.” (Mierzwinski, 5:25-34.)

(c) Nagai (EX1005)

84. **Nagai**, U.S. Patent No. 3,983,575 is titled “Color Saturation and Contrast Control Circuitry Responsive to Ambient Light.” I am informed that Nagai qualifies as prior art because it issued on September 28, 1976, before the earliest priority date of the ’117 patent.

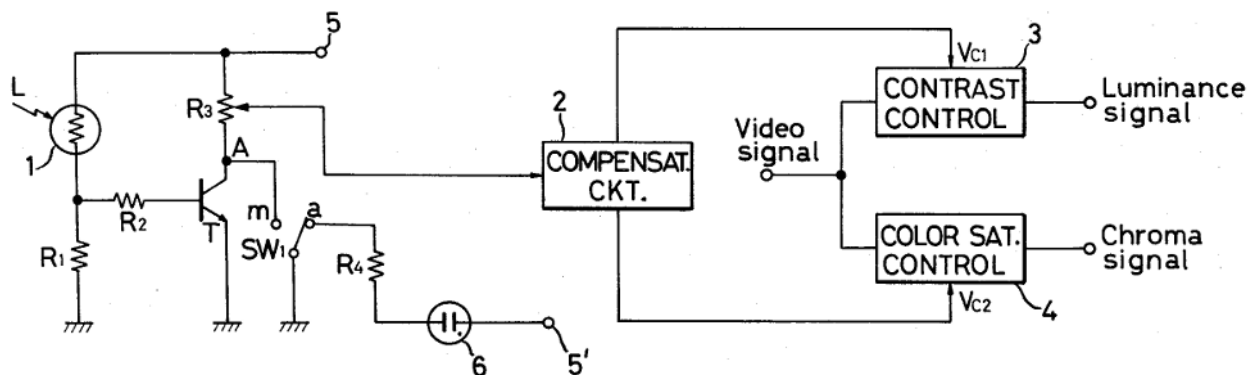
85. My Declaration relies on Nagai for a limited purpose – for its disclosures of a brightness control system in either an automatic or manual mode.

86. Nagai discloses “[i]t is known to use a photo-sensitive device to control the brightness, contrast and color saturation of the reproduced picture of a color television receiver in response to the ambient light level. However, in a conventional television receiver, complex circuits are needed to control the brightness, contrast and color saturation simultaneously, and it is difficult to provide a variable resistor serving both for manual control and fine control in an automatic control condition.” (Nagai, 1:13-21.)

87. Nagai discloses “[a] resistance of which is varied in response to the ambient light level, is connected to a transistor, and a variable resistor having a

movable contact also is connected to the transistor to derive a common control voltage for the contrast control circuit and the color saturation control circuit. By using the teaching of this invention, contrast and color saturation of the reproduced picture of the color television receiver can be well controlled by a simple circuit construction, and further a manual fine control can be achieved even in an automatic control condition.” (Nagai, 1:32-42.)

88. Nagai discloses the following circuit:



(Nagai, Fig. 1.)

89. Nagai discloses that “reference numeral 1 represents a photosensitive element such as a CdS photo cell, R_1 and R_2 represent bias resistors, T a transistor operable as a variable impedance, and R_3 a variable resistor for controlling a reproduced picture of a television receiver.” (Nagai, 2:6-10.) Nagai further discloses that “[r]eference numerals 5 and 5' represent power supply terminals, and SW_1 switch having contacts a and m for selecting an automatic control mode or a

manual control mode.” (Nagai, 2:15-18.)

90. Nagai discloses that “[t]he resistance of the CdS photo cell 1 varies with the level of the ambient light L. A voltage variable with the resistance of the CdS photo cell 1 is applied to the base electrode of the transistor T through the resistor R₂. Accordingly, the collector voltage at point A can vary from zero voltage to the power supply voltage, when the switch SW₁ is closed at the contact a. The variable DC voltage at the point A is applied to the compensating circuit 2 through the variable resistor R₃.” (Nagai, 2:32-40.) Further, “[t]he DC control voltage V_{c1} is applied to the contrast control circuit 3 to control the gain of the control circuit 3.” (Nagai, 2:43-45.)

91. In the automatic control mode, Nagai discloses that “[w]hen the level of the ambient light L becomes higher, the voltage at the point A is lowered to increase the contrast of the reproduced picture and the color saturation thereof.” (Nagai, 2:53-56.) Nagai’s automatic control mode also allows the user the ability to adjust the contrast of the display using variable resistor R₃. (Nagai, 3:30-39.) This is similar to the “automatic mode” described by the ’117 patent, which involves an output signal that adjusts based on both manual user input and automatic adjustment in response to the ambient light level. (*E.g.*, ’117 patent, 2:23-27.)

92. In the manual control mode, Nagai discloses that “the point A is

connected to ground,” and “[t]he reproduced picture can be manually controlled with the variable resistor R₃.” (Nagai, 2:59-63.)

(d) Shimomura (EX1006, EX1007)

93. **Shimomura**, Japanese Patent Application Publication No. H6[1994]-308891, is titled “Display Device.” Shimomura was filed on April 23, 1993, and published on November 4, 1994. I am informed that Shimomura qualifies as prior art to the ’117 patent because it is a published patent application filed and published before the earliest alleged priority date of the ’117 patent.

94. My Declaration cites Shimomura for **Ground 2**, for certain features recited in dependent claim 7. More specifically, my Declaration relies on Shimomura for the brightness control signal being “**provided to a display driver to control backlight illumination of a liquid crystal display.**” (’117, claim 7.)

95. Shimomura teaches a “display device that has a function to automatically control the brightness of the display screen according to changes in the brightness of the surrounding area of the display device, thereby making it easier for the user of the display device to see displayed characters and graphics in various illumination environments.” (Shimomura, ¶[0001].)

96. Shimomura explains that “display devices include **Cathode Ray Tubes (CRTs), Liquid Crystal Displays (LCDs)**, Plasma Display Panels (PDPs),

Electroluminescent (ELs), and **other light-emitting and non-light-emitting devices**, and these devices are arranged in a flat array as multiple pixels to present a display screen.” (Shimomura, ¶[0003].)³ Shimomura explains that in display devices, “the user of the display device can set the brightness of the display screen as desired by operating an adjustment switch that switches the brightness of the display screen in steps, or an adjustment knob that continuously changes the brightness of the display screen so that the displayed characters and graphics are always easy to see in response to various changes in the illumination environment.” (Shimomura, ¶[0004].) Shimomura elaborates that “automatic control features are designed to extend the life of the display device’s backlight unit **3**.” (Shimomura, ¶[0009].)

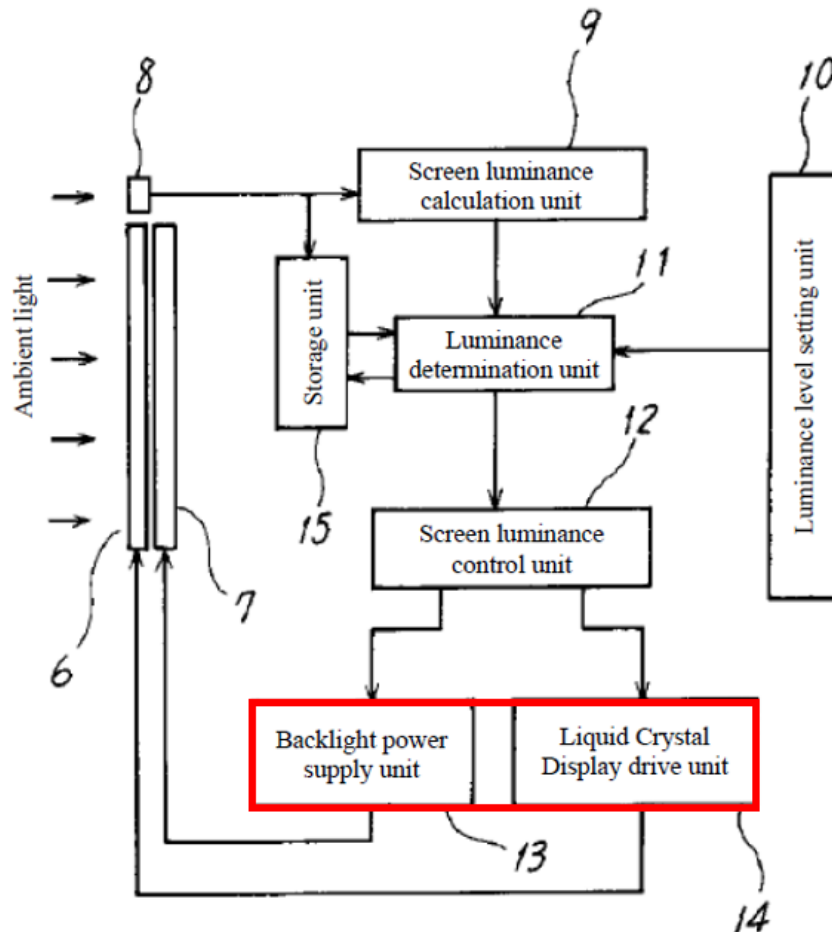
97. To address familiar problems in the field, Shimomura provides “a display device that can ensure legibility in consideration of changes in the characteristics of the human eye and can present characters and graphs that are easy for the user to see by evaluating the legibility of the display screen in response to

³ Except as otherwise noted, all emphasis in quotations from the prior art (such as underlining) was added by me for emphasis.

changes in the illumination environment by using visibility and controlling the luminance of the display screen. (Shimomura, ¶[0013]; *see also* Shimomura, ¶¶[0010-13].)

98. Shimomura teaches, among other things, “**14** is a Liquid Crystal Display drive unit that drives the Liquid Crystal Display elements used in display screen **6** and adjusts the transmittance of the Liquid Crystal Display elements[.]” (Shimomura, ¶[0027].) Shimomura also teaches “**13** is a backlight power supply unit that supplies power to the backlight **7** and controls the luminance of the backlight **7** by receiving signals from the screen luminance control unit **12**[.]” (Shimomura, ¶[0027].) For example, as shown below, Shimomura expressly contemplates a “Backlight power supply unit” at **13** and a “Liquid Crystal Display drive unit” at **14** (circled in red):

[FIGURE 1]



6 --- Display screen
 7 --- Backlight
 8 --- Ambient light receiving unit

(Shimomura, Fig. 1 (annotations added).) The backlight power supply unit supplies power and “controls the luminance of the backlight 7 by receiving signals from the screen luminance control unit 12,” and the Liquid Crystal Display drive unit “drives

the Liquid Crystal Display elements used in display screen 6 and adjusts the transmittance of the Liquid Crystal Display elements[.]” (Shimomura, ¶[0027].)

2. Brief Summary of References For Ground 3

(a) Gettemy (EX1013)

99. **Gettemy**, U.S. Patent No. 6,947,017 B1, is entitled “Dynamic Brightness Range for Portable Computer Displays Based on Ambient Conditions.” I am informed that Gettemy qualifies as prior art because it was filed on August 29, 2001, which is before the earliest alleged priority date of the ’117 patent.

100. As its title indicates, Gettemy discloses techniques for dynamically adjusting the brightness of a computer display based on ambient lighting conditions. The Background of Gettemy explains that portable computer systems are frequently powered using batteries, making power consumption “an important consideration in order to reduce the frequency at which the batteries either need to be recharged or replaced.” (Gettemy, 1:24-31.) “These systems, and others like them, have in common some type of screen for displaying images as part of a user interface. Many different kinds of screens can be used, such as liquid crystal displays, and field emission displays or other types of flat screen displays.” (Gettemy, 1:41-45.)

101. Gettemy identifies several known types of computer displays, including “transmissive” displays (which require backlighting) and “emissive” displays

(which contain lighting elements and thus require no backlighting). (Gettemy, 1:47-2:2.) But Gettemy explains that “[e]missive and transmissive displays can not [sic] be viewed very well in the sun unless the brightness is turned very high. High brightness can reduce the life of the display and cause poor battery performance.” (Gettemy, 2:2-5.) Gettemy identifies conventional approaches for adjusting the brightness of a display, including **(1)** adjusting the display brightness or backlighting based on ambient lighting and **(2)** allowing the user to manually control the brightness setting. (Gettemy, 2:6-17.) Gettemy states that each of these approaches presents drawbacks, including not always providing a comfortable viewing experience (for technique **(1)**) and less-than-optimal battery or backlight usage (for technique **(2)**). (Gettemy, 2:9-11, 2:17-25.)

102. Gettemy purports to address drawbacks of the prior art by disclosing a brightness control system that combines characteristics of both automatic ambient lighting adjustment and manual adjustment. The basic technique is straightforward.

103. Gettemy explains that portable computer includes an ambient light sensor that provides a signal used by a processor to adjust the brightness:

In one embodiment, portable computer system **300** includes one or more light sensors **390** to detect the ambient light and provide a signal to the main processor **310** for determining when to implement a change

in brightness range. Display controller **370** implements display control commands from the main processor **310** such as increasing or decreasing the brightness of the display device **105**.

(Gettemy, 5:31-37.)

104. But the signal from ambient light sensors **390** is not the only basis for brightness adjustment in Gettemy. Gettemy explains that the amount of ambient light is used to adjust the “range” of brightness settings under user control. Figure 5 provides one example of how current ambient light conditions impact the range of the user brightness setting under user control:

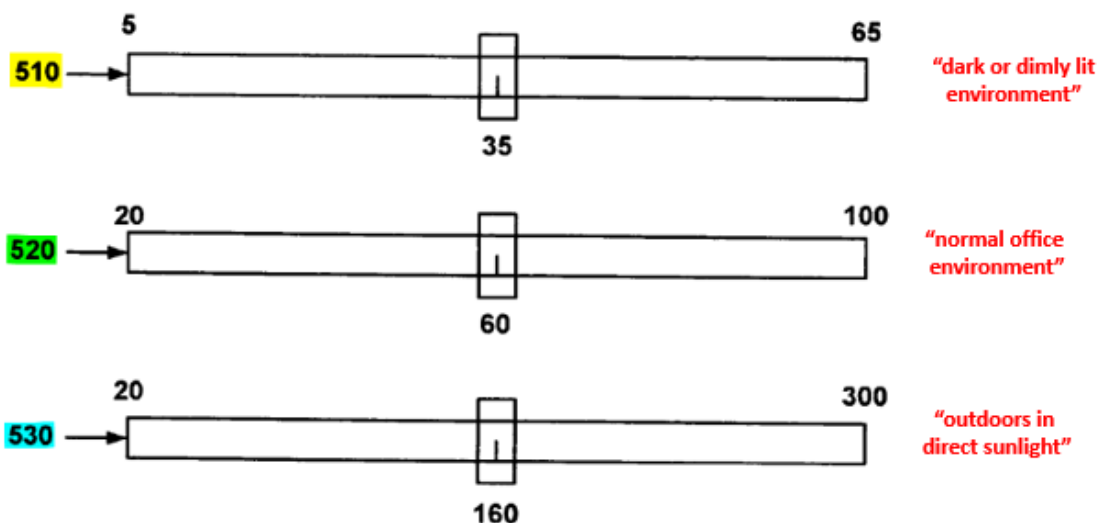


FIGURE 5

(Gettemy, Fig. 5 (highlighting and annotations added).) Figure 5 shows a user-selectable slider allowing the user to increase or decrease the brightness of the display, respectively, by moving the slider to the right or the left. (Gettemy, Figs.

4-5, 5:38-54.) Figure 5 shows the slider in the midpoint position within three different brightness ranges, each based on different ambient lighting conditions. (Gettemy, 6:7-10.) “Range **510** may be used when in a dark or dimly lit environment. Range **520** may be used in a normal office environment and range **530** may be used outdoors in direct sunlight.” (Gettemy, 5:50-53.) The numerical values for the ranges and the midpoint slider value “are in candelas per square meter (cd/m^2), also called nits.” (Gettemy, 5:47-49.) For example, range **510** shows a range between 5-65 nits with the midpoint slider at 35 nits, and range **530** shows a range between 20-300 nits with the slider at 160 nits. (Gettemy, Fig. 5, 6:6-10.)

105. Gettemy further describes adjusting the brightness range of the slider control – as well as changing the currently selected brightness for the display – based on both the light sensors and the user-specified position of the slider:

In step **610** [of Fig. 6] one or more light sensors detect the ambient light and send a signal representing this information to the processor. The signal can be from a single sensor, or can be the average of signals from a plurality of sensors. The processor then, as shown in step **620**, accesses stored data which configures the ranges and determines if the ambient light signal requires a change to the brightness range. If a change to brightness range is required, the processor then implements the range change.

(Gettemy, 5:56-64.) As a result:

At any time, the user can display the currently selected range setting and move the slider up or down to increase or decrease the brightness setting of the display. The computer processor will dynamically adjust the range when the ambient light changes sufficiently, keeping the brightness level commensurate with the slider position last selected relative to the new range setting.

(Gettemy, 6:16-22.) Figure 7 shows several examples of the above-described “user adjustments to the brightness settings and computer processor adjustments to the brightness range.”

(Gettemy, 6:22-24.) In steps 710-720 (at right), the user increases the brightness from 35 to 55 within the range from 5-65 nits. At step 730, the user moves to a brighter environment, thus resulting in an increase to both the range (to 20-100 nits) and the current value associated with the slider (to 87 nits). (Gettemy, 6:25-31.)

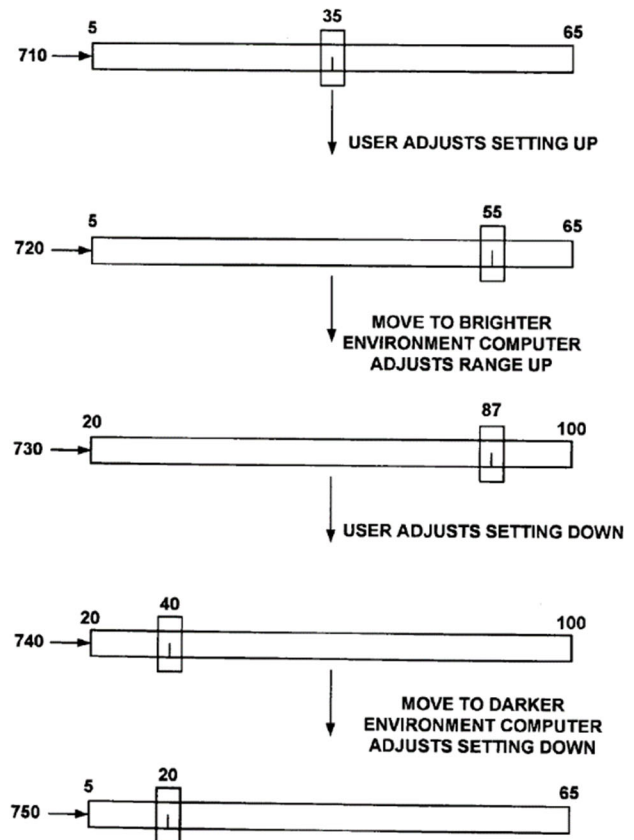


FIGURE 7

The two remaining steps (740-750) show that this exact same process also applies in the opposite direction of decreasing brightness. “The user now adjusts the setting

down to a preferred level, e.g., 40 nits as shown in step **740**. Now, when the user enters a darker environment, the computer processor adjusts the range down, as shown in step **750**, so the setting for the previously set slider position is now 20 nits.” (Gettemy, 6:31-36.) As each of these examples demonstrates, the brightness level for the display (*i.e.*, the numerical value associated with the slider) is computed based on **both** user preference (*i.e.*, where the user placed the slider) **and** the brightness range (*i.e.*, which is based on the amount of ambient light).

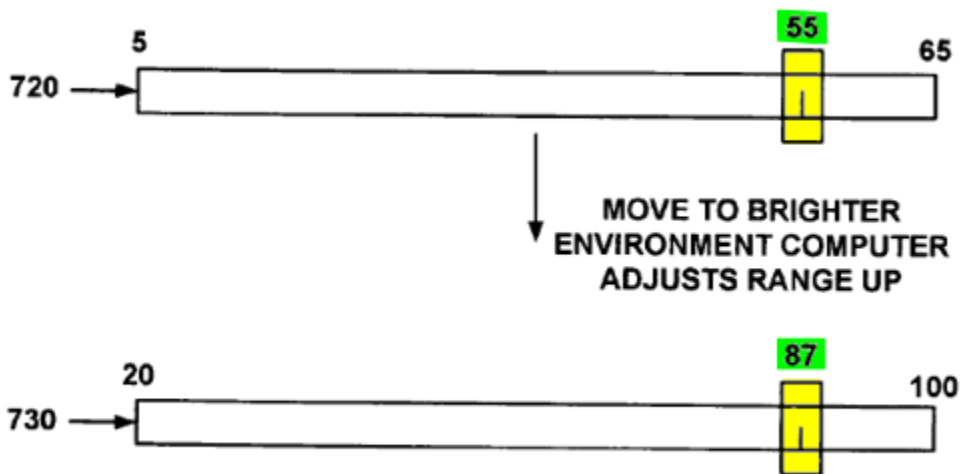
106. Although the embodiments in Gettemy are provided in the context of “a hand held computer system,” Gettemy notes that the alleged invention “may be practiced on any electronic device having a display screen, e.g., a pager, a cell phone, a remote control device, or a mobile computer system.” (Gettemy, 4:22-26.) I will provide more information about Gettemy in my discussion of the claims below.

(b) Kerman (Ex. 1014) and Rosenzweig (Ex. 1015)

107. **Kerman** is a textbook entitled *ActionScripting in Flash* (2001), and **Rosenzweig** is a textbook entitled *Using Macromedia Director 8* (2000). I am informed that both Kerman and Rosenzweig qualify as prior art to the ’117 patent because they are printed publications that were accessible to the public no later than 2002, which is before the earliest alleged priority date of the ’117 patent.

108. My Declaration relies on Kerman and Rosenzweig in combination with

Gettemy for limitation [c] of claim 1, reciting “a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal,” and the similar “selectively multiplying” step of in claim 15. As explained, Gettemy discloses generating a display brightness value based on both the user selection through the slider, and the brightness range selected by the processor based on the ambient light sensor(s) 390. But Gettemy does not disclose precisely how the system computes the new display brightness value in response to a change in the display brightness range. Referring back to Figure 7:



(Gettemy, Fig. 7 (partial figure; highlighting added).) In the example above, the processor in step 730 has clearly increased the display brightness from 55 to 87 nits when the user moved to a brighter environment, but what formula or technique did Gettemy employ to determine that the slider position in the new range now

corresponds to a value of 87?

109. Gettemy does not expressly answer this question, but this is likely because the calculation of the new value would have been little more than a routine implementation detail not warranting extended discussion. I have cited Kerman and Rosenzweig because, in fact, the calculation used in Gettemy is simply a standard and well-known technique for determining the value of a slider based on its position and the range applicable to the slider control.

110. Turning first to Kerman, it is a textbook describing programming techniques for Flash, a well-known software development platform commonly used for web and desktop applications. Kerman intended his book to serve as the bridge between intermediate and advanced Flash programmers. (Kerman, p.7.) Kerman focuses primarily on ActionScript, a programming language used to write programs for a number of development platforms, including Flash. (Kerman, p.47.)

111. I have cited Kerman for its disclosures relating to slider controls that were (and remain to this day) standard controls in the graphical user interfaces of countless software applications. As explained, Gettemy relies on slider controls as shown in Figures 5 and 7 discussed above.

112. Kerman devotes an entire chapter entitled “Creating a Horizontal Slider,” to “explor[ing] a popular user interface control: the slider.” (Kerman,

p.389.) Kerman explains that, as was well-known, “[m]any users prefer to specify a number by using the seemingly continuous scale offered by a slider rather than by typing into a field.” (Kerman, p.389.) Kerman describes various techniques for programming slider controls and incorporating them into applications.

113. Kerman explains that, to create a slider, the programmer must specify the “bounds” of the slider, *i.e.*, the minimum (`min`) and maximum (`max`) values. (Kerman, p.391, ¶7.) These are equivalent to the low and high values, respectively, that define a “range” in Gettemy. Kerman explains that these values “make sure that the `_x` property doesn’t go below `min` or above `max`.” (Kerman, p.391, ¶8.) The “`_x`” property, as noted below, refers to the value associated with the current position of the slider between `min` and `max`. (Kerman, p.391, ¶8)

114. The other key piece of information for determining the position of a slider, according to Kerman, is a *percentage* representing the location of the slider relative to the total length of the slider control. “Now that we know the bounds involved, we can calculate percentage. The formula for percentage is simply ‘current position / total distance.’ Total distance is `max - min` and current position is the slider’s `_x` property.” (Kerman, p.391, ¶9.) For example, if the percentage is “50,” the value of the `_x` property for the slider will be the midpoint

value between `min` and `max`.

115. Kerman discloses source code for a simple formula that calculates, based on `min` and `max`, the current value for the `_x` property for a given percent:

```
percent=50;  
_x= min+((max-min)*(percent/100));
```

(Kerman, p.397, ¶7.) The asterisk (`*`) in the source code above refers to a multiplication operation, and the forward slash (`/`) to a division operation. This formula is very straightforward and easily applied.

116. Take a simple example of a slider that operates in a range of values between 100 and 200. In this example, `max` = 200, `min` = 100, and let's assume `percent` = 50 consistent with the example from Kerman above. The value of property `_x` with the slider at the 50% position is thus: $100 + ((200 - 100) \times (50 \div 100))$, which equals 150. Stated more simply, 150 is the value of a slider when it is at the position 50% between 100 and 200.

117. Now suppose I change the range of values such that, `max` = 250, `min` = 150, and `percent` remains at 50. The value of property `_x` for the slider at the 50% position, using this formula, is now 200. The simple formula can thus calculate the new value associated with the current slider position, when the range of values

changes. Although the formula in Kerman above uses an exemplary percent of 50, different values could obviously have been used.

118. Now turning to Rosenzweig, it describes aspects of Macromedia Director, a software development platform for creating standalone and Web applications. (Rosenzweig, p.1.) Like Kerman, Rosenzweig details how to create slider controls. “A slider is a familiar user interface element used in all major software programs. Sliders offer the best way to enable users to input a number within a small range.” (Rosenzweig, p.320.) Rosenzweig explains that the software implementing a slider “needs to know far to the left and right it can move, and what range of values it represents, such as 1 to 3, 0 to 100, or -500 to 500.” (Rosenzweig, p.320.)

119. Rosenzweig discloses simple equations for determining the value associated with a slider control based on the slider’s current position and range – and those equations are mathematically equivalent to the equations in Kerman discussed above. For example, Rosenzweig discloses the following source code for determining the value associated with a slider in response to the user moving the slider to a different position using a computer mouse:

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```
-- this handler takes the mouse position and figures the
-- value of the slider
on moveMarker me
  -- compute the position as a number between 0 and 1
  x = the mouseH - pBounds.left
  sliderRange = pBounds.right-pBounds.left
  pos = float(x)/sliderRange

  -- translate to a value
  valueRange = pMaximumValue - pMinimumValue
  pValue = pos*valueRange + pMinimumValue
  pValue = integer(pValue)

  -- check to make sure it is within bounds
  if pValue > pMaximumValue then
    pValue = pMaximumValue
  else if pValue < pMinimumValue then
    pValue = pMinimumValue
  end if
end
```

(Rosenzweig, pp.322-323 (red box annotation added).)

120. The source code above was written in a programming language called Lingo, which was commonly used with Macromedia Director. (Rosenzweig, p.1.) The code is straightforward and organized into three sections divided by textual comments. The first section, as indicated by the comment above, “compute[s] the position [of the slider] as a number between 0 and 1[.]” (Rosenzweig, p.322.) In plain English, this code computes the relative pixel position of the mouse within the displayed slider (**x**), the number of pixels in the slider (**sliderRange**), and then

divides the former by the latter to calculate the slider position (**pos**). The value “**pos**” thus represents a percentage expressed as a floating point (decimal) value (*i.e.* “between 0 and 1”), which is equivalent to the “percent ÷ 100” calculation from Kerman above.

121. The next three lines under the comment entitled “translate to a value” use “**pos**” to calculate the underlying value associated with the position on the slider, which is equivalent to the value “_x” in Kerman. In plain English, these lines of code compute the range of the slider (**valueRange**), by subtracting the minimum value from the maximum value of the slider range (**pMaximumValue-pMinimumValue**), which is equivalent to “max - min” from Kerman above. The second line, boxed in **red**, calculates the value associated with the slider (**pValue**) by *multiplying* the decimal percent value of the slider position (**pos**) by the slider range (**valueRange**). It then adds back the minimum value (**pMinimumValue**), just like the calculation of “_x” in Kerman above. The next line simply converts the value (**pValue**) to an integer (non-decimal) value, and the final lines perform bounds checking to ensure that this value (**pValue**) falls within the slider range.

122. As I will explain in more detail below, it would have been obvious that the main processor **310** in Gettemy uses multiplication of values representing the relative position of the slider and the slider’s range, as disclosed in Kerman and

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Rosenzweig, to calculate the new display brightness value for the current slider position when the brightness range changes in response to ambient lighting conditions. These techniques, in fact, produce the exact same values for all of the exemplary sliders shown in Figures 5 and 7 of Gettemy. And those techniques, as applied to Gettemy, disclose and render obvious the “**multiplier**” and “**multiplying**” limitations of claims 1 and 15, respectively. I will provide more detail about Kerman and Rosenzweig in my analysis below.

(c) **Whitted (Ex. 1016) and Bell (Ex. 1017)**

123. **Whitted**, U.S. Patent No. 7,110,062 B1, is entitled “LCD with Power Saving Features.” I am informed that Whitted qualifies as prior art because it was filed on April 26, 1999, which is before the earliest alleged priority date of the ’117 patent. **Bell**, U.S. Patent No. 7,928,955 B1, is entitled “Automatic Brightness Control for Displays.” I am informed that Bell qualifies as prior art because it was filed on March 13, 2000, which is before the earliest alleged priority date of the ’117 patent.

124. My Declaration cites Whitted and Bell for the last limitation of claim 1, **“a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a**

predetermined level when the ambient light level decreases to approximately zero,” and the similar method step recited in independent claim 15.

125. My Declaration relies on Whitted and Bell for a simple and straightforward proposition – that it would have been obvious to further adapt the brightness control system of Gettemy such that the brightness of the display is maintained above a predetermined minimum threshold level. Whitted and Bell both disclose techniques for setting display brightness based on ambient lighting conditions, similar to Gettemy, but disclose the *further* feature of ensuring that the resulting brightness level is always above such a threshold level.

126. Starting with **Whitted**, as noted, it discloses techniques for adjusting the brightness of a display based on ambient lighting conditions. (Whitted, 3:25-27 (“One feature of the present invention is directed to automatically controlling the intensity of a backlight as a function of ambient, e.g., external, light levels.”).) Whitted explains that, “[b]y adjusting backlight intensity as a function of ambient light conditions backlight power consumption can be minimized while maintaining a satisfactory level of image visibility over a wide and possibly changing range of light conditions.” (Whitted, 3:33-37.)

127. To adjust the brightness of the display, Whitted discloses an intensity control circuit **503** and brightness control circuit **504** that determine the amount of

power supplied to the backlight **510** of the display, thus determining its brightness. (Whitted, 7:62-8:5.) Similar to Gettemy, brightness can be controlled by using two factors: **(1)** user input and **(2)** ambient lighting conditions. With respect to **(1)**, the user can adjust the brightness of the display using a potentiometer such as a knob that adjusts a brightness control signal. (Whitted, 8:5-8 (“A user may adjust the potentiometer, e.g., by turning a knob, thereby adjusting the brightness control signal supplied to the intensity control circuit **503**.”).) With respect to **(2)**, Whitted also discloses a photo sensor **502** mounted on the front of the display that measures the intensity of ambient light. (Whitted, 7:56-61.) Whitted discloses that “[t]he intensity control circuit **503** determines the amount of power supplied to the backlight **510** as a function of the output of the photo-sensor **502** and the received brightness control signal.” (Whitted, 8:9-12.)

128. Whitted thus discloses that “[w]hen the output of the photo-sensor **502** indicates an increase in the intensity of the ambient light striking the screen **206**, the power to the backlight **510** will be increased.” (Whitted, 8:16-19.) And conversely, “[a]s the intensity of the ambient light striking the screen **206** decreases, the intensity control circuit decreases the power supplied to the backlight **510** and thus the intensity of the light output therefrom.” (Whitted, 8:19-22.)

129. But what happens in very dark, or even entirely dark, environments?

Whitted answers this question by explaining “[a] minimum power level is set, e.g., pre-programmed, for the backlight **510** to insure that the display will be readable in low light conditions.” (Whitted, 8:22-25.) As Whitted further explains:

In one embodiment, even if the output of the photo-sensor **502** indicates little or no incident light, the intensity control circuit **503** does not lower the power output to the backlight **510** below a preselected threshold to insure that in dark or dimly lit conditions, images on the display panel **206** will remain visible. In such an embodiment, intensity control circuit **503** maintains backlight light output between a minimum threshold level and full intensity as a function of the output of the photo-sensor **502** and the brightness control circuit **504**.

(Whitted, 8:26-35.) The technique in Whitted thus ensures that regardless of the current ambient lighting condition or user setting, the display brightness will never fall below a “minimum threshold level,” even in dark conditions. I will provide more detail about Whitted in my discussion of the limitations below.

130. Now turning to **Bell**, like Whitted, it also discloses techniques for adjusting the brightness of a display based on ambient lighting conditions. (Bell, 1:67-2:4 (“Thus, according to one embodiment of the invention, the brightness setting for a display may be modified by first assessing the ambient luminance level and then using this assessment to select an appropriate display brightness setting.”).) Bell explains that, using her automatic brightness techniques, “[a]s the brightness of

the environment decreases, the brightness of the display is proportionally reduced for viewing.” (Bell, 5:54-56.)

131. Similar to Whitted, Bell explains that “[i]n a very dark environment, a minimum brightness level may afford comfortable viewing.” (Bell, 5:56-58.) “For low ambient luminance levels,” Bell explains, “a minimum but non-zero display brightness permits viewing of the microdisplay.” (Bell, 6:3-5.) The technique in Bell thus would have ensured that the resulting display brightness (whether based on current ambient lighting condition, user setting, or a combination of both) would have never fallen below this “minimum but non-zero” value. Figures 4 and 5 show examples:

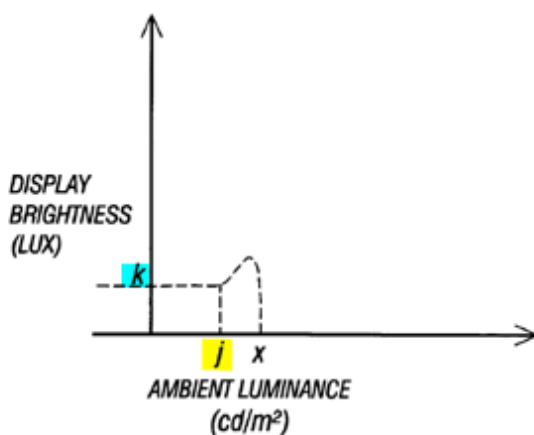


FIGURE 4

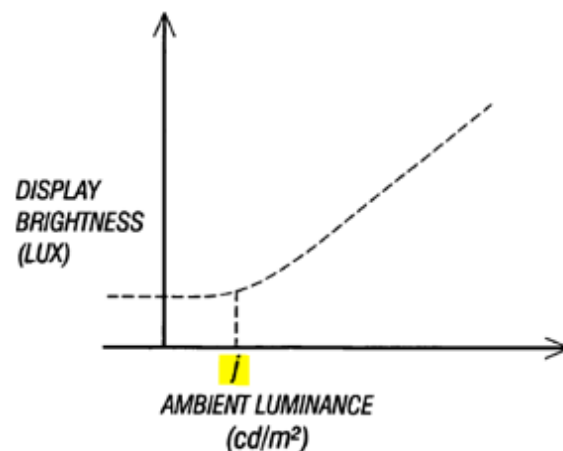


FIGURE 5

(Bell, Figs. 4-5 (highlighting added).) Figures 4 and 5 show the relationship between brightness of the display (vertical axis) and ambient brightness (horizontal axis). Both figures show that the brightness of the display will decrease as ambient

brightness decreases – but only until ambient brightness reaches **j** (measured as candela per square meter, cd/m^2) shown in highlighting, at which point display brightness does not further decrease. Display brightness is instead maintained at **k**, a minimum brightness that continues to apply as ambient brightness decreases to zero. Bell explains that “in very low light ambients, a display brightness of **k** LUX may be sufficient to readily view the display.” (Bell, 5:29-31.) Conversely, as ambient brightness exceeds **j**, display brightness increases. For purposes of my Declaration, there is no material difference between Figure 4 and Figure 5. Figure 4 shows the graph for a *transmissive* display, such as an LCD display that uses backlighting. Bell explains that once ambient brightness reaches **x**, the backlighting can be turned off because “the display has become readable without the assistance of the backlight.” (Bell, 5:39-42.) This is why Figure 4 shows the display brightness “dropping off” at ambient luminance **x**. In contrast, Figure 5 shows display brightness for an *emissive* display, in which display brightness continues to increase with ambient brightness “in a somewhat linear fashion.” (Bell, 6:5-7.) This difference is immaterial for purposes of my Declaration, because, as shown, both figures show the same relationship with respect to *decreasing* ambient brightness levels – a minimum display brightness level **k** regardless of the type of display as ambient brightness decreases toward zero. I will provide more detail about Bell in

my discussion of Ground 3 below.

**B. Ground 1: Claims 1, 2, 9, 15, and 16 Are Obvious Over
Stoughton in view of Mierzwinski and Nagai**

1. Independent Claim 1

132. For reference, claim 1 recites:

1. A brightness control circuit with selective ambient light correction comprising:
 - [a]** a first input configured to receive a user signal indicative of a user selectable brightness setting;
 - [b]** a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level;
 - [c]** a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal; and
 - [d]** a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.

(’117, 12:28-43 (Claim 1; bracketed notation (e.g., **[a]**) added).)

133. The preamble of claim 1 recites “[**a**] **brightness control circuit with selective ambient light correction.**”

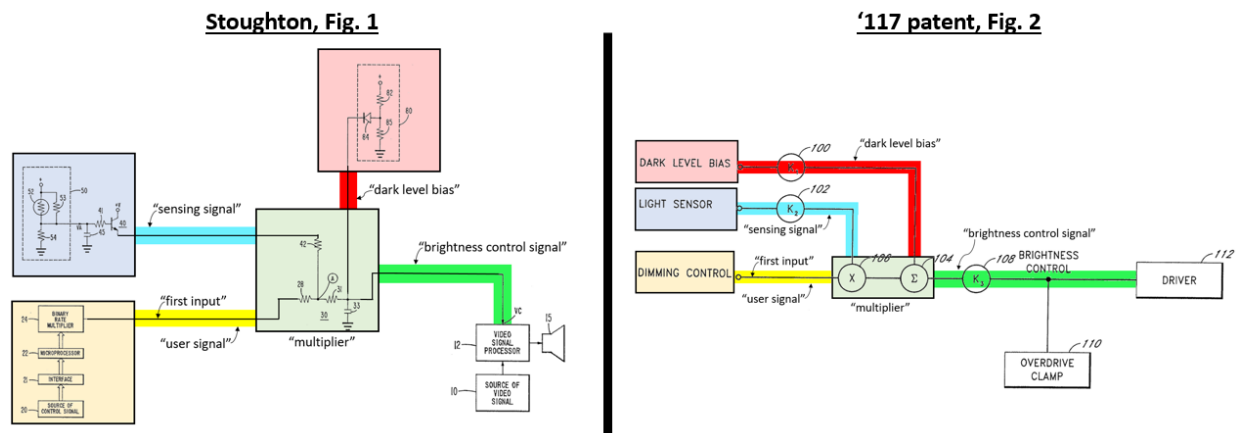
134. To the extent that the preamble of claim 1 is a limitation, it is disclosed by or obvious over **Stoughton** (EX1003).

135. As mentioned above, Stoughton is titled “Manual and Automatic Ambient Light Sensitive Picture Control for a Television Receiver.” Stoughton is directed to a television receiver with a “contrast control apparatus” for “both manually and automatically” controlling signals “in response to ambient light.” (Stoughton, 2:27-29, 1:6-9, Fig. 1.)

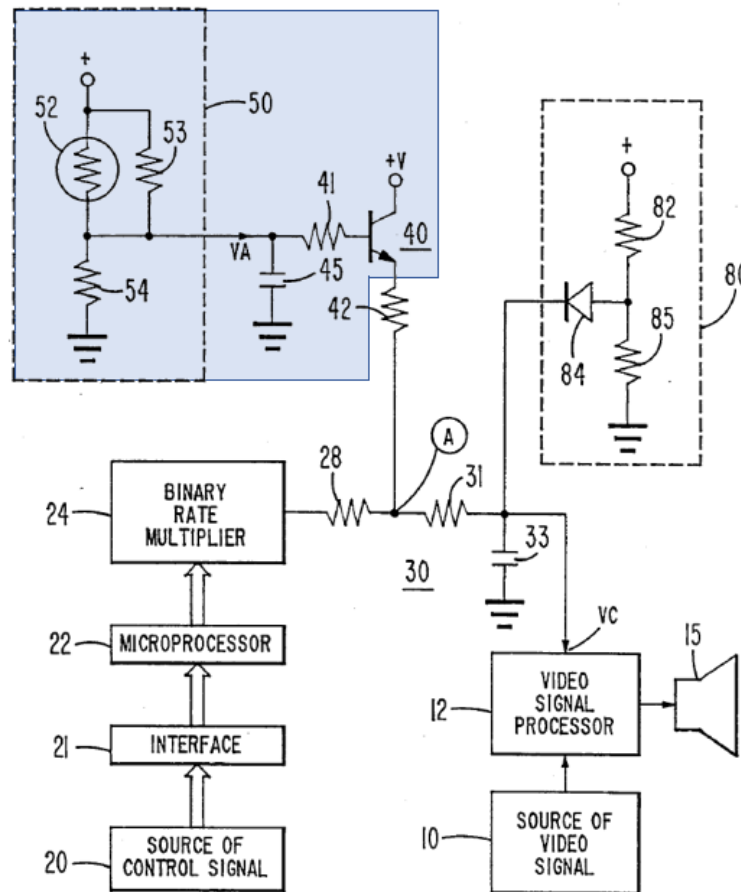
136. Stoughton explains that, as was well-known at the time, “[s]ome video display systems also include apparatus for automatically controlling picture contrast as a function of ambient light conditions in the environment in which the displayed picture is being viewed.” (Stoughton, 1:16-20.) Likewise, at the time, “a television receiver commonly includes a viewer adjustable device (e.g., a potentiometer or a remote control unit) for manually controlling the peak-to-peak amplitude of a video signal to achieve a desired level of contrast for a picture displayed by an image reproducing kinescope of the system.” (Stoughton, 1:10-16.)

137. Below, the claimed elements of the Stoughton circuit are shown alongside those same elements in Figure 2 of the ’117 patent:

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138. A POSITA would have understood that Stoughton taught a “**brightness control circuit with selective ambient light correction,**” as recited in the preamble. For example, Figure 1 in Stoughton is a “brightness control circuit with selective ambient light correction.” Figure 1 is a circuit, with a light sensor, and brightness control with selective ambient light correction. As shown below, Figure 1 shows ambient light sensing signal circuitry in a brightness control circuit:



(Stoughton, Fig. 1 (highlighting added).)

139. Stoughton discloses that its Figure 1 circuit performs “**ambient light correction**,” because Stoughton’s circuit changes (corrects) the contrast of a display based on the amount of ambient light around the display. Stoughton discloses that “[c]ontrol voltage VA modifies the DC value associated with the BRM output signal at node A in response to ambient light conditions, thereby providing an auxiliary means of controlling the contrast of a displayed image in response to ambient

lighting conditions.” (Stoughton, 3:36-41.) Stoughton discloses that its circuit performs ambient light correction using a “variable impedance network with an ambient light responsive light dependent resistor (LDR) **52** and resistors **53** and **54** arranged as a voltage divider between a source of positive DC operating potential (+) and ground reference potential.” (Stoughton, 3:22-26.) Stoughton further identifies voltage source **50**, filter capacitor **45**, and emitter follower transistor **40** as contributing to the Stoughton circuit’s “[a]uxiliary contrast (gain) control in response to ambient lighting conditions[.]” (Stoughton, 3:18-22.) The result is a circuit that provides a voltage VP at the emitter of transistor **40** that varies with the amount of ambient light detected by LDR **52**. Because this voltage impacts the voltage VC that controls the contrast of kinescope **15** through video signal processor **12**, Stoughton’s circuit performs “**ambient light correction**” on kinescope **15**.

140. Patent Owner may argue that Stoughton uses the word “contrast” as opposed to the word “brightness,” but for purposes of my analysis, that distinction is immaterial. An ordinarily skilled artisan would have understood that any change to the contrast of a displayed image would also have impacted the brightness of the image.

141. Accordingly, a POSITA would have considered Stoughton’s Figure 1 circuit to be a “**brightness control circuit**”—because it controls the contrast, which

directly affects the brightness, of a visual display.

142. This would have been basic knowledge of an ordinarily skilled artisan. This is confirmed by the 1957 book *Television Engineering Handbook* by Donald G. Fink (“Fink”) (**EX1008**), which indicates that “[i]t has been prepared by thirty-three experts.” (Fink at vii.) In the section “Definitions of Terms,” Fink provides “terms from the fields of television, photometry, and colorimetry ... compiled from lists of official definitions or standards.” (Fink at 1-35.) For the term “contrast control,” Fink provides the following definition from the 1948 Standards on Television, Definitions of Terms, from the Institute of Radio Engineers:

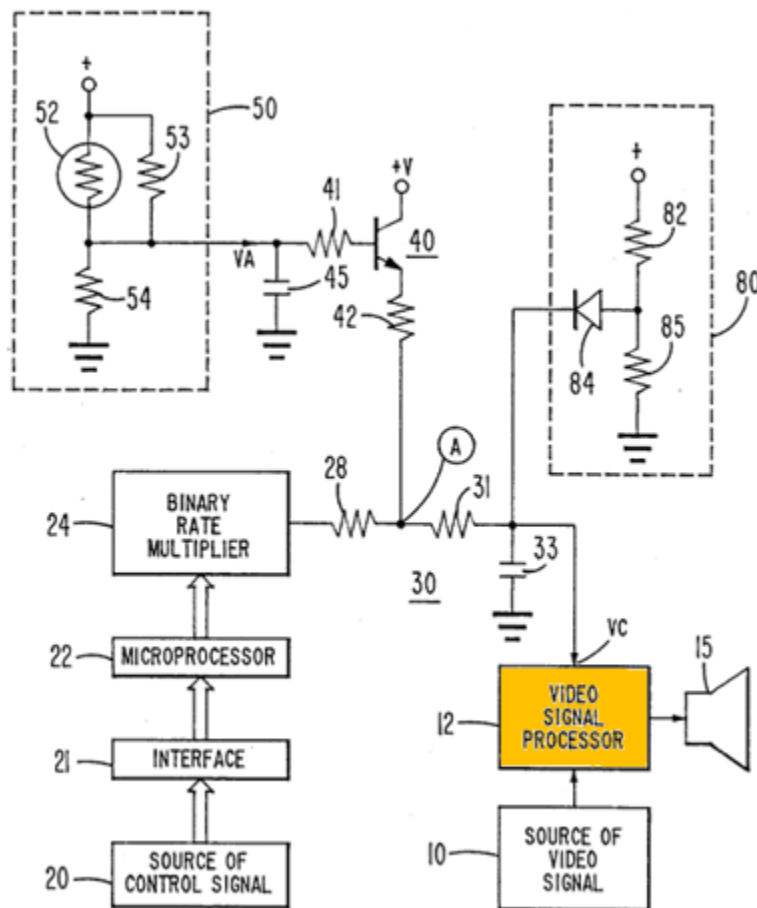
Contrast Control. The manual gain control for the picture signal.

Note: **The contrast control affects both the brightness and the contrast of the picture.** (IRE, 1948)

(Fink at 1-46.) This definition confirms that an ordinarily skilled artisan would have understood Stoughton’s contrast control or gain control circuit as a “**brightness control circuit**”—because contrast control impacts display brightness. As explained, Stoughton’s Figure 1 circuit controls the “peak-to-peak amplitude of [a] video signal, and hence the contrast of a displayed image.” (Stoughton, 2:37-40, 2:67-3:2, 3:39-41, 4:53-59, Figs. 1, 2.) That circuit provides “contrast control” or “gain control.” (*E.g.*, Stoughton, Abstract, 2:67-3:2.) An ordinarily skilled artisan

would thus have understood that Stoughton teaches and suggests a “**brightness control circuit with selective ambient light correction.**”

143. To the extent there is any question that a POSITA would have understood contrast and brightness to be interdependent or interchangeable concepts, it would have been obvious to a POSITA to use Stoughton’s Figure 1 circuit to control only the brightness of a display. A POSITA would have recognized that the only change that would need to be made to convert Stoughton’s Figure 1 circuit from one that controls “contrast” to one that controls “brightness” is to change what video signal processor **12**, highlighted below, does with voltage VC.



(Stoughton, Fig. 1 (highlighting added).) In either case—whether video signal processor **12** controls “contrast” or “brightness” of display **15**—a POSITA would have understood that all circuitry leading up to video signal processor **12** would function in the same way.

144. Further, to the extent there is any question that a POSITA would have understood contrast and brightness to be interdependent or interchangeable concepts, it would have been obvious to a POSITA to use Stoughton’s Figure 1 circuit to

control both the brightness and the contrast of a display. Such knowledge was well-known in the field to skilled artisans at the time, as explained below.

145. **Mierzwinski**—U.S. Patent No. 3,813,686—for example, issued more than 20 years before the alleged priority date of the '117 patent. Just like Stoughton, Mierzwinski is directed to television receivers and ambient light control. (E.g., Mierzwinski, Title, Abstract; Stoughton, Title, Abstract.) Mierzwinski discloses “[a] circuit deployed in a color television receiver for varying the brightness, contrast and color saturation of a displayed picture in accordance with variations in ambient light in the vicinity of a receiver screen[.]” (Mierzwinski, Abstract; *see also id.*, Fig. 2, 1:16-20, 1:47-53; 5:25-30.)

146. In Mierzwinski’s Figure 2 circuit, Mierzwinski discloses that LDR **41** leads to changes in display brightness, contrast, and color saturation. (Mierzwinski, 4:65-5:24, 3:35-61, Fig. 2.) Mierzwinski further discloses that a user can vary the magnitude and range of the display brightness, contrast, and color saturation by adjusting variable resistor **63** (magnitude) and variable resistor **65** (range). (Mierzwinski, 5:25-36.)

147. It would have been obvious to a skilled artisan that the output signal VC in Stoughton’s Figure 1 circuit could have been used to control both the brightness and the contrast of kinescope **15**, based on Mierzwinski. As explained in

Mierzwinski, “[v]ariable resistor **63** being effectively in series with the light dependent resistor **41** may be varied to compensate for differences in specific light dependent resistors so as to establish a desired level of picture brightness, contrast and color saturation for a given level of ambient light. Variable resistance **65** which is in parallel with the light dependent resistor **41** may be varied so as to effectively change the range of variation in brightness, contrast and color saturation for a specific range of variations in the ambient light conditions.” (Mierzwinski, 5:25-34.) Stoughton’s circuit, in view of Mierzwinski, would easily have had the video signal processor **12** controlling both the brightness and contrast of kinescope **15** based on VC.

148. **Rationale and Motivation to Combine (Stoughton with Mierzwinski):**

A POSITA would have been motivated to combine Stoughton with Mierzwinski, in the manner described above. The combination would have predictably resulted in the signal VC in Stoughton’s Figure 1 circuit being used to control both the brightness and contrast of kinescope **15**.

149. Stoughton and Mierzwinski are analogous references. Both are in the same field as the ’117 patent. Just like Stoughton, Mierzwinski relates to ambient light control for television receivers. (*E.g.*, Mierzwinski, 1:12-21, 1:46-52, Abstract, Title.)

150. A POSITA would have been motivated to combine Mierzwinski with Stoughton because Mierzwinski discloses that when the ambient light level changes, a user will “obtain the optimum viewing situation by changing” the level of contrast and brightness of a screen. (Mierzwinski, 1:22-29; *see also id.* at 1:47-53.) Thus, a POSITA would have understood based on Mierzwinski that Stoughton only changes one of the features of a display—contrast—that a user would want adjusted based on changes in ambient light. Therefore, a user would have been motivated to change screen brightness using Stoughton’s circuit, since Mierzwinski teaches that this is another feature a user would want adjusted based on changing ambient light.

151. A POSITA would have been further motivated to combine Mierzwinski with Stoughton because a POSITA would have recognized that to yield an optimal picture in changing ambient lighting conditions, both brightness and contrast need to be adjusted. This understanding of a POSITA is confirmed by U.S. Patent No. 3,096,399 (“Thomas”) (**EX1009**), which discloses that “an image that may have acceptable contrast and brightness with low ambient illumination on the tube face, may appear to be ‘washed out’ (too little brightness and contrast) with greater ambient illumination on the face. It may therefore be necessary for the viewer to adjust manually the brightness or contrast, or both with changing light conditions to restore an acceptable brightness and contrast to the image.” (Thomas, 1:17-25.)

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Thomas's date of publication on July 2, 1963-nearly 40 years prior to the 2003 priority date Patent Owner appears to be asserting—indicates that the impact of changing ambient lighting conditions on brightness and contrast of a display would have been well established in the knowledge of a POSITA. Based on this knowledge, a POSITA would have been motivated to combine Stoughton with Mierzwinski such that Stoughton's Figure 1 circuit is used to adjust both brightness and contrast of a display.

152. A POSITA would have been motivated to look to Mierzwinski's design, since like Stoughton, Mierzwinski changes display features both automatically (based on the ambient light level) and manually (based on user input). Similar to how Stoughton has both (1) ambient light sensor circuitry including LDR **52** and (2) BRM **24**, which outputs a signal based on a user setting, Mierzwinski has both (1) ambient light sensor circuitry including LDR **41** and (2) variable resistor **63** that changes the output signal based on a user setting. (*See, e.g.*, Stoughton 1:6-9, 2:54-3:2, 3:18-30, 4:18-31; Mierzwinski, 1:22-29, 1:47-53, 5:25-36.) The similarities between these circuits would have made them simple for a user to combine.

153. A POSITA would have also been motivated to combine Mierzwinski with Stoughton based on express disclosures in Mierzwinski discussing circuitry like

what Stoughton discloses. Mierzwinski discloses that “[w]hile the present invention is being described with respect to [a closed loop burst gain controlled system], it would, of course, be possible, in television circuits employing DC gain controls for chroma and/or contrast, to connect the ambient light tracking means to these direct current control circuits.” (Mierzwinski, 2:65-3:2.) Stoughton discloses DC gain controls for a display. (Stoughton, 2:63-3:2 (“DC voltage is applied to a contrast control (gain control) input of video processor **12** to control the magnitude of the video signal, and thereby to control the contrast of a reproduced image.”).) Accordingly, a POSITA would have recognized that Mierzwinski’s disclosures about implementing its circuit in a system with DC gain controls indicates that Mierzwinski’s teachings are applicable to a DC gain control system like Stoughton.

154. Further, a POSITA would have been motivated to combine Mierzwinski with Stoughton because a POSITA would have recognized the advantage of allowing a user to adjust both contrast and brightness by changing a single setting. A POSITA would have recognized that users of a display system would not necessarily have understood the difference between various display characteristics. Accordingly, a POSITA would have recognized that it is advantageous to minimize the number of settings a user can adjust. Mierzwinski discloses that brightness and contrast of its display can be adjusted using a single

variable resistor—element **63** in Mierzwinski’s Figure 2 circuit. (Mierzwinski, 5:25-30.) A POSITA would have understood that allowing a user to adjust both contrast and brightness by changing a single setting would yield a more user-friendly display control system, and one that can be competently adjusted even by users who do not understand the difference between various display characteristics. The article “One Knob Picture Control” by Gildo Cecchin (“Cecchin”) (**EX1010**), reflects the knowledge of a POSITA that “[i]t is difficult for the average layman and even for most engineers to properly set the contrast, brightness and chroma controls for optimum picture quality,” so a “single adjustment” controlling contrast, brightness, and chroma amplitude is desirable. (Cecchin at 179.) Based on such knowledge, a POSITA would have been motivated to combine Stoughton and Mierzwinski such that adjusting Stoughton’s user setting would change both the contrast and the brightness of kinescope **15**.

155. A POSITA would have further recognized that using Stoughton’s Figure 1 circuit to adjust both contrast and brightness would be more efficient than using Stoughton’s Figure 1 circuit to adjust only contrast and using a separate circuit to adjust brightness. Such a two-circuit system would involve significantly more hardware components—potentially double the number of parts—to construct than a system that used one circuit to adjust both contrast and brightness. A POSITA would

have recognized that a two-circuit system would be substantially more expensive than a one-circuit system. Further, a POSITA would have recognized that a two-circuit system would consume substantially more power than a one-circuit system. In the interest of hardware and power efficiency, a POSITA would have been motivated to combine Stoughton's Figure 1 circuit with Mierzwinski to yield a single circuit that adjusts both contrast and brightness of a display.

156. Based on the foregoing, a POSITA would have been motivated to combine Stoughton with Mierzwinski. Moreover, a reasonably skilled artisan would have had at least a reasonable expectation of success in implementing the proposed combination in the manner described above. As noted, in fact, the combination would have required few if any modifications to Stoughton's Figure 1 circuit. The same VC voltage signal could have been used, by video signal processor **12**, to adjust both contrast and brightness in accordance with the techniques in Mierzwinski. Stoughton and Mierzwinski provide more than sufficient detail to implement the proposed combination and the disclosures on which I rely, using conventional engineering techniques and without having to resort to undue experimentation.

* * *

157. As noted above, I understand that Petitioner is asserting in the district court litigation that the term "**selective**" is indefinite as to its full scope, *e.g.*,

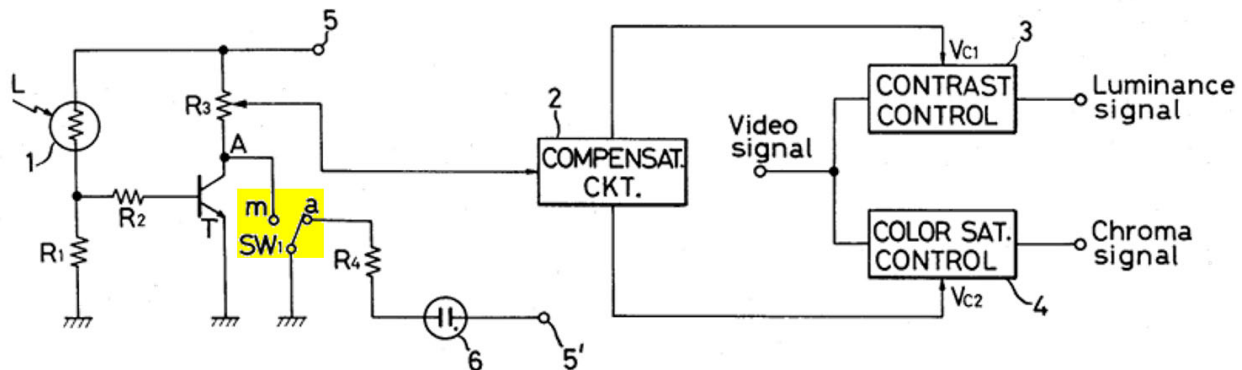
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what it covers beyond referring to a circuit that can operate in either auto or manual mode. While Stoughton does not disclose that the Figure 1 circuit can be operated in an auto or manual mode, it would have been obvious to a POSITA to modify Stoughton's circuit such that it can be operated in an auto or manual mode in view of **Nagai** (EX1005) as explained below. My analysis should not be construed as supporting any particular construction for "selective" or an opinion with respect to the indefiniteness (or lack of indefiniteness) of any claims of the '117 patent, as the disputes in litigation on these issues do not impact the application of the prior art to the challenged claims.

158. The Stoughton circuit in view of Nagai satisfies the scope of "selective." Specifically, it would have been easy and obvious to a POSITA to add a switch to Stoughton's Figure 1 circuit to allow a user to switch between an auto and a manual mode.

159. **Nagai** like Stoughton is a contrast control circuit used for a color "television receiver" responsive to ambient light. (Nagai, Abstract, Title.) Nagai in Figure 1 discloses a switch SW₁ that can connect to nodes "a" or "m." Figure 1 is shown below, with SW₁ highlighted in yellow:

Fig.1



(Nagai, Fig. 1 (highlighting added).) Nagai discloses that when connected to node “a,” its Figure 1 circuit is in an **automatic** mode, whereby changes in ambient light detected by ambient light sensor 1 cause a change in V_{C1} , which changes display contrast through contrast control unit 3. (Nagai, 2:32-58, 2:64-3:44.) Nagai further discloses that when SW_1 is connected to node “m,” its Figure 1 circuit is in a **manual** mode, whereby changes in ambient light detected by ambient light sensor 1 cause no change in V_{C1} , because point “A” in Nagai’s Figure 1 circuit (shown just above node “m”) is connected to ground through switch SW_1 . (Nagai, 2:53-60.) In manual mode, contrast can only be adjusted manually using variable resistor R_3 , which a user can adjust. (Nagai, 2:59-63.) Variable resistor R_3 can also be used to adjust contrast in automatic control mode. (Nagai, 3:3-44.) As the wiper of variable resistor R_3 gets closer to node A, there is more resistance along the path to

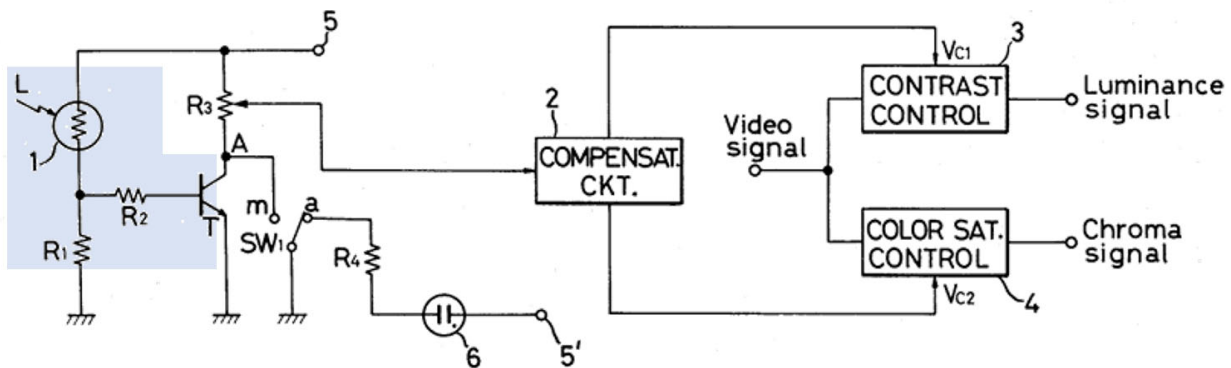
compensation circuit 2, and more current flows to the base of transistor T, causing more current to be drawn to ground from the collector to the emitter of transistor T. This causes the voltage connected to compensating circuit 2 to be lower—leading to increased contrast. When the wiper of variable resistor R₃ moves in the other direction—toward the node left of voltage source 5—the opposite occurs, and the voltage connected to compensating circuit 2 is higher, leading to decreased contrast.

160. In light of Nagai, it would have been obvious to a POSITA to add a switch to Stoughton's Figure 1 circuit to allow a user to switch between an auto and a manual mode. It would have further been obvious to place the switch in the Stoughton Figure 1 circuit such that in the auto mode, the switch would cause the Stoughton circuit to operate as shown in Figure 1. But in manual mode, the switch would disable the ambient light sensor, causing any change in ambient light to have no impact on the control signal VC. Like in Nagai's Figure 1 circuit, it would have been obvious to place the switch in Stoughton's Figure 1 circuit such that in manual mode, a user could still adjust the contrast of kinescope 15 by changing the output of BRM 24.

161. It would have been obvious to a POSITA to disable the ambient light sensor in Stoughton's Figure 1 circuit, because Nagai discloses a switch that similarly disables its ambient light sensor circuitry. In Nagai's Figure 1 circuit, the

ambient light sensor is disabled when the manual mode is selected. The ambient light sensor in Nagai's Figure 1 circuit is shown in blue highlighting below:

Fig.1



(Nagai, Fig. 1 (highlighting added).) A POSITA would have understood the circuitry highlighted above as the ambient light sensor, because when the level of ambient light is high, the impedance of variable resistor **1** is low, causing a larger current at the base of transistor T. (Nagai, 2:32-38.) This causes more current to pass from the collector to the emitter of transistor T, leading to a higher voltage drop across resistor R₃, and a lower voltage connected to compensating circuit **2**, which leads to higher contrast. (Nagai, 2:32-38.) When the level of ambient light decreases, the opposite happens—the impedance of variable resistor 1 increases, leading to a smaller current at the base of transistor T, which causes a lower voltage drop across resistor R₃ and an increase in the voltage connected to compensating

circuit 2, which leads to lower contrast. Based on this understanding, a POSITA would have recognized that the blue-highlighted circuitry—photosensitive element 1, resistors R_1 and R_2 , and transistor T—work together to serve as the ambient light sensor.

162. A POSITA would have further understood that when Nagai's Figure 1 circuit is in manual mode—when switch SW_1 is connected to point “m”—the blue-highlighted ambient light sensor circuitry is disabled. When switch SW_1 is connected to point “m,” point “A” is connected to ground. Accordingly, any current passing through R_3 to point “A” goes to ground rather than passing through transistor T. This causes the ambient light sensor circuitry to be disabled, because very little current flows through transistor T—instead going directly to ground through switch SW_1 .

163. Accordingly, it would have been obvious to a POSITA to include a switch in Stoughton's Figure 1 circuit such that it can disable the ambient light sensor circuitry.

164. One example of how a POSITA would have known to place the switch in Stoughton's Figure 1 circuit based on Nagai is above the “+” node highlighted in yellow in Stoughton's Figure 1 circuit below:

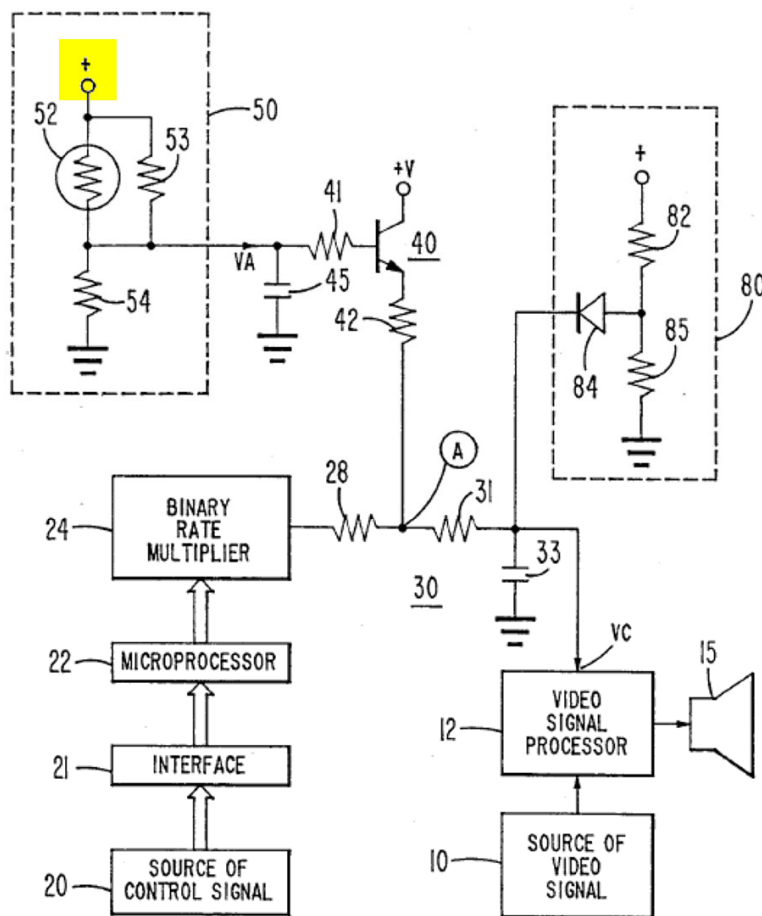


Fig. 1

(Stoughton, Fig. 1 (highlighting added).) A POSITA would have known to place the switch such that in auto mode, a voltage source is connected to the highlighted node above. In manual mode, the voltage source is disconnected, thereby disabling the ambient light sensor circuitry and causing it to have no impact on the output signal VC.

165. Another example of how a POSITA would have known to place the

switch in Stoughton's Figure 1 circuit is above the "+V" node highlighted in yellow
in Stoughton's Figure 1 circuit below:

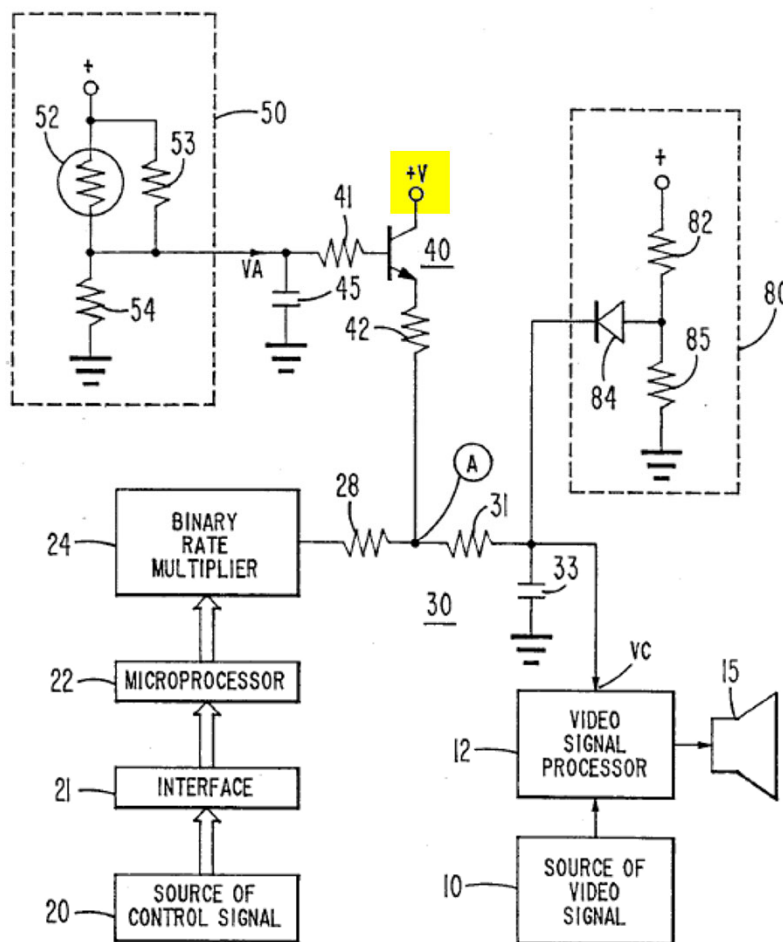


Fig. 1

(Stoughton, Fig. 1 (highlighting added).) A POSITA would have known to place the switch such that in auto mode, a voltage source is connected to the highlighted node above, causing current to pass through transistor 40 to its emitter. In manual mode, the voltage source is disconnected, thereby disabling the ambient light sensor

circuitry and causing it to have no impact on the output signal VC.

166. The above examples are nonlimiting. Adding a switch to any position in Stoughton's Figure 1 circuit that would have caused the circuit to operate like Nagai's Figure 1 circuit—with the ambient light sensor circuitry enabled in auto mode and disabled in manual mode—would have been obvious to a POSITA. Further, it would have been obvious to a POSITA to make other small adjustments to the resulting circuit like holding the voltage VP at the emitter of transistor 40 constant when the circuit is in manual mode so that the signal at the output of BRM 24 is not being multiplied by a voltage value of 0 V.

167. **Rationale and Motivation to Combine (Stoughton and Mierzwinski with Nagai)**: A POSITA would have been motivated to combine Stoughton with Nagai, in the manner described above. The combination would have predictably resulted in the brightness control circuit of Figure 1 of Stoughton, where a switch is added that a user can adjust to switch the circuit between an auto and a manual mode in which the ambient light sensor circuitry is enabled or disabled, respectively.

168. Stoughton and Nagai are analogous references. Both are in the same field as the '117 patent. Just like Stoughton, Nagai relates to ambient light control for television receivers. (Nagai, *e.g.*, 1:6-21, Abstract, Title.)

169. A POSITA would have further recognized many parallels between

Stoughton and Nagai. For example, in the circuits disclosed by both Stoughton and Nagai, the automatic mode adjusts the display based on *both* ambient light level and user input. (Nagai, 3:30-39; Stoughton, 4:42-59.) Automatic mode for the Stoughton and Nagai circuits does not mean that they adjust *solely* to ambient light level. Rather, they *also* adjust based on user settings. In other words, automatic mode for both the Stoughton and Nagai circuits represents a hybrid automatic and manual mode—since changes to either ambient light (automatic adjustment) or a user setting (manual adjustment) can change the output of the circuit. This would have made it particularly simple for a POSITA to combine the Stoughton and Nagai circuits, especially as to functionality and circuitry related to the automatic and manual mode functionality.

170. A POSITA would have been motivated to add a manual mode to Stoughton’s automatically adjusting circuit based on Nagai’s disclosure that “in a conventional television receiver, ... it is difficult to provide a variable resistor serving both for manual control and fine control in an automatic control condition.” (Nagai, 1:16-21; *see also id.*, 1:37-42 (“By using the teaching of this invention, contrast and color saturation of the reproduced picture of the color television receiver can be well controlled by a simple circuit construction, and further a manual fine control can be achieved even in an automatic control condition.”).) A POSITA

would have understood that Stoughton's Figure 1 circuit provides a user the ability to perform "fine control ... in an automatic control condition." Stoughton's circuit is in an auto mode by default, since the output signal is adjusted based on the ambient light level. But within this auto mode, a user can adjust the display contrast manually using the Stoughton circuit by adjusting the user setting that changes the signal output by BRM 24. (Stoughton, 2:34-3:2.) Further, Stoughton discloses that this can be a "fine" adjustment, since the BRM 24 signal can have 2^n different gradations. (Stoughton, 4:19-41.) Based on Nagai's disclosure that in a "conventional television receiver," it is difficult to provide a variable resistor "serving both for manual control and fine control in an automatic control condition," a POSITA would have been motivated to adjust the Stoughton circuit to remove it from the category of "conventional television receiver[s]." (Nagai, 1:16-21.) In other words, a POSITA would have been motivated to adjust the Stoughton circuit such that the BRM 24 signal can be used for "manual control"—in addition to its disclosed use in Stoughton for "fine control in an automatic control condition." A POSITA would have been motivated to do so to provide a kind of television receiver that Nagai discloses to be rare—since this would have suggested to a POSITA an unmet consumer need and/or a market opportunity.

171. A POSITA would have been motivated to add a manual mode to

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Stoughton's automatically adjusting circuit in order to maximize user choice. Nagai discloses that "[i]n the manual control condition, the control voltages V_{c1} and V_{c2} are varied with the manual operation of the variable resistor R_3 to adjust the contrast of the reproduced picture and the color saturation thereof to the choices of the users." (Nagai, 5:7-11.) Thus, a POSITA would have understood in light of Nagai that a manual mode provides a user more choice than a control circuit that always has an automatic adjustment component. A POSITA would have understood that it might be a user's preference to adjust screen brightness manually. For example, a POSITA would have understood that a user with poor eyesight might want to keep his or her screen at a high level of brightness and contrast despite a low level of ambient light. (Cf. **EX1011**, U.S. Patent No. 4,511,921 to Harlan at 1:31-37 ("[I]n low ambient light it is not possible to obtain maximum picture contrast due to the dominating effect of the automatic light sensing network, which then produces reduced picture contrast.")) Further, some users might be accustomed to screens that can only be manually adjusted—so automatic adjustment might be distracting or annoying to these viewers. (See Stoughton, 2:20-25 (teaching that it is preferable to "reduce the likelihood that a viewer will notice the operation of the limiter").) A POSITA would have recognized that there are all sorts of different use cases and user preferences for displays. Accordingly, a POSITA would have been motivated to provide more

than a single mode of operation to users, particularly in light of Nagai's disclosure that a manual mode accommodates the "choices of the users." (Nagai, 5:7-11.)

172. A POSITA would have been motivated to find a reference that discloses switching between auto and manual modes based on Stoughton's disclosure of existing manual-only display control systems. Stoughton discloses that video signal processing and display systems "commonly" include "a viewer adjustable device ... for manually controlling the peak-to-peak amplitude of a video signal to achieve a desired level of contrast for a picture displayed by an image reproducing kinescope of the system." (Stoughton, 1:10-16.) Stoughton further discloses that some of these systems also include circuitry for automatically controlling picture contrast as a function of ambient light conditions. (Stoughton, 1:16-20.) A POSITA would have understood based on these disclosures that some video signal processing and display systems can only be manually controlled—with no automatic control capability. Thus, a POSITA would have recognized that users of video signal processing and display systems might be accustomed to systems that have only manual control. Accordingly, a POSITA would have been motivated based on Stoughton to incorporate a manual-only mode into Stoughton's Figure 1 circuit, since such a mode might be the preference of users who are used to video signal processing and display systems that only have manual—and no automatic—control functionality. A

POSITA would have understood that incorporating a fully manual mode into Stoughton's part-automatic, part-manual circuit could potentially broaden the appeal and usability of Stoughton's Figure 1 circuit.

173. A POSITA would have been further motivated to find a reference that allows a user to switch between auto and manual modes based on Stoughton's disclosures related to minimizing service calls from users regarding their displays. Stoughton discloses that a display with contrast that depends on manual and automatic control can lead to a situation where the video signal is so attenuated that it "almost or completely extinguish[es] a displayed image." (Stoughton, 1:59-65.) Stoughton indicates that "[t]his situation is disturbing and may lead a viewer to believe that the receiver is inoperative, leading to an unnecessary service call." (Stoughton, 1:68-2:2.) Stoughton discloses limiter circuit 80 as a way of "prevent[ing] a displayed image from being extinguished due to excessive video signal attenuation." (Stoughton, 2:15-20.) But a POSITA would have recognized based on Stoughton's disclosures that any automatically controlled display behavior could lead to "unnecessary service call[s]"—since any automatic adjustment might be surprising or disfavored by a user. Accordingly, a POSITA would have been motivated to incorporate a manual mode into the Stoughton circuit as a failsafe. If users are faced with unfavorable automatic adjustment behavior, then they can

switch the circuit into a manual mode and set the contrast level they were expecting or hoping for. Thus, incorporating a manual mode into the Stoughton circuit could further decrease the likelihood of “unnecessary service calls[]”—beyond the decrease sought to be achieved by Stoughton’s limiter circuit. (Stoughton, 1:68-2:2.)

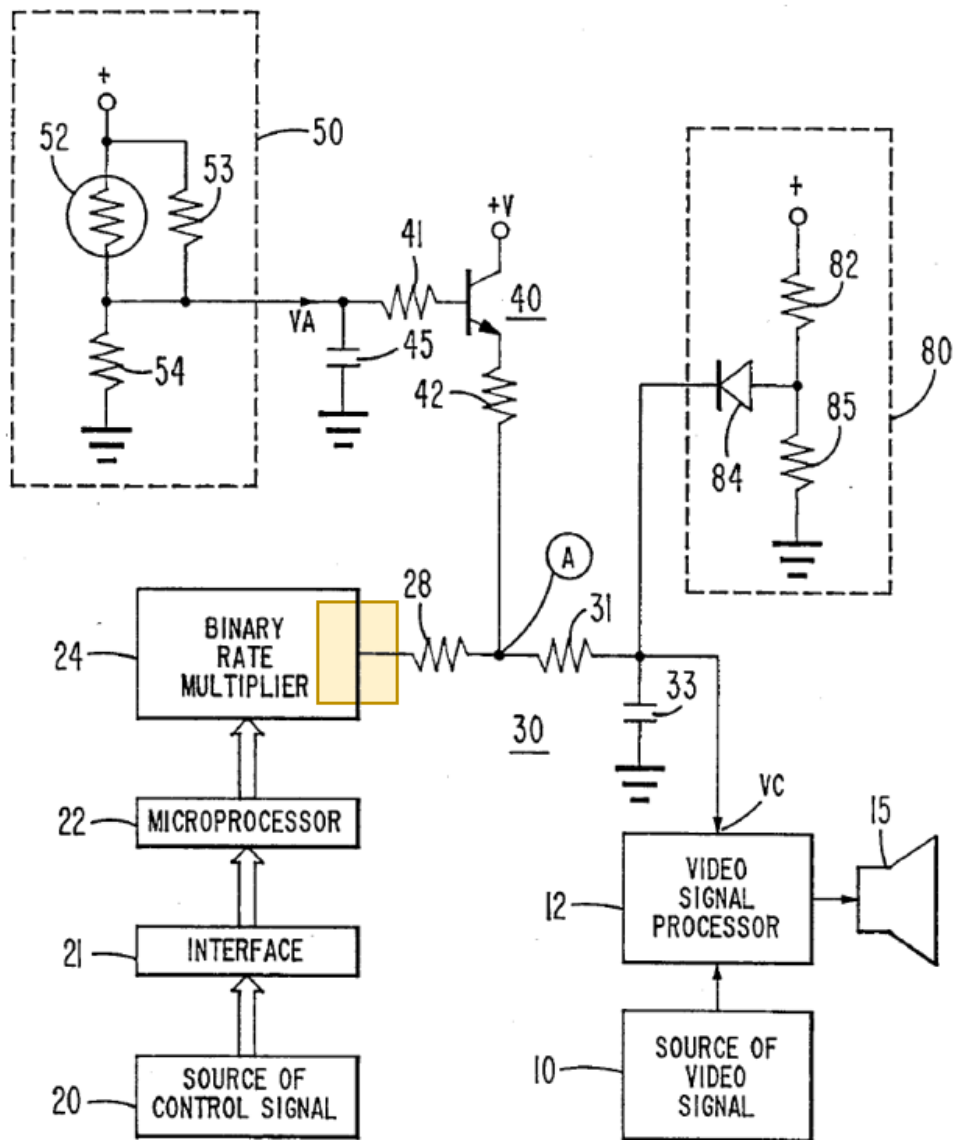
174. A POSITA would have further been motivated to incorporate Nagai’s manual mode into Stoughton’s Figure 1 circuit because a POSITA would have known that limiting the amount of time the ambient light sensor circuitry in Stoughton’s circuit is enabled would conserve power. A POSITA would have understood that a photosensor like Stoughton’s LDR **32** consumes electric power when it is enabled. For example, U.S. Patent No. 6,798,395 to Yamauchi et al (“Yamauchi”) (**EX1012**) discusses that the longer an optical sensor is supplied with electric power, the longer that “electric power is consumed.” (Yamauchi, 1:34-39.) A POSITA’s knowledge about the power consumption of LDR **32** would have motivated the POSITA to minimize the amount of time LDR **32** is provided with electric power. This would have motivated a POSITA to adjust Stoughton’s Figure 1 circuit such that a user can enable or disable the ambient light sensing circuitry based on whether the user determines that adjustment based on the ambient light level is necessary.

175. Based on the foregoing, a POSITA would have been motivated to combine Stoughton with Nagai. Moreover, a reasonably skilled artisan would have had at least a reasonable expectation of success in implementing the proposed combination in the manner described above. As noted, in fact, the combination would have required few modifications to Stoughton's Figure 1 circuit. The ability to include a switch to activate or deactivate specific circuitry was rudimentary knowledge of ordinarily skilled artisans. Stoughton and Nagai provide more than sufficient detail to implement the proposed combination and the disclosures on which I rely, using conventional engineering techniques and without having to resort to undue experimentation.

(a) **“a first input configured to receive a user signal indicative of a user selectable brightness setting;”**
(Claim 1[a])

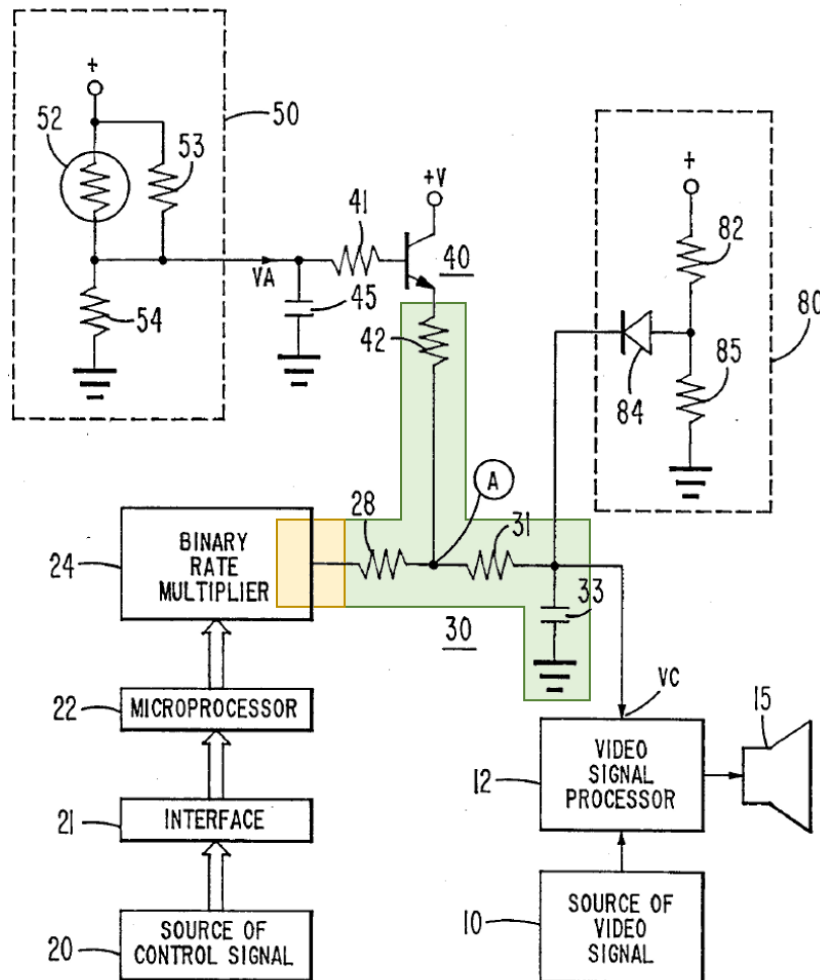
176. The limitation **“a first input configured to receive a user signal indicative of a user selectable brightness setting”** is disclosed by the prior art.

177. Stoughton discloses **“a first input configured to receive a user signal indicative of a user selectable brightness setting.”** The wire connected to the output of BRM 24-highlighted in yellow in the below annotated version of Stoughton's Figure 1-is a **“first input configured to receive a user signal indicative of a user selectable brightness setting.”**



(Stoughton, Fig. 1 (highlighting added).)

178. The wire at the output of BRM **24** is a “**first input**” because it is upstream from and connected to the “**multiplier**,” which is highlighted in green in the below figure:

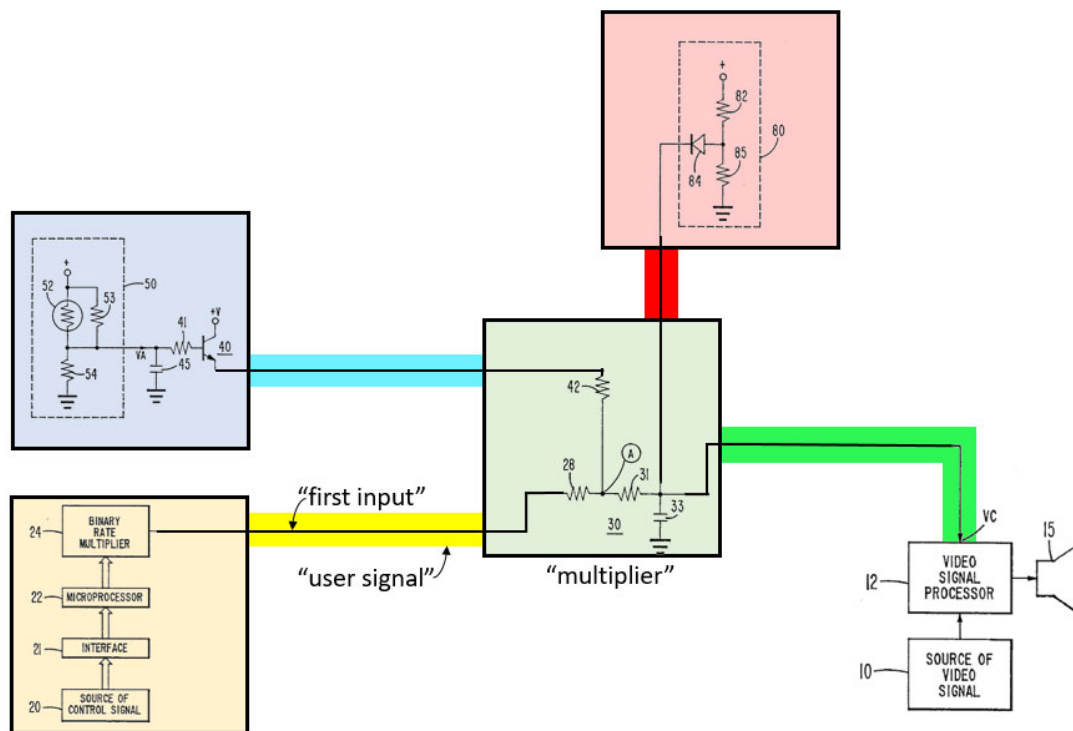


(Stoughton, Fig. 1 (highlighting added).)

179. The following demonstrative shows that the wire at the output of BRM **24** constitutes a “**first input**” to the “**multiplier**”. The “**multiplier**” is the circuitry inside the green box. The wire at the output of BRM **24** is a “**first input**” to that “**multiplier**” circuitry, because the wire at the output of BRM **24** is upstream from and connected to the “multiplier” circuitry. The “multiplier” circuitry uses the

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signal it receives from the “first input” wire at the output of BRM 24 in generating the “brightness control signal” output.



180. The wire at the output of BRM 24 is “**configured to receive a user signal indicative of a user selectable brightness setting.**” Stoughton discloses that “[a] binary output signal from BRM 24 is conveyed via a resistor 28 and an integrating or low pass filter network 30 including a resistor 31 and a filter capacitor 33.” (Stoughton, 2:57-59.) A POSITA would have recognized that the binary output signal from BRM 24 must pass through the wire at the output of BRM 24 to reach resistor 28, low pass filter network 30, resistor 31, and filter capacitor 33—since the

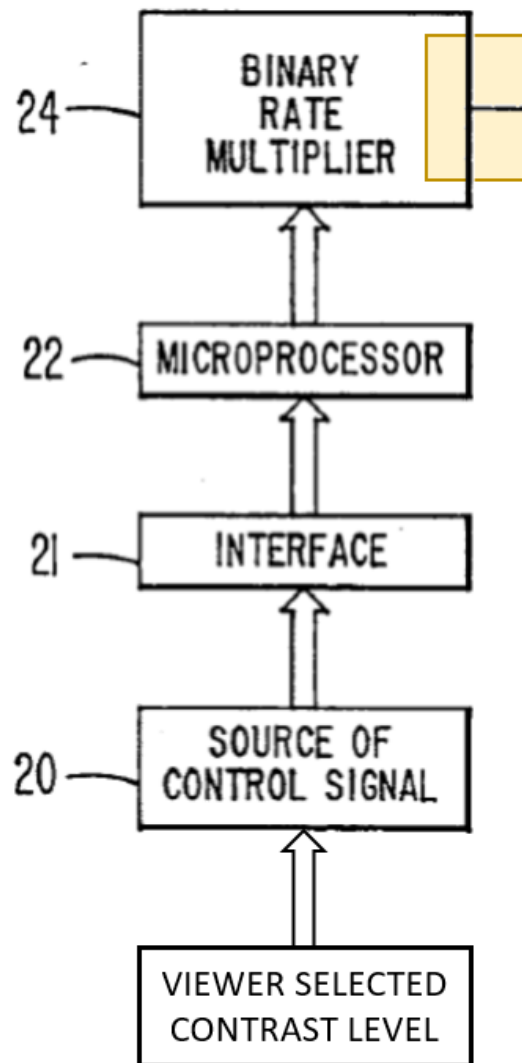
wire at the output of BRM 24 is between BRM 24 and any of that circuitry. Accordingly, Stoughton discloses that the wire at the output of BRM 24 is “**configured to receive**” the binary output signal from BRM 24.

181. Further, Stoughton discloses that the binary output signal from BRM 24-which the wire at the output of BRM 24 is also “**indicative of a user selectable brightness setting.**” Stoughton discloses that a viewer can provide to the circuit of Figure 1 a “viewer selected contrast level” using a “viewer operated remote control unit,” including an “infrared remote control unit.” (Stoughton, 2:40-44, 2:45-53.) A POSITA would have understood and found it obvious that Stoughton’s “viewer selected contrast level” is “**a user selectable brightness setting,**” as was fully explained for the preamble.

182. The signal at the output of BRM 24 is also “**indicative of**” the viewer selected contrast level because the fraction of time the signal is high changes based on the viewer selected contrast level. The fraction of time the output of BRM 24 is high depends on the binary input number stored in shift register 69, which changes when the viewer selected contrast level changes. (Stoughton, 4:35-52, 2:46-63.) As a result, BRM 24 receives from microprocessor 22 a binary coded signal (*e.g.*, four bits) that represents the viewer selected contrast level. (Stoughton, 2:41-56, 3:56-4:2.) BRM 24 uses this signal, in turn, to output a “binary output signal,” *i.e.*, the

“**user signal**,” that “comprises substantially constant amplitude pulses with a pulse width (duty factor) determined by the contrast control information supplied from microprocessor **22**.” (Stoughton, 2:57-63.)

183. The following annotated version of an excerpt from Stoughton’s Figure 1 circuit shows how the signal at the output of BRM **24** is “**indicative of a user selectable brightness setting**.” The “**user selectable brightness setting**” (viewer selected contrast level) impacts source of control signal **20**, and such impact is propagated through the below flow chart until it reaches BRM **24** and changes the pulse width of the signal at the wire connected to the output of BRM **24**.

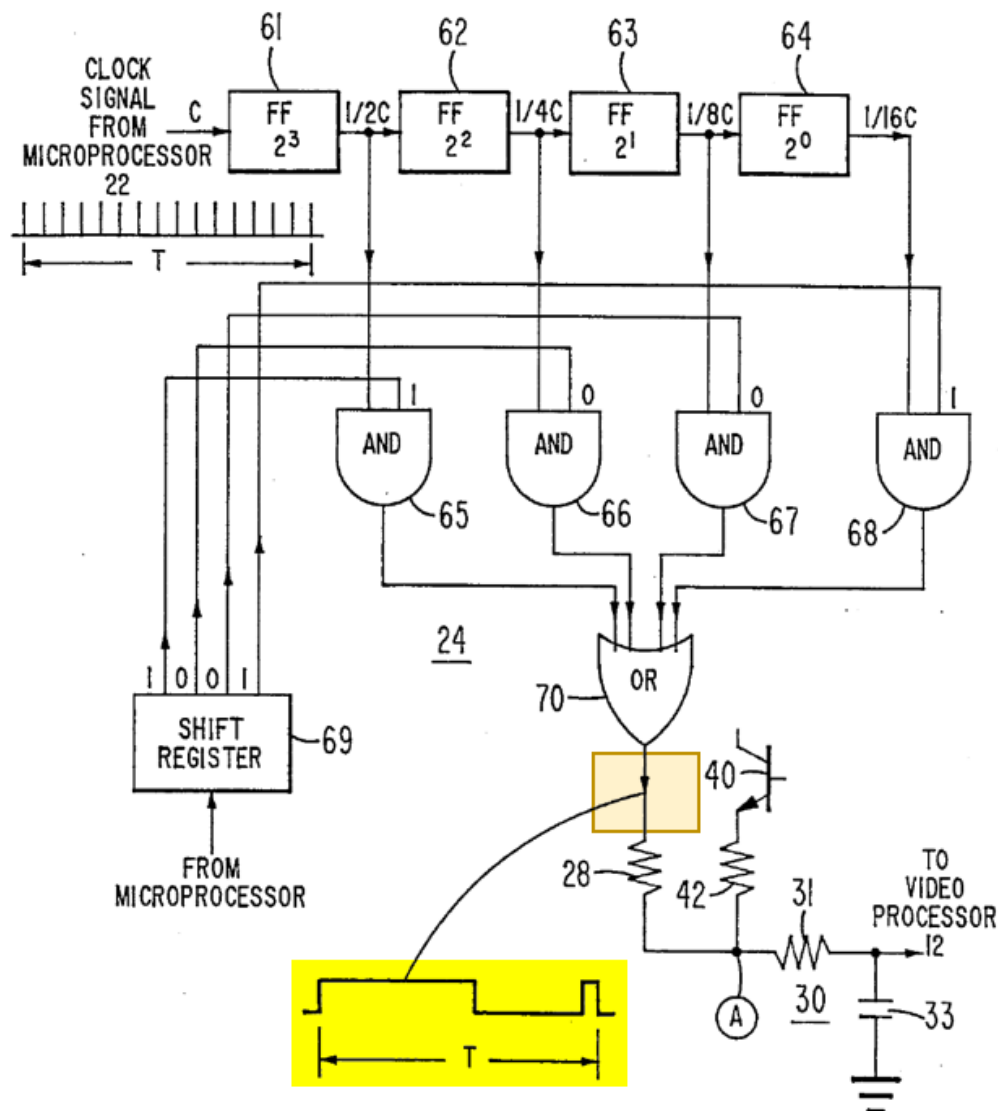


(Stoughton, Fig. 1 (excerpt; highlighting added).)

184. Figure 2 provides more detail on the process via which BRM 24 translates a binary signal from microprocessor 22 into a voltage signal at the output of BRM 24. The yellow highlighting in the below diagram identifies the wire at the output of BRM 24 that corresponds to the “**first input**”. As the diagram shows (with

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the arrow leading down to the time domain graph labeled “T”, highlighted in bright yellow below), the wire at the output of BRM 24 receives a signal alternating between high and low states that is high for a portion of time based on the binary signal from microprocessor 22 (which ultimately depends on the viewer selected contrast level).



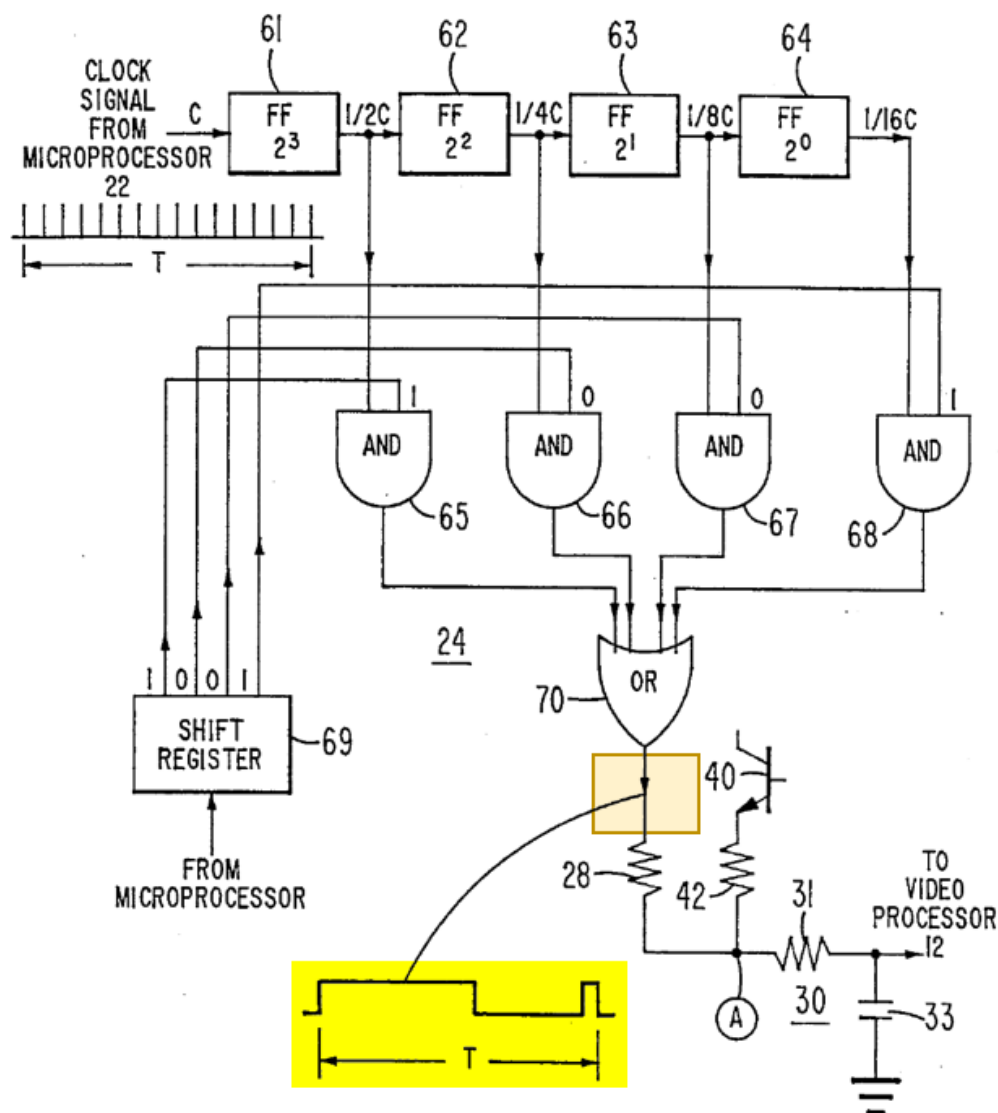
(Stoughton, Fig. 2, 3:56-4:16 (highlighting added).)

185. I am informed that in a prior litigation involving the '117 patent, a district court construed this claim limitation as “*first input actually programmed or implemented with hardware or software to receive a user signal indicative of a user selectable brightness setting.*” (EX1033, p.7.) If this construction is applied, it is readily satisfied by the prior art Stoughton. The wire at the output of BRM 24 receives a user signal because it is connected to the output of BRM 24, the signal being indicative of a user selectable brightness setting as explained. This input is “*actually ... implemented with hardware.*” Further, as outlined in Stoughton, all steps leading from the viewer selected contrast level to the signal at the output of BRM 24 are actually programmed or implemented with hardware or software. (Stoughton, 2:40-63, 3:56-4:16, Figs. 1, 2.)

186. I am informed that Patent Owner, in district court, argues that “**signal**” in the '117 patent should be given its plain and ordinary meaning and that the term includes both hardware and software signals. Petitioner has proposed that the term “**signal**” should be construed as “*a time-varying electrical quantity that can be used to transmit information.*” Stoughton discloses this limitation under either proposed construction. Stoughton discloses that the signal at the output of BRM 24 is a “time-varying electrical quantity,” *i.e.*, a hardware signal. The time domain chart in Figure

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2 of Stoughton (highlighted below) shows that the signal at the output of BRM **24** is high for certain periods and low for other periods—indicating that the signal is “time-varying”:



(Stoughton, Fig. 2 (highlighting added).) Further, Stoughton discloses that this signal is a time-varying voltage, since it charges capacitor **33** with the DC voltage

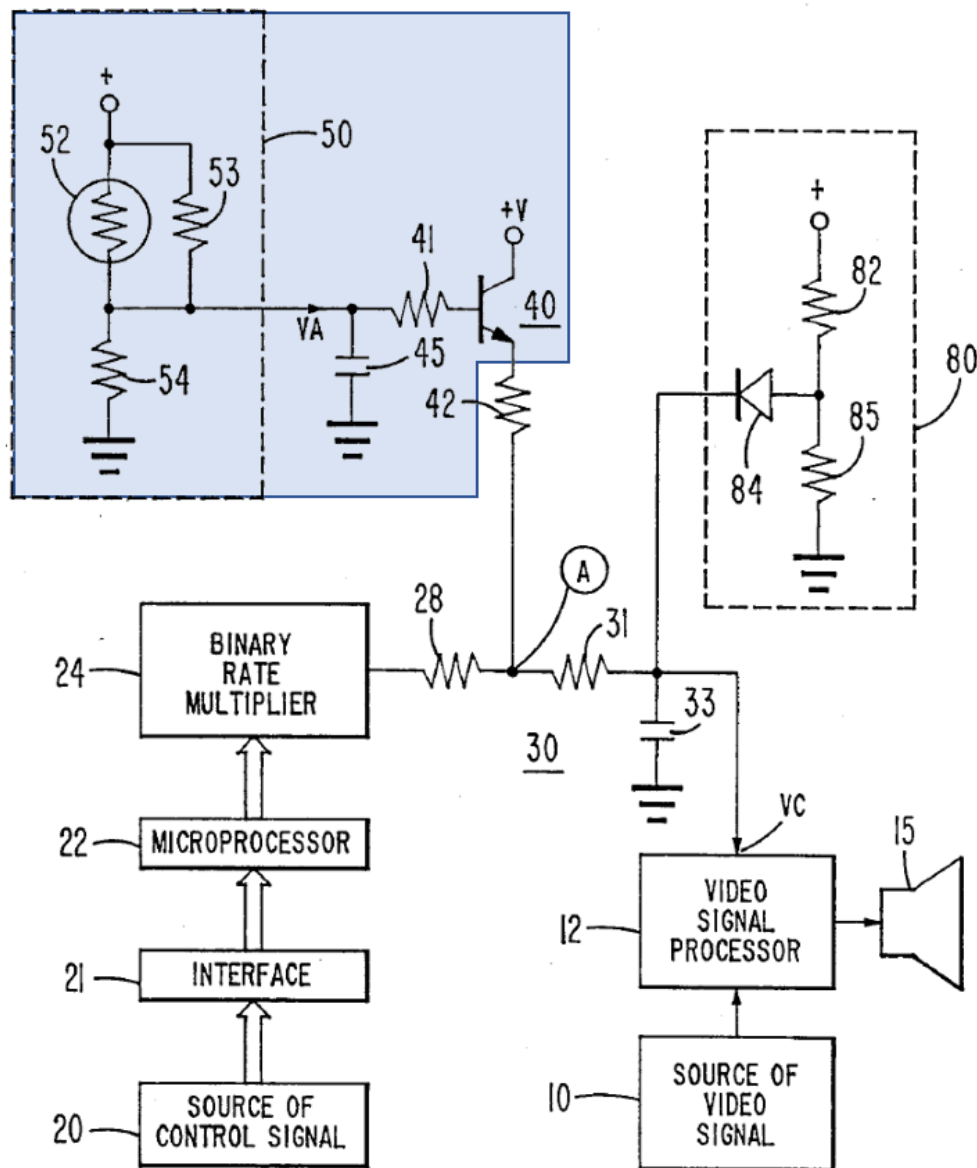
representing an average of the high and low voltage at the output of BRM 24 over time. (Stoughton, 2:63-67, 4:16-31, 1:45-49.)

187. Additionally, Stoughton discloses that the signal at the output of BRM 24 “*can be used to transmit information,*” under Petitioner’s proposed construction, because it is used in the Stoughton circuit to transmit the viewer selected contrast level. (Stoughton, 2:59-63, 3:66-4:2, 4:11-16, 4:42-52 (describing the “information content of the binary output signal”).)

(b) **“a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level;” (Claim 1[b])**

188. Stoughton discloses **“a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level.”** This claim element is disclosed by Stoughton.

189. The circuitry highlighted in blue in Stoughton’s Figure 1 below is **“a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level.”**



(Stoughton, Fig. 1 (highlighting added).)

190. Stoughton discloses that the blue-highlighted circuitry is configured to **“sense ambient light and to output a sensing signal indicative of the ambient light level.”** Stoughton discloses that “[s]ource 50 includes a variable impedance

network with an ambient light responsive light dependent resistor (LDR) **52**[.]” (Stoughton, 3:22-24.) Stoughton discloses that LDR **52** “is positioned close to the display screen of kinescope **15** so that the amount of ambient light striking LDR **52** is proportional to the amount of light striking the kinescope display screen.” (Stoughton, 3:26-30.) The impedance of LDR **52** changes based on the intensity of ambient light striking LDR **52**. (Stoughton, 3:31-34.) A voltage is provided at the node labeled “+” in the blue-highlighted circuitry above, and the voltage is divided between resistors **53** and **54** (which leads to ground) differently based on the ambient light-dependent impedance of LDR **52**. (Stoughton, 3:22-26.) Accordingly, a voltage V_A that varies in intensity based on the impedance of LDR **52** (which changes with the intensity of ambient light) is output along the wire leading to the right out of module **50**. This voltage signal V_A is “conveyed via resistor **41**, follower transistor **40** and resistor **42** to a node A[.]” (Stoughton, 3:34-35.) V_P , the magnitude of the pull-up voltage at the emitter of transistor **40**, depends on V_A . (Stoughton, Fig. 1, 4:30-31.)

191. The blue-highlighted circuitry in Stoughton’s Figure 1 circuit is thus “**configured to sense ambient light**” because it includes LDR **52** which changes the behavior of the blue-highlighted circuitry based on the intensity of ambient light detected. Further, the blue-highlighted circuitry is “**configured to ... output a**

sensing signal indicative of the ambient light level” because it causes output of a voltage VP that varies with the detected intensity of ambient light to pass through resistor **41** into the base of transistor **40**.

192. A POSITA would have further understood that the role of capacitor **45** and resistor **41** is as a low-pass filter for the output signal from circuitry **50**. Indeed, Stoughton describes capacitor **45** as a “filter capacitor.” (Stoughton, 3:20.) A POSITA would have understood that this circuitry serves to “smooth out” the signal from circuitry **50**. This circuitry is part of the “**light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level**” since it manipulates the signal from circuitry **50** to yield the signal at the emitter of transistor **40**.

193. My mapping of claim 1[b] also includes transistor **40** as part of the claimed light sensor. This is because the main role of transistor **40** is to isolate the operation of circuit **50** from the impact of BRM **24**, capacitor **33**, or limiter circuit **80**. Little to no current flows from emitter of transistor **40** to the base—so a POSITA would have understood that transistor **40** keeps any circuitry connected to emitter of transistor **40** from changing the operation of the circuit **50**—which might limit circuit **50**’s ability to detect light and output a light-dependent signal. Accordingly, a POSITA would have understood that transistor **40** is part of the “**light sensor**

configured to sense ambient light and to output a sensing signal indicative of the ambient light level.”

194. Stoughton discloses that the emitter of transistor **40**, part of the claimed light sensor, is **“configured to ... output a sensing signal indicative of the ambient light level.”** Stoughton discloses that the emitter of transistor **40** outputs a voltage that varies based on the ambient light intensity detected by LDR **52**. Stoughton discloses that “an ambient light variation” that impacts the impedance of LDR **52** causes “[a] change in the pull-up voltage (at the emitter of transistor **40**)[.]” (Stoughton, 4:53-56.) Stoughton further discloses that “[c]ontrol voltage VA is conveyed via resistor **41**, follower transistor **40** and resistor **42** to a node A,” where it “modifies the DC value associated with the BRM output signal at node A in response to ambient lighting conditions[.]” (Stoughton, 3:34-41.) The **“sensing signal”** in Stoughton thus corresponds to voltage VA.

195. A POSITA would have understood that a transistor like transistor **40** outputs at its emitter (*e.g.*, transistor **40**) a voltage that depends on the voltage at its collector (here, the terminal connected to the node labeled “+V”) and its base (here, the terminal connected to resistor **41**). Because the voltage at the base of transistor **40** is a voltage signal that varies with the intensity of ambient light detected by LDR **52**, and voltage “+V” is constant, the voltage at the emitter of transistor **40** varies

depending on the intensity of ambient light detected by LDR **52**.

196. Stoughton discloses that “[a]uxiliary contrast (gain) control in response to ambient lighting conditions is provided by a network including a voltage source **50**, a filter capacitor **45**, a resistor **41** an emitter follower transistor **40**, and a pull-up resistor **42**.” (Stoughton, 3:18-22.) A POSITA would have understood that resistor **42** could have been considered part of the “**multiplier**” circuitry (described below) rather than the circuitry involved with generating the sensing signal, because resistor **42** is at the emitter of transistor **40**. As described above, transistor **40** serves to isolate circuitry 50 from the circuitry at the emitter of transistor **40**. Resistor **42** is part of the impedance network downstream of transistor **40** that leads to the multiplication of the sensing and user signals. (Stoughton, 3:3-17.) Accordingly, resistor **42** is part of the “**multiplier**” circuitry—not the “**light sensor**” circuitry.

197. I am informed that in a prior litigation involving the ’117 patent, a district court construed “**configured to**” as requiring that the multiplier be “*actually programmed or implemented with hardware or software.*” The blue-highlighted circuitry in Stoughton’s Figure 1 circuit is “actually programmed or implemented with hardware or software to sense ambient light and to output a sensing signal indicative of the ambient light level” because it is implemented with hardware to operate in the manner described above.

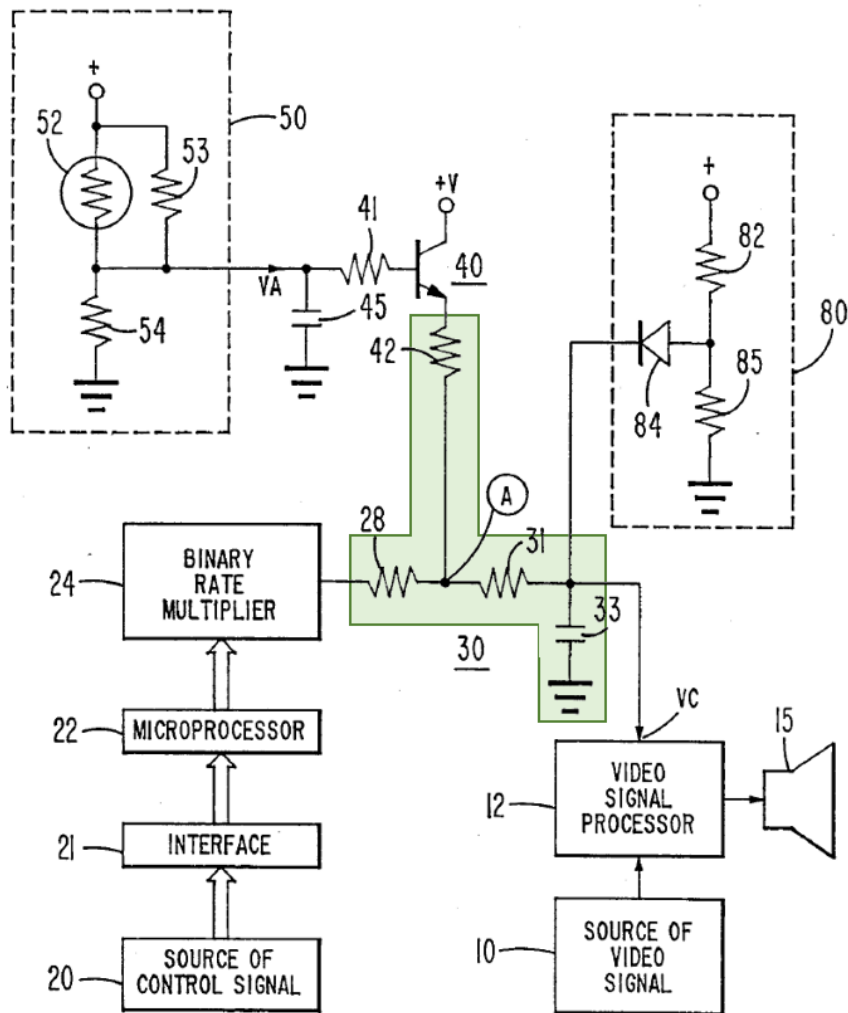
198. I understand that in the district court litigation, Petitioner asserts that “signal” should be construed as “*a time-varying electrical quantity that can be used to transmit information.*” The signal output by the blue-highlighted circuitry in Figure 1 of Stoughton shown above is “a time-varying electrical quantity,” because it is a voltage that changes over time based on the intensity of ambient light detected by LDR 52. Further, the signal output by the blue-highlighted circuitry “can be used to transmit information,” because it transmits information about the intensity of ambient light detected by LDR 52.

199. Based on the above, Stoughton discloses “**a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level.**”

(c) “**a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal; and**” (Claim 1[c])

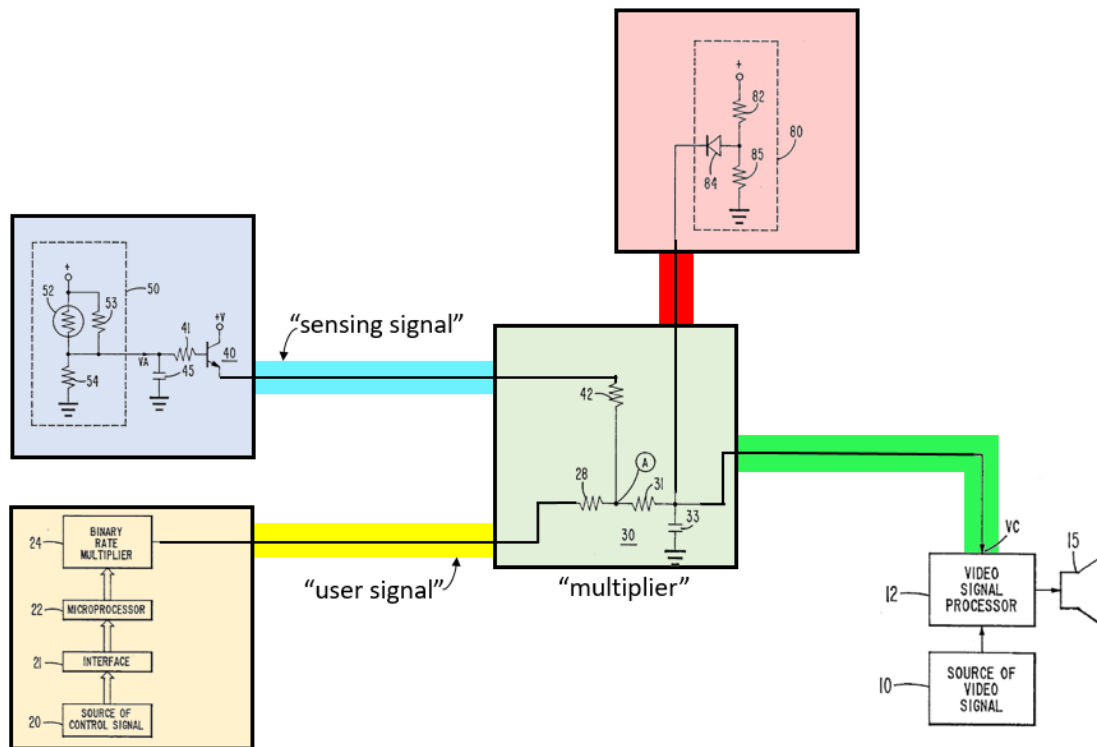
200. A POSITA would have found the limitation “**a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal**” obvious based on Stoughton, Mierzwinski, and Nagai. As explained above, Stoughton teaches a “**multiplier**” which takes the form of the components of Figure 1 shown in green below:

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(Stoughton, Fig. 1 (highlighting added).)

201. For purposes of illustration, I created the figure below based on the components in Figure 1 to show the relationship between the claimed **multiplier**, **user signal**, and **sensing signal** of the Stoughton circuit:



202. For completeness, I have also identified the circuitry for the “**dark level bias**” (in red) and the “**brightness control signal**” (in green), which I will describe in more detail below. In any case, the green-highlighted circuitry above qualifies as a “**multiplier**,” which results in a voltage signal across capacitor **33** that represents the product of the user signal and the sensing signal—or a “**combined signal**.” Stoughton explains that this voltage is determined by multiplying the “**user signal**” (of claim 1[a]) with the “**sensing signal**” (of claim 1[b]):

The DC value of the signal at node A is recovered for contrast control purposes by means of integrator **30**. The output signal of BRM **24**, when integrated over time by circuit **30**, provides a DC voltage across

capacitor **33** in accordance with the expression

$$\frac{N}{2^n} \times VP$$

where “N” is the output number of the BRM (the number of pulses per unit of time), “n” is the number of binary bit stages of the BRM (four in this example), and “VP” is the magnitude of the pull-up voltage at the emitter of transistor **40**.

(Stoughton, 4:16-31.) The factor $N \div 2^n$ above represents the portion of time during which the “**user signal**” at the output of BRM **24** is high. That factor is multiplied by VP, the voltage at the emitter of transistor **40**, which depends on the ambient light sensed by LDR **52** as described for claim 1[b]. Accordingly, a DC voltage in accordance with the above expression is a “**combined signal**” that is the product of both the user signal ($N \div 2^n$) and a sensing signal (VP).

203. Referring to the annotated Figure 1 from Stoughton above, the BRM output, the left side of resistor **28**, is high is for $\frac{N}{2^n} \cdot T$ as seen in Figure 2 and discussed above. During this time, the voltage across resistor **28** is minimized, so little current flows in it. This allows the voltage on the emitter of **40**, that is VP, to charge capacitor **33** through resistors **31** and **42** (“The charging time constant of capacitor **33** as determined by the values of resistors **31** and **42** ...”) (Stoughton, 3:11-12.) Thus, when the output of the BRM is high the voltage across capacitor **33**,

that is VC, will charge towards VP.

204. When the output of the BRM is low, the current from transistor **40** as well as the discharge current from capacitor **33** will flow into the output of the BRM. During this time, $\left(1 - \frac{N}{2^n}\right) \cdot T$, capacitor **33** will discharge through resistors **28** and **31** towards ground (0V). “... and the discharging time constant as determined by the values of resistors **28** and **31** ... ” (Stoughton, 3:13-14.)

205. To determine the resulting voltage across capacitor **33** an average, over a cycle T, of the time capacitor **33** is charged to VP with the time it is discharged to 0V is used resulting in $VC = \frac{\left(\frac{N}{2^n} \cdot T \cdot VP + \left(1 - \frac{N}{2^n}\right) \cdot T \cdot 0\right)}{T} = \frac{N}{2^n} \cdot VP$.

206. Consistent with the green-highlighted “multiplier” circuitry performing a multiplication operation, Stoughton discloses that “a 50% change in the magnitude of the pull-up voltage will produce a 50% change in image contrast regardless of the form (i.e., duty cycle) of the BRM output signal.” (Stoughton, 4:56-59.) A POSITA would have understood that a multiplication operation would have the property such that a 50% change in one of the multiplied terms will produce a 50% change in the output produce value. For example, $2 \times 5 = 10$. If the value of one of the terms—2—is changed by 50%—making 3 ($2 + 2 \times 50\% = 2 + 1 = 3$)—then the output (10) also changes by 50%: $3 \times 5 = 15$ ($10 + 10 \times 50\% = 10 + 5 = 15$). The same property

does not apply to an addition operation. For example, $2 + 5 = 7$. But $3 + 5 = 8$. And while 3 is 50% more than 2, 8 is not 50% more than 7 (10.5 is 50% more than 7). A POSITA would have understood this principle—so the fact that Stoughton discloses that a 50% change in the magnitude of the pull-up voltage will produce a 50% change in image contrast would have indicated to a POSITA that Stoughton multiplies the pull-up voltage at the emitter of transistor **40** by a value representing the user signal at the output of BRM **24**.

207. All the circuitry highlighted in green above that I have mapped to the claimed “**multiplier**” is involved in generating VC. As described above, the values of the resistors determine the behavior of the circuit at various times such that the voltage across capacitor **33** reflects the product of the user signal and the sensing signal. Stoughton provides guidance on the values of these resistors and describes their behavior. For example, Stoughton states that “[r]esistor **28** limits the output current of BRM **24**, and also acts as a lower range limiting device for a given ambient light condition.” (Stoughton, 3:3-5.) Further, Stoughton states that “[t]he value of resistor **31** is chosen to provide appropriate low pass filtering of the BRM output signal, in combination with capacitor **33**.” (Stoughton, 3:5-7.) Additionally, Stoughton discloses the following about the relationship between resistor **28**, **31**, and **42**:

The charge and discharge time constants of capacitor **33** are primarily determined by the value of resistor **31**. The value of resistor **28** also influences the discharge time constant. The charging time constant of capacitor 33 as determined by the values of resistors **31** and **42**, and the discharging time constant as determined by the values of resistors **28** and **31**, preferably should be substantially equal or within 10% of each other. This typically requires that the value of resistor **31** be significantly larger than the values of resistors **28** and **42**.

(Stoughton, 3:8-17.)

208. I am informed that in a prior litigation involving the '117 patent, a district court construed “**multiplier configured to**” as requiring that the multiplier be “*actually programmed or implemented with hardware or software.*” I am further informed that a district court construed “**combined signal**” as including, but not necessarily being limited to, “*the product of the user signal and the sensing signal.*” To the extent they apply, these constructions are readily satisfied by Stoughton.

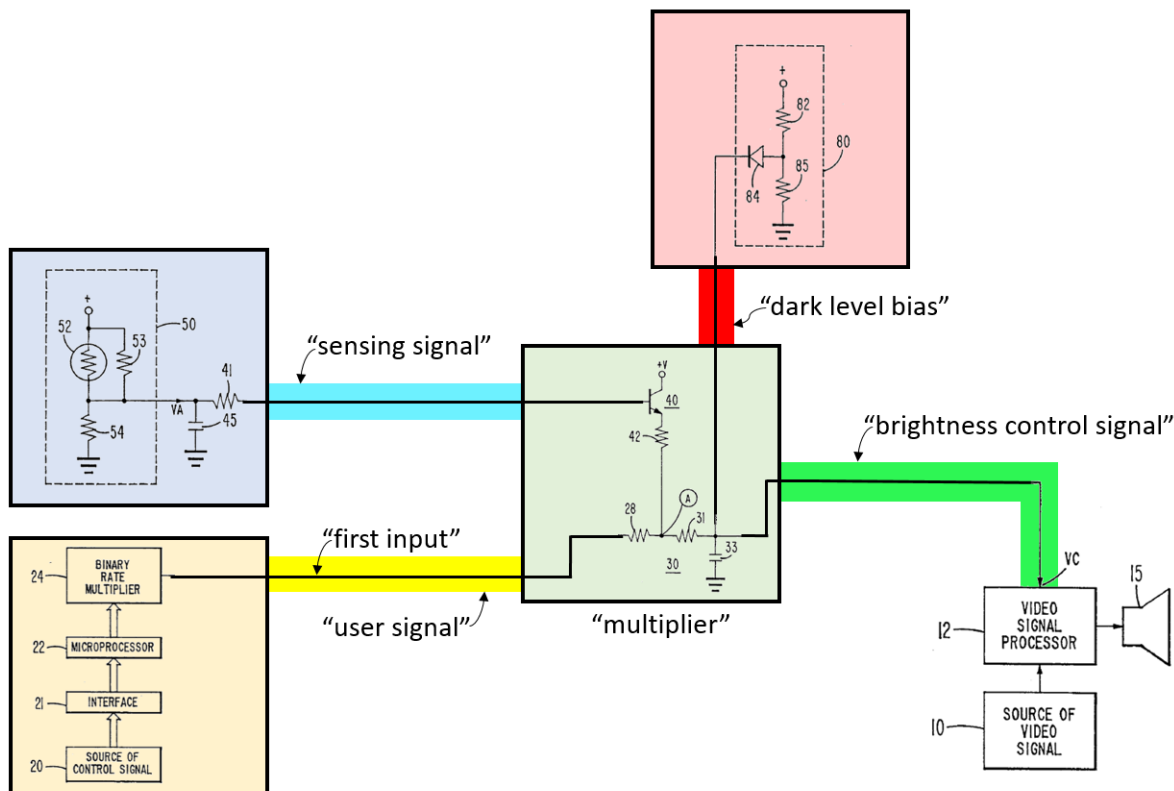
209. Stoughton discloses that the operation of the green-highlighted “**multiplier**” circuitry results in a combined signal that includes the product of the user signal and the sensing signal. The green-highlighted “multiplier” circuitry yields a voltage across capacitor **33** (combined signal) in accordance with the product of the duty cycle (or fraction of time the signal is in the high state) of the

signal at the output of BRM **24** (user signal) and the pull-up voltage at the emitter of transistor **40** (sensing signal). (Stoughton, 4:16-31, 4:56-59.)

210. Further, Stoughton discloses that the green-highlighted multiplier circuitry in Stoughton's Figure 1 circuit is "*actually programmed or implemented with hardware or software*" to operate as described above. The green-highlighted circuitry is implemented with hardware components—three resistors, a capacitor, and connecting wires.

211. As noted, I understand that in the district court litigation, Petitioner asserts that "**signal**" should be construed as "*a time-varying electrical quantity that can be used to transmit information,*" whereas Patent Owner contends that the term "signal" includes hardware or software signals. Both constructions are satisfied by Stoughton. For the reasons described above, the signal at the output of BRM **24** and the signal at the emitter of transistor **40** are each "*a time-varying electrical quantity that can be used to transmit information,*" *i.e.*, hardware signals. Further, the contrast control voltage VC output by the "multiplier" circuitry as a voltage over capacitor **33** is a "signal" under Petitioner's construction, because it is a voltage that varies over time (in accordance with the expression $(N \div 2^n) \times VP$ as the two terms of that expression change over time) and it can be used to transmit information (*i.e.*, the contrast level of kinescope **15**).

212. To the extent there is any suggestion that transistor **40** is involved in the multiplication of the user signal and sensing signal in Stoughton's Figure 1 circuit, a POSITA would have understood that transistor **40** could be considered to be part of the multiplier circuitry, as shown below. In this alternative way of viewing Stoughton's Figure 1 circuit, the "sensing signal" exists at the base of transistor **40**, and transistor **40** is part of what multiplies that "sensing signal" with the "user signal" at the output of BRM **24**. The followed figure that I created, which is a slight variation of the one provided earlier, shows this arrangement:



This way of mapping the components of Stoughton's Figure 1 to the claim does not

materially differ from the mapping above in which the “**multiplier**” circuitry does not include transistor **40**. Stoughton discloses that “[c]ontrol voltage VA is conveyed via resistor **41**, **follower transistor 40** and resistor **42** to a node A”—which indicates that regardless of whether the point at the base of the transistor or the point at the emitter of the transistor is considered as the start of the “**multiplier**,” essentially the same ambient-light reflective signal is at issue. (Stoughton, 3:18-36.) As I described above, a POSITA would have recognized that the main role of transistor **40** in Stoughton’s Figure 1 circuit is isolating circuitry **50** from other circuitry—not to change the signal at the transistor base in conveying it to the emitter.

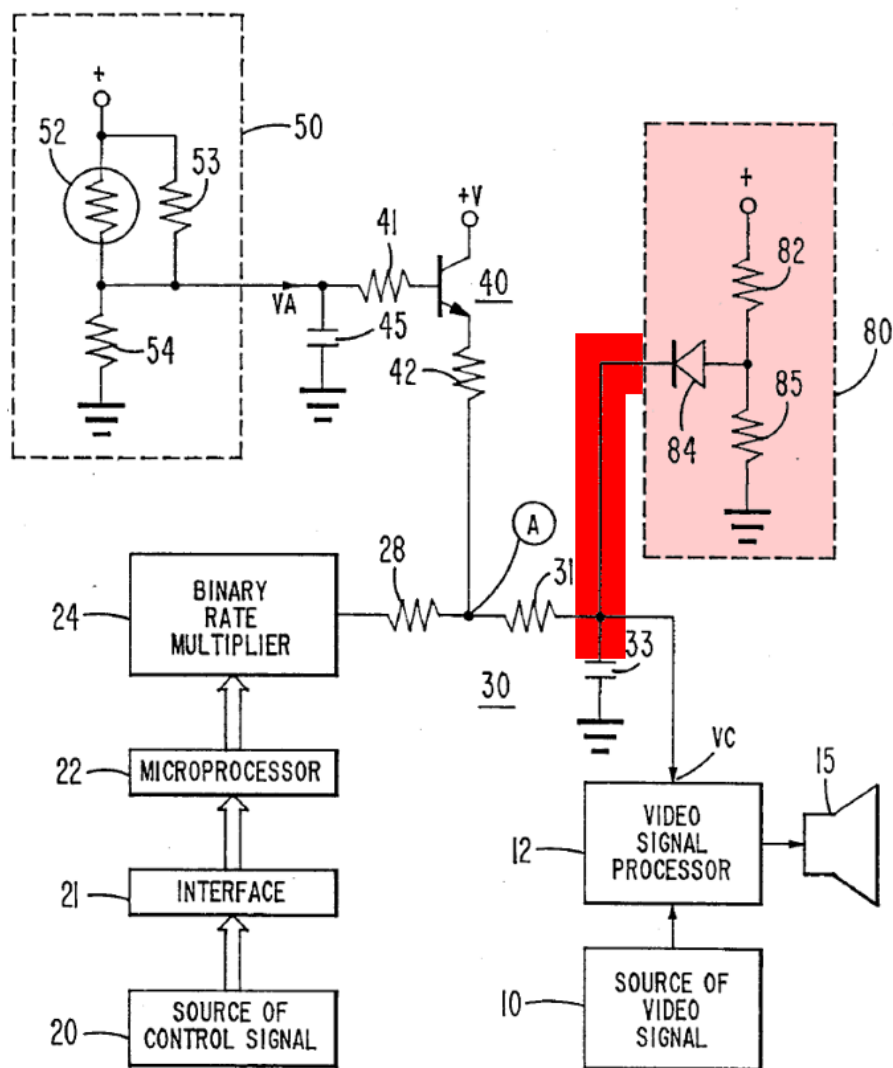
213. As described above for the preamble to claim 1, it would have been obvious to a POSITA to modify Stoughton’s Figure 1 circuit to allow for a manual mode. In the modified Stoughton Figure 1 circuit, the multiplier would be configured to “*selectively* generate a combined signal based on both the user signal and the sensing signal,” because in the manual mode, there would be no sensing signal available to combine the user signal with, since substantially no current would be passing through LDR **52**. A POSITA would have understood that Stoughton’s Figure 1 circuit would continue to function with no sensing signal—since capacitor **33** would continue to reach a voltage dependent on the portion of time the signal

from BRM 24 is in the high state. Accordingly, for the reasons outlined above for the preamble to claim 1, a POSITA would have found “**a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal**” obvious based on Stoughton in view of Mierzwinski and Nagai.

- (d) “**a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.**” (Claim 1[d])

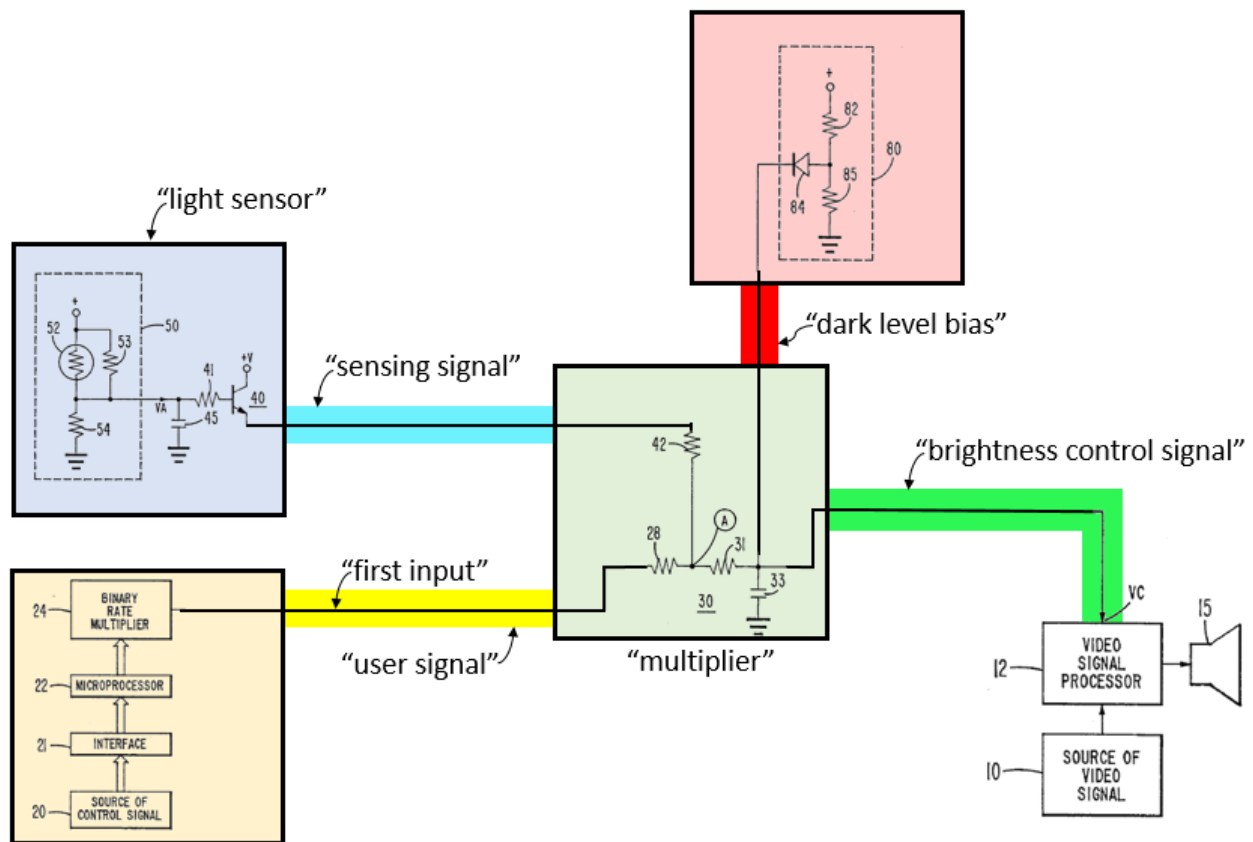
214. Stoughton discloses “**a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.**”

215. Stoughton’s limiter circuit 80 provides a “**dark level bias**” as claimed. Stoughton’s limiter circuit 80 is highlighted in pink in the below annotated version of Figure 1, with the wire via which the “**dark level bias**” is provided by limiter circuit 80 highlighted in red:



(Stoughton, Fig. 1 (highlighting added).)

216. The annotated figure below that I created, which was discussed previously, shows the “**dark level bias**” in Stoughton and its relationship to other components in Stoughton’s Figure 1 circuit:



217. Stoughton explains that the purpose of limiter circuit **80** is to ensure that, as ambient light decreases, the contrast control voltage does not fall below a predetermined threshold:

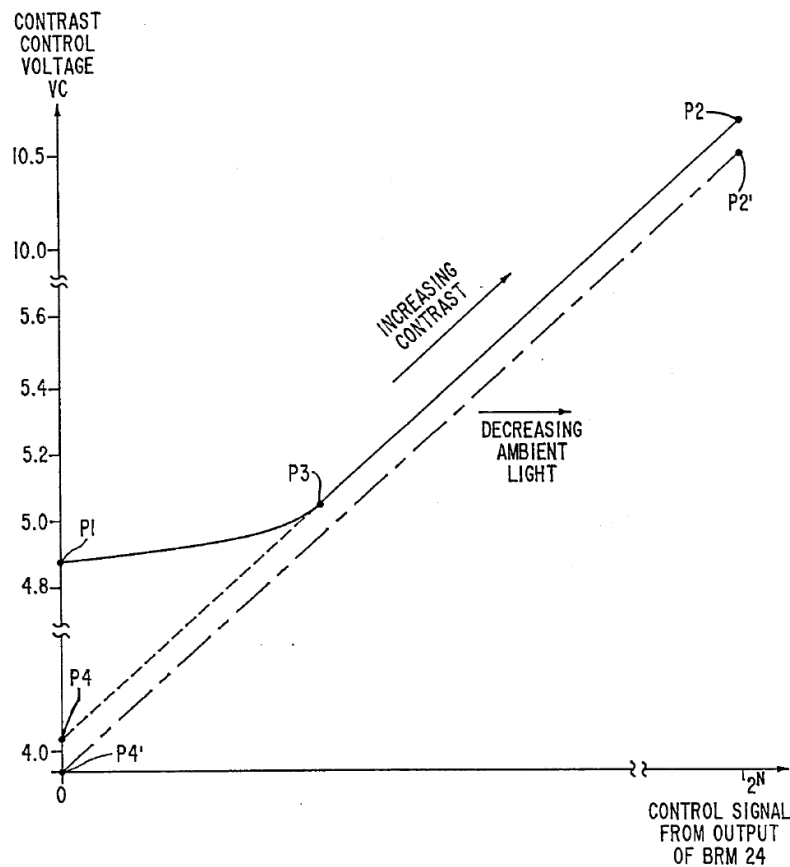
Referring again to FIG. 1, in accordance with the principles of the present invention a limiter circuit **80** is included in the contrast control system. Limiter **80** includes voltage divider resistors **82** and **84** coupled between a source of positive DC potential and ground. A normally

nonconductive limiter diode **85**⁴] is connected as shown between the junction of resistors **82** and **84** and the terminal of capacitor **33** at which the gain control voltage is developed. A desired threshold operating condition of diode **85** is established by a bias voltage applied to the anode of diode **85** from the junction of resistors **82** and **84**. As will be discussed, limiter diode is rendered conductive when the voltage across capacitor **33** decreases sufficiently in a direction related to reduced image contrast. When conductive, diode **85** limits the voltage across capacitor **33** to a value related to the DC voltage appearing at the junction of resistor **82** and **84** less the offset voltage drop across diode **85**, as will be explained in connection with FIG. 3.

(Stoughton, 4:60-5:10.) This relationship is shown in Figure 3, which shows how limiter circuit **80** maintains the contrast control voltage at this pre-determined threshold even with reductions in ambient lighting conditions:

⁴ As explained above, it would have been obvious to a POSITA that **84** in Figure 1 is a diode and **85** is a resistor, based on standard circuit diagram symbols that a POSITA would have recognized. Thus, “**84**” refers to the diode in limiter circuit **80** and “**85**” refers to the resistor in limiter circuit **80**, as shown in Figure 1.

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(Stoughton, Fig. 3.)⁵ Stoughton discloses that if its circuit did not include limiter

⁵ It is my opinion that a POSITA would have understood that Figure 3 was not intended to literally report precise voltage values reflecting the relationship between the signal at the output of BRM 24 and contrast control voltage VC in Stoughton's Figure 1 circuit. Rather, a POSITA would have understood Figure 3 as a hypothetical voltage response curve intended to show the impact of limiter circuit

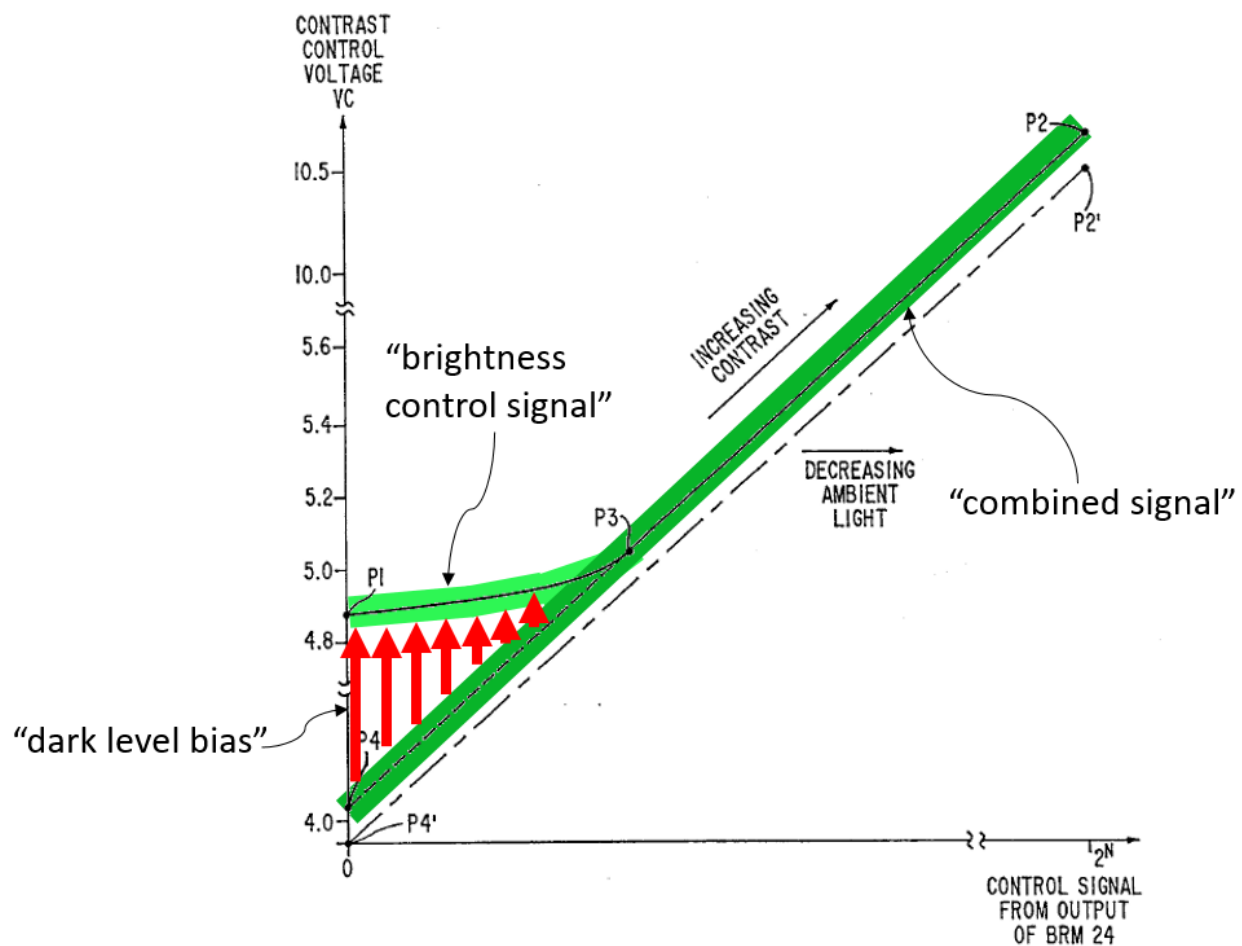
circuit 80, then the line from P2 to P4 would represent the contrast response. (Stoughton, 5:33-37.) The limiter circuit causes the control voltage VC to deviate from the line between P2 and P4 starting at P3. When the control voltage VC reaches the point represented by P3, limiter circuit **80** causes the rate of change of the contrast response to slow down, causing the “flatter” line between points P3 and P1. (Stoughton, 5:22-33; *see also id.* 4:60-5:21, 5:33-6:5.)

218. As the Stoughton specification describes, the limiter circuit **80** provides voltage to capacitor **33** when the voltage across capacitor **33** falls below a threshold. Accordingly, the output signal of Stoughton’s limiter circuit **80** is “**configured to**

80 on the contrast control voltage VC. For example, there are symbols on each axis of the above diagram indicating that there is a break or gap in the scale—but there is no corresponding break or gap in the plotted lines. An ordinarily skilled artisan would have understood that the voltage response of Stoughton’s Figure 1 circuit would have been more complex than the plotted lines in Figure 3, because the value of voltage VC would also have varied depending on component values that are not disclosed by Stoughton. But these omissions would not have prevented an ordinarily skilled artisan from understanding the relationship depicted in Figure 3.

adjust [*i.e.*, increase] **the combined signal** [the voltage VC across capacitor **33** from integrating the output of BRM **24** and the pull-up voltage at the emitter of transistor **40**] **to generate a brightness control signal** [the adjusted voltage VC across capacitor **33**] **that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level** [the brightness threshold maintained by limiter circuit **80** keeping capacitor **33** above a certain voltage] **when the ambient light level decreases to approximately zero.**” Limiter circuit **80** provides a dark level bias that adjusts a previously existing “**combined signal**” across capacitor **33**, because the value of this “**combined signal**” VC determines whether or not limiter circuit **80** provides the dark level bias at all. Thus, Stoughton discloses three distinct steps: (1) the formation of the combined signal across capacitor **33**; (2) the provision of the dark level bias from limiter circuit **80** if the voltage across capacitor **33** is too low; and (3) the upward adjustment of the voltage across capacitor **33** to form the brightness control signal.

219. The following annotated version of Stoughton’s Figure 3 shows the impact of limiter circuit **80**:



(Stoughton, Fig. 3 (highlighting and annotations added).) As the above annotated Figure 3 shows, the dark level bias (red arrows) causes the “combined signal” (dark green) of the voltage across capacitor **33** to increase—yielding a higher-voltage “brightness control signal” (light green) that remains above a threshold voltage (around 4.9 volts as shown in Figure 3) (Stoughton, 5:33-37, 5:48-54).

220. Stoughton discloses that limiter circuit **80** provides “a dark level bias configured to adjust the combined signal to generate a brightness control signal

that is used to control a brightness level of a visible display.”

221. Stoughton discloses that the voltage VC across capacitor **33** is input to video signal processor **12** to control the contrast of kinescope **15**. (Stoughton, Figs. 1, 2; 2:34-37, 4:16-18, 4:42-52.) As described above for the preamble to claim 1, a POSITA would have understood that a signal for controlling the contrast of a display is a “**brightness control signal**,” because a POSITA would have known that changing the contrast of a displayed image changes the brightness of the image. (See, e.g., Fink at 1-46 (“The contrast control affects both the brightness and the contrast of the picture.”).) For the same reason, a POSITA would have understood that controlling the contrast of kinescope **15** constitutes “**control[ing] a brightness level of a visible display**.” Further, as described above for the preamble to claim 1, to the extent there is any suggestion that brightness and contrast are independent, it would have been obvious in light of Mierzwinski to modify the Stoughton circuit such that it controls both contrast and brightness of kinescope 15. Thus, it would have been obvious to a POSITA to “**control a brightness level of a visible display**” using the Stoughton circuit.

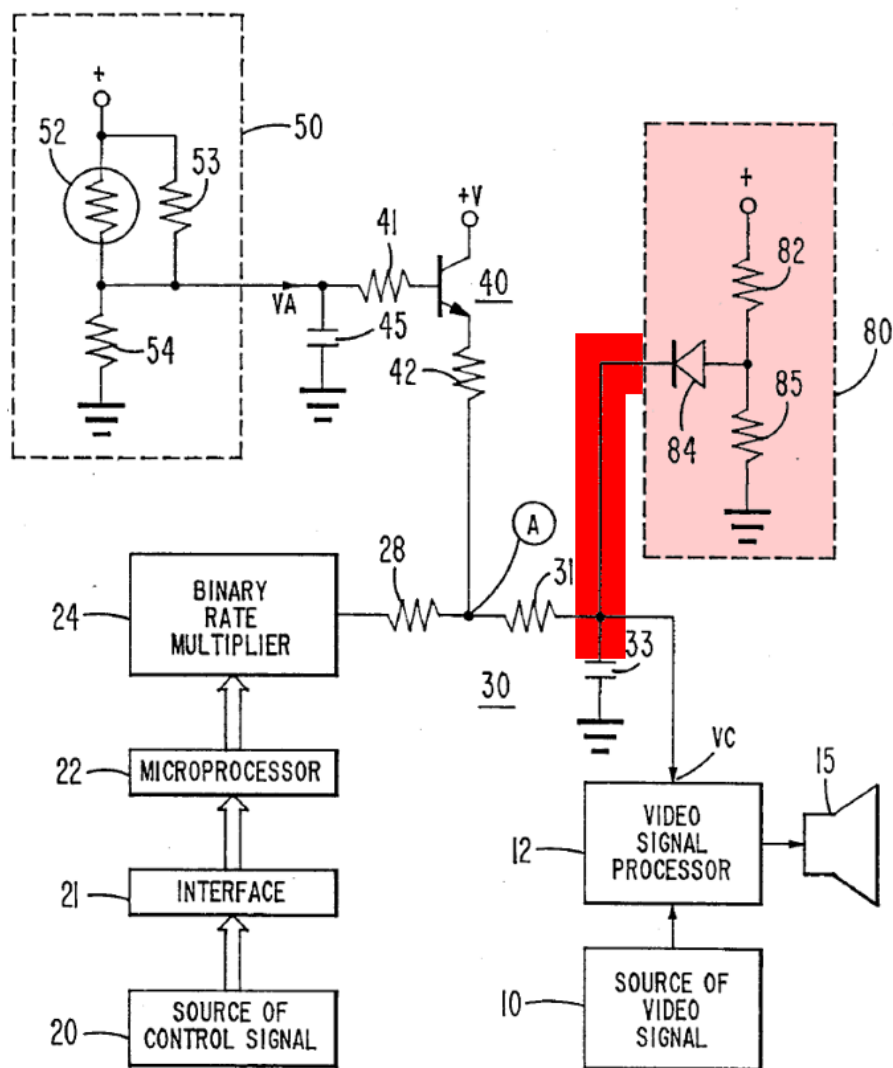
222. Further, Stoughton discloses that limiter circuit **80** operates “**such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero**.” As explained above

and shown in Figure 3 above, as ambient light decreases to approximately zero, the contrast control signal is maintained above a predetermined threshold of approximately 4.9. Stoughton further discloses that “as ambient light diminishes, the action of LDR **52** would cause otherwise existing minimum contrast end point P4 to shift downward proportionally, thereby placing end point P4 at a control voltage low enough to extinguish a display image.” (Stoughton, 5:43-48.) This is shown in Stoughton’s Figure 3 as the line from point P2’ to P4’, which represents the Stoughton circuit’s voltage response (if limiter circuit **80** was absent) given a “low ambient light condition.” (Stoughton, 5:48-50.) But Stoughton discloses that its circuit prevents this effect “by the action of limiter **80**, which maintains minimum contrast end point P1 at a voltage sufficient to prevent the displayed image from being extinguished.” (Stoughton, 5:50-54.) Thus, Stoughton discloses that where a decrease in ambient light level to a low level—which naturally includes an ambient light level of “approximately zero”—would normally extinguish the display due to a low brightness control signal, limiter circuit **80** instead maintains that control signal above a minimum level to prevent this effect. Accordingly, Stoughton discloses **“that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.”**

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223. I am informed that in a prior litigation involving the '117 patent, a district court construed “**dark level bias**” as “*a value that causes a deviation from the combined signal, where the value is a voltage value of an electrical signal or value of a software variable.*” A district court also construed this limitation as being “*actually programmed or implemented with hardware or software to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display.*” These constructions are readily satisfied and rendered obvious by Stoughton.

224. As shown in the below figure, the “**dark level bias**” (dark red) is implemented with hardware components (light red) in the Stoughton Figure 1 circuit:



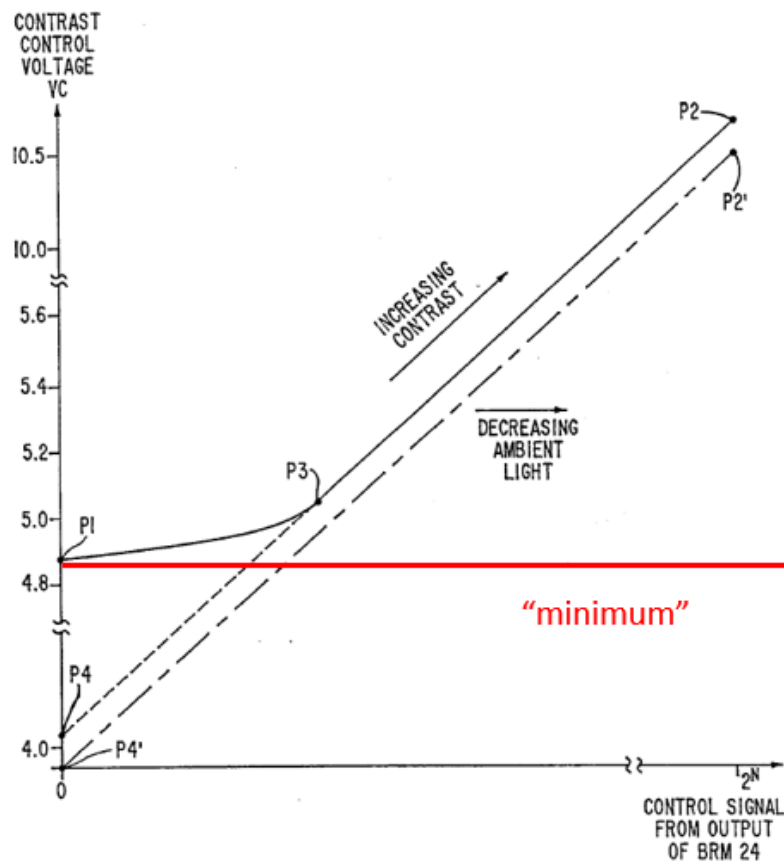
(Stoughton, Fig. 1 (highlighting added).)

225. Stoughton discloses that the “**dark level bias**” provided by limiter circuit 80 is a “*voltage value of an electrical signal*,” as explained above. Further, Stoughton discloses that the limiter circuit 80 causes a “*deviation*” from the combined signal, as shown above, including in the difference between curve P1 to P3 in Figure 3 and line P4 to P3.

226. I understand that in the district court litigation, Petitioner proposed that “**dark level bias**” should be construed as “*voltage or current.*” As described above, Stoughton discloses that limiter circuit 80 provides a voltage to capacitor **33**. (Stoughton, 4:62-5:10, Fig. 3.)

227. I understand that in the district court litigation, Petitioner proposed that “**predetermined**” should be construed as “*minimum.*” Stoughton discloses that limiter circuit **80** “maintains minimum contrast end point P1 at a voltage sufficient to prevent the displayed image from being extinguished.” (Stoughton, 5:50-54.) Figure 3 shows an example of such a “minimum” value maintained by limiter circuit 80:

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(Stoughton, Fig. 3 (annotated).)

228. I understand that Petitioner proposed that “**signal**” should be construed as “*a time-varying electrical quantity that can be used to transmit information,*” and that Patent Owner contends that “signal” should be given its plain and ordinary meaning but includes software and hardware signals. It is my opinion that the voltage across capacitor **33** after the provision of voltage by limiter circuit **80** is a “**signal**” that satisfies either construction. As Figure 3 shows, the voltage across capacitor **33** is a hardware signal that changes over time—including when limiter

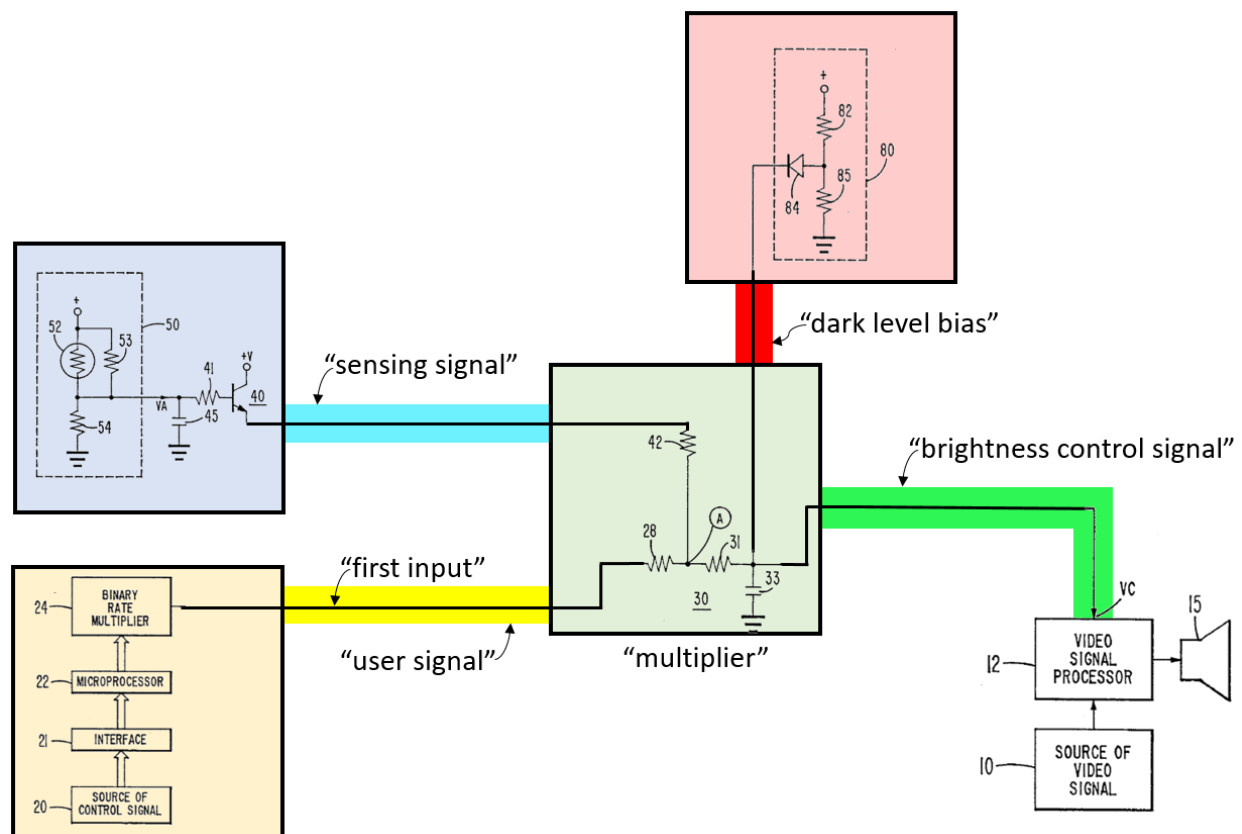
circuit **80** is operating to keep it at a minimum voltage. Further, Stoughton discloses that this signal can be used to transmit information about the contrast to be applied to kinescope **15**. (Stoughton, Abstract; *see also id.*, 2:14-25, 2:67-3:2, 4:53-59, Figs. 1-3.)

2. Claim 2

229. Claim 2 depends from claim 1, and further recites “[t]he **brightness control circuit of claim 1, wherein the dark level bias is provided to the multiplier such that the amount of adjustment to the combined signal is dependent on the user selectable brightness setting.**”

230. Claim 2 would have been obvious to a POSITA based on Stoughton in light of Mierzwinski and Nagai.

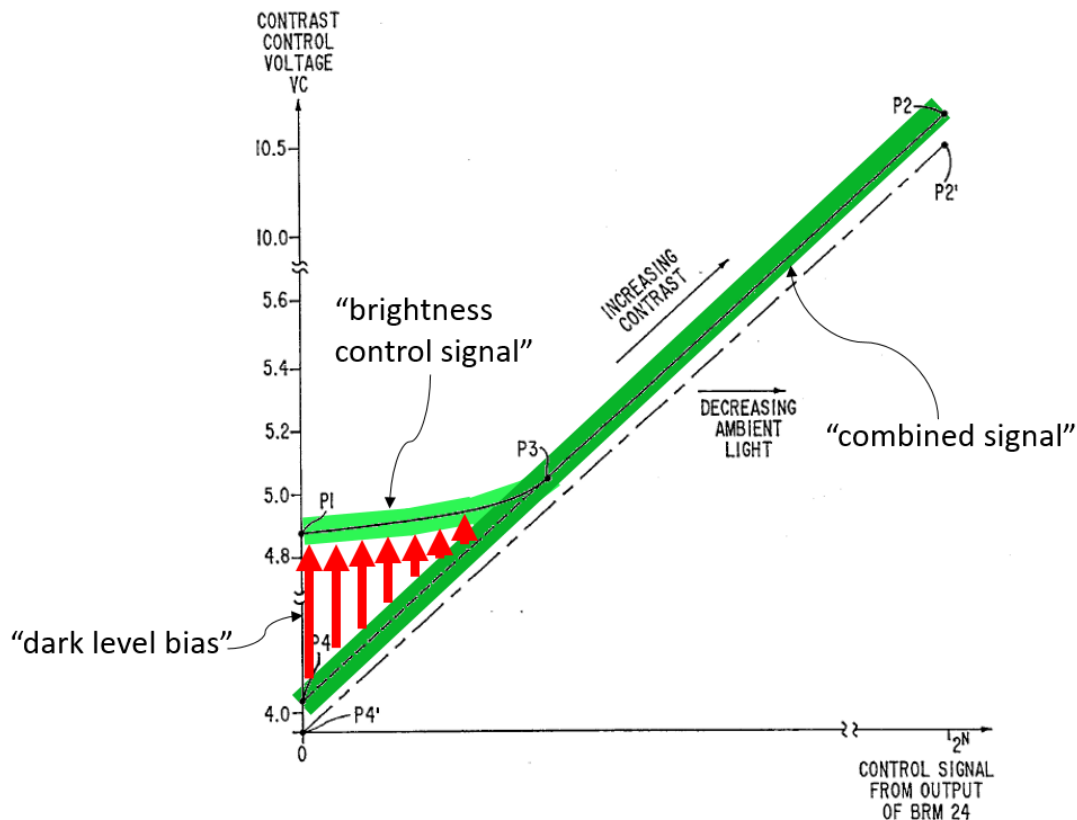
231. In Stoughton’s Figure 1 circuit, the “**dark level bias is provided to the multiplier,**” as shown in the diagram below, where the dark level bias is the signal along the dark red-highlighted wire and the multiplier is the light green-highlighted circuitry:



232. Stoughton further discloses that **“the amount of adjustment to the combined signal is dependent on the user selectable brightness setting.”**

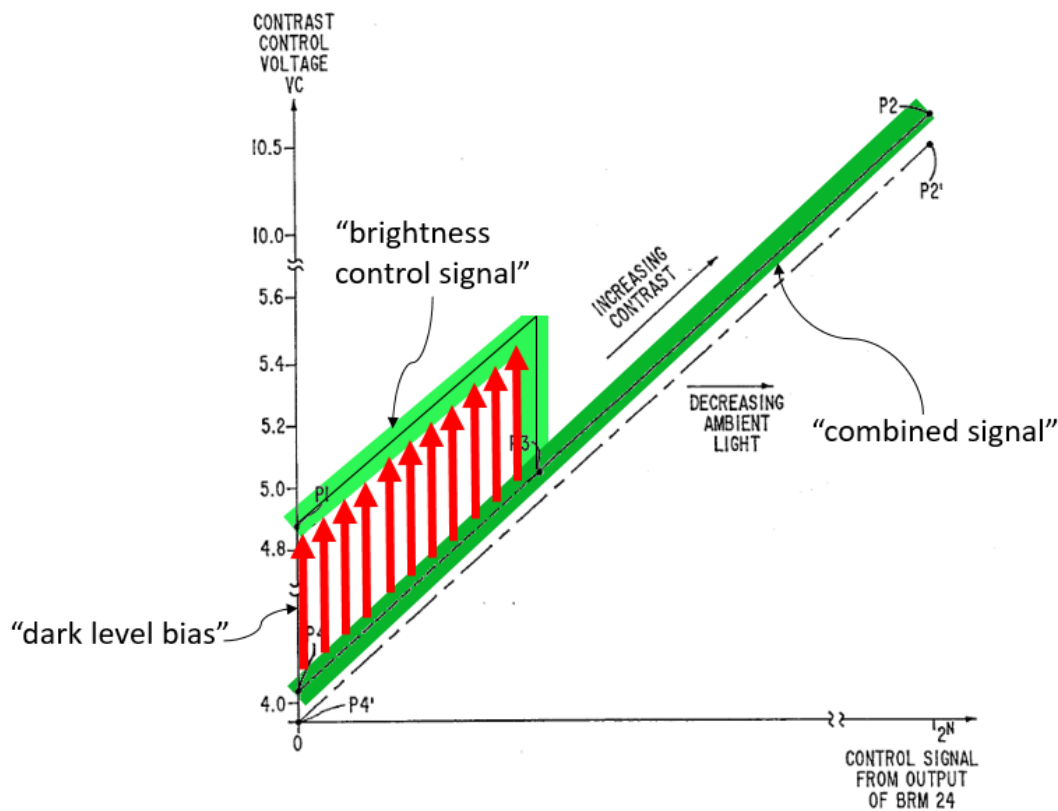
Figure 3 of Stoughton shows that the adjustment due to limiter circuit 80—*i.e.*, the difference between the curved line between P1 and P3 and the straight line between P3 and P4—depends on the signal at the output of BRM 24 (which is dependent on the viewer selectable contrast level). As the below annotated version of Stoughton’s Figure 3 shows, the amount of adjustment to the combined signal (the length of the red arrows) gets larger (longer arrows) the lower the user selectable brightness

setting (as reflected in the control signal from output of BRM 24):



(Stoughton, Fig. 3 (highlighting and annotations added).) It would have therefore been obvious that, assuming the same ambient lighting level, a *lower* user selectable brightness setting would have resulted in a *greater* adjustment to the combined signal, and vice versa. In fact, if the amount of adjustment to the combined signal were *not* dependent on the user selectable brightness setting in Stoughton's Figure 1 circuit, then a POSITA would have understood that Stoughton's Figure 3 would look like the below:

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(Stoughton, Fig. 3 (highlighting and annotations added).) The fact that the difference between the lower line (combined signal) and the upper line (brightness control signal following adjustment by dark level bias) in Stoughton's Figure 3 varies (different red arrow lengths) based on the level of the control signal (reflecting the user selectable brightness setting) and is not a constant adjustment (like the identical red arrows in the above modified Figure 3) indicates that Stoughton satisfies claim 2.

233. Accordingly, a POSITA would have found obvious "[t]he brightness

control circuit of claim 1, wherein the dark level bias is provided to the multiplier such that the amount of adjustment to the combined signal is dependent on the user selectable brightness setting.”

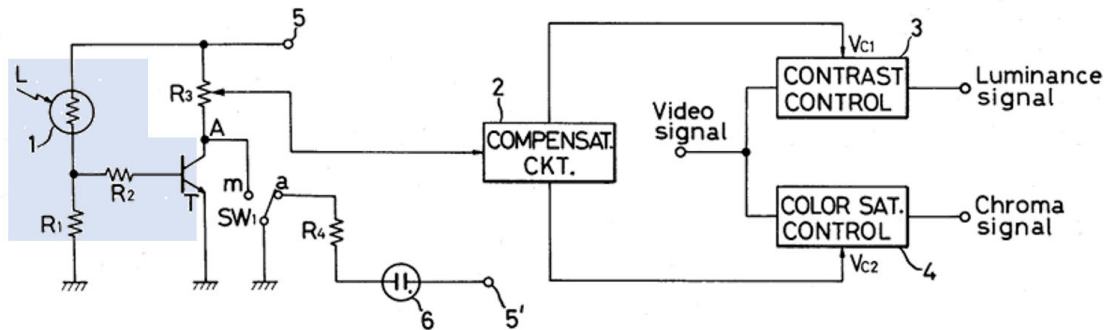
3. Claim 9

234. Claim 9 depends from claim 1, and further recites “[t]he **brightness control circuit of claim 1, further comprising a second input configured to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode, wherein the selection signal enables the light sensor in the auto mode and disables the light sensor in the manual mode.”**

235. For the reasons outlined above for the preamble to claim 1, based on Stoughton in light of Mierzwinski and Nagai, a POSITA would have found claim 9 obvious.

236. As discussed above for the preamble to claim 1, it would be obvious to modify Stoughton’s Figure 1 circuit to include a switch that connects and disconnects a voltage source and the light sensor. The signal (selection signal) flowing—or not flowing—through such a switch “**enables the light sensor in the auto mode and disables the light sensor in the manual mode,**” as discussed above for the preamble to claim 1.

Fig.1



237. Stoughton's Figure 1 circuit as modified in light of Nagai "**compris[es]** a second input configured to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode."

238. I understand that in the district court litigation, Patent Owner proposed construing "a second input configured to receive a selection signal" as "*a second input actually programmed or implemented with hardware or software to receive a selection signal.*" Since the modified versions of Stoughton's Figure 1 circuit that would have been obvious to a POSITA use wires and a mechanical switch or microprocessor to implement "receive a selection signal," this limitation would have been obvious to a POSITA under Patent Owner's construction.

4. Independent Claim 15

239. For reference, claim 15 recites:

15. A method to selectively provide ambient light correction, said method

comprising:

- [a] receiving a user input signal indicative of a user selectable brightness setting;
- [b] selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level; and
- [c] adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.

(EX1001, 13:34-14:9 (Claim 15; bracketed notation (e.g., [a]) added).)

240. The preamble of claim 15 recites “[a] **method to selectively provide ambient light correction.**”

241. To the extent that the preamble of claim 15 is a limitation, it is disclosed by or obvious over Stoughton in light of Mierzwinski and Nagai.

242. It is my opinion that a POSITA would have been motivated to actually practice a “method to selectively provide ambient light correction” as claimed in claim 15. For example, Stoughton discloses actually using its Figure 1 circuit to adjust contrast and brightness in a “television receiver.” (Stoughton, Abstract; *see*

also id., 2:14-25, 2:67-3:2, 4:53-59, Figs. 1-3.)

(a) **“receiving a user input signal indicative of a user selectable brightness setting” (Claim 15[a])**

243. Stoughton in light of Mierzwinski and Nagai renders obvious **“receiving a user input signal indicative of a user selectable brightness setting”** for the reasons outlined above for claim 1[a].

(b) **“selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level; and” (Claim 15[b])**

244. A POSITA would have found **“selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level”** obvious based on Stoughton in light of Mierzwinski and Nagai, for the reasons outlined above for the preamble to claim 1 and claims 1[b], 1[c], and 9. As discussed for the preamble to claim 1, it would have been obvious in light of Nagai to modify Stoughton’s Figure 1 circuit to include a switch that would allow the user to toggle between an auto and a manual mode, wherein no sense signal would be output by transistor 40 in the manual mode. Since multiplication would take place in the auto mode but not in the manual mode of the modified Stoughton circuit (since there is no sense signal to multiply the user signal with in the manual mode), the modified Stoughton circuit **“selectively multipl[ies]**

the input signal with a sense signal.”

245. It is my opinion that a POSITA would have been motivated to practice this limitation. For example, as outlined above for the preamble to claim 1 a POSITA would have been motivated to combine Stoughton with Nagai in part to fill an unmet consumer need, maximize consumer choice, broaden consumer appeal and usability, minimize user service calls, and conserve power. These goals would not be achieved by a system that merely *could* operate in a manual or automatic mode. Rather, a POSITA would have motivated to incorporate a switch that actually allowed a user to toggle the circuit between manual and auto modes.

(c) **“adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero” (Claim 15[c])**

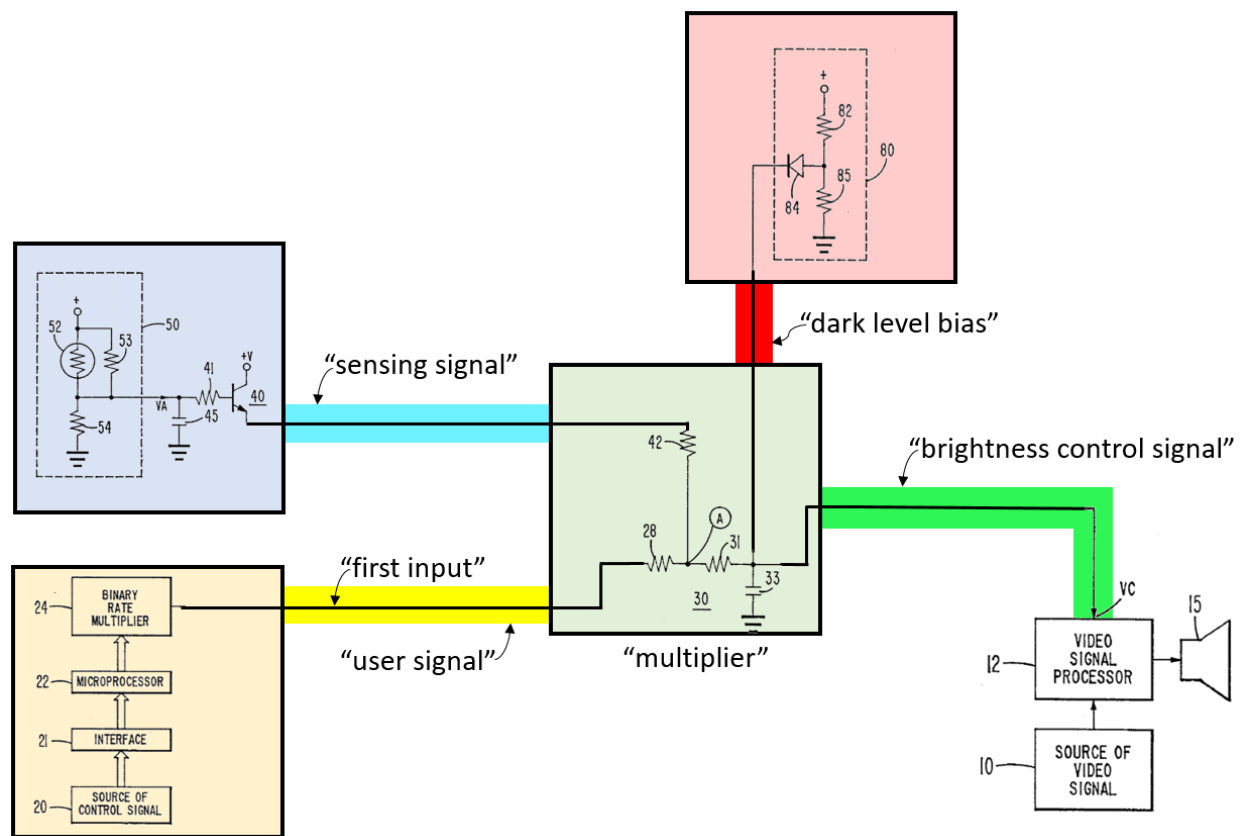
246. For the reasons outlined above for Claim 1[d], Stoughton in light of Mierzwinski and Nagai discloses **“adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.”**

5. Claim 16

247. Claim 16 depends from claim 15, and further recites “[t]he method of claim 15, wherein the step of selectively multiplying the input signal with the sense signal is performed by a software algorithm, an analog circuit, or a mixed-signal circuit.”

248. Claim 16 would have been obvious based on Stoughton in view of Mierzwinski and Nagai. For the reasons outlined above for claims 1[c] and 9, a POSITA would have found it obvious to “selectively multiply[] the input signal with the sense signal.”

249. Further, as shown in the below diagram, the “multiplying” circuitry is “an analog circuit”:



250. Additionally, as outlined above for claim 1[c], “selectively multiplying” is implemented in the Stoughton circuit modified in view of Mierzwinski and Nagai via either (1) mixed signal circuitry (microprocessor sending a signal to the switch in the ambient light sensor circuitry, leading to the analog multiplier circuitry multiplying user and sensing signals in the auto mode and not multiplying these signals in the manual mode) or (2) analog circuitry (a mechanical switch connected to the switch in the ambient light sensor circuitry, leading to the same behavior in the analog multiplier circuitry).

251. Accordingly, it would have been obvious to a POSITA to implement the “selectively multiplying” operation as claimed using either a mixed-signal circuit (digital and analog circuitry) or an analog circuit.

C. Ground 2: Claim 7 Is Obvious Over Stoughton, Mierzwinski, Nagai, and Shimomura

1. Claim 7

252. Claim 7 depends from claim 1, and further recites “[t]he **brightness control circuit of claim 1, wherein the brightness control signal is provided to a display driver to control backlight illumination of a liquid crystal display.**”

253. As explained above, Stoughton and Mierzwinski teach and render obvious the claimed “brightness control circuit” and “brightness control signal.” But Stoughton and Mierzwinski teach a brightness control signal in a CRT (Cathode Ray Tube) television, but do not expressly claim a liquid crystal display (“LCD”).

I rely on Shimomura for the LCD limitation of claim 7. **Shimomura** (EX1006, EX1007) teaches and renders obvious “**the brightness control signal is provided to a display driver to control backlight illumination of a liquid crystal display.**” Claim 7 is thus disclosed by **Stoughton**, **Mierzwinski**, and **Nagai** (*i.e.*, Ground 1 above), in combination with **Shimomura**. As explained

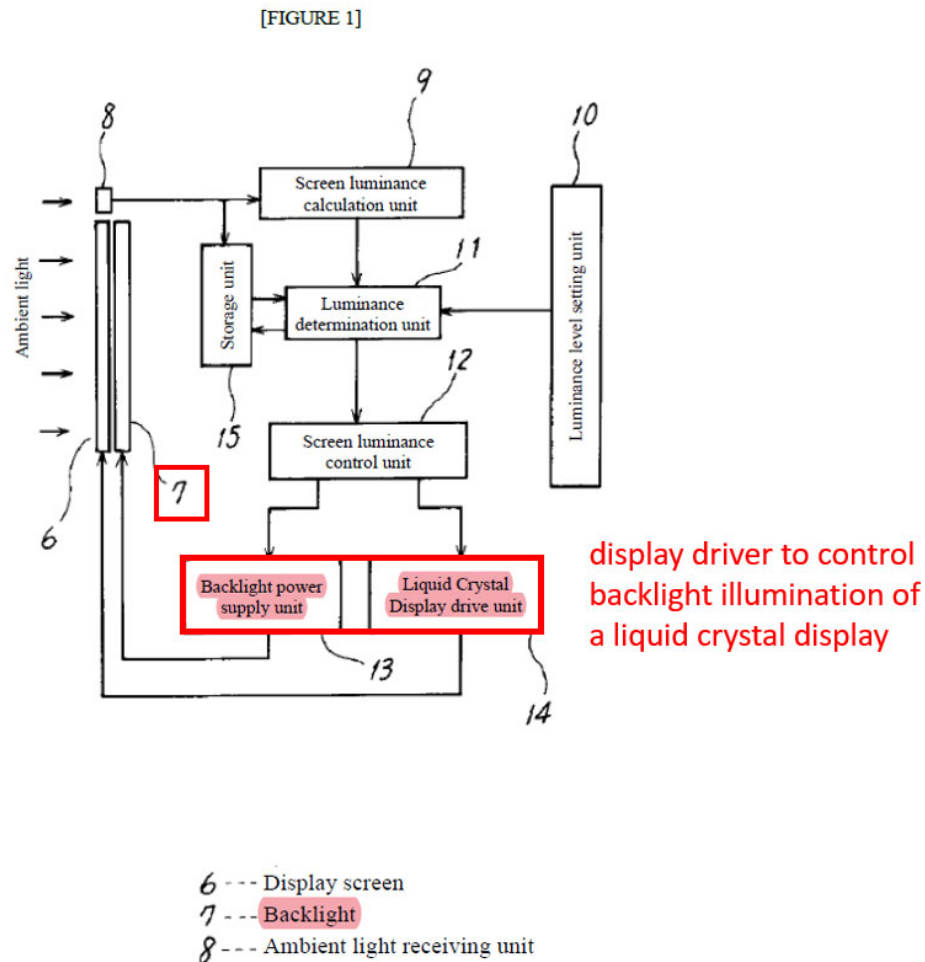
above, Stoughton and Mierzwinski disclose that the voltage VC across capacitor **33** is input to video signal processor **12** to control the brightness and contrast of kinescope **15**, thereby teaching the claimed “brightness control signal.” (*E.g.*, Stoughton, Figs. 1, 2; 2:34-37, 4:16-18, 4:42-52; Mierzwinski, Abstract, Figs. 1, 2, 1:16-20, 1:47-53; 5:25-30.)

254. Much like Stoughton, Mierzwinski, and Nagai, Shimomura explains that in display devices, “the user of the display device can set the brightness of the display screen as desired by operating an adjustment switch that switches the brightness of the display screen in steps, or an adjustment knob that continuously changes the brightness of the display screen so that the displayed characters and graphics are always easy to see in response to various changes in the illumination environment.” (Shimomura, ¶[0004]; Shimomura, ¶[0001].)

255. Shimomura teaches that brightness control can be easily applied to various types of display devices, whether it is Cathode Ray Tubes (CRTs) or Liquid Crystal Displays (LCDs): “display devices include **Cathode Ray Tubes (CRTs), Liquid Crystal Displays (LCDs)**, Plasma Display Panels (PDPs), Electroluminescent (ELs), and **other light-emitting and non-light-emitting devices**, and these devices are arranged in a flat array as multiple pixels to present a display screen.” (Shimomura, ¶[0003].) It was readily well-known at the time that

brightness control circuits could be adapted to LCDs.

256. Shimomura teaches, as shown in Figure 1 reproduced below, that “**14** is a **Liquid Crystal Display drive unit** that drives the Liquid Crystal Display elements used in display screen **6** and adjusts the transmittance of the Liquid Crystal Display elements,” and the “**backlight power supply unit**” at **13** “supplies power to the backlight **7** and controls the luminance of the backlight **7** by receiving signals from the screen luminance control unit **12**.” (Shimomura, ¶[0027].)



(Shimomura, Fig. 1 (annotations added).) In other words, the Liquid Crystal Display drive unit 14 and Backlight power supply unit 13 of Shimomura feed into backlight 7, thereby teaching “**display driver to control backlight illumination of a liquid crystal display.**” (See also Shimomura, ¶[0023], claim 4.) Shimomura therefore discloses and renders obvious controlling brightness of an LCD by controlling the backlight illumination of the LCD. Claim 7 is thus disclosed by

Ground 1 in combination with Shimomura.

257. **Rationale and Motivation to Combine (Stoughton with Shimomura):**

It would have been obvious to combine Stoughton and Shimomura, predictably resulting in the Stoughton brightness control system of Ground 1 adapted to further “control backlight illumination of a liquid crystal display,” as claimed. Under the proposed combination, therefore, the “**brightness control signal**” from claim 1[d] would have, in the case where an LCD was being used, controlled the illumination of its backlighting.

258. Both CRT and LCD technologies were well-known by at least 2003. For example, a 1992 article in *Applied Optics* states: “Liquid-crystal televisions (LCTV’s) have been popular for several years” (EX1022, Gregory, p.163.)

259. It would have been obvious to a person of ordinary skill in the art at the time to adapt a CRT brightness control technique to achieve brightness control for a LCD, and to use a display driver to control backlight illumination of a liquid crystal display. By the early 2000s, the industry was fast moving from CRTs to LCDs. LCDs had many well-recognized benefits, including lower weight, thinness, resolution, and lower power. For example, Kim, a 2001 IEEE article, explains that “LCD (Liquid Crystal Display) is the most suitable device to replace the existing CRT (Cathode Ray Tube) monitors, which are bulky and dissipates larger power

than an LCD does. The main advantages of LCD include lightweight, thinness, high-resolution, and low-power operation. In addition, FPD [Flat Panel Displays like LCDs] systems employ digital driving methods, which have more strong noise immunity. Moreover, it can represent high quality images when the length of digital data is increased.” (EX1023, Kim, p.263.)

260. Shimomura and Stoughton are closely analogous to the ’117 patent, coming from the same field of display brightness control. Stoughton, as reflected in its title, is directed to “Manual and Automatic Ambient Light Sensitive Picture Control for a Television Receiver,” whereas, Shimomura is directed to a “Display Device” that has “a function to automatically control the brightness of the display screen according to changes in the brightness of the surrounding area of the display device, thereby making it easier for the user of the display device to see displayed characters and graphics in various illumination environments.” (Shimomura, ¶[0001].) A person of ordinary skill would have consulted Shimomura to apply the techniques of Stoughton to LCDs.

261. Shimomura provides express motivations to combine by explaining that users may want to automatically or manually “set the brightness of the display screen as desired” so that “the displayed characters and graphics are always easy to see in response to various changes in the illumination environment.” (Shimomura,

¶[0004].) This is similar to Stoughton, which remarks that: “[s]ome video display systems also include apparatus for automatically controlling picture contrast as a function of ambient light conditions in the environment in which the displayed picture is being viewed.” (Stoughton, 1:15-20.) An ordinarily skilled artisan would thus have been motivated to adapt the LCD teachings of Shimomura to Stoughton as described above.

262. Shimomura would have been reasonably pertinent to a number of problems facing the inventor, including how to “provide a display device in which displayed characters and graphics are easily and visually recognized by a user at all times by automatically varying the screen luminance of a screen in accordance with the intensity of ambient light in the vicinity of the display screen.” (Shimomura, Abstract.)

263. Other analogous references further confirm the popularity of LCDs. For example, U.S. Patent No. 5,825,408 to Yuyama, a Casio patent is titled “Portable Compact Imaging and Displaying Apparatus.” (**EX1024.**) Yuyama explains that: “Recently, liquid-crystal television sets using a liquid-crystal display unit in the display section in place of a cathode ray tube (CRT), one of typical display devices, have become popular because of the relative lightness and thinness of the device.” (Yuyama, 1:14-18.)

264. Likewise, during prosecution of the '117 patent, the Examiner found it would have been obvious to one of ordinary skill in the art to combine a CRT reference with an LCD reference. The Examiner stated: “one of ordinary skill in the art would appreciate, the suggestion or motivation for doing so would have been to achieve predictable result of controlling a high quality of the image being displayed.” (EX1025, p.9.) Stoughton’s CRT would thus create no obstacle to applying those brightness control techniques to other common display technologies such as a LCD. Indeed, the difference between a CRT and a LCD are insignificant for purposes of our analysis here, because both were well-known and an ordinarily skilled artisan applying the Stoughton combination as described above would have easily understood that brightness is controlled by a display driver to control backlight illumination of a LCD, as taught by Shimomura.

265. An ordinarily skilled artisan would have perceived no technological obstacle to the proposed combination, and would have had more than a reasonable expectation of success. LCDs were already well-known by the time Shimomura was published in 1994, and thus would have been considered entirely trivial by 2003. An ordinarily skilled artisans would have found the disclosures in Stoughton and Shimomura sufficient to implement the teachings that I have applied to the proposed combination, without undue experimentation.

D. Ground 3: Claims 1-2, 7, 9, and 15-16 Are Obvious Over Gettemy in View of Kerman, Rosenzweig, Whitted, and Bell

1. Independent Claim 1

266. For reference, claim 1 recites:

1. A brightness control circuit with selective ambient light correction comprising:
 - [a] a first input configured to receive a user signal indicative of a user selectable brightness setting;
 - [b] a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level;
 - [c] a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal; and
 - [d] a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.

(EX1001, 12:28-43 (Claim 1; bracketed notation (e.g., [a]) added).)

267. The preamble of claim 1 recites “[a] **brightness control circuit with selective ambient light correction comprising.**”

268. To the extent that the preamble of claim 1 is a limitation, it is disclosed

by or obvious over Gettemy (EX1013).

269. Gettemy discloses, in the context of a portable computer, “a dynamic brightness range control to maximize readability in various ambient lighting conditions and to prolong the lifetime of the display, the light and the battery.” (Gettemy, 1:10-15.) Figure 3 of Gettemy shows a portable computer **300** with its main components used to implement dynamic brightness control:

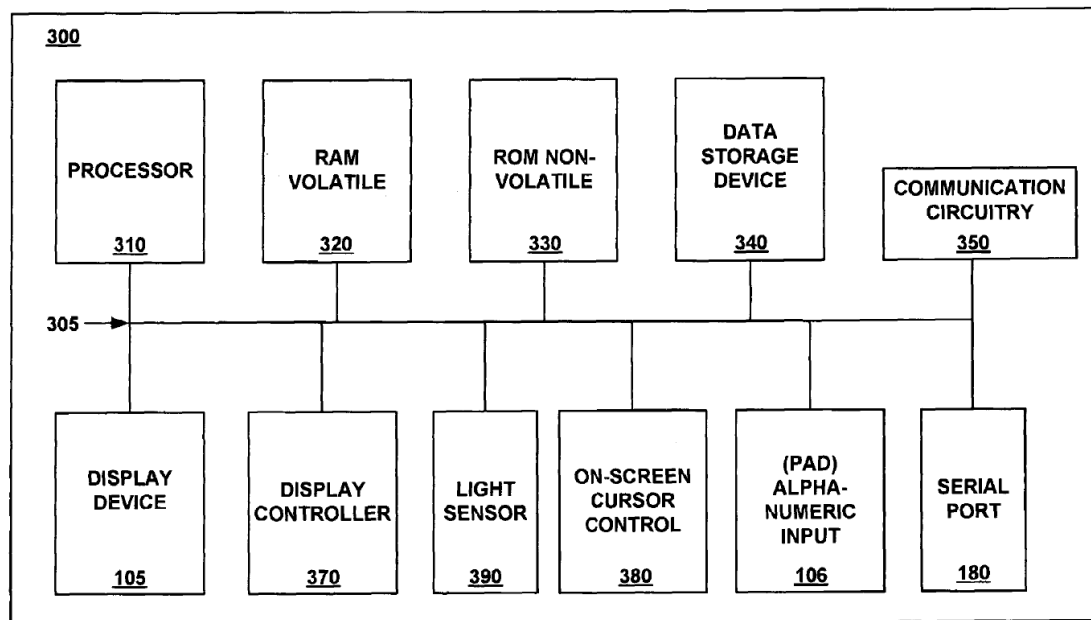


FIGURE 3

(Gettemy, Fig. 3.) The key components of portable computer **300** in Figure 3, for purposes of my analysis of claim 1, include processor **310**, light sensor **390**, display controller **370**, display device **105**, and on-screen cursor control **380**. As Gettemy explains:

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In one embodiment, portable computer system **300** includes one or more light sensors **390** to detect the ambient light and provide a signal to the main processor **310** for determining when to implement a change in brightness range. Display controller **370** implements display control commands from the main processor **310** such as increasing or decreasing the brightness of the display device **105**.

(Gettemy, 5:31-37.) It would have been obvious to a person of ordinary skill in the art that the components in the portable computer have formed at least one “**brightness control circuit**,” because they provide Gettemy’s brightness control functionality and would have been connected using electrical circuitry.

270. Gettemy also confirms that the brightness control circuit has “**ambient light correction**,” because as explained above, it can adjust (“correct”) the brightness of a display based on ambient lighting conditions. (Gettemy, *e.g.*, 5:31-37, 6:18-22.)

271. I understand that Petitioner is asserting in the district court litigation that the term “**selective**” is indefinite as to its full scope, *e.g.*, what it covers beyond referring to a circuit that can operate in either auto or manual mode. The indefiniteness issue is not pertinent to my analysis because it would have been obvious to operate the circuit in Gettemy in either a manual or automatic mode. It would have been obvious that the user in Gettemy could have selected to operate the

brightness control circuit in either automatic mode (discussed for claim 1 and claim 9 below), or a manual mode in which the user can override dynamic brightness control and manually control the display brightness (discussed for claim 9 below). My analysis should not be construed as supporting any particular construction for “**selective**” or an opinion with respect to the indefiniteness (or lack of indefiniteness) of any claims of the ’117 patent, as the disputes in litigation on these issues do not impact my application of the prior art to the challenged claims.

272. With respect to the automatic mode in Gettemy, on which I will focus for claim 1, the user can make selections through the user interface that influence the brightness of the display that will be taken into account when brightness is automatically adjusted based on ambient lighting conditions. (Gettemy, 6:16-22 (“At any time, the user can display the currently selected range setting and move the slider up or down to increase or decrease the brightness setting of the display. The computer processor will dynamically adjust the range when the ambient light changes sufficiently, keeping the brightness level commensurate with the slider position last selected relative to the new range setting.”).) I will describe these adjustments in more detail below.

- (a) “a first input configured to receive a user signal indicative of a user selectable brightness setting;”
(Claim 1[a])

273. Gettemy discloses “a first input configured to receive a user signal indicative of a user selectable brightness setting.”

274. Figure 4 of Gettemy shows a user interface for receiving a user selectable brightness setting:

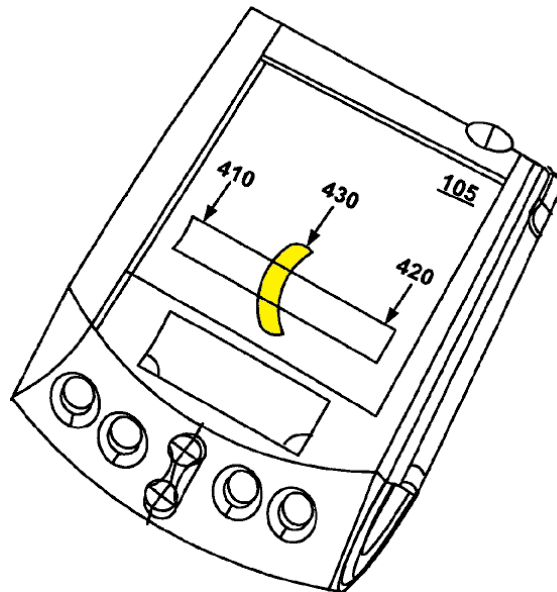


FIGURE 4

(Gettemy, Fig. 4 (highlighting added).)

275. Figure 4 shows display screen **105** of a portable computer system showing “the user brightness setting which may be implemented as a graphical user interface.” (Gettemy, 5:40-42.) “In this embodiment the user adjusts the on-screen

displayed brightness setting between the low level 410 of the range and the high level 420 of the range by moving the slider 430 to the right for an increase in brightness or to the left for a decrease in brightness.” (Gettemy, 5:42-46.) For purposes of claim 1[a], therefore, the “**user signal indicative of a user selectable brightness setting**” corresponds in Gettemy to the user selection, represented in this case as the slider position 430 relative to the currently-displayed low range 410 and high range 420. (Gettemy, 6:4-6 (“In step 640 of FIG. 6, the processor interprets the brightness setting of said slider position 430 relative to the low range setting 410 and the high range setting 420.”).) As will be explained in more detail below, it would have been obvious to represent the relative position of the slider in Gettemy as a percentage value (for example, “50” or decimal percentage “0.5” if the slider is at the midpoint position).

276. I am informed that Patent Owner, in district court, argues that “**signal**” in the ’117 patent should be given its plain and ordinary meaning, but adds that the term “*includes both hardware and software signals.*” (EX1026, ¶55.) I am informed that Patent Owner has pointed (among other things) to the ’117 patent’s statement that the claimed multiplier (discussed for claim 1[c] below), which multiplies the “**user signal**” and the “**sensing signal**” (discussed for claim 1[b] below), can be implemented using a software algorithm. (’117, 2:7-9, 5:37-38.) I am further

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informed that Patent Owner has also pointed to statements in the written description referring to the “**user signal**” as a “digital word,” which according to Patent Owner, indicates that a signal can take the form of a value in a software implementation. (’117, *e.g.*, 3:59-63, 10:33-35, 13:20-21 (claim 12: “...wherein the user signal corresponds to a digital word”).) I understand that Patent Owner has also pointed to extrinsic evidence (such as patents of various third parties) that purport to use the word “signal” to describe software values. (EX1026, ¶ 55.) While I understand that Petitioner disagrees with Patent Owner’s position regarding the scope of “**signal**,” Gettemy clearly teaches the claimed “**signals**” under Patent Owner’s view. For example, if the slider were placed at exactly the midpoint (50%) between the low range and high range, it would have been obvious to represent the “**user signal**” (as construed by Patent Owner) as a simple numerical value, *e.g.*, “0.5” or “50,” under Patent Owner’s software implementation view. Figure 5, which I will discuss in more detail for claim 1**[b]**-1**[c]** below, shows an example of the slider at this midpoint position within three different ranges:

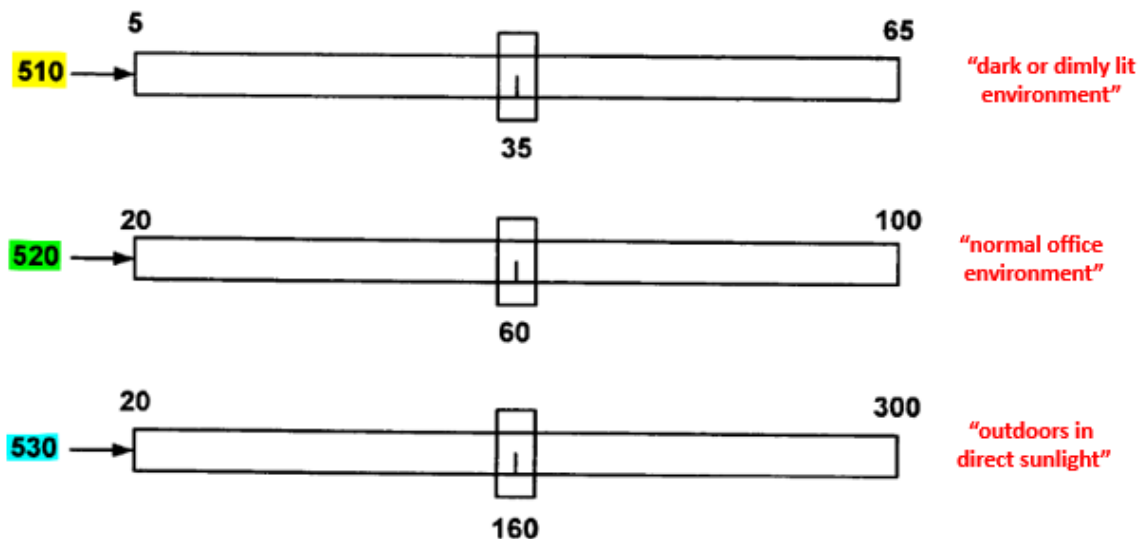


FIGURE 5

(Gettemy, Fig. 5 (colored highlighting and annotations added), 3:31-35.) Figure 5 shows three sliders, all at “the midpoint setting” (Gettemy, 6:7-10) within three different brightness ranges based on ambient lighting conditions. As shown, the midpoint value is 35 for range **510** of 5-65, 60 for range **520** of 20-100, and 160 for range **530** of 20-300. (Gettemy, 6:7-10.) But all three of these values represent the same relative (midpoint) position.

277. It therefore would have been obvious to represent the slider position in Gettemy as a numerical value representing a percentage value, such as “50” or “0.5” using the example above. As noted, Gettemy discloses that, when setting the brightness level for the display, “the processor interprets the brightness setting of said slider position 430 relative to the low range setting 410 and the high range

setting 420.” (Gettemy, 6:4-6.) Gettemy then uses this “relative” position to set a new brightness level based on the current slider position, when the brightness range later changes. (Gettemy, 6:18-22 (“The computer processor will dynamically adjust the range when the ambient light changes sufficiently, keeping the brightness level commensurate with the slider position last selected relative to the new range setting.”).) It would have been obvious that a percentage value such as “50” or “0.5” would have provided this “relative” position because, as shown above, it represents the position of the slider relative to the low and high values of the currently-displayed range, and therefore, consistently represents the midpoint across all possible ranges.⁶ The use of a percentage would have been regarded by an ordinarily

⁶ Moreover, even if one implemented Gettemy such that the slider control in Figure 4 of Gettemy reported the absolute (non-relative) value of the slider based on the current range, it would have been trivially simple to convert this to a relative percentage. (Kerman, pp.391-392, ¶9.) A person of ordinary skill in the art would have been motivated to convert an absolute value into a relative percentage because, as explained in the text, Gettemy relies on the relative position of the slider to set the

skilled artisan as the simplest and best known technique for representing the “relative” value of the slider, and the underlying calculation is so basic that it is taught as part of mathematics courses for middle school students.

278. Indeed, as explained in detail for claim 1[d] below, both Kerman and Rosenzweig, which provide more details about the types of slider controls used in Gettemy, disclose use of a percentage (or decimal percentage) to represent the relative position of the slider. For example, as described in more detail below, Rosenzweig discloses calculating the position of the slider “as a number between 0 and 1,” *i.e.*, as a decimal percentage, in response to the user moving the slider to a different position. (Rosenzweig, pp.321-323; *see also id.*, p.322 (“It computes the value of the slider as a number between 0 and 1, regardless of the real range.”).) Kerman similarly discloses calculating a percentage based on the current slider position. (Kerman, pp.391-392, ¶9.) I will provide more information about Rosenzweig and Kerman below in my discussion of the “**multiplier**” limitation, including a full explanation of the rationale and motivation to combine with

brightness level, consistent with the user’s slider selection, when the brightness range later changes in response to lighting conditions. (Gettemy, 6:18-22.)

Gettemy. For purposes of claim 1[a], these references confirm what would have already been obvious to an ordinarily skilled artisan, *i.e.*, that it would have been obvious to represent the relative slider position in Gettemy as a percentage or decimal percentage value.

279. Gettemy also discloses that the “**user signal**” is received by “**a first input,**” as claimed. Gettemy explains that the user input from an input device (such as a touch screen device) is provided to main processor **310**. (Gettemy, 5:14-20 (“Alphanumeric input device **106** can communicate information and command selections to main processor **310** via bus **305**. In one implementation, alphanumeric input device **106** is a touch screen device.”), 5:21-28 (“Portable computer system **300** also includes an optional cursor control or directing device (on-screen cursor control **380**) coupled to bus **305** for communicating user input information and command selections to main processor **310**. In one implementation, on-screen cursor control device **380** is a touch screen device incorporated with display device **105**. On-screen cursor control device **380** is capable of registering a position on display device **105** where a stylus element makes contact.”).)

280. A person of ordinary skill in the art would have understood that, in the software-based implementation that Gettemy describes, main processor **310** would then have processed the user input to determine the “**user signal,**” *i.e.*, the current

position of the slider relative to the low and high values of the currently-displayed range. (Gettemy, 6:4-6.) This is further confirmed by Figure 7, which shows two examples in which the processor updates the displayed user interface slider to reflect movement of the slider to different positions with the range in response to user action. (Gettemy, Fig. 7, Steps **710-720**, **730-740**, 6:22-24 (“FIG. 7 illustrates user adjustments to the brightness settings and computer processor adjustments to the brightness range.”).)

281. The “**first input**” in Gettemy thus corresponds to software functionality in Gettemy, such as a software variable or routine, that receives the “**user signal**” after the input device information has been processed to determine the relative slider position. As detailed below, that user signal is used by other software in Gettemy to adjust the display brightness. This is consistent with the ’117 patent. (’117, 2:7-9 (“software algorithm can be used to multiply the light sensor output with the user selectable brightness control”); *see also id.*, 14:10-13 (Claim 16: “The method of claim **15**, wherein the step of selectively multiplying the input signal with the sense signal is performed by a software algorithm, an analog circuit, or a mixed signal circuit.”).)

282. I am informed that in a prior litigation involving the ’117 patent, a district court construed this claim limitation as “*first input actually programmed or*

implemented with hardware or software to receive a user signal indicative of a user selectable brightness setting.” (EX1033, p.7.) If this construction is applied, this construction is readily satisfied by the prior art at Gettemy. The court previously construed “**first input**” as being “*actually programmed or implemented with hardware or software*” to receive the user signal. It would have been obvious that the “**first input**” would have been implemented using hardware, *e.g.* main processor **310**, and software executing on the processor for receiving the “**user signal**,” as explained. (Gettemy, 6:4-6.) It thus would have been obvious that Gettemy discloses a “**first input**” that receives the “**user signal**,” implemented using hardware, software, and a combination of both.

283. Finally, it would have been obvious to a person of ordinary skill in the art that the position of the slider relative to the low and high values of the currently-displayed range qualifies as a user “**signal**.” Although the slider position would have been represented as a value within the software (such as a numerical value stored in a software variable), it would have been obvious that such data nevertheless is represented within the computer as a “**signal**.” Gettemy itself confirms this by explaining that physical quantities may “take the form of electrical or magnetic signals” capable of being stored, transferred, combined, compared, and otherwise manipulated in a computer system. It has proven convenient at times, principally

for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.” (Gettemy, 3:66-4:5.)

(b) **“a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level;” (Claim 1[b])**

284. Gettemy discloses **“a light sensor configured to sense ambient light and to output a sensing signal indicative of the ambient light level”**.

285. Gettemy discloses a **“sensing signal”** in the form of a brightness range that is determined by the main processor **310** based on the current ambient light level, as explained in more detail below. Figure 5 provides several examples of brightness ranges based on different ambient light levels:

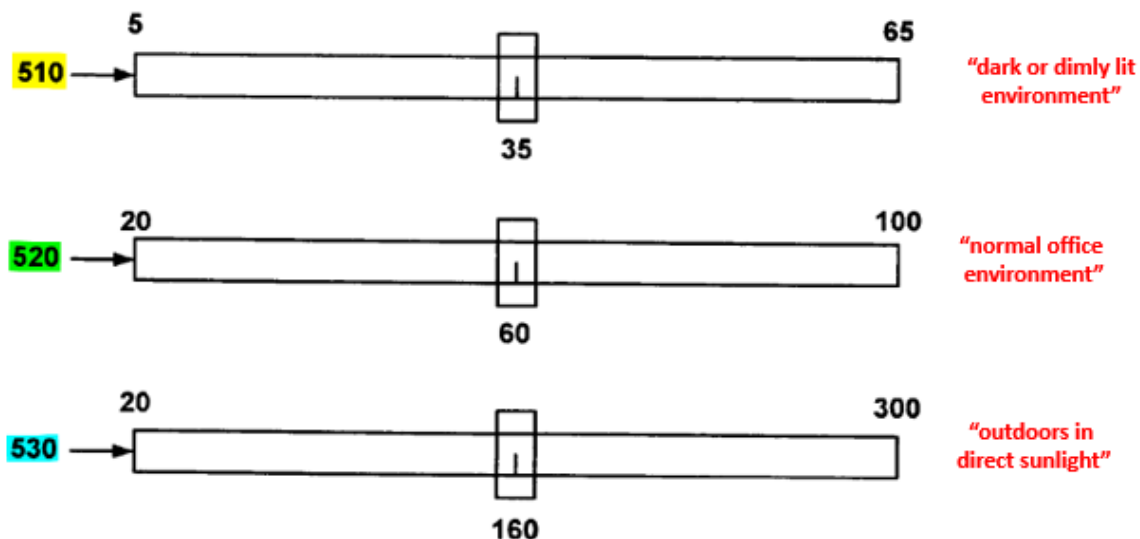


FIGURE 5

(Gettemy, Fig. 5 (colored highlighting and annotations added), 3:31-35.) “Range

510 may be used when in a dark or dimly lit environment. Range **520** may be used in a normal office environment and range **530** may be used outdoors in direct sunlight.” (Gettemy, 5:50-53.) The particular brightness range selected, therefore, is based on the amount of ambient light detected by one or more ambient light sensors. (Gettemy, 5:31-35 (“In one embodiment, portable computer system **300** includes one or more light sensors **390** to detect the ambient light and provide a signal to the main processor **310** for determining when to implement a change in brightness range.”).) As Gettemy further explains:

In step **610** [of Fig. 6] one or more light sensors detect the ambient light and send a signal representing this information to the processor. The signal can be from a single sensor, or can be the average of signals from a plurality of sensors. The processor then, as shown in step **620**, accesses stored data which configures the ranges and determines if the ambient light signal requires a change to the brightness range. If a change to brightness range is required, the processor then implements the range change.

(Gettemy, 5:56-64; *see also id.*, 2:41-44 (“In one embodiment, the processor implements the adjustment for the range settings based on prestored range configuration data and an ambient light information signal from the light sensor.”).)

286. To be clear, I have not mapped the “**sensing signal**” of claim 1[b] to a raw sensor signal provided by the ambient light sensors **390**, as this information is

not by itself directly used to determine the display brightness in Gettemy. I have instead mapped the “**sensing signal**” in Gettemy to the brightness range (which is defined by its maximum and minimum values), which the processor selects *based on* the ambient light sensor signal. (Gettemy, 5:60-64.) That brightness range is clearly “**indicative of the ambient light level**” because it reflects the current level of ambient light as determined by the ambient light sensor; using the exemplary ranges in Figure 5, range **510** is “**indicative**” of low ambient light level, range **520** is “**indicative**” of normal office ambient light level, and range **530** is “**indicative**” of very high ambient light level, as noted above. (Gettemy, 5:50-53, Fig. 5.) And like the '117 patent, Gettemy's sensing signal is “in proportion to the level of ambient light” ('117, 2:28-39) – as shown further below, Gettemy's brightness range increases as the ambient light level increases.

287. For example, with respect to all of the exemplary ranges disclosed in Gettemy, an *increase* in the ambient light level results in: (1) an *increase* in the maximum value in the selected brightness range, and also (2) an *increase* in the size of the selected range (*e.g.*, the number of possible values in the range based on the difference between its maximum and minimum values). For example, Figure 5 shows that the processor selects range **510** between 5-65 (60 possible brightness values) for a “*dark or dimly lit*” ambient light level, up to range **530** between 20-300

(280 possible brightness values) for “*outdoors in direct sunlight.*” (Gettemy, 6:6-10, 5:50-53; *see also Mathematics Dictionary and Handbook* (1993), **EX1018**, p.325 (describing range as “[t]he difference between the largest and smallest number in a set of data.”).) Because the range selected by main processor **310** (with respect to both its maximum value and the number of available values) increases or decreases, respectively, in response to increasing or decreasing ambient light levels as detected by light sensors **390**, the brightness range qualifies as a “**sensing signal**” that is “**indicative**” of the ambient light level. And although Figure 5 shows only three exemplary ranges **510**, **520**, and **530**, it would have been obvious to an ordinarily skilled artisan that the main processor **310** could have been enabled to select from a much larger number of possible ranges to provide more granularity and diversity in the available brightness levels based on differing ambient lighting conditions.

288. Accordingly, the “**light sensor**” in Gettemy for purposes of claim 1 [b] corresponds to light sensor(s) **390**, along with software executed by main processor **310** that uses the signal from the light sensor(s) to determine and output the appropriate brightness range based on the current ambient light level. As noted, main processor **310** uses stored configuration data to select a brightness range that corresponds to the ambient light level from the light sensors **390**. (Gettemy, 5:60-64, 2:41-44.) That selected brightness range (“**sensing signal**”) will then be used,

as further explained below, by other software in Gettemy to calculate the brightness for the display consistent with the position of the slider chosen by the user. This brightness range is also “**output**,” as claimed, because it is provided to and used by other software in Gettemy for calculating a new brightness display value, as explained for claim 1[c] below.

289. I note that nothing in the '117 patent requires that the claimed “**light sensor**” be limited solely to light detecting elements; the further inclusion of main processor **310** and software executed by that processor in Gettemy (in addition to light sensors **390**) thus presents no obstacle to my application of the prior art. In fact, the '117 patent similarly describes exemplary light sensors – even those based on simple electronic components – that include additional components and circuitry beyond light detector **500** for further processing and transforming the output of light detector **500**, before it is used by other components of the system. ('117, 8:10-40 (Fig. 5), 8:41-62 (Fig. 6), 4:48-57.) For example, the output of light detector **500** may be scaled and amplified by additional components (8:10-40), and further additional components may adjust response time (8:41-62). In the case of Gettemy, it discloses a “**light sensor**” as claimed because light sensor **390**, main processor **310** and software executed by that processor, working together, sense ambient light and output a sensing signal indicative of the ambient light level, as

explained

290. Finally, for the same reasons that I provided for the “**user signal**” discussed for claim 1[a], it would have been obvious to a person of ordinary skill in the art and based on Patent Owner’s interpretation of “**signal**” that the brightness range determined by the processor based on the sensed ambient light levels also qualifies as a “**signal**.” (Gettemy, 3:66-4:5.)

(c) “**a multiplier configured to selectively generate a combined signal based on both the user signal and the sensing signal; and**” (Claim 1[c])

291. I am informed that in a prior litigation involving the ’117 patent, a district court construed “**multiplier configured to**” as requiring that the multiplier be “*actually programmed or implemented with hardware or software*.” I am further informed that a district court construed “**combined signal**” as including, but not necessarily being limited to, “*the product of the user signal and the sensing signal*.” To the extent they apply, these constructions are readily satisfied and rendered obvious by the prior art.

292. For convenience, I will first address how Gettemy discloses combining both “**the user signal**” and “**the sensing signal**” to compute the display brightness value for the display. I will then address why it would have been obvious that this computed display brightness value would have qualified as a “**combined signal**”

generated using “**a multiplier**,” as recited in claim 1 [c].

293. Gettemy computes a brightness value for the display based on: **(1)** the selected brightness range based on ambient lighting conditions (“**sensing signal**”) and **(2)** the relative position of the slider (“**user signal**”). As Gettemy explains:

At any time, the user can display the currently selected range setting and move the slider up or down to increase or decrease the brightness setting of the display. The computer processor will dynamically adjust the range when the ambient light changes sufficiently, keeping the brightness level commensurate with the slider position last selected relative to the new range setting.

(Gettemy, 6:16-22.) Figure 7 shows several examples of how the processor keeps the brightness level commensurate with the slider position based on the range:

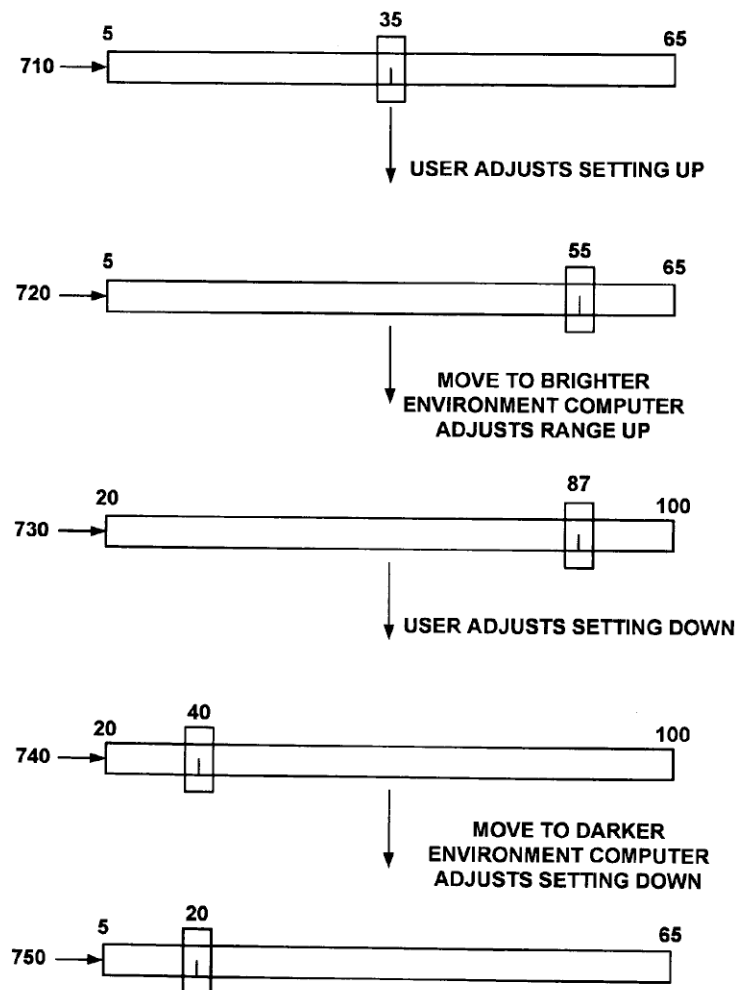


FIGURE 7

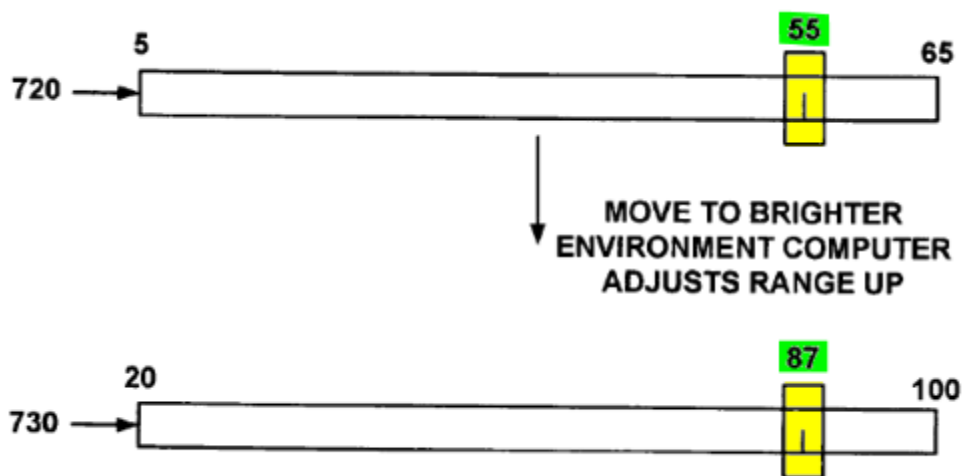
(Gettemy, Fig. 7.) Steps 710-720 in Figure 7 show the user moving the slider to the right to increase the display brightness, in this case to a position that corresponds to a brightness of 55 nits within the 5-65 range. At step 730, after the user moves to a brighter environment, the processor increases the brightness range to 20-100 nits, and accordingly, increases the brightness. (Gettemy, 6:25-31.) Accordingly, at step 730, “[t]he brightness setting for the previously set slider position is now 87 nits.”

(Gettemy, 6:30-31.) The two remaining steps in Figure 7 (**740-750**) show precisely the same process, but in the opposite direction of decreasing brightness. “The user now adjusts the setting down to a preferred level, e.g., 40 nits as shown in step **740**. Now, when the user enters a darker environment, the computer processor adjusts the range down, as shown in step **750**, so the setting for the previously set slider position is now 20 nits.” (Gettemy, 6:31-36.)

294. Gettemy therefore discloses and renders obvious generating a display brightness value “**based on both the user signal and the sensing signal**,” as claimed. This is because Gettemy determines the display brightness value based on **(1)** the brightness range selected by the processor based on the current ambient light level (“**sensing signal**”) and **(2)** the relative position of the slider (“**user signal**”). Referring back to Figure 7 above, **87** nits at step **730**, and **20** nits at step **750**, each provide an example of a display brightness value calculated based on both the user and sensing signals.

“Multiplier” Limitation

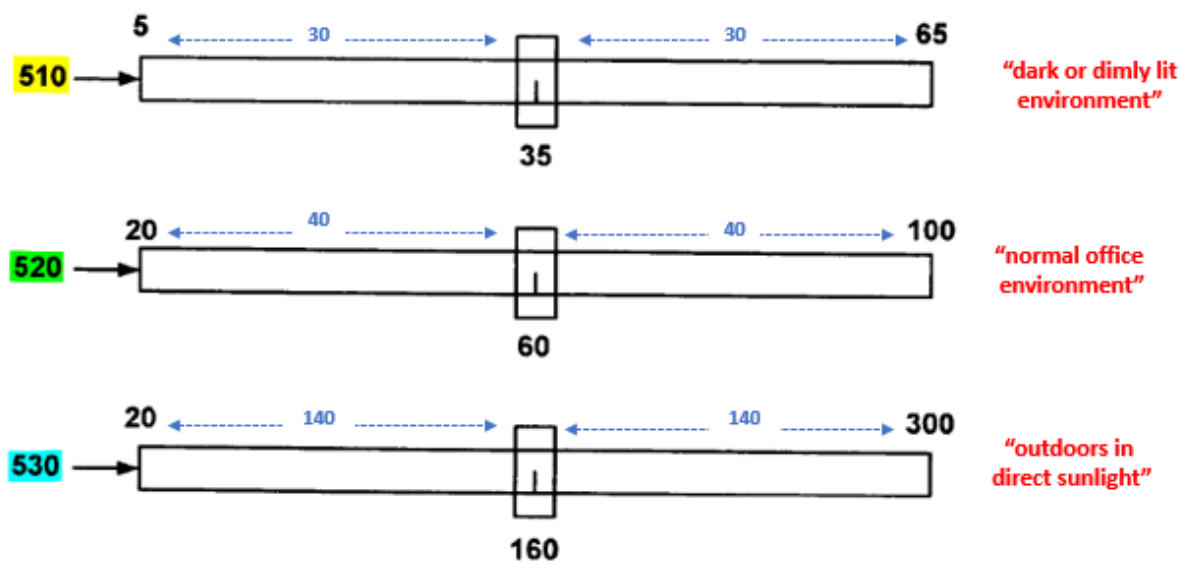
295. Gettemy does not disclose precise details about how the processor increases or decreases the brightness value associated with the slider position, in response to an increase or decrease the brightness range in response to changes in ambient lighting levels. Referring back to Figure 7:



(Gettemy, Fig. 7 (partial figure; highlighting added).) In the example above, the processor in step 730 has clearly increased the display brightness from 55 to 87 nits in response to the user moving to a brighter environment, but what formula or technique did Gettemy employ to determine that the slider position in the new range now corresponds to a value of 87?

296. Before answering this question, let me first explain that it would have been obvious to an ordinarily skilled artisan, after even a brief study of Gettemy,

that main processor **310** uses multiplication of the “**user signal**” and the “**sensing signal**” (as described above) to compute the display brightness value associated with the current position of the slider. This mathematical relationship is readily apparent from Figure 5, which I have annotated below:



(Gettemy, Fig. 5 (colored annotations added).) Gettemy explains that the slider in Figure 5 is at the “midpoint setting” in each of the three brightness ranges. (Gettemy, 6:6-10.) This is confirmed by the fact that, as shown in blue, the exact same number of possible values exist on both the left and the right of the slider for each range. Gettemy explains that to determine the value for the midpoint slider in Figure 5, “the processor interprets the brightness setting of said slider position 430 relative to the low range setting 410 and the high range setting 420.” (Gettemy, 6:4-6.) This

interpretation by the processor results in the display brightness value shown as the midpoint slider position in Figure 5, *i.e.*, of 35 nits for a 5-65 range, 60 nits for a 20-100 range, and 160 nits for a 20-300 range. (Gettemy, 6:6-10.)

297. It would have been obvious based on **Kerman** (EX1014) and **Rosenzweig** (EX1015) that the processor in Gettemy would have used multiplication to compute this display brightness value. For purposes of my analysis, Kerman and Rosenzweig provide similar and complementary disclosures on this point.

298. Kerman is a textbook describing programming techniques for Flash, a well-known software development platform commonly used for software applications. Kerman focuses on ActionScript, a well-known programming language used to write programs for a number of development platforms, including Flash. (Kerman, p.47.)

299. Kerman includes an entire chapter devoted to “explor[ing] a popular user interface control: the slider.” (Kerman, p.389.) Kerman explains that, as was well-known, “[m]any users prefer to specify a number by using the seemingly continuous scale offered by a slider rather than by typing into a field.” (Kerman, p.389.) Kerman describes various techniques for programming slider controls and incorporating them into applications.

300. Kerman explains that, to create a slider control, the programmer must specify the “bounds” of the slider, *i.e.*, the minimum (`min`) and maximum (`max`) values. (Kerman, p.391, ¶7.) These values are equivalent to the low and high values, respectively, that define the ranges for the slider controls of Gettemy. Kerman explains that these range values “make sure that the `_x` property doesn’t go below `min` or above `max`.” (Kerman, p.391, ¶8.) The “`_x`” property, as noted below, refers to the value (between `min` and `max`) associated with the slider at its current position. (Kerman, p.391, ¶8.)

301. Another key piece of information for a slider control, according to Kerman, is a **percent**, which represents the location of the slider relative to the total length of the slider control based on `max` and `min`. “Now that we know the bounds involved, we can calculate percentage. The formula for percentage is simply ‘current position / total distance.’ Total distance is `max - min` and the current position is the slider’s `_x` property.” (Kerman, p.391, ¶9.) For example, if the percentage is “50,” the `_x` property for the slider will be set to the midpoint value between `min` and `max`.

302. Kerman discloses source code for a simple formula that calculates, based on `min` and `max`, the current value of the slider (`_x`) based on a given percent:

```
percent=50;  
_x= min+((max-min)*(percent/100));
```

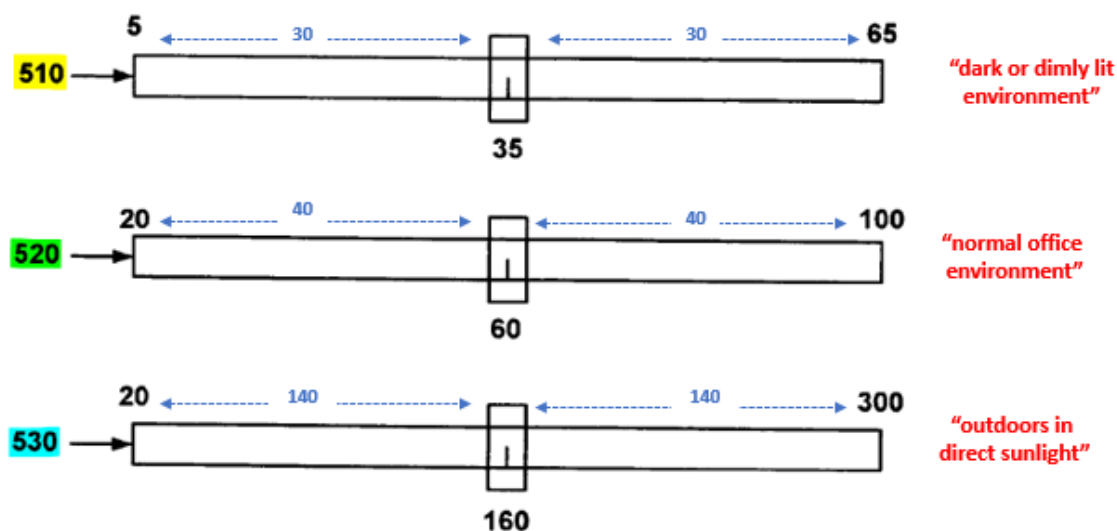
(Kerman, p.397, ¶7.) The asterisk (*) in the source code above refers to a multiplication operation, and the forward slash (/) to a division operation. This formula is very straightforward and easily applied.

303. Let's start with a simple example of a slider operating in the range of values between 100 and 200. In this example, $\text{max} = 200$, $\text{min} = 100$, and let's assume $\text{percent} = 50$, consistent with the example from Kerman above. The value of property $_x$ with the slider at the 50% position is thus: $100 + ((200 - 100) \times (50 \div 100))$, which equals 150. Stated simply, 150 is the value associated with the slider when it is located 50% between 100 (min) and 200 (max).

304. The key feature of this formula, for purposes of **Ground 3**, is that it can be used to calculate the new value for the current slider position when the range of values changes. For example, suppose I change the range of values such that, $\text{max} = 250$, $\text{min} = 150$, but I leave the percent at 50 because the slider is still at the 50% position. As a result of applying different ranges, the value of property $_x$ is now 200. Although the code from Kerman above assumes an exemplary percent of 50 , different values could obviously have been used.

305. It would have been apparent and obvious to an ordinarily skilled artisan

that Gettemy, which uses the same type of slider controls as Kerman, uses this technique to determine the display brightness value based on the current relative position of the slider (the “user signal”) and based on the current brightness range (the “sensing signal”). Referring again to the examples in Figure 5:



(Gettemy, Fig. 5 (colored annotations added).) Gettemy explains that the slider in Figure 5 is at the “midpoint setting” in each of the three brightness ranges. (Gettemy, 6:6-10.) Because the slider is at the midpoint position, the “**user signal**” in these examples can readily be understood as a percentage value as explained for claim 1[a], e.g., “50” or “0.5,” reflecting that the slider is halfway between the low and high values. And the “**sensing signal**” as noted for claim 1[b] represents the brightness range selected by the main processor based on the current ambient light level. When expressed as a numerical value, a “range” of a set of numbers is simply

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the difference between the highest and lowest values in the set, *e.g.*, “60” for the 5-65 brightness range 510 for “dark or dimly lit” environments. (See *Mathematics Dictionary and Handbook* (1993), EX1018, p.325 (describing range as “[t]he difference between the largest and smallest number in a set of data.”).) The display brightness values in Gettemy, represented as the current value of the slider, can thus be calculated using the formula in Kerman: $_x [\text{display brightness value}] = \text{min} [\text{low range setting}] + ((\text{max} [\text{high range setting}] - \text{min} [\text{low range setting}]) \times (\text{percent} [\text{slider position}] \div 100))$. Assuming the same midpoint percent of 50 (“user signal”) in Figure 5, and applying the min and max range values from Figure 5, this formula yields the same brightness display values:

Slider Position (“user signal”)	Brightness Range (<i>i.e.</i> max – min) from Figure 5 (“sensing signal”)	Display Brightness Value from Figure 5 (<i>i.e.</i> Value for Current Slider Position)
50	“dark or dimly lit” (5 to 65): 60	$5 + (60 \times (50 \div 100)) = 35$
50	“normal office” (20 to 100): 80	$20 + (80 \times (50 \div 100)) = 60$
50	“outdoor/direct sunlight” (20 to 300): 280	$20 + (280 \times (50 \div 100)) = 160$

The Kerman formula, as shown, yields the exact same display brightness values as shown in Figure 5 of Gettemy (*i.e.*, 35, 60, and 160). In each of these examples, the “user signal” (50) was divided by 100 to get 0.5, which is then multiplied by the

“**sensing signal**,” a numerical value reflecting the range (*i.e.*, difference between max and min values; *e.g.*, $65 - 5 = 60$). That value is then added to the low range setting value as shown in Figure 5 to obtain the display brightness value.

306. This formula also works for the other examples in Gettemy. For example, with respect to the increase in brightness levels in steps **720** and **730** of Figure 7, the user signal based on the slider position (which was moved to the right) can be represented as 5/6ths (rounded to 83.333%). (That is, $(55-5) \div (65-5)$.) For step **720**, therefore, the display brightness is $5 + (60 \times 0.83333) = 55$ (rounded up), and for step **730**, the display brightness is $20 + (80 \times 0.83333) = 87$ (rounded up), both values being the same as the values shown in Figure 7. And for the decrease in brightness in steps **740** and **750**, the user signal based on the slider position (which was moved to the left) can be represented as 25% (which is, $(40-20) \div (100-20)$). For step **740**, that means the display brightness is $20 + (80 \times 0.25) = 40$, and for step **750**, the display brightness is $5 + (60 \times 0.25) = 20$, also matching the values reported in Figure 7.

307. I previously posited the question, what formula or technique does the main processor **310** in Gettemy employ to calculate the new display brightness value for the current slider position, when the brightness range changes in response to changes in ambient lighting conditions? Gettemy does not expressly answer this

question, because as Kerman confirms, it is using nothing more than simple multiplication to perform a percentage-based calculation. Kerman confirms that the processor in Gettemy employs multiplication of the “**user signal**” with the “**sensing signal**,” using the slider control formula in Kerman (or a variation with immaterial differences).⁷ This is because Kerman specifically discloses how to determine a current value of a slider, based on its (1) relative location on the slider control and (2) the range within which the slider operates – precisely the same relationship reflected in the slider controls in Gettemy.

308. The fact that all of the display brightness values reported in Gettemy exactly follow the formula in Kerman is neither an accident nor a coincidence – it is simply a reflection of the fact that the Kerman formula is how one calculates the value corresponding to a relative percentage within the specified range of values.⁸

⁷ For example, if the “**user signal**” were represented as a decimal value (*e.g.*, “0.5”) instead of a percent value (*e.g.*, “50”), the formula in Kerman would simply not perform division of the “**user signal**” by 100.

⁸ In fact, the formula involves nothing more than a basic calculation using a percentage. The only supposed “complexity” introduced by the formula, $_x = \min$

309. This is further confirmed by Rosenzweig, which describes aspects of Macromedia Director, a software development platform for creating standalone and Web applications. (Rosenzweig, p.1.) Like Kerman, Rosenzweig details how to create slider controls. “A slider is a familiar user interface element used in all major software programs. Sliders offer the best way to enable users to input a number within a small range.” (*Id.*, p.320.) Rosenzweig explains that the software implementing a slider “needs to know how far to the left and right it can move, and what range of values it represents, such as 1 to 3, 0 to 100, or -500 to 500.” (*Id.*)

310. Rosenzweig discloses simple equations for determining the value associated with a slider control based on the slider’s current position and range – and those equations are equivalent (mathematically speaking) to the equations in Kerman described above. For example, Rosenzweig discloses the following source code for determining the value associated with a slider in response to the user moving the

$+ ((\text{max} - \text{min}) \times (\text{percent} \div 100))$, is to account for the fact that the range of values can begin at a non-zero (min) value. For example, if a range started at zero (*e.g.* a range from 0-60), min would be zero and the formula would reduce to: $_x = \text{max} \times (\text{percent} \div 100)$, which just multiplies max by a decimal percentage value.

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slider to a different position using a computer mouse:

```
-- this handler takes the mouse position and figures the
-- value of the slider
on moveMarker me
  -- compute the position as a number between 0 and 1
  x = the mouseH - pBounds.left
  sliderRange = pBounds.right-pBounds.left
  pos = float(x)/sliderRange

  -- translate to a value
  valueRange = pMaximumValue - pMinimumValue
  pValue = pos*valueRange + pMinimumValue
  pValue = integer(pValue)

  -- check to make sure it is within bounds
  if pValue > pMaximumValue then
    pValue = pMaximumValue
  else if pValue < pMinimumValue then
    pValue = pMinimumValue
  end if
end
```

(Rosenzweig, pp.322-323 (red box annotation added).)

311. The source code above was written in a programming language called Lingo, which was used with Macromedia Director. (Rosenzweig, p.1.) The code is straightforward and organized into three sections divided by textual comments. The first section, as indicated by the comment above, “compute[s] the position [of the slider] as number between 0 and 1.” (Rosenzweig, pp.322-323.) In plain English, this code computes the relative pixel position of the mouse within the displayed slider (**x**), the number of pixels in the slider (**sliderRange**), and then divides the former by the latter to calculate the slider position (**pos**). The value “**pos**” thus

represents a percentage expressed as a floating point (decimal) value (*i.e.* “between 0 and 1”), which is equivalent to the “percent ÷ 100” calculation from Kerman above.⁹

⁹ As noted in the text, Rosenzweig discloses two different ranges: (1) the range of pixels in the slider control physically displayed on the screen (“**sliderRange**”), and (2) the desired range of the underlying values selected using the slider control (“**valueRange**”). The range relevant to the claimed multiplier is the latter **(2)** range. Rosenzweig uses two ranges because there may not be a one-to-one relationship between the two; in a real-world implementation, the “**sliderRange**” **(1)** would have been considerably larger than the “**valueRange**” to allow the user to more easily make fine grained selections using the slider value using the computer mouse. The source code thus calculates “**pos**” to determine the relative position (based on a decimal percent) of the slider within the range. The value “**pos**” thus provides a relative or normalized value, *e.g.*, “0.5” would represent the halfway point in the slider regardless of the width (in pixels) of the slider on the screen. This relative value is then used, as explained in the text, to calculate the value of the slider position within the underlying range of values.

312. The next three lines under the comment entitled “translate to a value,” use “**pos**” to calculate the underlying value associated with the position on the slider. In plain English, these lines compute the range of the slider (**valueRange**), by subtracting the minimum value in the range from the maximum value (**pMaximumValue-pMinimumValue**), which is equivalent to “ $\text{max} - \text{min}$ ” from Kerman above. The second line, shown in **red**, calculates the value associated with the slider (**pValue**) by multiplying the decimal percent value of the slider position (**pos**) by the slider range (**valueRange**), which is equivalent to “ $((\text{max} - \text{min}) * (\text{percent} \div 100))$ ” from Kerman above. It then adds to that value the minimum value in the range (**pMinimumValue**), again mirroring the operation performed by the equation in Kerman detailed which adds “**min**” to “ $((\text{max} - \text{min}) * (\text{percent} \div 100))$ ” to yield “**_x**.” The equation in Rosenzweig, therefore, would have produced the same values as Kerman shown above provided that it was provided equivalent values for **pos**, **pMaximumValue**, and **pMinimumValue**. The equations in Rosenzweig and Kerman are therefore equivalent for purposes of my analysis. The remaining code in the excerpt above is not material to my analysis, but for completeness, the next line simply converts the value (**pValue**) to an integer (non-decimal) value, and the final lines perform bounds checking to ensure that the value (**pValue**) falls within the range for the slider.

313. Both references thus disclose an equation that, using multiplication, calculates the current value for a slider based on (a) the relative position of the slider and (b) the range of the slider control. It therefore would have been obvious that the brightness system of Gettemy would have included a “**multiplier**,” which would have taken the form of software executed by main processor **310** that determines the display brightness value using the techniques described above. That software, as explained in Gettemy, “interprets the brightness setting of said slider position **430** relative to the low range setting **410** and the high range setting **420**.” (Gettemy, 6:4-6.) The processor then uses the “relative” position of the slider to calculate the new display brightness level in response to a change in the brightness range and ambient lighting conditions. (Gettemy, 6:18-22 (“The computer processor will dynamically adjust the range when the ambient light changes sufficiently, keeping the brightness level commensurate with the slider position last selected relative to the new range setting”).) It would have been obvious that in order to interpret and apply the “relative” slider position, as disclosed in Gettemy, the software would have performed at least multiplication of the user and sensing signal in Gettemy. As noted previously, such multiplication would have produced the same values as reported in each of the examples in Gettemy (*e.g.*, Figs. 5 & 7).

314. I note that the display brightness value in Gettemy incorporates a

further addition of the minimum value of the selected brightness range (e.g., $5 + (60 \times 0.5) = 35$ in the “*dark or dimly lit*” embodiment above), consistent with the equations in Kerman and Rosenzweig. But this further adjustment presents no obstacle to obviousness of claim 1[c] because the system in Gettemy would have used *at least* multiplication of the “**user signal**” and “**sensing signal**.”

315. My mapping of claim 1[c] to the prior art is entirely consistent with the district court claim constructions noted above, which require a “**multiplier**” that is “*actually programmed or implemented with hardware or software.*” The multiplier in Gettemy would have been implemented using the software executed by main processor 310 that determines the display brightness level. The term “**combined signal**” was also construed as including, but not necessarily being limited to, “*the product of the user signal and the sensing signal.*” This is precisely what the display brightness value computed in Gettemy represents, *i.e.*, the mathematical product of the “**user signal**” and the “**sensing signal**.”

316. **Rationale and Motivation to Combine (Gettemy with Kerman and Rosenzweig)**: It would have been obvious to combine Gettemy with Kerman and Rosenzweig, predictably resulting in the Gettemy brightness control system in which the processor in Gettemy uses multiplication to obtain a display brightness value based on the “**user signal**” and the “**sensing signal**” as described above.

The claimed “**multiplier**” under the proposed combination, as explained, would have corresponded to the software executed by the main processor **310** in Gettemy that computes the display brightness value (“**combined signal**”), which would have represented the product of at least the Gettemy user signal and sensing signal.

317. Gettemy, Kerman, and Rosenzweig are all analogous references. Turning first to Gettemy, it is an analogous reference in the same field as the ’117 patent. The “Field of the Invention” of the ’117 patent states it “relates to brightness control in a visual information display system, and more particularly relates to adjusting the brightness level to compensate for changes in ambient lighting.” (’117, 1:19-22.) Gettemy similarly describes adjusting display brightness based on ambient lighting, and would also have been reasonably pertinent to a number of problems facing the inventor. For example, Gettemy would have been reasonably pertinent to a number of implementation issues including how to obtain information about the current level of ambient light and the user’s preferred brightness level, and how to use that information to adjust the display brightness based on both the user setting and the current ambient lighting level.

318. Kerman and Rosenzweig are also analogous references that describe techniques for obtaining input from a user through a user interface, such as a standard slider control. These references would have been reasonably pertinent to a number

of problems facing the inventor, including how to implement an appropriate user interface to acquire input from the user for the claimed “**user signal**” indicative of a user selectable brightness setting. More fundamentally, Kerman and Rosenzweig are textbooks describing computer programming techniques generally, and as such, would have been reasonably pertinent to a number of other problems faced by the inventor in programming software to carry out the alleged invention. Slider controls as described in Kerman and Rosenzweig were common user interface tools for obtaining user input relating to device parameters operating within a limited range, such as audio volume and, as Gettemy confirms, display brightness. The analogousness of Kerman and Rosenzweig is further enhanced by the fact that, in combination with Gettemy, they reveal exactly how to reproduce the exact same display brightness levels in Gettemy based on the sliders in Figures 5 and 7, using a simple formula as described above.

319. An ordinarily skilled artisan would also have been motivated to combine because Kerman and Rosenzweig provide further “under the hood” implementation details about computation of the values associated with the slider controls in Gettemy. An ordinarily skilled artisan, seeking to implement the brightness control system of Gettemy, would thus have been motivated to rely on the teachings of Kerman and Rosenzweig to better understand how to implement the

slider controls in Gettemy, including the precise formula that produces the exact display brightness values exhibited in Gettemy, when the brightness range changes in response to varying ambient lighting levels.

320. And more fundamentally, a person of ordinary skill in the art would also have appreciated that multiplication as disclosed in Kerman and Rosenzweig was among a very limited number of predictable solutions for how to combine the “**user signal**” and the “**sensing signal**” in Gettemy, as described above, to produce the display brightness value. Multiplication was and remains one of the most (if not the most) widely-used techniques used by computers to combine two values or signals. Kerman and Rosenzweig confirm that their multiplication techniques are applicable to any context in which the current value of a slider needs to be determined, and thus, an ordinarily skilled artisan would have been motivated to use those techniques to compute the new display brightness value in Gettemy for the current slider position, in response to a change of the display brightness range. In fact, an ordinarily skilled artisan could not have identified any solution *other than* multiplication of the user input and the new range, as described in Kerman and Rosenzweig, that produces the multiple output values expressly reported in both Figures 5 and 7.

321. Also, a person of ordinary skill in the art would have had at least a

reasonable expectation of success. The implementation of multiplication to produce the brightness display value, as described above, would have entailed nothing more than trivial arithmetic operations using conventional textbook programming techniques. An ordinarily skilled artisan would have found the disclosures in Gettemy, Kerman and Rosenzweig more than sufficient to implement the teachings that I have applied to the proposed combination, without undue experimentation.

- (d) **“a dark level bias configured to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.” (Claim 1[d])**

322. I am informed that in a prior litigation involving the '117 patent, where Petitioner was not involved, a district court construed **“dark level bias”** as *“a value that causes a deviation from the combined signal, where the value is a voltage value of an electrical signal or value of a software variable.”* A district court also construed this limitation as being *“actually programmed or implemented with hardware or software to adjust the combined signal to generate a brightness control signal that is used to control a brightness level of a visible display.”* If these constructions are applied, they are readily satisfied and rendered obvious by the prior art.

323. Gettemy explains that main processor **310** uses the display brightness value calculated as described for claim 1[c] (“**the combined signal**”) to control the brightness of the display, *i.e.*, by sending an appropriate control command to display controller **370**. (Gettemy, 6:11-16, 5:35-37 (“Display controller **370** implements display control commands from the main processor **310** such as increasing or decreasing the brightness of the display device **105**.”).) Gettemy therefore discloses “**a brightness control signal that is used to control a brightness level of a visible display,**” *i.e.*, a command signal sent to display controller **370** to change the brightness level of display device **105** (“**a visible display**”).

324. But Gettemy arguably does not alone disclose the claimed “**dark level bias,**” notwithstanding that the system in Gettemy will not permit the user to set the slider below the lower end of the displayed range. For example, in the “*dark or dimly lit*” embodiment of Gettemy described above, the display brightness value is computed as $5 + (60 \times 0.5) = 35$, with the **5** representing a further summation to ensure that the display brightness value does not fall below the lower bound of the range of 5-65 nits. But nothing in Gettemy states that the purpose of summation of the minimum value of the brightness range is to ensure that the final display brightness value used to control the brightness of the display meets a predetermined desired level of brightness. For example, as I explained for claim 1[b], it would have

been obvious that the system of Gettemy could have been implemented to include additional ranges beyond the specific examples in Figures 5 and 7, such as lower ambient light ranges for *even darker* conditions. It would also have been obvious, as I explain below, that there may have been situations in which the display brightness value in Gettemy would have nevertheless resulted in an unacceptably low level of brightness for the display. Accordingly, I have relied on Gettemy in combination with **Whitted** (EX1016) and **Bell** (EX1017) for the claimed dark level bias feature.

325. As noted in **Part V.A.2(c)** above, and starting with Whitted, it discloses techniques for adjusting the brightness of a display based on ambient lighting conditions. (Whitted, 3:25-27, 3:33-37.) My Declaration relies on Whitted for its disclosures of ensuring that the brightness level selected for the display never falls below a threshold minimum brightness.

326. Whitted discloses an intensity control circuit **503** and brightness control circuit **504** that determine the amount of power supplied to the backlight **510** of the display, and thus, its brightness. (Whitted, 7:62-8:5.) Similar to Gettemy, display brightness can be controlled by using two factors: **(1)** user input and **(2)** ambient lighting conditions. With respect to **(1)**, the user can adjust brightness using a potentiometer such as a knob that adjusts a brightness control signal. (Whitted, 8:5-

8.) With respect to **(2)**, a photo sensor **502** mounted on the front of the display measures the intensity of ambient light. (Whitted, 7:56-61.) “The intensity control circuit **503** determines the amount of power supplied to the backlight **510** as a function of the output of the photo-sensor **502** and the received brightness control signal.” (Whitted, 8:9-12.) Whitted thus discloses that “[w]hen the output of the photo-sensor **502** indicates an increase in the intensity of the ambient light striking the screen **206**, the power to the backlight **510** will be increased.” (Whitted, 8:16-19.) And conversely, “[a]s the intensity of the ambient light striking the screen **206** decreases, the intensity control circuit decreases the power supplied to the backlight **510** and thus the intensity of the light output therefrom.” (Whitted, 8:19-22.)

327. But what happens in dark environments? Whitted answers this question by explaining “[a] minimum power level is set, e.g., pre-programmed, for the backlight **510** to insure that the display will be readable in low light conditions.” (Whitted, 8:22-25.) As Whitted further explains:

In one embodiment, even if the output of the photo-sensor **502** indicates little or no incident light, the intensity control circuit **503** does not lower the power output to the backlight **510** below a preselected threshold to insure that in dark or dimly lit conditions, images on the display panel **206** will remain visible. In such an embodiment, intensity control circuit **503** maintains backlight light output between a minimum

threshold level and full intensity as a function of the output of the photo-sensor **502** and the brightness control circuit **504**.

(Whitted, 8:26-35.) The technique in Whitted thus ensures that regardless of the current ambient lighting condition, or user input, the display brightness will never fall below a “minimum threshold level,” even in dark lighting conditions.

328. Now turning to Bell, like Whitted, it also discloses techniques for adjusting the brightness of a display based on ambient lighting conditions. (Bell, 1:67-2:4 (“Thus, according to one embodiment of the invention, the brightness setting for a display may be modified by first assessing the ambient luminance level and then using this assessment to select an appropriate display brightness setting.”).) Bell explains that, using her automatic brightness techniques, “[a]s the brightness of the environment decreases, the brightness of the display is proportionally reduced for viewing.” (Bell, 5:54-56.) This proportional reduction thus creates the same problem confronted by Whitted – if the brightness level is proportionately reduced with decreases in ambient light levels, the brightness level could potentially fall to an unacceptably low level in a dark environment.

329. Bell addresses this issue by explaining that, “[i]n a very dark environment, a minimum brightness level may afford comfortable viewing.” (Bell, 5:56-58.) “For low ambient luminance levels,” Bell explains, “a minimum but non-

zero display brightness permits viewing of the microdisplay.” (Bell, 6:3-5.) Bell thus confirms that it would have been beneficial to ensure that the resulting display brightness (whether based on current ambient lighting condition, user setting, or a combination of both) would have never fallen below this “minimum but non-zero” value. Figures 4 and 5 show examples:

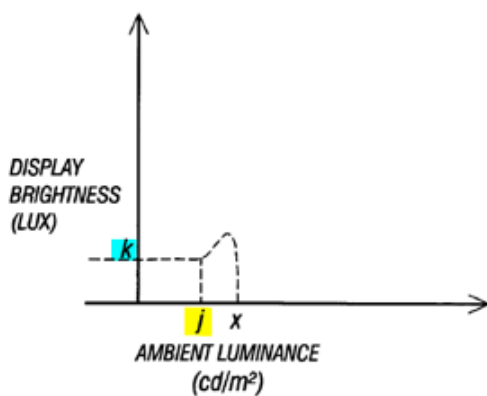


FIGURE 4

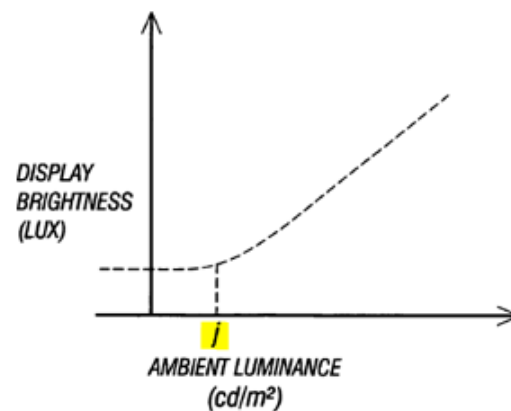


FIGURE 5

(Bell, Figs. 4-5 (highlighting added).) Figures 4 and 5 show the relationship between brightness of the display (vertical axis) and ambient luminance (horizontal axis). Both figures show that the brightness of the display will decrease as ambient luminance decreases – but only until ambient luminance reaches **j** (measured as candela per square meter, cd/m²) shown in highlighting, at which point display brightness does not further decrease. Display brightness is instead maintained at **k**, a minimum brightness that applies continues to apply as ambient luminance decreases to zero. Bell explains that “in very low light ambients, a display brightness

of **k** LUX may be sufficient to readily view the display.” (Bell, 5:29-31.)

Conversely, as ambient brightness exceeds **j**, display brightness increases.

330. For purposes of my Declaration, there is no material difference between Figure 4 and Figure 5. Figure 4 shows the graph for a *transmissive* display, such as an LCD display that uses backlighting. Bell explains that once ambient brightness reaches **x**, the backlighting can be turned off because “the display has become readable without the assistance of the backlight.” (Bell, 5:39-42.) This is why Figure 4 shows the display brightness “dropping off” at ambient luminance **x**. In contrast, Figure 5 shows display brightness for an *emissive* display, in which display brightness continues to increase with ambient brightness “in a somewhat linear fashion.” (Bell, 6:5-7.) This difference is immaterial for purposes of my Declaration, because, as shown, both figures show the same relationship with respect to *decreasing* ambient brightness levels – a minimum display brightness level **k** regardless of the type of display as ambient brightness decreases toward zero.

331. **Rationale and Motivation to Combine (Gettemy, Kerman, and Rosenzweig with Whitted and Bell):** It would have been obvious to combine Gettemy with Whitted and Bell, predictably resulting in the Gettemy brightness control system in which the “**multiplier**” as described for claim 1[c] would have been adapted to *further* adjust the computed display brightness value (“**combined**

signal”) to “**generate a brightness control signal [that] is maintained above a predetermined level when the ambient light level decreases to approximately zero,**” as claimed.

332. In a real-world implementation, this would have been trivially easy to implement. The proposed combination need not rely on any specific circuitry or techniques from Whitted and Bell, but rather, relies on them only for their general teachings about maintaining the brightness level above a predetermined minimum threshold value, and the reasons an ordinarily skilled artisan would have been motivated to do so (detailed below). Under the proposed combination based on Gettemy, the software executed by main processor **310** would have been further adapted, before generating the brightness control signal that it sends to display controller **370** to change the current display brightness (Gettemy, 6:11-16, 5:37-39), to check whether the display brightness value computed at claim 1[c] (“**combined signal**”) exceeds a predetermined minimum threshold level as disclosed in Whitted and Bell. For example, using an example from Gettemy above, suppose the user placed the slider at the ten percent (**10%**) position when the slider control was showing the “*dark or dimly lit*” range of Figure 5 between 5-65 nits. This would have resulted in the following display brightness value: $(0.1 \times 60) + 5 = 11$ (“**combined signal**”). Under the further combination with Whitted and Bell, the

main processor in Gettemy would have *further* adapted, for example using elementary IF-THEN logic, to check whether **11** (“**combined signal**”) is greater than a desired minimum threshold value. This is a simple and widespread programming technique referred to as “bounds checking” in which a value is checked to determine if it falls within a desired range. The excerpt of Rosenzweig discussed above, for example, discloses code to “check to make sure [the slider value] is within bounds.” (Rosenzweig, pp.322-323.) That code uses simple IF-THEN logic to check whether **pValue** (the value of the slider) is less than **pMinimumValue**, and if so, it sets the value of **pValue** to **pMinimumValue**. (Rosenzweig, pp.322-323 (“... if pValue < pMinimumValue then pValue = pMinimumValue”).) Applying that basic technique to implement the minimum threshold brightness teachings of Whitted and Bell would have predictably resulted in, “**when the ambient light level decreases to approximately zero,**” *i.e.*, in dimly lit to entirely dark environments, as ambient luminance approaches and/or reaches approximately zero, the display brightness value in Gettemy being adjusted to ensure that the corresponding “**brightness control signal**” that is sent to display controller **370** is maintained above a predetermined level.

333. As explained, a prior district court previously construed “**dark level bias**” as “*a value that causes a deviation from the combined signal, where the value*

is a voltage value of an electrical signal or a value of a software variable.”
(EX1028, p.34.) The Gettemy circuit modified in light of Whitted and Bell as described above would clearly have satisfied this construction, if it is applied, because the software adjustment to the display brightness value qualifies as a “*value that causes a deviation from the combined signal*” (i.e., a deviation from the pre-adjustment display brightness value), and this value is a “*value of a software variable*” (i.e., because it is a value used by the software to adjust the display brightness value).

334. Whitted and Bell, like Gettemy discussed above, are also analogous references in the same field as the '117 patent of controlling the brightness of a display based on ambient lighting conditions. Whitted and Bell would also have been reasonably pertinent to a number of problems facing the inventor, including how to implement a dark level bias ensuring that the brightness level of the display always exceeds a predetermined minimum level.

335. An ordinarily skilled artisan would have been motivated to combine for a straightforward reason – to maintain the brightness level of the display at a sufficiently high level to ensure that the user can view the display, even in very low ambient light environments. This motivation is expressly stated in Whitted, explaining that “[a] minimum power level is set, e.g., pre-programmed, for the

backlight 510 to insure that the display will be readable in low light conditions.” (Whitted, 8:22-25.) This motivation is also echoed throughout Bell, who explains that “[i]n a very dark environment, a minimum brightness level may afford comfortable viewing.” (Bell, 5:56-58; *see also id.*, 6:3-5.) Bell explains that “in very low light ambients, a display brightness of k LUX may be sufficient to readily view the display.” (Bell, 5:29-31.) The minimum brightness teachings of Whitted and Bell, in other words, would have beneficially prevented the display in Gettemy from being set to a brightness level so low that the user could not readily view it.

336. This would have provided a beneficial backstop to ensure that the combination of user input (through the slider) and ambient lighting conditions in Gettemy did not result a brightness level for the display that was undesirably low. Although the exemplary slider controls in Gettemy include non-zero minimum user settings (such as the minimum slider value of “5” in the “*dark or dimly lit*” range of Figure 5), these minimum values could nevertheless have produced brightness conditions that were unacceptably low based on additional factors, such as the age and condition of the display. For example, it was well-known that conventional displays would often become dimmer as they age, requiring a concomitant increase in brightness level to compensate for the degradation to maintain the desired level of brightness. I have cited additional contemporaneous references that confirm and

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reinforce this motivation to combine. For example, U.S. Patent No. 6,207,943 B1 to Smelker, entitled “Consistent Brightness Backlight System” (**EX1019**), discloses a system for compensating for degradation of the backlighting of an LCD. The Background of Smelker explains conventional LCDs over their lifetime “will decrease in brightness by about 50%,” which is “directly related to the degradation of the backlighting system associated with the liquid crystal structures which actually produce the image(s).” (**EX1019**, 1:48-52.) This would have been known not only to ordinarily skilled artisans, but even laypersons who would have noticed their computer LCDs (which were popular by the early 2000s) getting gradually dimmer with use and age. U.S. Patent Application No. 2002/0167637 A1 to Burke, entitled “Backlit LCD Monitor” (**EX1020**) similarly discloses that “[a]s the bulbs **102** [of an LCD-type display] age, it takes more current to generate the 1000 nits of luminance.” (**EX1020**, ¶0030.) Burke discloses a technique for increasing the output to an LCD to maintain the desired brightness level. (**EX1020**, ¶0032.) An ordinarily skilled artisan would thus have appreciated that, because of the degradation of the display brightness over time with age and use, the user could have selected a brightness setting so low that it made the display effectively unusable even for a dark ambient light environment. The teachings in Whitted and Bell would thus have enabled the system of Gettemy to compensate for these additional factors to

ensure that the confluence of **(1)** the user setting through the slider control, **(2)** the ambient lighting conditions, and **(3)** the age and condition of the display, did not collectively result in a brightness level that would have made the display useless to the user. (*E.g.*, U.S. Patent No. 6,618,042 B1 to Powell, entitled “Display Brightness Control Method and Apparatus for Conserving Battery Power” (**EX1021**), 6:20-24 (“It will be recognized that there is advantageously a minimum brightness setting below which a display brightness reduction performed... will not be effected, for example, in order to avoid completely or nearly completely blanking the screen.”).) And as explained above, it would have been obvious to implement Gettemy to provide many more possible brightness ranges, including ranges with potentially lower minimum values than the “*dark or dimly lit*” exemplary range of Figure 5 of Gettemy, thus making the minimum threshold teachings of Whitted and Bell even more useful.

337. An ordinarily skilled artisan would also have had at least a reasonable expectation of success in combining Gettemy with Whitted and Bell. As noted previously, the proposed combination does not rely on incorporating any specific circuitry or techniques from Whitted and Bell, but rather, relies on their more general teachings about maintaining brightness above a predetermined minimum threshold value and the reasons to do so. It would have been trivially simple to adapt the

Gettemy brightness control system to implement a minimum threshold for low light values, as described above, which would have entailed nothing more than routine and trivial IF-THEN logic and mathematic operations using conventional programming techniques. And although I am not relying on the non-zero lower values within each brightness range in Gettemy (e.g. “5” for the “*dark or dimly lit*” example in Figure 5) for the claimed “**dark level bias**” for the reasons provided above, the existence of these lower bounds nevertheless confirms that Gettemy’s technique would have been entirely consistent and complementary with making a further upward adjustment to the display brightness value, if needed, as disclosed in Whitted and Bell. An ordinarily skilled artisans would have found the disclosures in Gettemy, Whitted, and Bell sufficient to implement the teachings that I have applied to the proposed combination, without undue experimentation.

2. Claim 2

338. Claim 2 depends from claim 1, and further recites “[t]he **brightness control circuit of claim 1, wherein the dark level bias is provided to the multiplier such that the amount of adjustment to the combined signal is dependent on the user selectable brightness setting.**”

339. Claim 2 adds very little to what was already discussed for claim 1. As just explained, under the proposed combination, the “**dark level bias**” would have

been provided to the software executed by main processor **310** that determines the display brightness value (“**the multiplier**”), which it would have used to adjust the display brightness value (“**the combined signal**”). It would have been obvious that the dark level bias would have been provided to the “**multiplier**” in Gettemy because it would have been used to determine the *final* display brightness value, as explained for claim 1[d].

340. It would also have been obvious that the amount of the adjustment could have been “**dependent on the user selectable brightness setting,**” depending on the user setting and the desired predetermined minimum level. Take the example in Figure 5 of the range **510** involving a “*dark or dimly lit environment,*” *i.e.*, between **5-65** nits. Suppose the user moved the slider to the left to a relative position corresponding to a value of **11** nits, near the lower limit of range **510**. If the desired predetermined minimum level was **15** nits, for example, the display brightness would have been adjusted (*i.e.*, by **+5** so it exceeds **15**) to that minimum level. But if the user moved the slider to a position corresponding to **13** nits, the display brightness would again have to be adjusted – but by a lesser amount to exceed the predetermined minimum level (*i.e.*, by **+3**).

341. Accordingly, it would have been obvious that the amount of the required adjustment to the display brightness value would have been “**dependent on**

the user selectable brightness setting,” as recited in claim 2. I note that the two scenarios described above are mere examples; it would have been obvious to an ordinarily skilled artisan that a wide variety of other scenarios could have existed in which – based on the brightness range and desired minimum display brightness – the amount of the adjustment to the **“combined signal”** would have depended on the user selectable brightness setting.

3. Claim 7

342. Claim 7 depends from claim 1, and further recites **“[t]he brightness control circuit of claim 1, wherein the brightness control signal is provided to a display driver to control backlight illumination of a liquid crystal display.”**

343. Gettemy discloses a **“display driver”** in the form of display controller **370** that controls the brightness of the display, as explained for claim 1[d]. (Gettemy, 5:35-37 (“Display controller **370** implements display control commands from the main processor **310** such as increasing or decreasing the brightness of the display device **105**.”), 6:11-16.) Gettemy also confirms, as would have been obvious to an ordinarily skilled artisan, that the display could have been **“a liquid crystal display.”** (Gettemy, 1:43-45 (“Many different kinds of screens can be used, such as liquid crystal displays, and field emission displays or other types of flat screen displays.”).)

344. It would have been obvious to a person of ordinary skill in the art that controlling the brightness of a liquid crystal display would have required “**control[ing] [its] backlight illumination,**” as claimed, because the backlight controls the perceived brightness of the display. (*See also* Whitted, 8:12-16, 1:55-57 (“Transmissive LCDs... use an internal light source **107**, referred to as a backlight, for illumination.”).) This is further confirmed by Bell, which explains that the display brightness of an LCD is dependent on the brightness of its backlighting. (Bell, 5:26-27 (“In FIG. 4, a graph of backlight brightness versus ambient luminance for a hypothetical direct view LCD is plotted.”), Fig. 4 (graph showing brightness of LCD based on ambient lighting conditions).) Under the proposed combination, therefore, the “**brightness control signal**” used by the “**display driver**” in Gettemy to control the display brightness – in those instances where the display was an LCD device – would have resulted in controlling the backlight illumination of the LCD.

4. Claim 9

345. Claim 9 depends from claim 1, and further recites “[t]he **brightness control circuit of claim 1, further comprising a second input configured to receive a selection signal to selectively operate the brightness control circuit in an auto mode or a manual mode, wherein the selection signal enables the light**

sensor in the auto mode and disables the light sensor in the manual mode.”

346. It would have been obvious that the system built based on the proposed combination could have operated in “**a manual mode.**” Gettemy describes a “conventional approach” that “gives the user manual control of the amount of light being produced for the transmissive and emissive display screens. This approach is satisfactory for conscientious users who regularly monitor the brightness settings and manually adjust them accordingly.” (Gettemy, 2:11-16.) Gettemy further explains that “[t]he dynamically adjustable range settings, in still another embodiment, can be overridden by the user, enabling the user to control the brightness of the display screen.” (Gettemy, 2:54-57.)

347. It therefore would have been obvious based on Gettemy to provide a “**second input**” to receive a selection from the user (“**selection signal**”) to selectively operate the brightness control circuit in either “**an auto mode,**” *i.e.*, the dynamic brightness mode of Gettemy described for claim 1, or in “**a manual mode,**” *i.e.*, by deferring entirely to user selection. The “**second input**” would have taken the form of software executed by main processor **310** for receiving and implementing the user’s selection reflecting a desire to switch to either auto or manual mode. It would have been obvious that receiving the user selection could have been implemented in a number of different ways, including through an on-

screen menu, switch, button, or any number of conventional user interface techniques.

348. It therefore would have been obvious that “**the selection signal enables the light sensor in the auto mode,**” because the light sensor would have been required in the auto mode in order for the processor to select the appropriate brightness range based on ambient lighting conditions. Conversely, it would have been obvious that “**the selection signal... disables the light sensor in the manual mode,**” because the light sensor would not be needed as the brightness adjustment is under manual user control without regard to ambient lighting conditions. It would have been obvious that the light sensor would have been disabled because the processor in manual mode would not receive and take into account ambient lighting information from the light sensor. An ordinarily skilled artisan would also have been motivated to disable the light sensor circuitry in Gettemy, when operating in manual mode, in order to conserve battery power. This is consistent with Gettemy, which explains that providing “a pleasant battery experience” is one of the goals of his alleged invention. (Gettemy, 2:29-35.)

349. A person of ordinary skill in the art would have been motivated to implement Gettemy to provide for this selective auto or manual mode operation to provide further flexibility over the display brightness. Gettemy itself provides an

express motivation by explaining that manual brightness setting “is satisfactory for conscientious users who regularly monitor the brightness settings and manually adjust them accordingly.” (Gettemy, 2:14-17.) And while Gettemy also touts the benefits of his dynamic brightness control system, nothing in Gettemy teaches away from also providing the option to operate in manual mode. To the contrary, Gettemy acknowledges that there is no “one-size-fits-all” approach to display brightness applicable to all users. For certain classes of users, such as the “conscientious users” identified in Gettemy, a manual mode would have been beneficial to afford them full control over the display brightness. For these “conscientious” or more experienced users, a manual mode providing a consistent user-selected display brightness would have avoided the potentially jarring impact of automatic brightness adjustment. An ordinarily skilled artisan would thus have appreciated the benefits of a system that allows selective switching between “**an auto mode and a manual mode,**” which would have enabled the system to appeal to both more experienced/conscientious users who prefer manual control, and to less experienced users who could have benefitted from the automatic and dynamic adjustment technique in Gettemy.

5. Independent Claim 15

350. For reference, claim 15 recites:

15. A method to selectively provide ambient light correction, said method

comprising:

- [a] receiving a user input signal indicative of a user selectable brightness setting;
- [b] selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level; and
- [c] adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero.

(’117, 13:34-14:9 (Claim 15; bracketed notations (e.g., [a], [b], [c]) added).) Claim 15 including the preamble is substantially similar, for purposes of my Declaration, to claim 1. As explained for claim 1[a], Gettemy discloses and renders obvious **“receiving a user input signal indicative of a user selectable brightness setting,”** *i.e.*, the user brightness selection represented as the relative slider position (*e.g.*, as a percentage value). The proposed combination also discloses and renders obvious **“selectively multiplying the input signal with a sense signal to generate a combined signal, wherein the sense signal indicates an ambient light level,”** because it multiplies the user input signal by the range selected by the processor

(“**sense signal**”), which based on and is indicative of the current ambient light level as explained for claim 1 [b] and 1 [c]. And finally, the proposed combination renders obvious “**adjusting the combined signal with a dark level bias to generate a brightness control signal for controlling brightness of a visible display such that the brightness control signal is maintained above a predetermined level when the ambient light level decreases to approximately zero,**” based on the combination of Gettemy, Whitted, and Bell, as was fully described for claim 1 [d]. As also fully explained for claim 1, an ordinarily skilled artisan would have been motivated to combine the prior art in the manner described and to operate the system in a manner that practices each and every limitation of claim 15.

6. Claim 16

351. Claim 16 depends from claim 15, and further recites “[t]he **method of claim 15, wherein the step of selectively multiplying the input signal with the sense signal is performed by a software algorithm, an analog circuit, or a mixed-signal circuit.**” As fully explained for claim 1 [c], the multiplier is performed by “a **software algorithm.**”

VI. NO SECONDARY CONSIDERATIONS OF NONOBVIOUSNESS

352. As explained in **Part III.B**, I understand that “secondary considerations” may be used as indicia of nonobviousness, provided that there is a

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nexus to the invention claimed. I understand from counsel, that Patent Owner in the district court litigation has not yet identified any secondary considerations evidence with a nexus to the claimed invention. Nor am I aware of information, such as commercial success, unexplained results, long felt but unsolved need, industry acclaim, simultaneous invention, copying, skepticism by experts, and failure of others, suggesting that the claims in this Declaration are not obvious. To the extent Patent Owner provides information it claims relates to secondary considerations, I reserve the right to supplement my analysis and opinions to comment on it.

VII. CONCLUSION

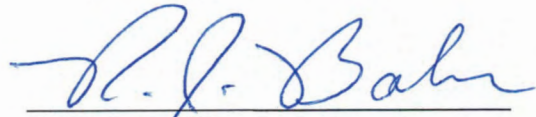
353. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in this proceeding. If required, I will appear for cross-examination at the appropriate time. I reserve the right to offer opinions relevant to the invalidity of the challenged claims at issue and/or offer testimony in support of this Declaration.

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354. I hereby declare that all statements made herein of my own knowledge are true and that all statements are made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

Dated: MARCH 27, 2023

Respectfully submitted,



R. Jacob Baker

APPENDIX A

R. JACOB (JAKE) BAKER, PH.D., P.E.

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PROFESSIONAL SUMMARY

Russel Jacob (Jake) Baker, Ph.D., P.E. (IEEE Student Member 1983, Member 1988, Senior Member 1997, and Fellow 2013) was born in Ogden, Utah, on October 5, 1964. He received the B.S. and M.S. degrees in electrical engineering from the University of Nevada, Las Vegas, in 1986 and 1988. He received the Ph.D. degree in electrical engineering from the University of Nevada, Reno in 1993. His Google Scholar profile is [here](#) and his ResearchGate profile is [here](#).

From 1981 to 1987 he served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division). From 1985 to 1993 he worked for E. G. & G. Energy Measurements and the Lawrence Livermore National Laboratory designing nuclear diagnostic instrumentation for underground nuclear weapons tests at the Nevada Test Site. During this time, he designed, and oversaw the fabrication and manufacture of, over 30 electronic and electro-optic instruments including high-speed cable and fiber-optic receiver/transmitters, PLLs, frame- and bit-syncs, data converters, streak-camera sweep circuits, Pockels cell drivers, micro-channel plate gating circuits, and analog oscilloscope electronics. From 1991-1992 he was an adjunct faculty member in the department of electrical engineering at the University of Nevada, Las Vegas (UNLV). From 1993 to 2000 he served on the faculty in the department of electrical engineering at the University of Idaho (UI), first as an untenured Assistant Professor and then from 1998 as a tenured Associate Professor. In 2000 he joined a new electrical and computer engineering (ECE) program at Boise State University (BSU) where he was promoted to Full Professor in 2002. He then served as the ECE department chair at BSU from 2004 to 2007. At BSU he helped establish graduate programs in ECE including, in 2006, the university's second PhD degree. In 2012 he re-joined the faculty at UNLV as a tenured Full Professor of ECE. During his service at the UI, BSU, and UNLV he has been the major professor to more than [100 graduate students](#). In addition to this industry and academic experience, he has done consulting, both technical and expert witness, for over [200 companies](#).

Over the last 35+ years his [research/development interests](#) and [publications](#) have been, or currently are, focused on: analog-to-digital/digital-to-analog data conversion and transmission, optoelectronics (imagers, displays, LIDARs, APDs, SiPMs, and associated electronics), analog and digital integrated circuit design and fabrication, design of diagnostic electrical and electro-optic instrumentation for scientific research, integrated electrical/biological circuits and systems, array (memory, imagers, and displays) fabrication and design, CAD tool development and online tutorials, low-power interconnect and packaging (electrical and optical) techniques, design of wired/wireless communication and interface circuits, circuit design for the use and storage of renewable energy, power electronics and power supply design, and the delivery of [online engineering education](#).

Dr. Baker is the named inventor on over [150 US patents](#). He is a member of the honor societies Eta Kappa Nu and Tau Beta Pi, a licensed Professional Engineer, a popular lecturer that has delivered over [50 invited talks](#) around the world, an IEEE Fellow, and the author of the books CMOS Circuit Design, Layout, and Simulation, CMOS Mixed-Signal Circuit Design, and a coauthor of DRAM Circuit Design: Fundamental and High-Speed Topics. He received the 2000 Best Paper Award from the IEEE Power Electronics Society, the 2007 Frederick Emmons Terman Award,

the 2011 IEEE Circuits and Systems Education Award and the 2021 Wiley-IEEE Press Textbook Award for the 4th Edition of his book CMOS Circuit Design, Layout, and Simulation.

His service activities include the IEEE Press Editorial Board (1999-2004), editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), the Technical Program Chair of the 2015 IEEE 58th International Midwest Symposium on Circuits and Systems (MWSCAS 2015), the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), Distinguished Lecturer for the SSCS (2012-2015), Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the IEEE Solid-State Circuits Magazine, IEEE Kirchhoff Award Committee (2020-2023), and advisor for the student branch of the IEEE at UNLV (2013-2023).

INDUSTRY EXPERIENCE

2008 - present: Expert witness in intellectual property disputes in electrical, electro-optic, and computer engineering matters for: 1) district court and ITC patent disputes, 2) inter partes reviews at the PTAB, and 3) arbitrations and mediations.

2013 - 2022: Worked with Freedom Photonics, Santa Barbara, CA, on the integration, fabrication and design, of optoelectronics with CMOS integrated circuits. Work includes the design of compact optical transceivers for range finding applications, high-efficiency integrated silicon avalanche photodetectors for quantum key receivers, Geiger mode SiGe receivers for long-range communications, cryptography, and the fabrication of near-infrared focal plane arrays. Packaging and testing of numerous chips fabricated in both CMOS and SiGe technologies using LEDs, ILDs, PIN, APDs, and ROICs.

2017 - 2019: Worked with Vorpil Research Systems, Las Vegas, NV on the design of integrated circuit electronics and optoelectronics for optical transceivers used in LIDARs/LADARs.

2016 - 2019: Worked with Attollo Engineering on the design of transient digitizers for the capture of high-speed signals for range finders using LEDs and lasers in compact optical transceivers.

2013 - 2018: Working with Mission Support and Test Services, LLC (MSTS, formerly National Security Technologies, LLC, [NSTec]) on the Design and Fabrication of Integrated electrical/photonic application specific integrated circuit (ASIC) design for use in the implementation of diagnostic instrumentation.

2013 - 2015: Consultant for OmniVision. Working on integrating CMOS image sensors (CIS) with memory for very high-speed consumer imager products. Design specialty DRAM, high-speed interfaces between CIS and DRAM, packaging techniques to pair the CIS with DRAM.

2010 - 2013: Worked with Arete' Associates on the design of high-speed compressive transimpedance amplifiers for LADAR projects and the design of ROIC unit cells. Work funded by the U. S. Air Force.

2013: Cirque, Inc. Consulting on the design of analog-to-digital interfaces for capacitive touch displays and pads.

2012: Consultant at Lockheed-Martin Santa Barbara Focal Plane Array. CMOS circuit design and fabrication for the development and manufacture of infrared components and imaging systems with an emphasis on highest sensitivity Indium Antimonide (InSb) focal plane arrays (FPAs) in linear through large staring formats. Product groups include FPAs, integrated dewar assemblies (IDCAs), camera heads, high-speed interfaces between image processors and imaging systems, and infrared imaging systems.

2010 - 2012: Working with Aerius Photonics (and then FLIR Inc. when Aerius was purchase by FLIR) on the design of Focal Plane Arrays funded (SBIRs and STTRs) by the U.S. Air Force, Navy, and Army. Experience with readout integrated circuits (ROICs) and the design/layout of photodetectors in standard CMOS.

2009 - 2010: Sun Microsystems, Inc. (and then Oracle) VLSI research group. Provided consulting on memory circuit design/fabrication and proximity connection (PxC) interfaces to DRAMs and SRAMs for lower power, 3D packaging, for memory modules and controllers implemented with FPGAs and custom ASICs.

2009 - 2010: Contour Semiconductor, Inc. Design of NMOS voltage and current references as well as the design of a charge pump for an NMOS memory chip.

1994 - 2008: Affiliate faculty (Senior Designer), Micron Technology. Designed CMOS circuits for DRAMs including DLLs, PLLs for embedded graphics chips, voltage references and regulators, data converters, field-emitting display drivers, sensing for MRAM (using delta-sigma data conversion topologies), SRAMs, RFIDs, CMOS active pixel imagers and sensors, power supply design (linear and switching), input buffers, etc. Worked on a joint research

project between Micron and HP labs in magnetic memory fabrication and design using the MTJ memory cell. Worked on numerous technologies ranging from LED lighting to medical imaging using CMOS image sensors (too many to list) resulting in numerous US patents (see following list). Considerable experience working with product engineering to ensure high-yield from the production line from fabrication to test. Co-authored a book on DRAM circuit design through the support of Micron. Gained knowledge in the entire memory design process from fabrication to packaging. Developed, designed, and tested circuit design techniques for multi-level cell (MLC) Flash memory using signal processing.

January 2008: Consultant for Nascentric located in Austin, TX. Provide directions on circuit operation (DRAM, memory, and mixed-signal) for fast SPICE circuit simulations.

May 1997 - May 1999: Consultant for Tower Semiconductor, Haifa, Israel. Designed CMOS integrated circuit cells for various modem chips, interfaces, and serial buses including USB circuits, charging circuits based upon power up/down circuits using an MOS or bandgap reference, pre-amplifiers, comparators, etc.

Summer 1998: Consultant for Amkor Wafer Fabrication Services, Micron Technology, and Rendition, Inc., Design PLLs and DLLs for custom ASICs and a graphics controller chip.

Summers 1994 - 1995: Micron Display Inc. Designing phase locked loop for generating a pixel clock for field emitting displays and a NTSC to RGB circuit on chip in NMOS. These displays are miniature color displays for camcorder and wrist watch size color television. Worked on the fabrication and design of video peripheral circuits for these displays.

September - October 1993: Lawrence Berkeley Laboratory. Designed and constructed a 40 A, 2 kV power MOSFET pulse generator with a 3 ns rise-time and 8 ns fall-time for driving Helmholtz coils.

Summer 1993: Lawrence Livermore National Laboratory, Nova Laser Program. Researched picosecond instrumentation, including time-domain design for impulse radar and imaging.

December 1985 - June 1993: (from July 1992 to June 1993 employed as a consultant while finishing up my Ph.D.), E.G.&G. Energy Measurements Inc., Nevada, Senior Electronics Design Engineer. Responsible for the design and manufacturing of instrumentation used in support of Lawrence Livermore National Laboratory's Nuclear Test Program. Responsible for designing and fabricating over 30 electronic and electro-optic instruments including: CCD camera design, communication networks, fiber optic transmitters employing high speed laser drive electronics, receivers employing envelop tracking for DC voltage restoration and regeneration of received information, receiver low noise amplifier design, frame synchronizers for re-assembling transmitted images, high-speed SRAM memory system design with battery back-up, calibration equipment design such as a tunnel diode pulse generator for testing compensation of oscilloscopes and DAC design for calibrating CCD readout electronics, power supply and battery charger designs, sweep circuits for streak cameras, Pockel's cell drive electronics, vertical amplifier design using HBTs for analog oscilloscopes used at the Nevada Test Site, and 10 kV ramp designs using a planar triode to name some of the designs.

This position provided considerable fundamental grounding in EE with a broad exposure ranging from the design of PC boards to, for example, the design of cable equalizers. Summarizing, gained experience in circuit design technologies including: bipolar, vacuum tubes (planar triodes for high voltages), hybrid integrated circuit fabrication and design, GaAs (high speed logic and HBTs), Mach-Zehnder interferometers, Pockels cells, krytrons, power MOSFETs, microwave techniques, power supplies, fiber optic transmitters/receivers, etc.

Summer 1985: Reynolds Electrical Engineering Company, Las Vegas, Nevada. Gained hands on experience in primary and secondary power system design, installation and trouble-shooting electric motors on mining equipment.

ACADEMIC EXPERIENCE

January 1991 – present: Professor of Electrical and Computer Engineering at the **University of Nevada, Las Vegas** from August 2012 to present. From January 2000 to July 2012 held various positions at **Boise State University** including: Professor (2003 – 2012), Department Chair (2004 - 2007), and tenured Associate Professor (2000 - 2003). From August 1993 to January 2000 was a tenured/tenure track faculty member at the **University of Idaho:** Assistant Professor (1993 - 1998) and then tenured Associate Professor (1998 - 2000). Lastly, from January 1991 to May 1993 held adjunct faculty positions in the departments of Electrical Engineering at the University of Nevada, Las Vegas and Reno. Additional details:

- Research is focused on analog and mixed-signal integrated circuit fabrication and design. Worked with multi-disciplinary teams (civil engineering, biology, materials science, etc.) on projects that have been funded by EPA, DARPA, NASA, Army, DMEA, Navy, and the AFRL.
- Current and past research and development interests are:
 - Design and packaging of electrical/optical systems (e.g., LiDARs/LADARs) using LEDs, semiconductor lasers, lens for focusing and directing light, integrated circuits, and associated control and communication systems/circuits.
 - Capacitive sensing techniques using delta-sigma modulation and interfacing to sensors
 - Design of high-voltage and energy switching circuits
 - Circuit design and fabrication for the control, use, and storage of renewable energy using thermoelectric generators
 - Design of electrical/biological/optical circuits and systems using electrowetting on dielectric for automating and controlling biological experiments
 - Design of readout integrated circuits (ROICs) for use with focal plane arrays (FPAs)
 - Heterogeneous integration of III-V photonic devices (e.g., FPAs and VCSELs) with CMOS
 - Methods (e.g., 3D packaging and capacitive interconnects) to reduce power consumption in semiconductor memories, memory modules, and digital systems using custom and non-custom (e.g., FPGAs) implementations
 - Analog and mixed-signal circuit fabrication and design for communication systems, synchronization, energy storage, data conversion, and interfaces
 - The design of writing and sensing circuitry for emerging nonvolatile memory technologies, focal planes, and displays (arrays) in nascent nanotechnologies (e.g., magnetic, chalcogenide)
 - Reconfigurable electronics design and fabrication using nascent memory technologies such as the memristor to implement FPGAs
 - Finding an electronic, that is, no mechanical component, replacement for the hard disk drive using nascent fabrication technologies
 - Power electronics circuit design for consumers and consumer electronics including power management and adaptive control to reduce power consumption
 - Design of bandpass delta-sigma modulators for IQ demodulation in wireless communication systems in OFDM, WiFi, 802.11, Bluetooth, 3G, 4G, etc.
 - University prototyping, fabricating, and packaging of integrated circuits
- Led, as chair, the department in graduate curriculum (MS and PhD), program development, and ABET accreditation visits.
- Worked with established and start-up companies to provide technical expertise and identify employment opportunities for students.
- Held various leadership and service positions including: ECE chair, graduate coordinator, college curriculum committee (chair), promotion and tenure committee, scholarly activities committee, faculty search committee, university level search committees, etc. Collaborate with College of Engineering faculty on joint research projects.
- Taught courses in circuits, analog IC design, digital VLSI design and fabrication, fiber optics, and mixed-signal integrated circuit design to both on- and, via the Internet, off-campus students. Research emphasis in integrated circuit design using nascent technologies.

EDUCATION

- Ph.D. in Electrical Engineering; December 1993; University of Nevada, Reno, GPA 4.0/4.0. Dissertation Title: *Applying power MOSFETs to the design of electronic and electro-optic instrumentation.*
- M.S. and B.S. in Electrical Engineering; May 1986 and May 1988; University of Nevada, Las Vegas. Thesis Title: *Three-dimensional simulation of a MOSFET including the effects of gate oxide charge.*

MEMBERSHIPS IN PROFESSIONAL AND SCHOLARLY ORGANIZATIONS

IEEE (student, 1983; member, 1988; senior member, 1997; Fellow, 2013)
Member of the honor societies Eta Kappa Nu and Tau Beta Pi
Licensed Professional Engineer

HONORS AND AWARDS

- Consolidated Students of the University of Nevada, Las Vegas (CSUN) Faculty Award, 2017
- Tau Beta Pi UNLV Outstanding Professor of the Year in 2013, 2014, 2015 and 2016
- UNLV ECE Department Distinguished Professor of the Year in 2015
- IEEE Fellow for contributions to the design of memory circuits - 2013
- Distinguished Lecturer for the IEEE Solid-State Circuits Society, 2012 - 2015
- IEEE Circuits and Systems (CAS) Education Award - 2011
- Twice elected to the Administrative Committee of the Solid-State Circuits Society, 2011 - 2016
- Frederick Emmons Terman Award from the American Society of Engineering Education - 2007
- President's Research and Scholarship Award, Boise State University - 2005
- Honored Faculty Member - Boise State University Top Ten Scholar/Alumni Association 2003
- Outstanding Department of Electrical Engineering faculty, Boise State 2001
- Recipient of the IEEE Power Electronics Society's Best Paper Award in 2000
- University of Idaho, Department of Electrical Engineering outstanding researcher award, 1998-99
- University of Idaho, College of Engineering Outstanding Young Faculty award, 1996-97

SERVICE

Reviewer for IEEE transactions on solid-state circuits, circuits and devices magazine, education, instrumentation, nanotechnology, VLSI, etc. Reviewer for several American Institute of Physics journals as well (Review of Scientific Instruments, Applied Physics letters, etc.) Board member of the IEEE press (reviewed dozens of books and book proposals). Reviewer for the National Institutes of Health. Technology editor and then Editor-in-Chief for the Solid-State Circuits Magazine.

Led the Department on ABET visits, curriculum and policy development, and new program development including the PhD in electrical and computer engineering. Provided significant University and College service in infrastructure development, Dean searches, VP searches, and growth of academic programs. Provided university/industry interactions including starting the ECE department's advisory board. Held positions as the ECE department Master's graduate coordinator and coordinator for the Sophomore Outcomes Assessment Test (SOAT).

Also currently serves, or has served, on the IEEE Press Editorial Board (1999-2004), as a member of the first Academic Committee of the State Key Laboratory of Analog and Mixed-Signal VLSI at the University of Macau, as editor for the Wiley-IEEE Press Book Series on Microelectronic Systems (2010-2018), on the IEEE Solid-State Circuits Society (SSCS) Administrative Committee (2011-2016), as an Advisory Professor to the School of Electronic and Information Engineering at Beijing Jiaotong University, as a Distinguished Lecturer for the SSCS (2012-2015), as the Technical Program Chair for the IEEE 58th 2015 International Midwest Symposium on Circuits and Systems, MWSCAS 2015, as advisor for the student branch of the IEEE at UNLV (2013-2023), and as the Technology Editor (2012-2014) and Editor-in-Chief (2015-2020) for the *IEEE Solid-State Circuits Magazine*, and IEEE Kirchhoff Award Committee (2020-2023).

ARMED FORCES

From 1981 to 1987 served in the United States Marine Corps (from September of 1982 in the Reserves, Fox Company, 2nd Battalion, 23rd Marines, 4th Marine Division), Honorable Discharge. Military Occupational Specialty (MOS) was Machine Gunner (MOS 0331)

TEXTBOOKS AUTHORED

Baker, R. J., "CMOS Circuit Design, Layout and Simulation, Fourth Edition" *Wiley-IEEE Press*, 1234 pages. ISBN 9781119481515 (2019) **Over 50,000 copies of this book in print.** (Third Edition published in 2010, Revised Second Edition published in 2008, and Second Edition Published in 2005)

Baker, R. J., "CMOS Mixed-Signal Circuit Design," *Wiley-IEEE*, 329 pages. ISBN 978-0470290262 (second edition, 2009) and ISBN 9780471227540 (First Edition published in 2002)

Keeth, B., Baker, R. J., Johnson, B., and Lin, F., "DRAM Circuit Design: Fundamental and High-Speed Topics", *Wiley-IEEE*, 2008, 201 pages. ISBN: 9780470184752

Keeth, B. and Baker, R. J., "DRAM Circuit Design: A Tutorial", *Wiley-IEEE*, 2001, 201 pages. ISBN 0780360141

Baker, R. J., Li, H.W., and Boyce, D.E. "CMOS Circuit Design, Layout and Simulation," *Wiley-IEEE*, 1998, 904 pages. ISBN 9780780334168

BOOKS, OTHER (edited, chapters, etc.)

Saxena, V. and Baker, R. J., "Analog and Digital VLSI," chapter in the CRC Handbook on Industrial Electronics, edited by J. D. Irwin and B. D. Wilamowski, *CRC Press*, 2009 second edition.

Baker, R. J., "CMOS Analog Circuit Design," (A self-study course with study guide, videos, and tests.) IEEE Education Activity Department, 2000. ISBN 0-7803-4822-2 (with textbook) and ISBN 0-7803-4823-0 (without textbook)

Baker, R. J., "CMOS Digital Circuit Design," (A self-study course with study guide, videos, and tests.) *IEEE Education Activity Department*, 2000. ISBN 0-7803-4812-5 (with textbook) and ISBN 0-7803-4813-3 (without textbook)

Li, H.W., Baker, R. J., and Thelen, D., "CMOS Amplifier Design," chapter 19 in the CRC VLSI Handbook, edited by Wai-kai Chen, *CRC Press*, 1999 (ISBN 0-8493-8593-8) and the second edition in 2007 (ISBN 978-0-8493-4199-1)

INVITED TALKS AND SEMINARS

Have given over 50 invited talks and seminars at the following locations: AMD (Fort Collins), AMI semiconductor, Arizona State University, Beijing Jiaotong University, Boise State University, Carleton University, Carnegie Mellon, Columbia University, Dublin City University (Ireland), E.G.&G. Energy Measurements, Foveon, the Franklin Institute, Georgia Tech, Gonzaga University, Hong Kong University of Science and Technology, ICSEng Keynote, ICySSS keynote, IEEE Computing and Communication Workshop (CCWC), IEEE Electron Devices Conference (NVMETS), IEEE Workshop on Microelectronics and Electron Devices (WMED), Indian Institute of Science (Bangalore, India), Instituto de Informatica (Brazil), Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM, Mexico), Iowa State University, Lawrence Livermore National Laboratory, Lehigh University, Lockheed-Martin, Micron Technology, Nascentric, National Semiconductor, Princeton University, Rendition, Saintgits College (Kerala, India), Southern Methodist University, Sun Microsystems, Stanford University, ST Microelectronics (Delhi, India), Temple University, Texas A&M University, Tower Semiconductor (Israel), University of Alabama (Tuscaloosa), University of Arkansas, University of Buenos Aires (Argentina), University of Houston, University of Idaho, University of Illinois (Urbana-Champaign), Université Laval (Québec City, Québec), University of Macau, University of Maryland, Université de Montréal (École Polytechnique de Montréal), Xilinx (Ireland), University of Nevada (Las Vegas), University of Nevada (Reno), University of Toronto, University of Utah, Utah State University, and Yonsei University (Seoul, South Korea).

RESEARCH FUNDING (LAST 5 YEARS AS A PROFESSOR)

Recent funding listed below. In-kind, equipment, and other non-contract/grant funding [e.g., MOSIS support, money for travel for invited talks, etc.] not listed.

- Baker, R. Jacob, (2017-2023) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit," NASA, \$29,999 (Phase I), \$225,238 (Phase II), and \$79,697 (Phase IIE)
- Goldman, J., Menezes, J., and Baker, R. J., (2021-2022) "Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling," UNLV Sports Research & Innovation Initiative. Proof of Concept Grant Program, \$50,000
- Baker, R. Jacob, (2019-2021) "Dual-Mode, Extended Near-Infrared, Focal Plane Arrays Fabricated with CMOS Compatible GeSiSn Alloy Materials," DARPA, \$149,998
- Baker, R. Jacob, (2018-2020) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$99,996
- Baker, R. Jacob, (2019) "Improved Quantum Efficiency Photo-Detector," Navy, \$29,999

- Baker, R. Jacob, (2018-2019) "Tiled Silicon Photomultiplier Array Read-Out Integrated Circuit – Phase I," NASA, \$29,999
- Baker, R. Jacob, (2017-2019) "Quantum Cryptography Detector Chip," Defense MicroElectronics Activity (DMEA), \$266,029
- Baker, R. Jacob, (2017-2019) "Advanced Printed Circuit Board Design Methods for Compact Optical Transceiver," U.S. Army/DOD, \$299,605
- Baker, R. Jacob, (2016-2018) "High-Sensitivity Monolithic Silicon APD and ROIC," U.S. Air Force/DOD, \$299,665
- Baker, R. Jacob, (2017-2018) "Transimpedance Amplifier Integrated Circuit Collaboration," Department of Energy, National Security Technologies, LLC, \$100,436
- Baker, R. Jacob, (2017) "Geiger Mode SiGe Receiver for Long-Range Optical Communications," NASA, \$30,000
- Baker, R. Jacob, (2016-2017) "Testing and development of BiCMOS photodetectors and diagnostic instrumentation," Department of Energy, National Security Technologies, LLC, \$181,605
- Baker, R. Jacob, (2016-2017) "Dual-Mode, Extended Near Infrared, Focal Plane Arrays fabricated with a Commercial SiGe BiCMOS Process," DARPA, \$41,892

DOCTORAL STUDENT SUPERVISION

11. Mario Valles Montenegro (underway)
10. Sachin Namboodiri – A Multi-channel MCP-PMT based Readout Integrated Circuit for LiDAR Applications (2020)
9. Wenlan Wu – High-Speed Radhard Mega-Pixel CIS Camera for High-Energy Physics (2019)
8. Kostas Moutafis – A Highly-Sensitive Global-Shutter CMOS Image Sensor with On-Chip Memory for Hundreds of kilo-frames per second Scientific Experiments (2019)
7. Yiyan Li – Portable High Throughput Digital Microfluidics and On-Chip Bacteria Cultures (2016)
6. Yacouba Moumouni – Designing, Building, and Testing a Solar Thermoelectric Generation, STEG, for Energy Delivery to Remote Residential Areas in Developing Regions (2015)
5. Qawi IbnZayd Harvard – Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design (2011)
4. Vishal Saxena – K-Delta-1-Sigma Modulators for Wideband Analog-to-Digital Conversion (2010)
3. Robert Russell Hay – Digitally-Tunable Surface Acoustic Wave Resonator (2009)
2. Xiangli Li (the first Boise State University College of Engineering PhD graduate) – MOSFET Modulated Dual Conversion Gain CMOS Image Sensors (2008)
1. Feng Lin, Research and Design of Low Jitter, Wide Locking-Range Phase-Locked and Delay-Locked Loops (2000)

MASTERS STUDENT SUPERVISION

93. Abraham Lopez (underway)
92. David Santiago (underway)
91. Khulan Tsogt (underway)
90. Jazmin Bolor (underway)
89. Chris Barr (underway)
88. Minsung Cho – Studies of Forward Projection Algorithms and Implementation on PC and FPGA (2023)
87. Armani Alvarez – A Control Integrated Circuit for a Hysteretic Flyback Power Converter (2022)
86. Francisco Mata-carlos – A Wearable Electronic Monitoring Device for Low Pressure Garment Applications and Temperature Analysis for Prevention of Ulceration and Infection (2022)
85. Daniel Senda – Designs and Outcomes of Transcranial Magnetic Stimulation (TMS) and Repetitive Transcranial Magnetic Stimulation (rTMS) Circuits (2021)
84. James Skelly – Monitored Compression Therapy: Using Smart Technology to Optimize the Treatment of Lower Extremity Swelling (2021)
83. Gonzalo Arteaga – Current-mode photon-counting circuit with SiGe BiCMOS input stage (2020)
82. Jason Silic – Design and Fabrication of a 6-bit Current-Mode ADC for Lidar and High-Speed Applications (2020)
81. Brandon Wade (2020)
80. Mario Valles Montenegro – Front-End CMOS Transimpedance Amplifiers on a Silicon Photomultiplier Resistant to Fast Neutron Fluence (2020)
79. Jonathan DeBoy (2018)
78. Dane Gentry – Design, Layout, and Testing of SiGe APDs Fabricated in a BiCMOS Process (2018)

77. James Mellot – Variable Transition Time Inverters in a Digital Delay Line with Analog Storage for Processing Fast Signals and Pulses (2018)
76. Eric Monahan – High Speed Fast Transient Digitizer Design and Simulation (2018)
75. Shada Sharif – Design and Analysis of First and Second Order K-Delta-1-Sigma Modulators in Multiple Fabrication Processes (2018)
74. Vikas Vinayaka – Analysis and Design of Analog Front-End Circuitry for Avalanche Photodiodes (APD) and Silicon Photo-Multipliers (SiPM) in Time-of-Flight Applications (2018)
73. Claire Tsagkari – Design, Fabrication and Testing of a Capacitive Sensor Using Delta-Sigma Modulation (2017)
72. Kevin Buck – Fast Transient Digitizer and PCB Interface (2015)
71. Marzieh Sharbat Maleki (2015)
70. Angsuman Roy – Design, Fabrication and Testing of Monolithic Low-Power Passive Sigma-Delta Analog-to-Digital Converters (2015)
69. Daniel Anderson – Design and Implementation of an Instruction Set Architecture and Instruction Execution Unit for the RZ9 Coprocessor System (2014)
68. Jared Gordon – Design and Fabrication of an Infrared Optical Pyrometer ASIC (2013)
67. Justin Butterfield (2012)
66. Adam Johnson – Methods and Considerations for Testing Resistive Memories (2012)
65. Ben Millemon – CMOS Characterization, Modeling, and Circuit Design in the Presence of Random Local Variation (2012)
64. Justin Wood (2012)
63. Chamunda Ndinawe Chamunda (2011)
62. Gary VanAckern – Design Guide for CMOS Process On-Chip 3D Inductors using Thru-Wafer Vias (2011)
61. Lucien Jan Bissey – High-Voltage Programmable Delta-Sigma Modulation Voltage-Control Circuit (2010)
60. Kaijun Li (2010)
59. Yingting Li (co-supervised with Maria Mitkova) (2010)
58. Lael Matthews (co-supervised with Said Ahmed-Zaid) (2010)
57. Priyanka Mukeshbhai Parikh (2010)
56. Todd Plum (co-supervised with Jeff Jessing) – Design and Fabrication of a Chemicapacitive Sensor for the Detection of Volatile Organic Compounds (2010)
55. Rahul Srikonda (2010)
54. Avani Falgun Trivedi (2010)
53. Kuang Ming Yap – Gain and Offset Error Correction for CMOS Image Sensors using Delta-Sigma Modulation (2010)
52. Mahesh Balasubramanian – Phase Change Memory - Array Development and Sensing Circuits using Delta-Sigma Modulation (2009)
51. Lincoln Bollschweiler (2009)
50. Shantanu Gupta (2009)
49. Qawi Harvard – Wide I_O DRAM Architecture Utilizing Proximity Communication (2009)
48. Avinash Rajagiri (2009)
47. Ramya Ramarapu (2009)
46. Harikrishna Rapole (2009)
45. Aruna Vadla (2009)
44. Hemanth Ande (2008)
43. Curtis Cahoon – Low-Voltage CMOS Temperature Sensor Design using Schottky Diode-Based References (2008)
42. Prashanth Busa (2008)
41. John McCoy III (2008)
40. Dennis Montierth – Using Delta-Sigma-Modulation for Sensing in a CMOS Imager (2008)
39. Rudi Rashwand (2008)
38. Barsha Shrestha (co-supervised with Zhu Han) – Wireless Access in Vehicular Environments using Bit Torrent and Bargaining (2008)
37. Eric Becker – Design of an Integrated Half-Cycle Delay Line Duty Cycle Corrector Delay Locked Loop (2007)

36. Matthew Leslie – Noise-Shaping Sense Amplifier for Cross-Point Arrays (2007)
35. Jose Monje (2007)
34. Sanghyun Park (2007)
33. Vishal Saxena – Indirect Feedback Compensation Techniques for Multi-Stage Operational Amplifiers (2007)
32. Meshack Appikarla (2006)
31. Eric Booth – Wide Range, Low Jitter Delay-Locked Loop Using a Graduated Digital Delay Line and Phase Interpolator (2006)
30. Sucheta Das (2006)
29. Krishna Duvvada – High Speed Digital CMOS Input Buffer Design (2006)
28. Krishnamraju Kurra (2006)
27. Soumya Narasimhan (2006)
26. Roger Porter (2006)
25. David Butler – Low-Voltage Bandgap Reference Design Utilizing Schottky Diodes (2005)
24. Dragos Dimitriu (2005)
23. Surendranath Eruvuru – Sensing Circuit Design for an Ion Mobility Spectrometer (2005)
22. Sandhya Sandireddy (2005)
21. Harish Singidi (2005)
20. Indira Vemula – Delta-Sigma Modulator Used in CMOS Imagers (2005)
19. Bhavana Kollimarla – A 1-Bit Analog-to-Digital Converter Using Delta Sigma Modulation for Sensing in CMOS Imagers (2004)
18. Sandeep Pemmaraju – High Voltage Charge Pump Circuit for an Ion Mobility Spectrometer (2004)
17. Ravindra Puthumbaka – Circuit Design for an Ion Mobility Spectrometer (2004)
16. Brandon Roth – Comparison of Asynchronous vs. Synchronous Design Technologies using a 16-bit Binary Adder (2004)
15. Jennifer Taylor – Reading and Writing Flash Memory Using Delta-Sigma Modulation (2004)
14. Jing Plaisted – Methods for Memory Testing (2003)
13. Murugesh Subramaniam – Flash Memory Sensing Using Averaging (2003)
12. Brian Johnson – Application of an Asynchronous FIFO in a DRAM Data Path (2002)
11. Scott Ward – Electrostatic Discharge (ESD) Protection in CMOS (2002)
10. Tyler Gomm – Design of a Delay-Locked Loop with a DAC-Controlled Analog Delay Line (2001)
9. Gexin Huang (2001)
8. Chris Atkins (2000)
7. Thaddeus Black (2000)
6. Zuxu Qin (2000)
5. Hao Chen (1999)
4. Doug Hackler (co-supervised with Steve Parke) – TMOS: A Novel Design for MOSFET Technology (1999)
3. Song Liu – Design of a CMOS 6-bit Folding and Interpolating Analog-to-Digital Converter (1999)
2. Ben Ba (1997)
1. Brent Keeth – A Novel Architecture for Advanced High Density Dynamic Random Access Memories (1996)

GRANTED US PATENTS

152. Baker, R. J., "Quantizing circuits having improved sensing," **10,658,018**, May 19, 2020.
151. Baker, R. J., "Quantizing circuits having improved sensing," **10,403,339**, September 3, 2019.
150. Baker, R. J., "Digital Filters with Memory," **10,366,744**, July 30, 2019.
149. Baker, R. J., "Quantizing circuits having improved sensing," **10,127,954**, November 13, 2018.
148. Baker, R. J. and Parkinson, W., "NMOS regulated voltage reference," **9,753,481**, September 5, 2017.
147. Baker, R. J., "Digital Filters with Memory," **9,734,894**, August 15, 2017.
146. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **9,697,883**, July 7, 2017
145. Baker, R. J., "Comparators for delta-sigma modulators," **9,641,193**, May 2, 2017.
144. Baker, R. J., "Quantizing circuits having improved sensing," **9,449,664**, September 20, 2016.
143. Baker, R. J., "Error detection for multi-bit memory," **9,336,084**, May 10, 2016.
142. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **9,299,423**, March 29, 2016.

141. Baker, R. J., "Methods for sensing memory elements in semiconductor devices," **9,299,405**, March 29, 2016.
140. Baker, R. J., "Comparators for delta-sigma modulators," **9,135,962**, September 15, 2015.
139. Baker, R. J., "Resistive memory element sensing using averaging," **9,081,042**, July 14, 2015.
138. Baker, R. J., "Digital Filters with Memory," **9,070,469**, June 30, 2015.
137. Baker, R. J., "Reference current sources," **8,879,327**, November 4, 2014.
136. Baker, R. J. and Beigel, K. D., "Multi-resistive integrated circuit memory," **8,878,274**, November 4, 2014.
135. Baker, R. J., "Methods for sensing memory elements in semiconductor devices," **8,854,899**, October 7, 2014.
134. Baker, R. J., "Quantizing circuits with variable parameters," **8,830,105**, September 9, 2014.
133. Baker, R. J., "Integrators for delta-sigma modulators," **8,754,795**, June 17, 2014.
132. Baker, R. J., "Methods of quantizing signals using variable reference signals," **8,717,220**, May 6, 2014.
131. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **8,712,249**, April 29, 2014.
130. Baker, R. J., "Resistive memory element sensing using averaging," **8,711,605**, April 29, 2014.
129. Baker, R. J., "Memory with correlated resistance," **8,681,557**, March 25, 2014.
128. Baker, R. J., "Reference current sources," **8,675,413**, March 18, 2014.
127. Baker, R. J., "Methods for sensing memory elements in semiconductor devices," **8,582,375**, November 12, 2013.
126. Linder, L. F., Renner, D., MacDougall, M., Geske, J., and Baker, R. J., "Dual well read-out integrated circuit (ROIC)," **8,581,168**, November 12, 2013.
125. Li, W., Schoenfeld, A., and Baker, R. J., "Method and apparatus for providing symmetrical output data for a double data rate DRAM," **8,516,292**, August 20, 2013.
124. Baker, R. Jacob, "Resistive memory element sensing using averaging," **8,441,834**, May 14, 2013.
123. Qawi, Q. I., Drost, R. J., and Baker, R. Jacob, "Increased DRAM-array throughput using inactive bitlines," **8,395,947**, March 12, 2013.
122. Baker, R. Jacob, "Memory with correlated resistance," **8,289,772**, October 16, 2012.
121. Lin, F. and Baker, R. Jacob, "Phase splitter using digital delay locked loops," **8,218,708**, July 10, 2012.
120. Baker, R. Jacob, "Subtraction circuits and digital-to-analog converters for semiconductor devices," **8,194,477**, June 5, 2012.
119. Baker, R. J., "Digital Filters for Semiconductor Devices," **8,149,646**, April 3, 2012.
118. Baker, R. J., "Error detection for multi-bit memory," **8,117,520**, February 14, 2012.
117. Baker, R. J., "Integrators for delta-sigma modulators," **8,102,295**, January 24, 2012.
116. Baker, R. J., "Devices including analog-to-digital converters for internal data storage locations," **8,098,180**, January 17, 2012.
115. Baker, R. J. and Beigel, K. D., "Multi-resistive integrated circuit memory," **8,093,643**, January 10, 2012.
114. Baker, R. J., "Quantizing circuits with variable parameters," **8,089,387**, January 3, 2012.
113. Baker, R. J., "Reference current sources," **8,068,367**, November 29, 2011.
112. Baker, R. J., "Methods of quantizing signals using variable reference signals," **8,068,046**, November 29, 2011.
111. Baker, R. J., "Systems and devices including memory with built-in self-test and methods of making using the same," **8,042,012**, October 18, 2011.
110. Baker, R. J., "Memory with correlated resistance," **7,969,783**, June 28, 2011.
109. Baker, R. J. and Keeth, B., "Optical interconnect in high-speed memory systems," **7,941,056**, May 10, 2011.
108. Baker, R. J., "K-delta-1-sigma modulator," **7,916,054**, March 29, 2011.
107. Li, W., Schoenfeld, A., and Baker, R. J., "Method and apparatus for providing symmetrical output data for a double data rate DRAM," **7,877,623**, January 25, 2011.
106. Lin, F. and Baker, R. J., "Phase splitter using digital delay locked loops," **7,873,131**, January 18, 2011.
105. Hush, G. and Baker, R. J., "Complementary bit PCRAM sense amplifier and method of operation," **7,869,249**, January 11, 2011.
104. Baker, R. J., "Subtraction circuits and digital-to-analog converters for semiconductor devices," **7,839,703**, November 23, 2010.
103. Baker, R. J., "Digital Filters with Memory" **7,830,729**, November 9, 2010.
102. Baker, R. J., "Systems and devices including memory with built-in self test and methods of making using the same," **7,818,638**, October 19, 2010.
101. Baker, R. J., "Integrators for delta-sigma modulators," **7,817,073**, October 19, 2010.

100. Baker, R. J., "Digital filters for semiconductor devices," **7,768,868**, August 3, 2010.
99. Baker, R. J., "Quantizing circuits with variable reference signals," **7,733,262**, June 8, 2010.
98. Baker, R. J., "Quantizing circuits for semiconductor devices," **7,667,632**, February 23, 2010.
97. Baker, R. J., and Beigel, K. D., "Multi-resistive integrated circuit memory," **7,642,591**, January 5, 2010.
96. Baker, R. J., "Offset compensated sensing for a magnetic random access memory," **7,616,474**, November 10, 2009.
95. Baker, R. J., "Resistive memory element sensing using averaging," **7,577,044**, Aug. 18, 2009.
94. Baker, R. J., "Quantizing circuits with variable parameters," **7,538,702**, May 26, 2009.
93. Baker, R. J., "Method and system for reducing mismatch between reference and intensity paths in analog to digital converters in CMOS active pixel sensors," **7,528,877**, May 5, 2009.
92. Baker, R. J., "Method and system for reducing mismatch between reference and intensity paths in analog to digital converters in CMOS active pixel sensors," **7,515,188**, April 7, 2009.
91. Taylor, J. and Baker, R. J., "Method and apparatus for sensing flash memory using delta-sigma modulation," **7,495,964**, February 24, 2009.
90. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **7,489,575**, February 10, 2009.
89. Baker, R. J., "Per column one-bit ADC for image sensors," **7,456,885**, November 25, 2008.
88. Staples, T. and Baker, R. J., "Input buffer design using common-mode feedback," **7,449,953**, November 11, 2008.
87. Li, W., Schoenfeld, A., and Baker, R. J., "Method and apparatus for providing symmetrical output data for a double data rate DRAM," **7,421,607**, September 2, 2008.
86. Baker, R. J., "Methods for resistive memory element sensing using averaging," **7,372,717**, May 13, 2008.
85. Taylor, J. and Baker, R. J., "Method and apparatus for sensing flash memory using delta-sigma modulation," **7,366,021**, April 29, 2008.
84. Hush, G. and Baker, R. J., "Method of operating a complementary bit resistance memory sensor and method of operation," **7,366,003**, April 29, 2008.
83. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **7,330,390**, February 12, 2008.
82. Baker, R. J., "Input and output buffers having symmetrical operating characteristics and immunity from voltage variations," **7,319,620**, January 15, 2008.
81. Staples, T. and Baker, R. J., "Method and apparatus providing input buffer design using common-mode feedback," **7,310,018**, December 18, 2007.
80. Baker, R. J., "Offset compensated sensing for a magnetic random access memory," **7,286,428**, October 23, 2007.
79. Baker, R. J., and Cowles, T. B., "Method and apparatus for reducing duty cycle distortion of an output signal," **7,271,635**, September 18, 2007.
78. Baker, R. J., and Cowles, T. B., "Method and apparatus for reducing duty cycle distortion of an output signal," **7,268,603**, September 11, 2007.
77. Hush, G., Baker, R. J., and Moore, J., "Skewed sense AMP for variable resistance memory sensing," **7,251,177**, July 31, 2007.
76. Hush, G. and Baker, R. J., "Method of operating a complementary bit resistance memory sensor," **7,242,603**, July 10, 2007.
75. Li, W., Schoenfeld, A., and Baker, R. J., "Method and apparatus for providing symmetrical output data for a double data rate DRAM," **7,237,136**, June 26, 2007.
74. Moore, J. and Baker, R. J., "Rewrite prevention in a variable resistance memory," **7,224,632**, May 29, 2007.
73. Baker, R. J., "Integrated charge sensing scheme for resistive memories," **7,151,698**, December 19, 2006.
72. Baker, R. J., "Adjusting the frequency of an oscillator for use in a resistive sense amp," **7,151,689**, December 19, 2006.
71. Baker, R. J., "Resistive memory element sensing using averaging," **7,133,307**, Nov. 7, 2006.
70. Lin, F. and Baker, R. J., "Phase detector for all-digital phase locked and delay locked loops," **7,123,525**, October 17, 2006.
69. Baker, R. J., and Beigel, K. D., "Integrated circuit memory with offset capacitor," **7,109,545**, September 19, 2006.
68. Baker, R. J., "Input and output buffers having symmetrical operating characteristics and immunity from voltage variations," **7,102,932**, September 5, 2006.
67. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **7,095,667**, August 22, 2006.

66. Baker, R. J., "Offset compensated sensing for a magnetic random access memory," **7,082,045**, July 25, 2006.
65. Baker, R. J., "System and method for sensing data stored in a resistive memory element using one bit of a digital count," **7,009,901**, March 7, 2006.
64. Hush, G. and Baker, R. J., "Complementary bit resistance memory sensor and method of operation," **7,002,833**, February 21, 2006.
63. Lin, F. and Baker, R. J., "Phase detector for all-digital phase locked and delay locked loops," **6,987,701**, January 17, 2006.
62. Baker, R. J., "Adjusting the frequency of an oscillator for use in a resistive sense amp," **6,985,375**, January 10, 2006.
61. Baker, R. J., "Method for reducing power consumption when sensing a resistive memory," **6,954,392**, October 11, 2005.
60. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **6,954,391**, October 11, 2005.
59. Baker, R. J., "Noise resistant small signal sensing circuit for a memory device," **6,954,390**, October 11, 2005.
58. Lin, F. and Baker, R. J., "Phase splitter using digital delay locked loops," **6,950,487**, September 27, 2005.
57. Baker, R. J., "Method and apparatus for measuring current as in sensing a memory cell," **6,930,942**, August 16, 2005.
56. Baker, R. J., "Offset compensated sensing for a magnetic random access memory," **6,917,534**, July 12, 2005.
55. Baker, R. J., "Dual loop sensing scheme for resistive memory elements," **6,914,838**, July 5, 2005.
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- Harvard, Q. I. and Baker, R. J., "Low-Power, High-Bandwidth, and Ultra-Small Memory Module Design," a presentation covering semiconductor packaging, DRAM architectures, and I/O circuits. The goal of this work is to investigate replacing the currently used dual in-line memory modules (DIMMs) with a smaller and a lower power memory module, a "Nano-Module."
- Baker, R. J., and Campbell, K. A., "Reconfigurable Analog Electronics using the Memristor."
- Baker, R. J., and Saxena, V., "A K-Delta 1-Sigma Modulator for Wideband Analog-to-Digital Conversion."
- Li, K., Saxena, V., and Baker, R. J., "The Baker ADC: An Overview,"
- Saxena, V., and Baker, R. J., "High-Speed Op-Amp Design: Compensation and Topologies for Two and Three Stage Designs,"
- Baker, R. J., "Circuit Design for MLC Flash: Towards a Semiconductor Replacement for the Hard Disk Drive."

- Baker, R. J., Terman Award Acceptance Speech, given at the Frontiers in Education Conference (FIE 2007), Milwaukee, WI, October 11, 2007.
- Baker, R. J., "The One-Transistor, One-Capacitor (1T1C) Dynamic Random Access Memory (DRAM), and its Impact on Society," presented at the Franklin Institute, in the symposium honoring Dr. Robert H. Dennard and his receipt of the 2007 Benjamin Franklin Medal in Electrical Engineering, April 25, 2007.
- Baker, R. J. and Saxena, V., "Design of Bandpass Delta-Sigma Modulators: Avoiding Common Mistakes."
- Baker, R. J., "Sensing Circuits for Resistive Memory."
- Hadrick, M. and Baker, R. J., "Sensing in CMOS Imagers using Delta-Sigma Modulation."
- Baker, R. J., "Design of High-Speed CMOS Op-Amps for Signal Processing," IEEE/EDS Workshop on Microelectronics and Electron Devices (WMED), April, 2005
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31. Loo, S. M., Cole, J., Youngberg, R., Baker, R. J., Gribb, M. M., "Field-programmable gate array in a miniature ion mobility spectrometer sensor system," *Proceedings of the 2006 International Conference on Embedded Systems & Applications*, June 26-29, 2006, Las Vegas, NV.
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29. Duvvada, K., Saxena, V., and Baker, R. J., High Speed Digital Input Buffer Circuits, *Proceedings of the IEEE/EDS Workshop on Microelectronics and Electron Devices (WMED)*, pp. 11-12, April, 2006.
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26. Sevier, D., Gribb, M., Plumlee, D., Moll, A. J., Hill, H. H., Hong, F., Baker, R. J., Loo, S. M., Walters, R. and Imonigie, J., "An In-Situ Ion Mobility Spectrometer Sensor System for Detecting Gaseous VOCs in the Vadose Zone," *Fourth International Conference on Unsaturated Soils (UNSAT '06) Conference, April 2-6, 2006, Carefree, AZ.*
25. Gribb, M., Hill, H. H., Baker, R. J., Loo, S. M., and Moll, A. J., "Ion Mobility Spectrometer (IMS) Sensor Project," presented at the *Environmental & Subsurface Science Symposium*, Inland Research Alliance, Sept. 19-21, 2005, Big Sky, Montana.
24. Ogas, M. L., Price, P. M., Kiepert J., Baker R. J., Bersuker G., and Knowlton W.B., *Degradation of Rise Time in NAND Gates Using 2.0 nm Gate Dielectrics*, oral presentation and publication at the 2005 IEEE Integrated Reliability Workshop, October 2005.
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22. Cheek, B. J., Southwick III, R. G., Ogas, M. L., Nagler, P. E., Whelchel, D., Kumar, S., Baker, R. J., and Knowlton, W. B., "Preliminary Soft Breakdown (SBD) Effects In CMOS Building Block Circuits," poster presentation at *2004 IEEE International Integrated Reliability Workshop*, Oct. 18-21, 2004.
21. Ogas, M., Southwick, R. G., Cheek, B. J., Lawrence, C. E., Kumar, S., Haggag, A., Baker, R. J., and Knowlton, W. B., "Multiple Waveform Pulse Voltage Stress Technique for Modeling Noise in Ultra-Thin Oxides," poster presentation at the *Workshop on Microelectronics and Electron Devices*, Boise, Idaho, April 16, 2004.
20. Ogas, M. L., Southwick III, R. G., Cheek, B. J., Baker, R. J., Bersuker, G., and Knowlton, W. B., "Survey of Oxide Degradation in Inverter Circuits Using 2.0nm MOS Devices," in *Proceedings of the 2004 IEEE International Integrated Reliability Workshop*, pp. 32-36.
19. Cheek, B. J., Stutzke, N., Santosh, K., Baker, R. J., Moll, A. J., and Knowlton, W. B., Investigation of Circuit-Level Oxide Degradation and its Effect on CMOS Inverter Operation Performance and MOSFET Characteristics, *2004 IEEE International Reliability Physics Symposium*, April, 25-29.

18. Stutzke, N., Cheek, B. J., Wiscombe, M., Lowman, T., Kumar, S., Baker, R. J., Moll, A. J., and Knowlton, W. B., *Effects of Circuit-Level Stress on Inverter Performance and MOSFET Characteristics*, 2003 IEEE International Integrated Reliability Workshop, Oct, 20-23.
17. Ogas, M. L., Southwick, R. G., Cheek, B. J., Lawrence, C. E., Kumar, S., Haggag, A., Baker, R. J., and Knowlton, W. B., *Investigation of Multiple Waveform Pulse Voltage Stress (MWPVS) Technique in Ultra-Thin Oxides*, poster presentation at the 2003 IEEE International Integrated Reliability Workshop Oct, 20-23.
16. Baker, R. J., *Mixed-Signal Design in the Microelectronics Curriculum*, IEEE University/Government/Industry Microelectronics (UGIM) Symposium, June 30 - July 2.
15. Hartman, J. A., Baker, R. J., Gribb, M., Hill, H. H., Jessing, J., Moll, A. J., Prouty, and Russell, D., *A Miniaturized Ion Mobility Spectrometer (IMS) Sensor for Wireless Operation*, FAME (Frontiers in Assessment Methods for the Environment) Symposium, Sponsored by NSF, Minneapolis, Minnesota, August 10-13, 2003.
14. Lawrence, C.E., Cheek, B. J., Lawrence, T. E., Kumar, S., Haggag, A., Baker, R. J., and Knowlton, W. B., *Gate Dielectric Degradation Effects on nMOS Devices Using a Noise Model Approach*, IEEE University/Government/Industry Microelectronics (UGIM) Symposium, June 30 - July 2, 2003.
13. Cheek, B., Lawrence, C., Lawrence, T., Gomez, J., Caldwell, T., Kiri, D., Kumar, S., Baker, R. J., Moll, A. J., and Knowlton, W. B., *Gate Dielectric Degradation Effects on nMOS Devices and Simple IC Building Blocks (SICBBs)*, IEEE Electron Devices Society Boise Meeting, Boise, ID Oct. 25, 2002.
12. Lawrence, C., Cheek, B., Caldwell, T., Lawrence, T., Kiri, D., Kumar, S., Baker, R. J., Moll, A. J., and Knowlton, W. B., *Pulse voltage stressing of ultrathin gate oxides in NMOS devices*, poster session at IEEE International Integrated Reliability Workshop, October 21-24, 2002.
11. Cheek, B., Lawrence, C., Lawrence, T., Caldwell, T., Kiri, D., Kumar, S., Baker, R. J., Moll, A. J., and Knowlton, W. B., *Circuit level reliability of ultrathin gate oxides for SICBBs: Preliminary study concentrated on the effect of stress on the NMOSFET of an inverter*, poster session at the IEEE International Integrated Reliability Workshop, October 21-24, 2002.
10. Baker, R. J., "Sensing Circuits for Resistive Memory," *IEEE Electron Devices Society Meeting*, Boise, Idaho October 25, 2002.
9. Rivera, B., Baker, R. J., Melngailis, J., "Design and Layout of Schottky Diodes in a Standard CMOS Process," 2001 International Semiconductor Device Research Symposium, Washington DC, Dec. 2001.
8. Hess, H. and Baker, R. J., "Easier Method to Simultaneously Trigger Series-Connected MOS Devices," *Power Systems World Conference 2000*, Boston, Massachusetts, September 2000.
7. Baker, R. J., and Hess, H., "Transformerless Capacitive Coupling of Gate Signals for Series Operation of Power MOSFET Devices." *International Electric Machines and Drives Conference*, Seattle, Washington, May 1999, pp. 673-676.
6. Baker, R. J., "A windows based integrated circuit design tool for distance education," *International Conference on Simulation and Multimedia in Engineering Education*."
5. Chen, H. and Baker, R. J., "A CMOS Standard-Cell Library for the PC-based LASI Layout System," *Proceedings of the 41st International Midwest Symposium on Circuits and Systems*, August 9-12, 1998.
4. Liu, S. and Baker, R. J., "Process and temperature performance of a CMOS beta-multiplier voltage reference," *Proceedings of the 41st International Midwest Symposium on Circuits and Systems*, August 9-12, 1998.
3. Boyce, D.E. and Baker, R. J., "A Complete Layout System for the PC," *IEEE 40th International Midwest Symposium on Circuits and Systems*, 1997.
2. Baker, R. J., and Blair, J. J., "Step response considerations and the design of a suitable step generator for high speed digitizer testing," *LLNL's Third Annual Workshop on High Speed Digitizers*, April 3-4, Las Vegas, Nevada, 1991.
1. Baker, R. J., "Step-recovery diodes sharpen pulses," *Engineering Design News Magazine*, pp. 154-156, May 10, 1990.

EXPERT WITNESS EXPERIENCE (LAST 4 YEARS)

The law firms and clients (underlined) whom I have provided expert witness services in electrical and computer engineering are listed below. I have been deposed 94 times, given expert testimony at 12 trials (7 USITC, 2 D. Del., 1 Arbitr., 1 S.D. Cal., and 1 E.D. Tex.), and participated in 1 mediation.

Bookoff McAndrews, PLLC (Washington, DC)

Case – Lenovo Inc. and Motorola Mobility LLC v. Theta IP, LLC

Case Numbers – IPR2023-00694, IPR2023-00697, and IPR2023-00698. Petitions filed on March 7, 2023.

Case Subject Matter – Power in wireless communication circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

McDermott Will & Emery LLP (Chicago, IL and Austin, TX)

Case – Xilinx, Inc. v. Polaris Innovations Limited

Case Numbers – IPR2023-00513 and IPR2023-00514. Petitions filed on February 6, 2023.

Case Subject Matter – Methods for terminating a memory chip with various termination resistances and output drivers for integrated circuits.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Norton Rose Fulbright LLP (Austin, TX and Dallas, TX)

Case – Current Lighting Solutions, LLC d/b/a GE Current v. Jiaxing Super Lighting Electric Appliance Co., Ltd.

Case Number – IPR2023-00270. Petition filed on December 19, 2022.

Case Number – IPR2023-00271. Petition filed on December 14, 2022.

Case Subject Matter – LED lighting, lamps, tube lamps, assembly, and associated circuits and electronics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes review.

Paul Hastings LLP (Washington, DC)

Case – Ex Parte Reexaminations

Case Numbers – 90/015155 and 90/015156. Requests filed on November 7, 2022.

Case Number – 90/015134. Request filed on October 14, 2022.

Case Number – 90/015130. Request filed on September 30, 2022.

Case Subject Matter – Packaging and fabrication of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declaration.

Sheppard, Mullin, Richter & Hampton LLP (Menlo Park, CA)

Case – Bell Semiconductor, LLC v. NXP, SMC, Micron, Nvidia, Advanced Micro Devices (AMD), Acer, Infineon, Qualcomm, Motorola Mobility, and Western Digital

Case Number – ITC Investigation No. 337-TA-1340. Complaint filed October 6, 2022.

Case Subject Matter – Electronic devices, semiconductor devices, and components.

Work Performed – Provided expert consulting services.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Daedalus Prime LLC v. Samsung Electronics and TSMC

Case Number – ITC Investigation No. 337-TA-1335. Complaint filed September 12, 2022.

Case Subject Matter – Semiconductor devices, mobile devices, and components.

Work Performed – Provided expert consulting services.

DLA Piper (Chicago, IL and Washington, DC)

Case – Ampt, LLC v. SolarEdge Technologies, Inc.

Case Number – ITC Investigation No. 337-TA-1327. Complaint filed July 28, 2022.

Case Subject Matter – Solar power optimizers, inverters, and components.

Work Performed – Provided expert consulting services including writing declarations for claim construction, expert reports, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Scramoge Technology Ltd.

Case Numbers – IPR2022-01052, IPR2022-01053, and IPR2022-01058. Petitions filed on May 26, 2022.

Case Numbers – IPR2022-01054, IPR2022-01055, IPR2022-01056, and IPR2022-01057. Petitions filed on May 24, 2022.

Case Number – IPR2022-00939. Petition filed on April 29, 2022.

Case Subject Matter – An antenna that supports wireless charging.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Ex Parte Reexaminations

Case Number – 90/015020. Request filed on May 2, 2022.

Case Number – 90/014906. Request filed on November 12, 2021.

Case Number – 90/014899. Request filed on November 10, 2021.

Case Number – 90/014888. Request filed on October 21, 2021.

Case Numbers – 90/014886 and 90/014887. Requests filed on October 20, 2021.

Case Number – 90/014885. Request filed on October 19, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging.

Work Performed – Provided expert consulting services and wrote declarations.

DLA Piper (Chicago, IL, Austin, TX, and Washington, DC)

Case – SolarEdge Technologies, Inc. v. Fronius International GMBH

Case Number – IPR2022-00849. Petition filed on April 14, 2022.

Case Subject Matter – Mechanical assembly and enclosure whereby an upper housing part is detached from a lower housing part using a “rotate-and-lift” feature.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Kirkland & Ellis LLP (New York, NY)

Case – Samsung Electronics Co. v. Sonrai Memory Ltd.

Case Numbers – IPR2022-00305 and IPR2022-00306. Petitions filed on December 10, 2021.

Case Subject Matter – USB devices and circuits for saving power.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews.

Haynes and Boone, LLP (Washington, DC)

Case – Unified Patents, LLC v. Arigna Technology Limited

Case Number – IPR2022-00285. Petition filed on December 9, 2021.

Case Subject Matter – High voltage driver circuit for driving power devices such as insulated gate bipolar transistors (IGBTs).

Work Performed – Provided expert consulting services, wrote declaration for inter partes review and was deposed.

Paul Hastings LLP (Washington, DC)

Case – Samsung Electronics Co., Ltd. v. Lynk Labs, Inc.

Case Numbers – IPR2022-00149 and IPR2022-00150. Petitions filed on November 12, 2021

Case Numbers – IPR2022-00100 and IPR2022-00101. Petitions filed on October 28, 2021.

Case Numbers – IPR2022-00051, IPR2022-00052, and IPR2022-00098. Petitions filed on October 27, 2021.

Case Numbers – IPR2021-01575 and IPR2021-01576. Petitions filed on October 1, 2021.

Case Numbers – IPR2021-01299, IPR2021-01300, IPR2021-01345, IPR2021-01346, and IPR2021-01347. Petitions filed on September 7, 2021.

Case Subject Matter – Circuit design, including switching power supply design, rectifiers, power factor correction, etc. for lighting and displays using light emitting diodes (LEDs).

Work Performed – Provided expert consulting services, wrote declarations, and was deposed ten times.

Haynes and Boone, LLP (Plano, TX)

Case – Pure Storage, Inc. v. Digital Cache, LLC

Case Number – IPR2022-00121. Petition filed on October 29, 2021.

Case Subject Matter – Non-volatile memory (NVM) devices capable of retaining stored data in case of a power failure.

Work Performed – Provided expert consulting services and wrote declaration for inter partes review.

Banner Witcoff (Washington, DC)

Case – SolarEdge Technologies Ltd. v. Koolbridge Solar, Inc.

Case Numbers – IPR2022-00007, IPR2022-00008, IPR2022-00009, IPR2022-00010, IPR2022-00011, and IPR2022-00012. Petitions filed on October 11, 2021.

Case Numbers – IPR2022-00013, IPR2022-00014, and IPR2022-00015. Petitions filed on October 8, 2021.

Case Subject Matter – DC-to-AC converters using full-bridges, multi-level conversion for power systems, and other electronics for harvesting solar energy.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung Electronics Co., Ltd. v. LED Wafer Solutions LLC

Case Number – IPR2021-01554. Petition filed on September 20, 2021.

Case Number – IPR2021-01526. Petition filed on September 10, 2021.

Case Number – IPR2021-01506. Petition filed on September 7, 2021.

Case Number – IPR2021-01491. Petition filed on September 3, 2021.

Case Subject Matter – Packaging of light emitting diodes (LEDs).

Work Performed – Provided expert consulting services and wrote declarations.

Paul Hastings, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/014,846. Request filed on August 30, 2021.

Case Subject Matter – Wireless power transmission and ways to wirelessly charge and/or discharge a battery.

Work Performed – Provided expert consulting services and wrote declaration.

Jones Day (San Diego, CA and Pittsburgh, PA)

Case – SOLiD, Inc. v. CommScope Technologies LLC

Case Numbers – IPR2021-01390, IPR2021-01391, IPR2021-01392, IPR2021-01393, and IPR2021-01394. Petitions filed on August 12, 2021.

Case Subject Matter – Digital antenna system that enables extension of radio frequency (RF) analog signals from base stations to areas (e.g., inside of buildings) where access to such signals is inhibited.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declaration.

Unified Patents, LLC (Washington, DC)

Case – Ex Parte Reexamination

Case Number – 90/019,015. Request filed on July 20, 2021.

Case Subject Matter – Voltage-controlled oscillator (VCO) temperature compensation.

Work Performed – Provided expert consulting services and wrote declaration.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC v. Unification Technologies LLC

Case Numbers – IPR2021-00940, IPR2021-00941, and IPR2021-00942. Petitions filed on June 4, 2021.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Kaijet Technology v. Sanho Corporation

Case Number – IPR2021-00886. Petition filed on April 30, 2021.

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services for inter partes review, wrote declaration, was deposed.

O'Melveny & Myers LLP (Los Angeles, CA and New York, NY)

Case – Solas OLED LTD. v. Samsung Electronics Co. LTD.

Case Number – Texas, ED (Marshall) 2:21-cv-00105. Complaint filed March 22, 2021.

Case Subject Matter – Touch-sensors for gesture recognition and signal processing for capacitive touch displays.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

O'Melveny & Myers LLP (San Francisco, CA)

Case – Super Interconnect Technologies LLC v. Google LLC

Case Number – Texas, ED (Marshall) 2:18-cv-00463 (complaint filed November 2, 2018) and Texas, WD (Waco) 6:21-cv-00259 (complaint filed March 15, 2021).

Case Subject Matter – Transmission of data and clock signals. Serial signals such as transition minimized differential signaling. Communications between processors and non-volatile storage such as Universal Flash Storage (UFS) and embedded MultiMedia Controller (eMMC).

Work Performed – Provided expert consulting services and wrote expert reports.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, and Irvine, CA)

Case – Fundamental Innovation Systems International LLC v. Anker Innovations and Fantasia Trading LLC d/b/a Ankerdirect

Case Number – Delaware, 1:21-cv-00339. Complaint filed on March 5, 2021.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – TCT Mobile Inc. and TCL Communication, Inc. v. Fundamental Innovation Systems International LLC

Case Numbers – IPR2021-00597, IPR2021-00598, and IPR2021-00599. Petitions filed on February 26, 2021.

Case Number – IPR2021-00428. Petition filed on January 13, 2021.

Case Number – IPR2021-00410. Petition filed on January 11, 2021.

Case Number – IPR2021-00395. Petition filed on December 31, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations for inter partes reviews. Was deposed twice.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. Pictos Technologies, Inc.

Case Number – IPR2021-00557. Petition filed on February 18, 2021.

Case Number – IPR2021-00436. Petition filed on January 19, 2021.

Case Numbers – IPR2021-00437 and IPR2021-00438. Petitions filed on January 15, 2021.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote declarations for inter partes reviews.

O'Melveny & Myers LLP (San Francisco, CA) and DLA Piper (New York, NY)

Case – Solas OLED Ltd. v. BOE Technology Group Co. Ltd. and Samsung Electronics

Case Number – ITC Investigation No. 337-TA-1243. Complaint filed January 5, 2021.

Case Subject Matter – Active matrix OLED display devices and components

Work Performed – Provided expert consulting services, wrote expert reports, was deposed, and testified at trial.

Paul Hastings LLP (Washington, DC)

Case – Samsung, Inc. v. Garrity Power Services LLC

Case Number – IPR2021-00389. Petition filed on December 31, 2020.

Case Subject Matter – Power electronics including full-bridge PWM modules for wireless power transmission using magnetic coupling via antennas and transformers. Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declaration for inter partes reviews.

Morgan, Lewis & Bockius LLP (Palo Alto, CA and Shanghai, CN)

Case – Monolithic Power Systems, Inc. v. Meraki Integrated Circuit Technology, Inc. and Promate Electronic Company, LTD.

Case Number – Texas, WD (Waco) 6:20-cv-00876. Complaint filed on December 24, 2020.

Case Subject Matter – Design of switching power supplies including synchronous rectification.

Work Performed – Provided expert consulting services including declaration for claim construction, trade secret analysis and declaration, and Markman tutorial.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC; Dell Technologies Inc.; Dell Inc.; and HP Inc. v. Unification Technologies LLC

Case Numbers – IPR2021-00343, IPR2021-00344, and IPR2021-00345. Petitions filed on December 22, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services for inter partes reviews, wrote declarations, and was deposed.

Jones Day (Chicago, IL and Dallas, TX)

Case – WSOU Investments, LLC d/b/a Brazos Licensing and Development v. Xilinx, Inc.

Case Numbers – Delaware, 1:20-cv-01231 and Delaware, 1:20-cv-01233. Complaints filed on November 23, 2020 and September 16, 2020.

Case Subject Matter – Controlling power cycles in communication devices and transferring multiple asynchronous clock signals.

Work Performed – Provided expert consulting services, wrote claim construction declaration, wrote expert reports, and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Cosemi Technologies, Inc. v. EverPro Technologies, Fibbr Technologies, Logitech, Inc., and Facebook Technologies

Case Number – ITC Investigation No. 337-TA-1233. Complaint filed October 28, 2020.

Case Subject Matter – Data cables, including HDMI, Display Port, and USB Type A, USB Type C and USB Type A/C data cables.

Work Performed – Provided expert consulting services.

Kirkland & Ellis LLP (Boston, MA and New York, NY)

Case – Pictos Technologies, Inc. v. Samsung Electronics Co., LTD. and Samsung Semiconductor, Inc.

Case Number – ITC Investigation No. 337-TA-1231. Complaint filed September 25, 2020.

Case Subject Matter – Solid-state imaging devices including red, green, and blue pixels, correction of bad pixels, data conversion circuits, and interpolation circuits. CMOS imagers including fabrication and design, active pixels, and semiconductor physics.

Work Performed – Provided expert consulting services and wrote expert report.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. TCT Mobile Inc. and TCL Communication, Inc.

Case Number – Delaware, 1:20-cv-00552. Complaint filed on September 11, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declarations, expert report on invalidity, and was deposed.

Walters Wilson LLP (Redwood City, CA)

Case – Western Digital Corporation and SanDisk, LLC v. Martin Kuster

Case Numbers – IPR2020-01410 and IPR2020-01411. Petitions filed on August 3, 2020.

Case Subject Matter – Computer connectors such as universal serial bus (USB) that connect to peripheral devices such as mice, keyboards, displays, printers, external storage, etc.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed.

O'Melveny & Myers LLP (Los Angeles, CA)

Case – Advanced Micro Devices, Inc. v. Monterey Research, LLC

Case Number – IPR2020-01315. Petition filed on July 16, 2020.

Case Number – IPR2020-00985. Petition filed on May 26, 2020.

Case Subject Matter – Reading and writing to semiconductor memory such as SRAM and double data rate (DDR) DRAM. Buffer circuits with variable current supplies for controlling the rise and fall times of output signals.

Work Performed – Provided expert consulting services for inter partes review, wrote declarations and was deposed twice.

Winston & Strawn LLP (Dallas, TX and Palo Alto, CA)

Case – Unification Technologies LLC v. Micron Technology, Inc.; Micron Semiconductor Products, Inc.; Micron Technology Texas LLC

Case Number – Texas, WD (Waco) 6:20-cv-00500. Complaint filed June 5, 2020.

Case Subject Matter – Solid-State Drive (SSD), flash non-volatile memory management, memory controller operation and addressing.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and was deposed.

Ari Law, P.C. (Palo Alto, CA) and Hill, Kertscher & Wharton, LLP (Atlanta, GA)

Case – Sanho Corporation v. Kaijet Technology, Magic Control Technology, and Star View Global

Case Numbers – Georgia, ND (Atlanta) 1:18-cv-05385 (third amended complaint filed November 14, 2019) and Georgia, ND (Atlanta) 1:20-cv-02150 (filed May 19, 2020).

Case Subject Matter – Port extension apparatus for headphone jack, USB (Universal Serial Bus or Type-C ports), and video ports such as VGA (Video Graphics Array), DVI (Digital Visual Interface), HDMI (High-Definition Multimedia Interface), DP (Display Port), and mini-DP.

Work Performed – Provided expert consulting services, wrote declaration for claim construction, and expert reports. Was deposed.

Orrick, Herrington & Sutcliffe LLP (Houston, TX, Irvine, CA, and Menlo Park, CA)

Case – Fundamental Innovation Systems International LLC v. Coolpad Group Limited, Coolpad Technologies, Inc., and Yulong Computer Telecommunication Scientific Co. Ltd.

Case Number – Texas, ED (Marshall) 2:20-cv-00117. Complaint filed on April 23, 2020.

Case Subject Matter – Universal Serial Bus (USB) for charging mobile devices.

Work Performed – Provided expert consulting services including writing declaration for claim construction.

Pillsbury Winthrop Shaw Pittman LLP (San Francisco, CA and Shanghai, China)

Case – SMIC, Americas v. Innovative Foundry Technologies LLC

Case Numbers – IPR2020-00837 and IPR2020-00839. Petitions filed on April 14, 2020.

Case Subject Matter – Methods of manufacturing a semiconductor component, such as a short-channel MOS device, including forming graded-junctions using spacers along the sidewalls of a transistor's gate.

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Russ August & Kabat (Los Angeles, CA)

Case – Oyster Optics, LLC v. Ciena Corporation

Case Number – California, ND (Oakland) 3:20-cv-02354. Complaint filed on April 7, 2020.

Case Subject Matter – Fiber optic telecommunication systems.

Work Performed – Provided expert consulting services, wrote claim construction declaration, and was deposed.

Russ August & Kabat (Los Angeles, CA)

Case – Seoul Semiconductor Co., Ltd. v. Document Security Systems, Inc.

Case Number – IPR2020-00938. Petition filed on May 18, 2020.

Case – Nichia Corporation v. Document Security Systems, Inc.

Case Number – IPR2020-00908. Petition filed on May 18, 2020.

Case – Cree, Inc. v. Document Security Systems, Inc.

Case Number – IPR2020-00557. Petition filed on February 11, 2020.

Case Subject Matter – Light emitting diodes (LEDs) as a light source, extraction of light.

Work Performed – Provided expert consulting services, wrote declaration for inter partes reviews, and was deposed three times.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Flex Logix Technologies, Inc. v. Konda Technologies Inc.

Case Numbers – IPR2020-00260, IPR2020-00261, and IPR2020-00260. Petitions filed on December 16, 2019.

Case Numbers – PGR2019-00037, PGR2019-00040, and PGR2019-00042. Petitions filed on March 18, 2019.

Case Subject Matter – FPGA layout routing for integrated circuits and networks, electrical and computer engineering.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews.

DLA Piper (Chicago, IL, Houston, TX, and Washington, DC) and White & Case LLP (New York, NY and Washington, DC)

Case – M-Red Inc. v. Panasonic Corporation

Case Number – Texas, ED (Marshall) 2:19-cv-00251. Complaint filed on July 16, 2019.

Case Subject Matter – Integrated circuit electronics adjustment, such as ring oscillators, using auto calibration. Evaluating a known good die using both wire and flip-chip interconnects.

Work Performed – Provided expert consulting services and wrote declaration for claim construction.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. NuCurrent, Inc.

Case Number – IPR2019-01217. Petition filed on June 19, 2019.

Case Numbers – PGR2019-00049 and PGR2019-00050. Petitions filed on May 28, 2019.

Case Numbers – IPR2019-00858, IPR2019-00859, IPR2019-00860, IPR2019-00861, IPR2019-00862, and IPR2019-00863. Petitions filed on March 22, 2019.

Case Subject Matter – Wireless power transmission using magnetic coupling via antennas and transformers. Design of inductors and coils.

Work Performed – Provided expert consulting services and wrote declarations for post grant and inter partes reviews. Was deposed five times.

DLA Piper (East Palo Alto, CA)

Case – Invensas Corporation and Tessera Advanced Technologies, Inc. v. NVIDIA Corporation

Case Number – Delaware, 1:19-cv-00861. Complaint filed on May 8, 2019.

Case Subject Matter – Reference voltage circuits (programmable bandgaps) having a substantially zero temperature coefficient using bipolar and MOS transistors.

Work Performed – Provided expert consulting services.

Irell & Manella LLP (Los Angeles, CA)

Case – VLSI Technology LLC v. Intel Corporation

Case Number – Texas, WD (Waco) 6:19-cv-00256. Complaint filed on April 11, 2019.

Case Subject Matter – Static Random Access Memory (SRAM) having a variable power supply using charge-sharing capacitors, methods for designing digital systems, and hardware managed interrupt control.

Work Performed – Provided expert consulting services, wrote expert reports, declaration, and was deposed.

Paul Hastings LLP (Austin, TX and Washington, DC)

Case – Samsung, Inc. v. ProMOS Technologies, Inc.

Case Numbers – IPR2019-00779, IPR2019-00780, IPR2019-00781, IPR2019-00784, and IPR2019-00785. Petitions filed on March 5, 2019.

Case Subject Matter – Programmable latches that include non-volatile programmable elements, digital delay elements, and decoders for memory chips.

Work Performed – Provided expert consulting services, wrote declarations for inter partes reviews, and was deposed four times.

Pillsbury Winthrop Shaw Pittman LLP (San Francisco, CA)

Case – Kingston Technology Company, Inc. v. Memory Technologies, LLC

Case Numbers – IPR2019-00645, IPR2019-00648, IPR2019-00651, and IPR2019-00654. Petitions filed on January 31, 2019.

Case Numbers – IPR2019-00642, IPR2019-00643, and IPR2019-00644. Petitions filed on January 30, 2019.

Case Number – IPR2019-00638. Petition filed on January 29, 2019.

Case Subject Matter – Memory cards including PC cards, compact flash (“CF”) cards, secure digital (“SD”) cards, programmable credit cards, and embedded multimedia cards (“eMMC”). Uses of EEPROM and Flash memory in built-in operating system (BIOS).

Work Performed – Provided expert consulting services for inter partes reviews and wrote declarations.

Morrison & Foerster LLP (San Francisco, CA) and Schwabe, Williamson & Wyatt PC (Portland, OR)

Case – Steven A.W. de Jaray, Perienne de Jaray, and Darrell R. Oswald v. Lattice Semiconductor Corporation

Case Number – Oregon, Circuit Court (Multnomah), 3:19-cv-00086. Complaint filed on January 17, 2019.

Case Subject Matter – Export controlled integrated circuits in various packages. Programmable logic devices (PLDs).

Work Performed – Provided expert consulting services. wrote expert reports, and was deposed.