

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APUTURE IMAGING INDUSTRIES CO., LTD.,

Petitioner,

v.

ROTOLIGHT LIMITED,

Patent Owner.

Case No.: IPR2024-01423
U.S. Patent No. 10,203,101

**DECLARATION OF P. MORGAN PATTISON, PhD
IN SUPPORT OF PETITION FOR *INTER PARTES*
REVIEW OF U.S. PATENT NO. 10,203,101**

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I, P. Morgan Pattison, PhD, hereby declare as follows:

I. INTRODUCTION

A. Engagement

1. I have been retained by Aputure Imaging Industries Co., LTD. to offer technical analysis and opinions relating to U.S. Patent No. 10,203,101 (Ex. 1001) (the “’101 Patent”) and certain prior art references relating to its subject matter.

2. As far as I am aware, I have no financial interest in the Petitioner, Patent Owner, the ’101 Patent, or in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis at my standard consulting rate. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

3. I have been informed that the ’101 Patent was challenged by Arnold & Richter Cine Technik GmbH & Co. Betriebs KG (“ARRI”) in 2021-2023. I have reviewed the September 3, 2021 and September 9, 2022 declarations submitted by Michael Wood in which he opined, among other things, that the claims of the ’101 Patent are invalid in view of U.S. Patent No. 9,743,010 to Edwards (“Edwards”). I agree with Mr. Wood’s conclusion that the claims of the ’101 anticipated by or are obvious in view of Edwards.

4. It is also my opinion that the claims of the ’101 Patent are obvious over U.S. Patent Application Publication No. 2005/0275626 to Mueller *et al.* (“Mueller”).

This is a prior art combination that was not contemplated by Mr. Wood in either of his expert declarations.

5. I present this Declaration in order to present my opinions on the '101 Patent and its relation to the prior art.

B. Background and Qualifications

6. I received my B.S. in Electrical Engineering, Electronic Devices and Materials from the University of California, San Diego, in 1996. From there, I worked as a laser test engineer at Cymer Laser in San Diego. During my time there, I tested and developed test methodology for production and prototype KrF and ArF excimer lasers used in deep UV photolithography for manufacturing of advanced semiconductor products.

7. After working at Cymer Laser, I attended the University of California, Santa Barbara and received my M.S. in Electrical Engineering, Electronics and Photonics in 2003 and my Ph.D. Materials Science, Electronic and Photonic Materials in 2006.

8. In early 2006, I started working as a project manager for the U.S. Department of Energy where I managed DOE funded R&D projects in energy efficient LED and OLED based lighting technologies, so called solid state lighting (SSL). In this capacity I identified priority R&D areas to achieve the maximum energy savings, I managed R&D funding solicitations, and I managed DOE funded

R&D projects covering all aspects of LED and OLED lighting technology including, light emitting devices (LEDs and OLEDs), power supplies, optics, integrated fixtures, lighting controls, and lighting applications.

9. In 2007, I founded and am still currently the President of Solid State Lighting Services, Inc. Part of the services we offer include providing technical, strategic, and market expertise in the areas of LEDs, OLEDs, Lighting, Solid State Lighting (SSL) displays, and optoelectronic materials and devices. We also provide services related to LED and lighting product failure and reliability evaluation. I have worked at Solid State Lighting Services, Inc. for almost 17 years.

10. Further details regarding my qualifications are included in my CV, which is attached hereto as Appendix A and incorporated by reference as if set forth in its entirety herein.

II. UNDERSTANDING OF THE GOVERNING LAW

A. Invalidity by Anticipation

11. I understand that invalidity of a patent claim may be established under the legal doctrine of anticipation. A determination that a claimed invention is anticipated requires a showing that each and every element of the claim is disclosed in a single prior art reference, either expressly or inherently, or that the claimed invention was previously known or embodied in a single prior art device, product, or method. Additional references may be relied upon in limited circumstances, to

explain terminology in the anticipating reference, to show that the anticipating reference is enabling, or to show that a characteristic not disclosed expressly in the reference is nonetheless disclosed inherently.

12. I understand that under the doctrine of inherency, if a structure in the prior art necessarily functions in accordance with the limitations of a patent claim, the claim is anticipated. This doctrine also applies to inherent properties and inherent uses. For instance, if a claim to a new method recites the same steps as those disclosed in a prior art method using the same compound, then the new use is not patentable, and any benefit achieved by the claimed method will be considered to naturally flow from the prior method, even if that benefit was not recognized at the time the prior method was disclosed.

13. I understand that whether a reference is available as “prior art” is determined in accordance with 35 U.S.C. §102, which sets forth a number of subsections that define “prior art,” or knowledge that is deemed to be within the public domain for purposes of ascertaining novelty.

14. A patent claim is invalid for anticipation under (post-AIA) §102(a) when:

(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention; or

(2) the claimed invention was described in a patent issued under 35 U.S.C. § 151, or in an application for patent published or deemed published under 35 U.S.C. § 122(b), in which the patent or application, as the case may be, names another inventor and was effectively filed before the effective filing date of the claimed invention.

15. Thus, a timely publication printed in any country, or a timely public use, sale, or offer for sale will invalidate a patent claim under 35 U.S.C. § 102(a)(1).

B. Invalidity by Obviousness

16. I understand that obviousness is analyzed from the perspective of a person of ordinary skill in the art (a “POSITA”) at the time the alleged invention was made. I also understand that a POSITA is presumed to have been aware of all pertinent prior art at the time of the alleged invention.

17. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention as a whole would have been obvious to a POSITA in view of the prior art, and in light of the general knowledge in the art at the time the invention was made. I also understand that the invention may be deemed obvious when a POSITA would have reached the claimed invention through routine experimentation.

18. I understand that obviousness can be established by combining or modifying disclosures to the prior art to achieve the claimed invention. It is also my understanding that where there is a reason to modify or combine the prior art to

achieve the claimed invention, there must also be a reasonable expectation of success in so doing to render the claimed invention obvious. I understand that the reason to combine prior art references can come from a variety of sources, not just the prior art itself or the specific problem the patentee was trying to solve. I also understand that the references themselves need not provide a specific hint or suggestion of the alteration needed to arrive at the claimed invention; the analysis may include recourse to logic, judgment, and common sense available to a POSITA.

19. I understand that when there is some recognized reason to solve a problem, and there are a finite number of identified, predictable solutions, a POSITA has good reason to pursue the known opinions within his or her technical grasp. If such an approach leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense. In such a circumstance, when a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious.

20. I understand that when considering the obviousness of an invention, one should also consider whether there are any objective indicia that support the non-obviousness of the invention. I further understand that objective indicia of non-obviousness include failure of others, copying, unexpected results, information that “teaches away” from the claimed subject matter, perception in the industry,

commercial success, and long-felt but unmet need. I also understand that in order for objective indicia of non-obviousness to be applicable, the indicia must have some sort of nexus to the subject matter in the claim that was known in the art. I understand that this nexus includes a factual connection between the patentable subject matter of the claim and the objective indicia alleged.

21. Finally, I understand that Patent Examiners at the U.S. Patent and Trademark Office (“USPTO”) rely upon certain exemplary rationales in review patent applications to understand whether the subject matter of the claims is obvious. I understand that the following is a list of exemplary rationales relied upon by Patent Examiners at the USPTO:

- (A) Combining prior art elements according to known methods to yield predictable results;
- (B) Simple substitution of one known element for another to obtain predictable results;
- (C) Use of a known technique to improve similar devices (methods, or products) in the same way;
- (D) Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- (E) “Obvious to try”- Choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

- (F) Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and
- (G) Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

C. Materials Relied on in Forming My Opinions

22. In forming my opinions expressed in this declaration, I have relied on my own knowledge, experience, and expertise, as well as the knowledge of a POSITA in the relevant timeframe. In addition, I have reviewed and relied upon the following list of materials, and any other cited reference, in this declaration:

- U.S. Patent No. 10,203,101 (the “’101 Patent”) (EX1001);
- Prosecution History of the ’101 Patent (EX 1002);
- U.S. Patent No. 9,743,010 to Edwards (“Edwards”) (EX1004);
- U.S. Patent Application Publication No. 2005/0275626 to Mueller *et al.* (“Mueller”) (EX1005);
- The Astera Manual (“Astera”) (EX1011);

- Declaration of Simon Canins from *Arnold Richter Cine Technik GmbH & Co. Betriebs KG v. Rotolight Ltd.*, IPR2021-01498 (P.T.A.B.) (EX1012); and
- Declaration of Mike Wood submitted in connection with IPR2021-01498.

III. BACKGROUND OF THE '101 PATENT

23. Independent Claims 1, 11, and 17 of '101 Patent recite a method, system, and computer program, respectively, for “produc[ing] user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera[.]” EX1001, 11:59-62, 12:47-50, 13:16-20.

24. Claim 1 recites:

[1p] A method for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the method comprising:

[1a] calculating, using an effect simulator, a time varying lighting value;

[1b] compensating for the rolling shutter artefacts produced by the camera, the time varying lighting value being calculated based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable

parameter indicative of a member of a group consisting of:

a camera recording frequency of the camera,

a camera shutter speed of the camera, and

a camera frame rate of the camera; and

[1c] outputting, from said effect simulator, said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for the rolling shutter artefacts.

Id., 11:59-62.

25. Claim 11 recites:

[11p] A controller adapted to control a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the controller comprising:

[11a] an effect simulator adapted to calculate a time varying lighting value

[11b] compensating for the rolling shutter artefacts produced by the camera based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:

a camera recording frequency of the camera;

a camera shutter speed of the camera; and

a camera frame rate of the camera; and

[11c] wherein the effect simulator is adapted to output said calculated time varying lighting value to the lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.

Id., 12:47-50.

26. Claim 17 recites:

[17p] A computer program comprising software code for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the computer program adapted to perform, when executed, the steps of:

[17a] calculating, using an effect simulator, a time varying lighting value

[17b] compensating for the rolling shutter artefacts based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:

a camera recording frequency of the camera,

a camera shutter speed of the camera, and

a camera frame rate of the camera; and

[17c] wherein the effect simulator is adapted to output, from said effect simulator, said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.

Id., 13:16-20.

27. “Rolling shutter” cameras include an image sensor that is typically made up of rows or bands of sensors that each capture a pixel. These sensors are not all exposed to light at the same time. Instead, each row is exposed to light sequentially, one at a time, corresponding with an open shutter for that row.

28. The time shift in acquisition of the image can cause unwanted artifacts if the lighting changes during the times the shutter is open for each row of sensors to capture the camera frame of the full image. If the light changes during the acquisition of the frame, then some bands may not have the same illumination as others, resulting in unwanted dark bands or other distortions in the image.

29. To compensate for these unwanted effects, it has long been known to adjust the lights so that they provide consistent illumination during the time the shutter is open to record the entire image frame with the camera. For example, it has long been known to set the pulse length of the lights so that they remain on for the entire duration of the camera frame capture to eliminate the potential for the light changing between captured bands. It has also long been known to adjust the lighting

refresh rate so that the refresh rate does not closely match the frame rate of the camera. By having lights refresh at a much higher rate than the camera frame rate, each band would capture a similar amount of light and no artifacts would be captured in the image.

30. The claims of the '101 Patent recite an “effect simulator” used to calculate time-varying lighting values that are used to produce an effect while compensating for rolling shutter artifacts produced by the Camera. EX1001, 11:63-12:7, 12:51-60; 13:21-14:3. The time-varying lighting value is based on user input of a “simulation parameter” associated with camera “recording frequency,” “shutter speed,” or “frame rate.” *Id.* The calculated values are output to a lighting device to simulate the lighting effect compensated for the rolling shutter artifact. *Id.*, 12:8-11, 12:61-61, 14:4-8.

31. The '101 Patent describes the effect simulator as the component of the system that creates data characterizing a lighting effect. *Id.*, 5:55-65, 7:54-65, 8:44-56. This data is “in the form of brightness and/or color values that vary over time” to produce the desired lighting effects. *Id.*, 8:44-56.

32. To compensate for rolling shutter artifacts, the '101 Patent describes how, for example, the system allows for “the minimum light pulse width to be adjusted to suit the shutter speed or frame rate of the user’s camera in order to prevent ‘strobing’ due to the light effect being out of phase/sync with the frame rate

of the camera, ensuring that each frame captured by the camera is fully illuminated.
Id., 4:25-31.

33. The '101 Patent also describes a number of variants that correspond to dependent Claims 2-10, 12-16, and 18-21. These variants include limiting the light effect produced to a short time-period effect with a user adjustable minimum pulse width (Claim 2); matching the time varying lighting value to camera recording frequency, frame rate, or shutter speed (Claims 3, 4, and 19); limiting user input of a simulation parameter as occurring through a user interface (Claim 5); designing the simulated lighting effect to mimic various phenomena, such as a fire or lightning (Claim 6); converting brightness and/or color data to lighting signals (Claims 7, 8, and 14); storing and recalling simulation parameters (Claims 9 and 21); limiting the system to use for videography, broadcasting, cinematography, studio filming, and location filming (Claim 10); using a controller to control a plurality of lighting devices (Claim 12); limiting the controller to on with an interface with a wireless communication interface, dial, slider, display, or buttons (Claim 13); limiting the lighting device to one that includes an LED (Claim 15); limiting the lighting device to one that includes a controller into a combined unit (Claim 16); and ensuring that the time varying lighting value evenly illuminates a camera frame (Claims 18 and 20).

A. '101 Patent File History

34. I understand that the '101 Patent issued on February 19, 2019, from U.S. Patent Application No. 15/849,793, which is a continuation of U.S. Patent Application No. 15/481,460, and claims priority to U.S. Provisional Patent Application No. 62/319,809, filed April 8, 2016. In an Office Action dated March 22, 2018, the Examiner rejected the original claims under 35 U.S.C. § 112 but made no rejections relating to prior art. The claims were amended to overcome the Examiner's § 112 rejections, and a Notice of Allowance was sent on October 2, 2018. In the Notice, the Examiner indicated that the prior art fails to teach or suggest elements of the amended independent claims.

B. Compensation of Rolling Shutter and Camera Artifacts

35. Film cameras use a shutter to either block light from the camera lens or allow the light to pass through the lens where it will be captured on film. In operation, the shutter is opened to expose a frame of the film, then the shutter is closed, and the film is moved onwards one frame to position the next frame for exposure. This process is repeated at a "frame rate" indicative of how many frames are advanced and exposed per second. For example, the frame rate of a film camera might be 25 frames per second ("fps"). Many frame rates are used, but 24 fps and 25 fps are common. This rate is sufficient such that, when projected back, the human eye perceives these rapidly changing individual images as a single moving image.

The physical shutter in a film camera can either expose the entire frame at the same time, called a global shutter, or in a slit that moves across the film frame, called a rolling shutter.

36. Modern video cameras do not usually have a physical shutter, nor do they use film. However, the term “frame rate” is still applicable. Instead of a strip of film, video cameras have an electronic sensor that is sensitive to light. Just like a film camera, video cameras need to read out the data from that sensor at a frame rate which is fast enough that the image is seen by the human eye as moving. With video cameras, this frame rate is often 30 fps in the USA and 25 fps in Europe. How this data read out happens varies from sensor type to sensor type.

37. In very general terms, older video cameras and camcorders often used CCD¹ sensors, while more modern cameras, including many used in film and TV studios as of the priority date of the '101 Patent, use CMOS-based² sensors. Both sensor types do fundamentally the same job of turning light energy into an electrical signal representing an image, but they do it in different ways. For purposes of this Declaration, the difference we are interested in is the timing of how the sensor is exposed to light and whether that exposure utilizes a global or a rolling shutter.

¹ “CCD” stands for charge-coupled device.

² “CMOS” stands for complementary metal oxide semiconductor.

38. As a broad statement, most CCD sensors utilize a global shutter, while CMOS sensors use a rolling shutter (though this is not a hard and fast rule, and it is possible for CMOS sensors to simulate a global shutter).

39. A sensor using a global shutter exposes the entire image at one time. When the real or virtual shutter opens, the sensor starts gathering and integrating light at every pixel across the whole frame at the same time. At the end of that light integration time (shutter time), the accumulated electrical charges on every pixel are simultaneously transferred to a non-light sensitive area of the chip and light collection stops. This simultaneity across the frame means that a global shutter effectively freezes a moment in time.

40. The rolling shutter in a CMOS sensor, on the other hand, typically behaves very differently. The pixels in a CMOS sensor are not all exposed to light at the same time. Instead, each row of sensors (usually a horizontal row, but it can be vertical) is exposed to light one at a time. The top row is enabled to collect light first and then, some short time later, the next row will be enabled, and so on. After a row has been exposed for the selected integration or shutter time, light collection for that row is disabled. Each subsequent row will then be disabled, one after another, in sequence. Each row is enabled for the same selected shutter time, but every row is staggered as to its start and end times. The result is a band of enabled pixels that moves down the sensor, with the width of that band defining the shutter speed.

41. This time shift from top to bottom of the image can cause some strange effects. Of particular relevance here is that the time shift between the top and bottom of the frame can be a problem with light sources that don't emit continuous light, such as an arc or HID (High Intensity Discharge) light source, an LED source using pulse width modulation ("PWM") dimming, or a light source strobing or flashing. PWM dimming of an LED source is achieved by turning the LED on and off very rapidly and varying the ratio between the amount of time the light is on compared to the time that it's off. When the light is on all the time, then the LED is at full output. When it's off all the time, it's off. And, when it's on for half the time and off for half the time, our eyes see it as being illuminated at 50% brightness. As long as the pulses are quick enough, our eyes convert that time-based pulsing into an apparently constant brightness level. Most of the time cameras behave the same way as our eyes; in particular, a global shutter sensor will also convert the light pulses into an effective brightness level by integrating those pulses into each captured frame.

42. Rolling shutter sensors present different issues, resulting in an image with two issues. Firstly, and most obviously, there are bands of the image which received no light when the PWM cycle was off, so they show up as a dark stripe across the picture. Secondly, the areas of the image that did receive light are overexposed. Those areas see the LEDs on at full power no matter what the dim level is actually set to. A rolling shutter doesn't integrate the light across the whole PWM

cycle, as both our eyes and a global shutter do. Instead, each pixel sees the light as either off or on at full power. In practice, you rarely see a stationary black stripe across an overexposed image. Instead, in a CMOS sensor video camera, the band will be moving up or down the image at a speed dependent on the ratio between the CMOS scan frequency and the PWM frequency and can show up as a flickering effect.

43. This rolling shutter phenomenon has been well known and understood for at least 50 years, and a number of different techniques have been used to mitigate the issues. The most common mitigation technique when using discontinuous light sources, both now and at the time of the '101 patent, is to adjust the oscillation frequency of the light source or the frame rate and/or shutter speed of the camera. In the days of discharge light sources, dating from the introduction of HMI lamps to the film industry in the 1960's, this was done by adjusting the camera frame rate to match the frequency of the lights.

44. The '101 Patent appears to use the term "rolling shutter artefacts" to refer to any unwanted camera artifacts that may be captured due to the camera recording frequency, frame rate, or shutter speed, regardless of whether the camera is a rolling shutter camera, global shutter camera, or another type. In any event, techniques to mitigate and compensate for unwanted camera artifacts have been well-known since long before the '101 Patent. To compensate or mitigate for these

unwanted artifacts, it has long been well known to adjust the lights so that they provide consistent illumination during the time the shutter is open to record the entire image frame with the camera. For example, setting the pulse width of the lights so that they will remain on for the entire duration of the camera frame capture eliminates the potential for the light changing between captured bands. As another example, it has long been well known to adjust the PWM refresh rate of the LEDs so that the refresh rate does not closely match the frame rate of the camera. The PWM refresh rate is the rate, in Hz, at which the LEDs turn on and off to create the desired light output. By having the LEDs refresh at a much higher rate than the camera frame rate, for example, each band would capture a similar amount of light, and no artifacts would be captured in the image.

IV. CLAIM CONSTRUCTION AND POSITA DEFINITION

A. Claim Construction

45. It is my understanding that claims in an *inter partes* review are generally given their ordinary and customary meaning, which is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention.

46. I have analyzed the patentability of Claims 1-21 in the '044 Patent based on their ordinary and customary meaning, unless otherwise stated below.

B. Definition of a Person of Ordinary Skill in the Art

47. A POSITA in the field of the '101 Patent, as of April 8, 2016, would have had a good working knowledge of electrical engineering and entertainment lighting systems, controls, and effects. They would have gained this through an undergraduate degree in electrical engineering or a comparable field as well as some experience in the field of entertainment lighting systems. The more education one has, the less experience needed to attain an ordinary level of skill. Similarly, more experience in the field may serve as a substitute for formal education.

V. THE ELEMENTS IN CLAIMS 1-21 OF THE '101 PATENT ARE DISCLOSED IN OR TAUGHT BY THE PRIOR ART

48. I have been asked to provide an analysis as to whether the elements of Claims 1-21 of the '101 Patent (the “Challenged Claims”) are disclosed in or taught Edwards and the combination of Mueller and Edwards.

49. My analysis of these prior art references relative to the elements of the Challenged Claims—specifically, how and where the prior art references disclose or teach the limitations of the Challenged Claims—is provided below. The citations that I have included are not intended to provide an exhaustive list, but rather provides examples of how the references disclose or teach the elements of these claims.

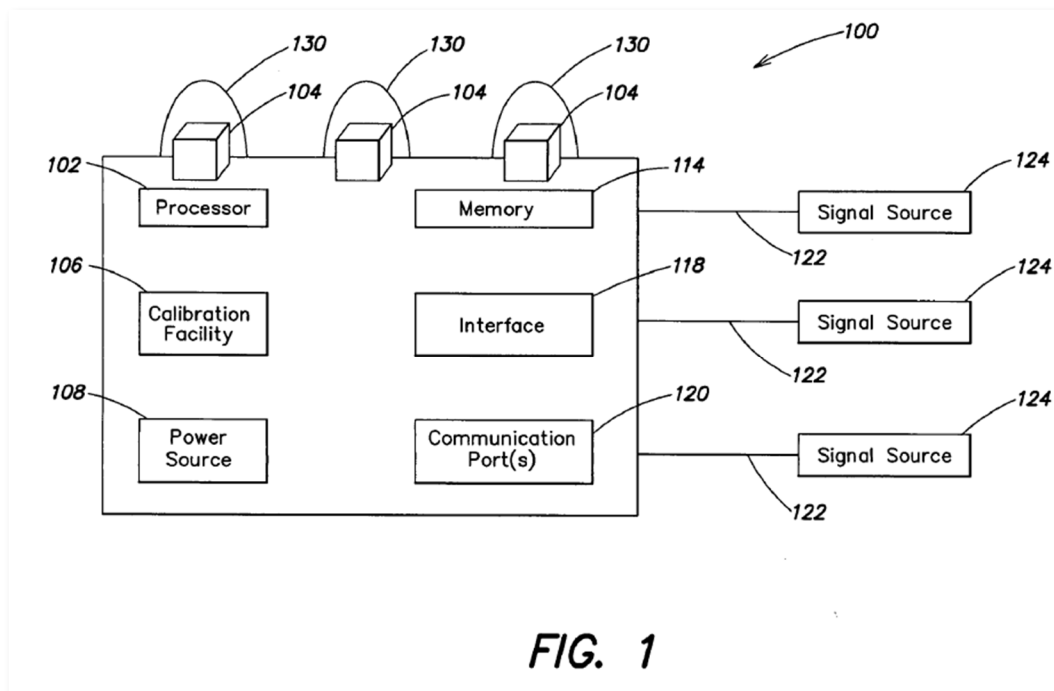
A. Ground 1: Claims 1-21 are invalid under 35 U.S.C. § 103 as obvious over Mueller in view of Edwards

1. Overview of Mueller

50. U.S. Patent Application Publication 2005/0275626 to Mueller *et al.*, titled “Entertainment Lighting System” was filed on March 2, 2005, and published on December 15, 2005. I understand Mueller is therefore prior art to the ’101 Patent at least under 35 U.S.C. 102(a).

51. Mueller describes the creation and modification of coordinated lighting effects in real time. In doing so, Mueller describes a processor 102 that is configured to output one or more control signals to drive light sources 104 so as to generate various intensities of light from each light source 104. EX1004, [0168]. The processor 102 may be particularly configured (*e.g.*, programmed) to provide control signals to one or more of the light sources 104 so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects. *Id.*, [0170]. Mueller further describes that the processor’s control of one or more of the light sources 104 could be based, at least in part, on user signals provided through an interface 118. *Id.*, [0183]. Such user signals could be user-selectable settings or functions, including, but not limited to, generally controlling the light output of the lighting unit 100, changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, changing and/or selecting various parameters of selected lighting effects, and setting particular

identifiers such as addresses or serial numbers for the lighting unit. *Id.*, [0182].



Id., Figure 1.

52. Mueller discloses a number of alternative embodiments utilizing the general concepts disclosed therein in a variety of specific devices and settings. A POSITA would understand that the concepts discussed in the context of each of these embodiments are applicable to Mueller's other embodiments. Generally, employing these concepts across Mueller's embodiments would require only the alteration or addition of software code, a concept with which a POSITA would be familiar. A POSITA would thus be motivated, where required, to combine the teachings of Mueller's various embodiments with those of other embodiments.

2. Overview of Edwards

53. Edwards was filed as U.S. Patent Application No. 15/061,893 on March 4, 2016, and issued as U.S. Patent No. 9,743,010 on August 22, 2017. Edwards Claims priority to Provisional Application No. 62/128,392, filed March 4, 2015, and Provisional Application No. 62/264,673, filed December 8, 2015. I understand that this means that Edwards is prior art to the '101 Patent under at least 35 U.S.C. § 102(a)(2).

54. Edwards discloses a system and method for synchronizing LED light fixtures to digital camera shutters. EX1004, Abstract. The system controls the LEDs so that “changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame.” *Id.*

55. Edwards discloses that its lighting system can produce lighting effects, such as lightning, a camera flash, strobing, street light flicker, fire, and a candle, while compensating for rolling shutter artifacts. *Id.*, 3:18-28, 11:38-12:1. The lighting system includes “LED light fixtures” and a “lighting controller.” *Id.*, 5:18-51, 6:49-62. The lighting controller “can be included inside each individual LED light fixture” or in “an external third system which links all the lights together and coordinates the commands.” *Id.*, 6:57-62; *see also id.*, 7:20-8:1. A user can input a camera synchronization signal to the lighting controller, along with the “commands

that control the lights” and produce the effect. *Id.*, 5:18-24, 6:57-62, 7:20-8:1. The lighting controller compensates for the rolling shutter artifacts by holding commands to control the lights “until the next vertical frame synch pulse,” and then times any lighting transitions for each frame to “occur during the closed shutter period prior to the frame being captured by the camera.” *Id.*, 5:24-29.

56. In Edwards, the LEDs are synchronized to the camera shutter frequency, such that they are “on” while the camera shutter is open, and changes to the LED lighting, which would otherwise introduce undesired visual artifacts, occur only when the shutter is closed. *Id.*; *see also id.*, 1:25-30 (“The present invention is related to synchronization of changes in lighting to the camera shutter for videos and motion pictures. This enables all lighting transitions to be done between frames making the resulting frame image capture clean and free from artifacts that occur when lighting changes occur in the middle of a frame.”)

3. Motivation to Combine Mueller and Edwards

57. Mueller and Edwards are in the same field of art, namely entertainment lighting methods and systems. Mueller provides abundant disclosures regarding the control of lighting devices to produce a wide range of entertainment lighting effects, including light effects to be used in film and video recording. Mueller does not specifically provide significant disclosure relating to use of lighting controls to compensate for camera shutter speeds and frame rates to prevent the creation of

flicker or rolling shutter artifacts. As demonstrated by Edwards, however, the need for such controls, and the methods to carry them out, were well known as of the priority date of the '101 Patent. Knowing the necessity of such controls, a POSITA would have been motivated to supplement the disclosures of Mueller with known methods for preventing flicker and rolling shutter artifacts, such as those taught by Edwards.

4. Claim 1

58. It is my opinion that Mueller in view of Edwards renders Claim 1 obvious.

a. Claim Element 1p

59. Claim Element 1p recites “A method for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the method comprising:” EX1001, 11:59-62.

60. For the purposes of this declaration, I assume that the preamble of Claim 1, and the preambles of independent Claims 11 and 17, are limiting and must be considered for the purposes of evaluating the validity of these claims.

61. Regardless, Mueller in view of Edwards teaches Claim Element 1p.

62. Mueller describes a method for controlling a lighting device. In particular, Mueller describes “methods and systems for managing control instructions for a plurality of light systems.” EX1005, [0025]. Mueller specifically

describes a “**lighting unit 100** that may serve as a device in a lightning environment.” *Id.*, [0164] (emphasis added). Lightning unit 100 is controlled by a processor 102 that “may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources [within the lighting unit 100] so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.” *Id.*, [0170]; *see also id.* at [0182] (referring to user-selectable settings or functions that “generally controlling the light output of the lightning unit 100 . . .”).

63. Mueller further discloses that control of the lightning unit 100 includes producing user-customizable lightning effects. Specifically, Mueller describes “controlling the light output of lighting unit 100, **changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, changing and/or selecting various parameters of selected lighting effects**, [and] setting particular identifiers such as addresses or serial numbers for the lighting unit . . .” *Id.*, [0182] (emphasis added); *see also id.*, [0202] (“a lighting system user may want to generate a color changing effect that varies colors from one lighting unit 100 to another lighting unit 100, or across a number of the lighting units 100 in such a way as to generate the appearance of a propagating rainbow of colors (‘rainbow chase’), given a particular placement of lighting units 100 with respect to one another. In this example, the user may provide a simple instruction to the central controller 204 to

accomplish this”), [214] (“An explosion icon can be selected with a mouse-controlled cursor or other interface technique, which may prompt the user to click on a starting and ending point for the explosion in the coordinate system. By locating a vector in the representation, the user can cause an explosion to be initiated”).

64. Edwards discloses a method and system for “synchronizing one or more [LED] light fixtures to the shutters of one or more digital cameras and changing an intensity of the one or more lights while the shutter on each of the one or more cameras is closed.” EX1004, 1:44-49. The “LED lighting fixtures” are controlled with “changing of lighting [being] synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame,” producing user-customizable special effects, including “a simulated camera flash, lighting pattern or gun flash.” *Id.*, 3:18-28; *see also id.*, Abstract, 11:21-53, 14:60-15:3.

65. The “lighting systems have the benefit of being synchronized to the start of the frame. Therefore, a DMX³ command typically will not be implemented mid frame. This avoids the undesirable effect of half bright/half dark frames.” *Id.*, 11:19-12:1. By synchronizing to the start of a camera frame,

³ “DMX” is a standard communication protocol used in entertainment lighting to provide commands and data relating to lighting values and effects.

all lighting commands . . . are synchronized and changed during the closed shutter angle time slot. All frames have constant lighting with all changings occurring during the off shutter time. This also enables higher speed effects such as single frame gun shot or paparazzi flash, which cannot be reliably done without synchronizing lighting to the shutter.

Id.

66. It would have been obvious to a POSITA to apply Edwards's teachings to Mueller. Both references include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

b. Claim Element 1a

67. Claim Element 1a recites “calculating, using an effect simulator, a time varying lighting value;” EX1001, 11:63-64.

68. Mueller in view of Edwards teaches Claim Element 1a.

69. Mueller describes an effect simulator which performs calculations, namely a processor/controller. Specifically, Mueller describes that a processor 102 within lighting device 100 is configured to output at least one control signal for each light source 104 so as to independently control the intensity of light generated by each light source 104. EX1005, [0168].

70. Mueller further explains that the processor 102 calculates a time varying lighting value: “the processor 102 may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.” *Id.*, [0170]; *see also id.*, [0182] (“changing and/or selecting various parameters of selected lighting effects”).

71. In connection with a number of additional embodiments, Mueller further discloses the use of a processor as an effect simulator to calculate a time varying lighting value:

- “The program may be configured, for example to generate an array of lighting effects such as color-changing effects, stroboscopic effects, flashing effects, coordinated lighting effects, lighting effects coordinated with other media such as video or audio, color wash where ***the color changes in hue, saturation or intensity over a period of time***, ambient color generation, color fades, effects that simulate movement such as a color chasing rainbow, a flare streaking across a room, a sun rising, a plume from an explosion, other moving effects, and any other lighting effect consistent with the environment 602 and the lighting system 200.” *Id.*, [0215] (emphasis added);
- “By changing the coordinates in the configuration file, the real world lights can be mapped to the virtual world represented on the screen in a way that

allows them to reflect what is happening in the virtual environment. The developer can thus create time-based effects, such as an explosion.” *Id.*, [0242].

72. In connection with several embodiments, Mueller discusses the use of software, algorithms, and the like to calculate time varying lighting values. *See, e.g., id.*, [0063], [0064], [0170], [0172], [0178], [0205]-[0207], [0211], [0220], [0302], [0303]. A POSITA would have understood that such software or algorithms would provide processor 102 with the ability to calculate these dynamic lighting values.

73. A POSITA would have understood that the Mueller disclosed an effect simulator (processor 102) that could be programmed in a multitude of different ways, including to calculate a time-varying lighting value based on a recalled simulation parameter in the manner disclosed in multiple embodiments withing Mueller.

c. Claim Element 1b

74. Claim Element 1b recites

compensating for the rolling shutter artefacts produced by the camera, the time varying lighting value being calculated based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera,
a camera shutter speed of the camera, and
a camera frame rate of the camera;

EX1001, 11:65-12:7.

75. Mueller in view of Edwards teaches Claim Element 1b.

76. Edwards discloses compensating for rolling shutter artifacts by allowing a user to input parameters indicative of at least camera shutter speed and frame rate, in the form a camera synchronization signal. EX1004, Abstract, 1:44-49, 3:18-28, 11:19-12:1. The lighting controller, based on a user choosing to feed the camera sync signal to the controller, “preferably holds the commands until the next vertical *frame sync pulse*,” so that the “lighting transitions for each frame are preferably timed to occur during the *closed shutter period* prior to the frame being captured by the *camera*. In this way *lighting is stable throughout the frame* and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31 (emphasis added). By providing an input to synchronize lighting changes to the times when the camera shutter is closed and making all transitions between captured camera frames as described above, parameters of at least camera shutter speed and frame rate are accounted for in activating the LEDs.

77. Edwards further specifies that the “synchronization of changes in lighting to the camera shutter for videos and motion pictures . . . enables all lighting transitions to be done between frames making the resulting frame image capture clean and free from artifacts that occur when lighting changes occur in the middle of a frame.” EX1004, 1:25-30. “[T]he active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open. This ensures the lighting event is

captured cleanly on camera in that specific frame.” *Id.*, 4:47-54; *see also id.*, 3:18-28, 7:54-8:1, 11:33-12:1, 14:60-66, 15:46-17:10.

78. In addition, Edwards discloses that camera settings, including shutter speed, may be stored as part of commands sent to lighting devices, and recalled when implementing a lighting scheme. *Id.*, 7:33-8:1 (stating that camera settings, including “gamma, ISO, color settings, shutter speed, resolutions, etc., . . . could be stored and recalled for use in each scheme.”); *see also id.*, 15:13-16:5.

79. Moreover, Edwards discloses controlling the lights to avoid “the lighting chang[ing] mid frame [that] can cause artifacts and ruin the lighting setup,” *id.*, 8:37-40, through a “combination” of, for example, the following:

1. Sync signal: A smart sync signal can turn on the lighting scheme with a rising edge and turn it off with a falling edge. This is preferably carefully timed with frame capture on the camera to make sure the lighting and frame capture are cleanly synchronized.
2. Shutter angle: Motion picture cameras were developed for film that was advanced between each frame. Shutter angle refers to the amount of time used by the camera to advance the film between frame captures. The original camera angle was 180 degrees which equals 50% shutter closed and 50% shutter open. The shutter angle creates a cinematic “look” and is critical to making films that look like “movies”. Digital cameras have preserved this concept of shutter angle. There is a “shutter off” time in between each frame capture. This shutter off time needs to be indicated as part of the sync signal. In this solution the SYNC signal triggers the onset of the “shutter off time”. This gives the lighting time to change schemes before the frame capture occurs.
3. Pulse Width: In this mode a scheme memory setting is provided to the active lighting for “pulse width”. In this mode the light only stay on for the length of the pulse width setting. This would likely be a rising or falling edge trigger that fires once per frame. This method has the added advantage that it can be used for strobing action capture and also

can be used to reduce the total exposure time. This is an alternate way of dimming—using frame sync'd pulse width verses reduced light levels for the full frame. A 50% pulse width time duration is equal to a 50% reduction in light level for 100% of the frame.

Id., 8:40-9:6.

80. Camera shutter speed and frame rate define the period when the shutter is closed, and Edwards ensures that lighting transitions only take place when the shutter is closed, and no image is being captured. *Id.*; *see also supra* Claim elements 1p-1a. Thus, in Edwards, there is no image capture of the lighting transition itself, ensuring that there is also no capture of rolling shutter artifacts that would otherwise occur if lighting changes occurred mid-frame while the camera shutter was open.

81. Further, as explained above in the context of Claim Element 1p, a POSITA would have well understood the benefits of incorporating the method of Edwards to compensate for rolling shutter artifacts and would have understood how to do so. *See supra* Claim Element 1p.

d. Claim Element 1c

82. Claim Element 1c recites “outputting, from said effect simulator, said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for the rolling shutter artefacts.” EX1001, 12:8-11.

83. Mueller in view of Edwards teaches Claim Element 1c.

84. The lighting controller of Edwards holds commands to control the lights “until the next vertical frame sync pulse,” so that any lighting transitions for each frame are timed to “occur during the closed shutter period prior to the frame being captured by the camera.” EX1004, 5:24-29. The commands from the lighting controller are output to the lights, causing “changing of lighting [to] be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame.” *Id.*, 3:18-28. This synchronization is “extremely useful for simple visual effects such as a simulated camera flash, lighting pattern or gun flash.” *Id.*; *see also id.*, Abstract, 11:21-53.

85. Moreover, by using “synchronized lighting[,] the controller may in addition read a system time stamp and play a lighting ‘scrip’ or series of commands. This allows special effects and lighting timing to be replayed perfectly, synchronized across different takes.” *Id.*, 5:38-42. That is, the lighting controller outputs commands comprising time-varying lighting values to the LEDs to implement the cinematographer’s desired lighting schemes and special effects, with any lighting transitions synchronized to the camera shutter to compensate for rolling shutter artifacts. *See supra* Claim Elements 1a-1b.

86. For example,

[a]ll lights would wait for the rising edge of the sync signal to trigger turning on each scheme frame. At the falling edge the lights would all

turn off. At the next rising edge all lights would turn on the next sequential scheme. Each active light in the network or [] system will therefore recall the stored values for each of these schemes and replay them in order, sequentially in sync with the sync signal.

EX1004, 7:54-8:1; *see also id.*, 16:13-36.

87. By synchronizing lighting changes of the LEDs to times when the camera shutter is closed, the lighting schemes and lighting special effects are captured “clean and free from artifacts that occur when lighting changes occur in the middle of a frame.” *Id.*, 1:25-30; *see also supra* Claim Elements 1p-1b.

88. It would have been obvious to a POSITA to apply Edwards’s additional teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. Both include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

5. Claim 2

89. Claim 2 recites “The method according to claim 1, wherein the lighting effect comprises a short time-period (e.g. stroboscopic) lighting effect with a user adjustable minimum pulse width.” EX1001, 12:12-14.

90. It is my opinion that Mueller in view of Edwards renders Claim 2 obvious.

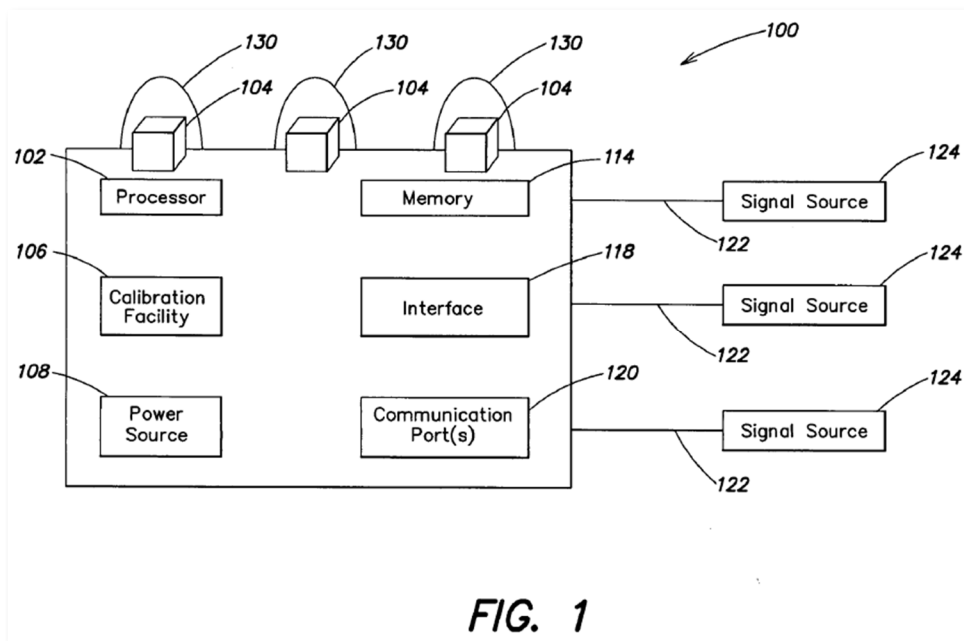
91. In connection with an embodiment in which multiple lighting devices 100 are employed together, Mueller describes a stroboscopic lighting effect. *See, e.g.,* EX1005, [0215]. (“The program may be configured, for example to generate an array of *lighting effects* such as color-changing effects, *stroboscopic effects*” (emphasis added)). Such stroboscopic effects are short time-period lighting effects. A POSITA would understand that this type of effect could be generated with a single lighting unit of Mueller as well as an embodiment employing multiple lighting units.

6. Claim 3

92. Claim 3 recites “The method according to claim 1 wherein the time varying lighting value is calculated so as to vary at a rate equivalent to at least one of: said camera recording frequency; and said camera frame rate.” EX1001, 12:15-18.

93. It is my opinion that Mueller in view of Edwards renders Claim 3 obvious.

94. Mueller discloses that the lighting unit 100 described therein “may be configured to receive one or more signals 122 from one or more other signal sources 124.” EX1005, [0185]; *see also id.*, Figure 1.



Id., Figure 1. Mueller further explains that these signals 122 can be used by the processor 102, “either alone or in combination with other control signals (e.g., signals generated by executing a lighting program), to control one or more of the light sources 104 . . . in connection with the interface 118.” *Id.*, [0185]. Mueller discloses that the signal source 124 can be, among other things, a camera. *Id.*, [0187], [0188].

95. A POSITA as of the priority date of the '101 Patent would have understood the advantages of lighting unit 100 receiving signals such as camera recording frequency and camera frame rate as the signals 122 received from a camera

as a signal source 124. Such information would enable the lighting system to operate in a way that avoids flicker or other undesired effects that can result from dynamic lighting effects that are executed without utilizing such data from a camera. A POSITA would understand how to use such data from a camera to avoid the production of such undesired effects. That such techniques used to prevent flicker artifacts were well known in the art is demonstrated by, among other things, Edwards.

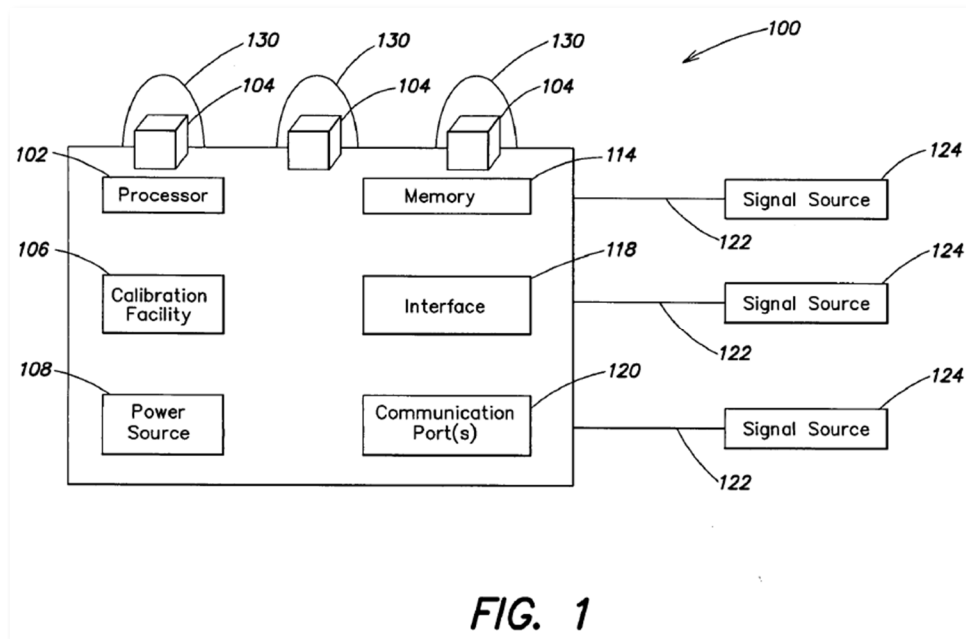
96. Edwards's lighting controller, based on the received camera "sync signal," calculates the lighting control signals so that they vary at a rate equivalent to the camera shutter speed and frame rate. *See supra* Claim Element 1b. Varying the lighting values so that the pulse width of the light, which is the amount of time the light is "on," is matched to the camera shutter speed and camera frame rate. *Id.*

7. Claim 4

97. Claim 4 recites "The method according to claim 1, further comprising matching a minimum pulse width of the time varying lighting value to a member of the group consisting of: said camera recording frequency of the camera; said camera shutter speed of the camera; and said camera frame rate of the camera." EX1001, 12:19-24.

98. It is my opinion that Mueller in view of Edwards renders Claim 4 obvious.

99. Mueller discloses that the lighting unit 100 described therein “may be configured to receive one or more signals 122 from one or more other signal sources 124.” EX1005, [0185]; *see also id.*, Figure 1.



Id., Figure 1. Mueller further explains that these signals 122 can be used by the processor 102, “either alone or in combination with other control signals (e.g., signals generated by executing a lighting program), to control one or more of the light sources 104 . . . in connection with the interface 118.” *Id.*, [0185]. Mueller discloses that the signal source 124 can be, among other things, a camera. *Id.*, [0187], [0188].

100. A POSITA as of the priority date of the '101 Patent would have understood the advantages of lighting unit 100 receiving signals such as camera recording frequency, camera shutter speed, and camera frame rate as the signals 122

received from a camera as a signal source 124. Such information would enable the lighting system to operate in a way that avoids flicker or other undesired effects that can result from dynamic lighting effects that are executed without utilizing such data from a camera. A POSITA would understand how to use such data from a camera to avoid the production of such undesired effects. That such techniques used to prevent flicker artifacts were well known in the art is demonstrated by, among other things, Edwards.

101. Edwards's lighting controller, based on the received camera "sync signal," calculates the lighting control signals so that they vary at a rate equivalent to the camera shutter speed and frame rate. *See supra* Claim Element 1b. Varying the lighting values so that the pulse width of the light, which is the amount of time the light is "on," is matched to the camera shutter speed and camera frame rate. *Id.*

102. The minimum pulse width or duration of the light, which is the amount of time the light is "on," is controlled based on the camera shutter speed and frame rate. *See supra* Claim Element 1b. For example, "the changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame." EX1004, 3:18-28; *see also id.*, Abstract, 1:25-48, 3:18-28, 4:47-52, 11:19-12:1. The lighting controller "holds the commands until the next vertical frame sync pulse," so that the "lighting transitions for each frame are preferably timed to occur during the

closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31. That is, the lights are changed (or varied) only when the camera shutter is closed, so that they are “on” when the camera shutter is open, and all captured frames are complete and without visual artifacts. *Id.*; *see also supra* Claim Elements 1a-1b.

8. Claim 5

103. Claim 5 recites “The method according to claim 1, wherein said user input of said user selectable parameter comprises a user selecting the at least one user input simulation parameter, via a user interface.” EX1001, 12:25-28.

104. It is my opinion that Mueller in view of Edwards renders Claim 5 obvious.

105. Mueller states that the interface 118 can present a graphical user interface to a user for controlling the lighting unit 100. EX1005, [0182]. Mueller thus discloses user input through the interface 118.

106. Mueller further describes that the interface 118 can enable a user to both “chang[e] and/or select[] various pre-programmed lighting effects to be generated by the lighting unit” and “***chang[e] and/or select[] various parameters*** of selected lighting effects.” *Id.* (emphasis added).

107. Mueller also discloses that the interface 118 “may be coupled . . . to a computer that provides a graphical user interface to a user for controlling the lighting unit 100.” *Id.*

9. Claim 6

108. Claim 6 recites “The method according to claim 1, wherein the lighting effect is designed to mimic at least one of fire; lightning; police car light; television; a neon flickering sign; a candle; muzzle (gunshot); welding; spark/short circuit; a scan (e.g. fingerprint scanner); paparazzi flashes; fireworks; flashes (strobe); a propeller; a (nuclear) explosion; and a wormhole.” EX1001, 12:29-34.

109. It is my opinion that Mueller in view of Edwards renders Claim 6 obvious.

110. In connection with an embodiment in which multiple lighting devices 100 are employed together, Mueller discloses a number of user customizable lighting effects included in the list comprising Claim 7, including a fire EX1005, [0221], an explosion, *id.*, [0215], flashes, *id.*, “and many others,” *id.*, [0221]. A POSITA would understand that these types of effects could be generated with a single lighting unit of Mueller as well as an embodiment employing multiple lighting units.

10. Claim 7

111. Claim 7 recites “The method according to claim 1, wherein the lighting value comprises at least one of: brightness; and colour data.” EX1001, 12:35-36.

112. It is my opinion that Mueller in view of Edwards renders Claim 7 obvious.

113. Mueller includes multiple disclosures of lighting values which comprises brightness/intensity and/or color data. For instance, Mueller states that “the processor 102 may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources so as to **generate** a variety of static or **time-varying (dynamic) multi-color** (or multi-color temperature) lighting effects.” EX1005, [0170] (emphasis added).) Mueller also states that processor 102 can be “configured to output one or more control signals to drive the light sources 104 so as to generate various intensities of light from the light sources 104.” *Id.*, [0168].

11. Claim 8

114. Claim 8 recites “The method according to claim 7, further comprising converting said at least one of: brightness; and colour data into lighting signals and outputting the lighting signal data.” EX1001, 12:37-39.

115. It is my opinion that Mueller in view of Edwards renders Claim 8 obvious.

116. Mueller includes multiple disclosures of lighting values which comprises brightness/intensity and/or color data. For instance, Mueller states that “the processor 102 may be particularly configured (e.g., programmed) to provide

control signals to one or more of the light sources so as to **generate** a variety of static or **time-varying (dynamic) multi-color** (or multi-color temperature) lighting effects.” EX1005, [0170] (emphasis added).) Mueller also states that processor 102 can be “configured to output one or more control signals to drive the light sources 104 so as to generate various intensities of light from the light sources 104.” *Id.*, [0168].

117. Mueller also discloses converting at least one of brightness and color data into a lighting signal and outputting that lighting signal to the light source(s) of lighting unit 100. Specifically, Mueller discloses that a user may interact with one or more interfaces 118, which are provided “to facilitate any of a number of user-selectable settings or functions (e.g., . . . changing and/or selecting various parameters of selected lighting effects)” EX1005, [0182]. Mueller further explains that the processor 102 “controls one or more light sources 104” based at least in part on user signals provided through interface 118. *Id.*, [0183]. Such control is the result of the processor being configured “to respond to operation of the interface 118 by originating one or more control signals for controlling one or more of the light sources 104.” *Id.*

12. Claim 9

118. Claim 9 recites “The method according to claim 1 further comprising storing said at least one user input simulation parameter corresponding to said user customisable lighting effect.” EX1001, 12:40-42.

119. It is my opinion that Mueller in view of Edwards renders Claim 9 obvious.

120. Mueller describes, associated with the processor disclosed therein, “one or more storage media generically referred to . . . as ‘memory[.]’” EX1005, [0064]. “[T]he storage media may be encoded with one or more programs that, when executed on one or more processors, perform at least some of the functions discussed herein.” *Id.* Mueller describes such functions as including, “generally controlling the light output of the lighting unit 100, changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, changing and/or selecting *various parameters of selected lighting effects*, setting particular identifiers such as addresses or serial numbers for the lighting unit. *Id.*, [0182] (emphasis added).

121. Mueller further provides that

[t]he lighting unit 100 also may include a *memory* 114 to *store* various information. For example, the memory 114 may be employed to *store one or more lighting programs* for execution by the processor 102 (e.g., to generate one or more control signals for the lights sources, as well as various types of data useful for generating variable color radiation

Id. (emphasis added).

122. A POSITA would understand that a lighting program stored in memory
114 could include a user input simulation parameter depending on a selected lighting
effect to be simulated. This is particularly true because, in connection with another
embodiment, Mueller describes storing at least one simulation parameter in memory:
“the lighting control interface allows for the storage and downloading of new
functions and new parameter settings.” EX1005, [0380].

13. Claim 10

123. Claim 10 recites “The method according to claim 1, wherein the
controlling is for a lighting system for at least one of: videography, broadcast,
cinematography, studio filming and location filming.” EX1001, 12:43-46.

124. It is my opinion that Mueller in view of Edwards renders Claim 10
obvious.

125. Mueller explains that the systems described therein can be used in a
variety of contexts and locations, including “a film studio, [and] a video studio.”
EX1004, [0034]. A POSITA would understand that the lighting systems and methods
described in Mueller could be used in a number of entertainment settings, including
videography, broadcast, cinematography, studio filming, and/or location filming.

14. Claim 11

126. It is my opinion that Mueller in view of Edwards renders Claim 11 obvious.

a. Claim Element 11p

127. The preamble of Claim 11, designated Claim Element 11p herein, recites “A controller adapted to control a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the controller comprising:” EX1001, 12:47-50.

128. For the purposes of this Declaration, I assume that the preamble of Claim 11 is limiting and must be considered for the purposes of evaluating the validity of the claim.

129. Regardless, Mueller in view of Edwards teaches Claim Element 11p.

130. Mueller discloses that the method of Claim 1 is implemented on a system that includes the lighting unit 100 as controlled by processor 102, which functions as a controller that is adapted to control a lighting device to produce user customizable lighting effects. *See supra* Claim 1.

131. The controller of Mueller functions to enable “methods and systems for managing control instructions for a plurality of light systems.” EX1005, [0025]. Mueller specifically describes a “**lighting unit 100** that may serve as a device in a lightning environment.” *Id.*, [0164] (emphasis added). Lightning unit 100 is

controlled by a processor 102 that “may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources [within the lighting unit 100] so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.” *Id.*, [0170]; *see also id.* at [0182] (referring to user-selectable settings or functions that “generally controlling the light output of the lightning unit 100 . . .”).

132. Mueller further discloses that control of the lightning unit 100 includes producing user-customizable lightning effects. Specifically, Mueller describes “controlling the light output of lighting unit 100, ***changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, changing and/or selecting various parameters of selected lighting effects***, [and] setting particular identifiers such as addresses or serial numbers for the lighting unit” *Id.*, [0182] (emphasis added); *see also id.*, [0202] (“a lighting system user may want to generate a color changing effect that varies colors from one lighting unit 100 to another lighting unit 100, or across a number of the lighting units 100 in such a way as to generate the appearance of a propagating rainbow of colors (‘rainbow chase’), given a particular placement of lighting units 100 with respect to one another. In this example, the user may provide a simple instruction to the central controller 204 to accomplish this”), [214] (“An explosion icon can be selected with a mouse-controlled cursor or other interface technique, which may prompt the user to click

on a starting and ending point for the explosion in the coordinate system. By locating a vector in the representation, the user can cause an explosion to be initiated”).

133. It would have been obvious to a POSITA to apply Edwards’s additional teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. Both include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

b. Claim Element 11a

134. Claim Element 11a recites “an effect simulator adapted to calculate a time varying lighting value”. EX1001, 12:51-52.

135. Mueller in view of Edwards teaches Claim Element 11a.

136. Mueller describes an effect simulator which performs calculations, namely a processor/controller. Specifically, Mueller describes that a processor 102 within lighting device 100 is configured to output at least one control signal for each light source 104 so as to independently control the intensity of light generated by each light source 104. EX1005, [0168].

137. Mueller further explains that the processor 102 calculates a time varying lighting value: “the processor 102 may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.” *Id.*, [0170]; *see also id.*, [0182] (“changing and/or selecting various parameters of selected lighting effects”).

138. In connection with a number of additional embodiments, Mueller further discloses the use of a processor as an effect simulator to calculate a time varying lighting value:

- “The program may be configured, for example to generate an array of lighting effects such as color-changing effects, stroboscopic effects, flashing effects, coordinated lighting effects, lighting effects coordinated with other media such as video or audio, color wash where ***the color changes in hue, saturation or intensity over a period of time***, ambient color generation, color fades, effects that simulate movement such as a color chasing rainbow, a flare streaking across a room, a sun rising, a plume from an explosion, other moving effects, and any other lighting effect consistent with the environment 602 and the lighting system 200.” *Id.*, [0215] (emphasis added);
- “By changing the coordinates in the configuration file, the real world lights can be mapped to the virtual world represented on the screen in a way that

allows them to reflect what is happening in the virtual environment. The developer can thus create time-based effects, such as an explosion.” *Id.*, [0242].

139. In connection with several embodiments, Mueller discusses the use of software, algorithms, and the like to calculate time varying lighting values. *See, e.g., id.*, [0063], [0064], [0170], [0172], [0178], [0205]-[0207], [0211], [0220], [0302], [0303]. A POSITA would have understood that such software or algorithms would provide processor 102 with the ability to calculate these dynamic lighting values.

140. A POSITA would have understood that the Mueller disclosed an effect simulator (processor 102) that could be programmed in a multitude of different ways, including to calculate a time-varying lighting value based on a recalled simulation parameter in the manner disclosed in multiple embodiments withing Mueller.

c. Claim Element 11b

141. Claim Element 11b recites

compensating for the rolling shutter artefacts produced by the camera based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera;
a camera shutter speed of the camera; and
a camera frame rate of the camera; and

EX1001, 12:52-60.

142. Mueller in view of Edwards teaches Claim Element 11b.

143. Edwards discloses compensating for rolling shutter artifacts by allowing a user to input parameters indicative of at least camera shutter speed and frame rate, in the form a camera synchronization signal. EX1004, Abstract, 1:44-49, 3:18-28, 11:19-12:1. The lighting controller, based on a user choosing to feed the camera sync signal to the controller, “preferably holds the commands until the next vertical *frame sync pulse*,” so that the “lighting transitions for each frame are preferably timed to occur during the *closed shutter period* prior to the frame being captured by the *camera*. In this way *lighting is stable throughout the frame* and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31 (emphasis added). By providing an input to synchronize lighting changes to the times when the camera shutter is closed and making all transitions between captured camera frames as described above, parameters of at least camera shutter speed and frame rate are accounted for in activating the LEDs.

144. Edwards further specifies that the “synchronization of changes in lighting to the camera shutter for videos and motion pictures . . . enables all lighting transitions to be done between frames making the resulting frame image capture clean and free from artifacts that occur when lighting changes occur in the middle of a frame.” EX1004, 1:25-30. “[T]he active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open. This ensures the lighting event is

captured cleanly on camera in that specific frame.” *Id.*, 4:47-54; *see also id.*, 3:18-28, 7:54-8:1, 11:33-12:1, 14:60-66, 15:46-17:10.

145. In addition, Edwards discloses that camera settings, including shutter speed, may be stored as part of commands sent to lighting devices, and recalled when implementing a lighting scheme. *Id.*, 7:33-8:1 (stating that camera settings, including “gamma, ISO, color settings, shutter speed, resolutions, etc., . . . could be stored and recalled for use in each scheme.”); *see also id.*, 15:13-16:5.

146. Moreover, Edwards discloses controlling the lights to avoid “the lighting chang[ing] mid frame [that] can cause artifacts and ruin the lighting setup,” *id.*, 8:37-40, through a “combination” of, for example, the following:

1. Sync signal: A smart sync signal can turn on the lighting scheme with a rising edge and turn it off with a falling edge. This is preferably carefully timed with frame capture on the camera to make sure the lighting and frame capture are cleanly synchronized.
2. Shutter angle: Motion picture cameras were developed for film that was advanced between each frame. Shutter angle refers to the amount of time used by the camera to advance the film between frame captures. The original camera angle was 180 degrees which equals 50% shutter closed and 50% shutter open. The shutter angle creates a cinematic “look” and is critical to making films that look like “movies”. Digital cameras have preserved this concept of shutter angle. There is a “shutter off” time in between each frame capture. This shutter off time needs to be indicated as part of the sync signal. In this solution the SYNC signal triggers the onset of the “shutter off time”. This gives the lighting time to change schemes before the frame capture occurs.
3. Pulse Width: In this mode a scheme memory setting is provided to the active lighting for “pulse width”. In this mode the light only stay on for the length of the pulse width setting. This would likely be a rising or falling edge trigger that fires once per frame. This method has the added advantage that it can be used for strobing action capture and also

can be used to reduce the total exposure time. This is an alternate way of dimming—using frame sync'd pulse width verses reduced light levels for the full frame. A 50% pulse width time duration is equal to a 50% reduction in light level for 100% of the frame.

Id., 8:40-9:6.

147. Camera shutter speed and frame rate define the period when the shutter is closed, and Edwards ensures that lighting transitions only take place when the shutter is closed, and no image is being captured. *Id.*; *see also supra* Claim elements 1p-1a. Thus, in Edwards, there is no image capture of the lighting transition itself, ensuring that there is also no capture of rolling shutter artifacts that would otherwise occur if lighting changes occurred mid-frame while the camera shutter was open.

d. Claim Element 11c

148. Claim Element 11c recites “wherein the effect simulator is adapted to output said calculated time varying lighting value to the lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.” EX1001, 12:61-64.

149. Mueller in view of Edwards teaches Claim Element 11c.

150. Mueller describes the outputting a time varying lighting value to simulate a selected lighting effect, as it explains that “processor 102 . . . is configured to output one or more control signals to drive the light sources 104 so as to generate various intensities of light from the light sources 104. EX1005, [0168]. Mueller

further discloses that “the processor 102 may be particularly configured (e.g., programmed) to provide controls signals to one or more of the light sources so as to generate a variety of static or *time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.*” *Id.*, [0170] (emphasis added).

151. Again, Mueller offers multiple disclosures of outputting a time varying lighting value to a lighting device, as it describes, for instance, a “simulation window 4970 [that] can be used to *display a simulation of any effect selected by the user*” *Id.*, [0304].

152. It would have been obvious to a POSITA to apply Edwards’s additional teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. Both include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

15. Claim 12

153. Claim 12 recites “The controller according to claim 11, wherein the controller is adapted to control a plurality of lighting devices in dependence on the time varying lighting value.” EX1001, 12:65-67.

154. It is my opinion that Mueller in view of Edwards renders Claim 12 obvious.

155. Mueller describes processor 102 controlling a plurality of LEDs to produce a user desired output, i.e., lighting conditions. EX1005, [0170]-[0171]. In particular, Mueller describes that “the lighting unit 100 may include *a wide variety of colors of LEDs* in various combinations Such combinations of *differently colored LEDs in the lighting unit 100* can facilitate accurate reproduction of a *host of desirable spectrums of lighting conditions.*” *Id.*, [0171] (emphasis added).

16. Claim 13

156. Claim 13 recites “The controller according to claim 11, wherein the controller comprises an input interface adapted to receive a user input, and wherein the input interface comprises at least one of: a wireless communication interface; a dial; a slider; a display; and buttons.” EX1001, 13:1-5.

157. It is my opinion that Mueller in view of Edwards renders Claim 13 obvious.

158. Mueller discloses an input interface in the form of interface 118. EX1005, [0182]. Mueller further provides that “[t]he interface 118 may present external controls that are, for example, physical controls such as switches, dials, buttons, or the like, programmatic controls, such as an application programming

interface, or a user interface such as a graphical user interface on a computer.” *Id.*, [0182].

159. Mueller goes on to explain that “the interface 118 may simply present a network interface that may be accessed through any corresponding network facility and may be coupled in turn to a computer that provides a graphical user interface to a user for controlling the lighting unit 100.” *Id.*

160. Mueller further discloses the manner in which lighting unit 100 can be wirelessly networked with other devices through “communication ports 120” which are interfaces for communication with other lighting devices. *Id.*, [0190] (“the lighting unit 100 may include one or more communication ports 120 to facilitate coupling of the lighting unit 100 to any of a variety of other devices . . . the communication port 120 may include an interface for any suitable wireless communications”), Figure 1.

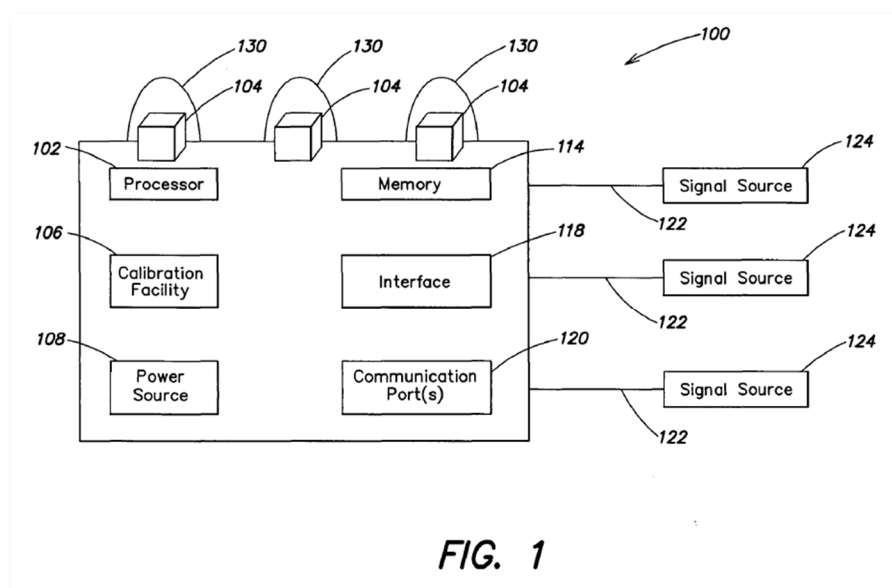


FIG. 1

Id., Figure 1.

161. Mueller explains that the communication port(s) 120 can be integrated into the processor 102, as it describes that “any of the components discussed above, such as the signal sources 124, interfaces 118, communication ports 120, and other components . . . either as stand alone components, integrated components or shared components” can be flexibly configured to be included with processor 102. *Id.*, [0198].

17. Claim 14

162. Claim 14 recites “The controller according to claim 11, further comprising a converter adapted to convert at least one of: brightness; and colour data from the simulator into lighting signals.” EX1001, 13:6-9.

163. It is my opinion that Mueller in view of Edwards renders Claim 14 obvious.

164. Mueller includes multiple disclosures of lighting values which comprises brightness/intensity and/or color data. For instance, Mueller states that “the processor 102 may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources so as to **generate** a variety of static or **time-varying (dynamic) multi-color** (or multi-color temperature) lighting effects.” EX1005, [0170] (emphasis added).) Mueller also states that processor 102 can be “configured to output one or more control signals to drive the light sources

104 so as to generate various intensities of light from the light sources 104.” *Id.*, [0168].

165. Mueller also discloses converting at least one of brightness and color data into a lighting signal and outputting that lighting signal to the light source(s) of lighting unit 100. Specifically, Mueller discloses that a user may interact with one or more interfaces 118, which are provided “to facilitate any of a number of user-selectable settings or functions (e.g., . . . changing and/or selecting various parameters of selected lighting effects . . .).” EX1005, [0182]. Mueller further explains that the processor 102 “controls one or more light sources 104” based at least in part on user signals provided through interface 118. *Id.*, [0183]. Such control is the result of the processor being configured “to respond to operation of the interface 118 by originating one or more control signals for controlling one or more of the light sources 104.” *Id.*

18. Claim 15

166. Claim 15 recites “The lighting system comprising a controller according to claim 11 and at least one lighting device; wherein said lighting device comprises at least one light emitting diode.” EX1001, 13:10-12.

167. It is my opinion that Mueller in view of Edwards renders Claim 15 obvious.

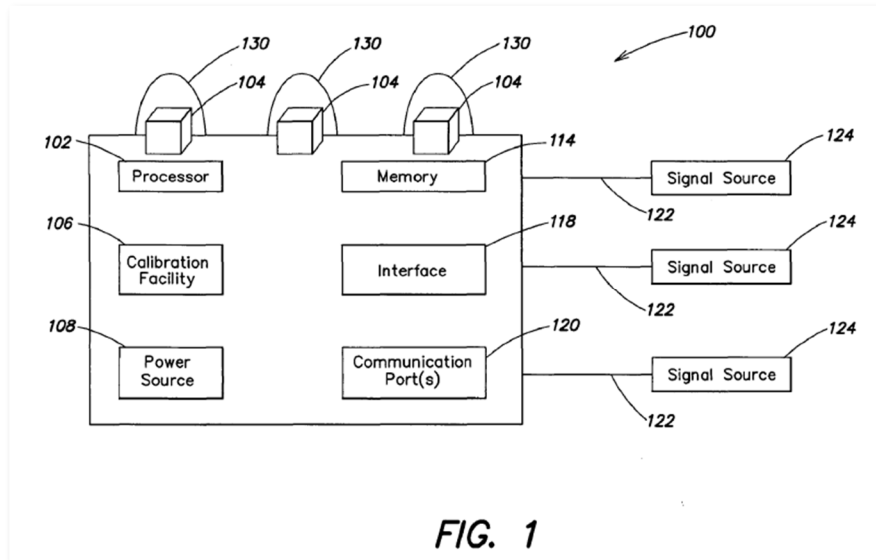
168. Mueller discloses that the lighting device (lighting unit 100) comprises one or more light sources 104, and that those light sources 104 may be light emitting diodes (LEDs). EX1004, [0167] (“The lighting unit 100 may include one or more light sources 104, wherein one or more of the light sources may be an LED-based light source that includes one or more light emitting diodes (LEDs).”).

19. Claim 16

169. Claim 16 recites “The lighting system according to claim 15 wherein said controller and said lighting device are integrated in a combined unit.” EX1001, 13:13-15.

170. It is my opinion that Mueller in view of Edwards renders Claim 16 obvious.

171. Mueller explains that processor 102, input interface 118, memory 114, and light sources 104 are integrated in a combined unit: lighting unit 100. EX1004, [0168], Figure 1.



Id., Figure 1.

20. Claim 17

172. It is my opinion that Mueller in view of Edwards renders Claim 17 obvious.

a. Claim Element 17p

173. The preamble of Claim 17, designated Claim Element 17p herein, recites “A computer program comprising software code for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the computer program adapted to perform, when executed, the steps of:” EX1001, 13:16-20.

174. For purposes of this Declaration, I assume that the preamble of Claim 17 is limiting and must be considered for the purposes of evaluating the validity of the claim.

175. Regardless, Mueller in view of Edwards teaches Claim Element 17p.

176. Mueller discloses the method of Claim 1 can be performed by a “software program” as in Claim 17. Mueller discloses that, “[i]n some implementations [of the methods and systems described therein], the storage media may be encoded with one or more programs that, when executed on one or more processors, perform at least some of the functions discussed herein.” EX1004, [0064]. Mueller further provides that “[t]he terms ‘program’ and ‘computer program’ are used herein in a generic sense to refer to any type of computer code (e.g., high or low level software, microcode, and so on) that can be employed to control operation of a processor.” (*Id.*) A POSITA would thus understand that the control of lighting systems and methods disclosed in Mueller is via the processor’s execution of software code.

177. Mueller describes a method for controlling a lighting device. In particular, Mueller describes “methods and systems for managing control instructions for a plurality of light systems.” EX1005, [0025]. Mueller specifically describes a “**lighting unit 100** that may serve as a device in a lightning environment.” *Id.*, [0164] (emphasis added). Lightning unit 100 is controlled by a processor 102 that “may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources [within the lighting unit 100] so as to generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature)

lighting effects.” *Id.*, [0170]; *see also id.* at [0182] (referring to user-selectable settings or functions that “generally controlling the light output of the lightning unit 100 . . .”).

178. Mueller further discloses that control of the lightning unit 100 includes producing user-customizable lightning effects. Specifically, Mueller describes “controlling the light output of lighting unit 100, ***changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, changing and/or selecting various parameters of selected lighting effects***, [and] setting particular identifiers such as addresses or serial numbers for the lighting unit . . .” *Id.*, [0182] (emphasis added); *see also id.*, [0202] (“a lighting system user may want to generate a color changing effect that varies colors from one lighting unit 100 to another lighting unit 100, or across a number of the lighting units 100 in such a way as to generate the appearance of a propagating rainbow of colors (‘rainbow chase’), given a particular placement of lighting units 100 with respect to one another. In this example, the user may provide a simple instruction to the central controller 204 to accomplish this”), [214] (“An explosion icon can be selected with a mouse-controlled cursor or other interface technique, which may prompt the user to click on a starting and ending point for the explosion in the coordinate system. By locating a vector in the representation, the user can cause an explosion to be initiated”).

179. It would have been obvious to a POSITA to apply Edwards’s additional teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. Both include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

b. Claim Element 17a

180. Claim Element 17a recites “calculating, using an effect simulator, a time varying lighting value”. EX1001, 13:21-22.

181. Mueller in view of Edwards teaches Claim Element 17a.

182. Mueller describes an effect simulator which performs calculations, namely a processor/controller. Specifically, Mueller describes that a processor 102 within lighting device 100 is configured to output at least one control signal for each light source 104 so as to independently control the intensity of light generated by each light source 104. EX1005, [0168].

183. Mueller further explains that the processor 102 calculates a time varying lighting value: “the processor 102 may be particularly configured (e.g., programmed) to provide control signals to one or more of the light sources so as to

generate a variety of static or time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.” *Id.*, [0170]; *see also id.*, [0182] (“changing and/or selecting various parameters of selected lighting effects”).

184. In connection with a number of additional embodiments, Mueller further discloses the use of a processor as an effect simulator to calculate a time varying lighting value:

- “The program may be configured, for example to generate an array of lighting effects such as color-changing effects, stroboscopic effects, flashing effects, coordinated lighting effects, lighting effects coordinated with other media such as video or audio, color wash where ***the color changes in hue, saturation or intensity over a period of time***, ambient color generation, color fades, effects that simulate movement such as a color chasing rainbow, a flare streaking across a room, a sun rising, a plume from an explosion, other moving effects, and any other lighting effect consistent with the environment 602 and the lighting system 200.” *Id.*, [0215] (emphasis added);
- “By changing the coordinates in the configuration file, the real world lights can be mapped to the virtual world represented on the screen in a way that allows them to reflect what is happening in the virtual environment. The developer can thus create time-based effects, such as an explosion.” *Id.*, [0242].

185. In connection with several embodiments, Mueller discusses the use of software, algorithms, and the like to calculate time varying lighting values. *See, e.g., id.*, [0063], [0064], [0170], [0172], [0178], [0205]-[0207], [0211], [0220], [0302], [0303]. A POSITA would have understood that such software or algorithms would provide processor 102 with the ability to calculate these dynamic lighting values.

186. A POSITA would have understood that the Mueller disclosed an effect simulator (processor 102) that could be programmed in a multitude of different ways, including to calculate a time-varying lighting value based on a recalled simulation parameter in the manner disclosed in multiple embodiments withing Mueller.

c. Claim Element 17b

187. Claim Element 17b recites

compensating for the rolling shutter artefacts based on at least one user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera,
a camera shutter speed of the camera, and
a camera frame rate of the camera; and

EX1001, 13:22-14:3.

188. Mueller in view of Edwards teaches Claim Element 17b.

189. Edwards discloses compensating for rolling shutter artifacts by allowing a user to input parameters indicative of at least camera shutter speed and frame rate, in the form a camera synchronization signal. EX1004, Abstract, 1:44-49,

3:18-28, 11:19-12:1. The lighting controller, based on a user choosing to feed the camera sync signal to the controller, “preferably holds the commands until the next vertical *frame sync pulse*,” so that the “lighting transitions for each frame are preferably timed to occur during the *closed shutter period* prior to the frame being captured by the *camera*. In this way *lighting is stable throughout the frame* and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31 (emphasis added). By providing an input to synchronize lighting changes to the times when the camera shutter is closed and making all transitions between captured camera frames as described above, parameters of at least camera shutter speed and frame rate are accounted for in activating the LEDs.

190. Edwards further specifies that the “synchronization of changes in lighting to the camera shutter for videos and motion pictures . . . enables all lighting transitions to be done between frames making the resulting frame image capture clean and free from artifacts that occur when lighting changes occur in the middle of a frame.” EX1004, 1:25-30. “[T]he active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open. This ensures the lighting event is captured cleanly on camera in that specific frame.” *Id.*, 4:47-54; *see also id.*, 3:18-28, 7:54-8:1, 11:33-12:1, 14:60-66, 15:46-17:10.

191. In addition, Edwards discloses that camera settings, including shutter speed, may be stored as part of commands sent to lighting devices, and recalled when implementing a lighting scheme. *Id.*, 7:33-8:1 (stating that camera settings, including “gamma, ISO, color settings, shutter speed, resolutions, etc., . . . could be stored and recalled for use in each scheme.”); *see also id.*, 15:13-16:5.

192. Moreover, Edwards discloses controlling the lights to avoid “the lighting chang[ing] mid frame [that] can cause artifacts and ruin the lighting setup,” *id.*, 8:37-40, through a “combination” of, for example, the following:

1. Sync signal: A smart sync signal can turn on the lighting scheme with a rising edge and turn it off with a falling edge. This is preferably carefully timed with frame capture on the camera to make sure the lighting and frame capture are cleanly synchronized.
2. Shutter angle: Motion picture cameras were developed for film that was advanced between each frame. Shutter angle refers to the amount of time used by the camera to advance the film between frame captures. The original camera angle was 180 degrees which equals 50% shutter closed and 50% shutter open. The shutter angle creates a cinematic “look” and is critical to making films that look like “movies”. Digital cameras have preserved this concept of shutter angle. There is a “shutter off” time in between each frame capture. This shutter off time needs to be indicated as part of the sync signal. In this solution the SYNC signal triggers the onset of the “shutter off time”. This gives the lighting time to change schemes before the frame capture occurs.
3. Pulse Width: In this mode a scheme memory setting is provided to the active lighting for “pulse width”. In this mode the light only stay on for the length of the pulse width setting. This would likely be a rising or falling edge trigger that fires once per frame. This method has the added advantage that it can be used for strobing action capture and also can be used to reduce the total exposure time. This is an alternate way of dimming—using frame sync'd pulse width verses reduced light levels for the full frame. A 50% pulse width time duration is equal to a 50% reduction in light level for 100% of the frame.

Id., 8:40-9:6.

193. Camera shutter speed and frame rate define the period when the shutter is closed, and Edwards ensures that lighting transitions only take place when the shutter is closed, and no image is being captured. *Id.*; *see also supra* Claim elements 1p-1a. Thus, in Edwards, there is no image capture of the lighting transition itself, ensuring that there is also no capture of rolling shutter artifacts that would otherwise occur if lighting changes occurred mid-frame while the camera shutter was open.

d. Claim Element 17c

194. Claim Element 17c recites “wherein the effect simulator is adapted to output, from said effect simulator, said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.” EX1001, 14:4-8.

195. Mueller in view of Edwards teaches Claim Element 17c.

196. Mueller describes the outputting a time varying lighting value to simulate a selected lighting effect, as it explains that “processor 102 . . . is configured to output one or more control signals to drive the light sources 104 so as to generate various intensities of light from the light sources 104. EX1005, [0168]. Mueller further discloses that “the processor 102 may be particularly configured (e.g., programmed) to provide controls signals to one or more of the light sources so as to

generate a variety of static or *time-varying (dynamic) multi-color (or multi-color temperature) lighting effects.*” *Id.*, [0170] (emphasis added).

197. Again, Mueller offers multiple disclosures of outputting a time varying lighting value to a lighting device, as it describes, for instance, a “simulation window 4970 [that] can be used to *display a simulation of any effect selected by the user*” *Id.*, [0304].

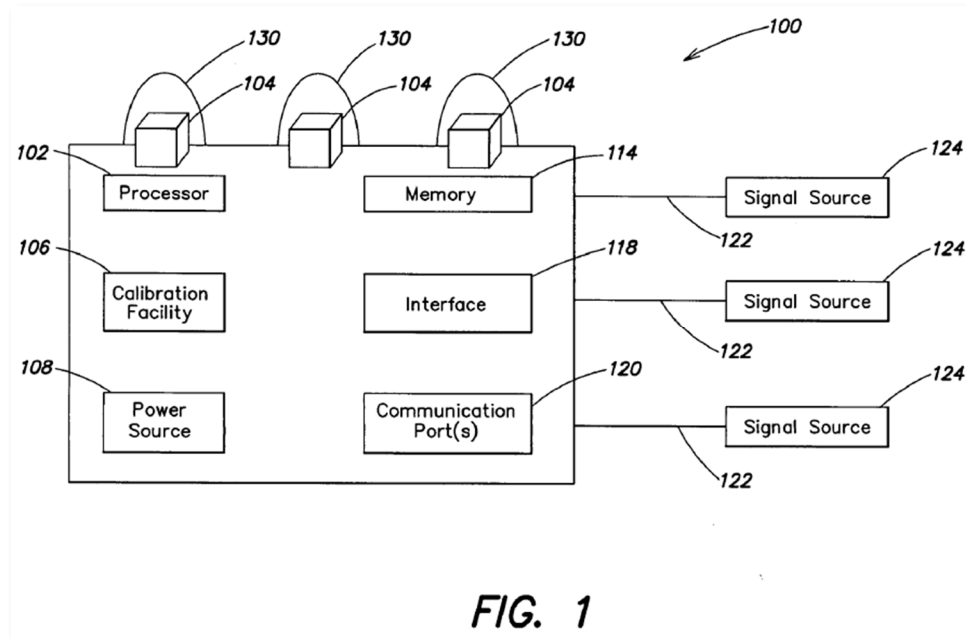
198. It would have been obvious to a POSITA to apply Edwards’s additional teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. Both include controllers allowing a user to select and customize lighting effects. A POSITA would have thus understood that adding the feature of compensating for rolling shutter artifacts produced by a camera as described in Edwards, would simply be the addition of a known method to a compatible system.

21. Claim 18

199. Claim 18 recites “The method according to claim 1, further comprising controlling said time varying lighting value to illuminate evenly a camera frame.” EX1001, 14:9-11.

200. It is my opinion that Mueller in view of Edwards renders Claim 18 obvious.

201. Mueller teaches that lighting unit 100 described therein may be configured to receive signals from one or more external signal sources 124. See *supra* Claims 3 and 4; see also EX1005, ¶¶ [0185], Figure 1.



Id., Figure 1.

202. Mueller further teaches that such signal source 124 can be, among other things, a camera. *Supra* Claims 3 and 4; EX1005, [0187], [0188].

203. It would have been obvious to a POSITA to combine the teachings of Mueller with those of Edwards to control lighting unit 100 based on recording frequency, camera shutter speed, and/or camera frame rate to ensure even illumination of every camera frame.

204. Edwards discloses that time varying lighting values can be controlled so that the minimum pulse width, or time the light is “on,” matches the camera

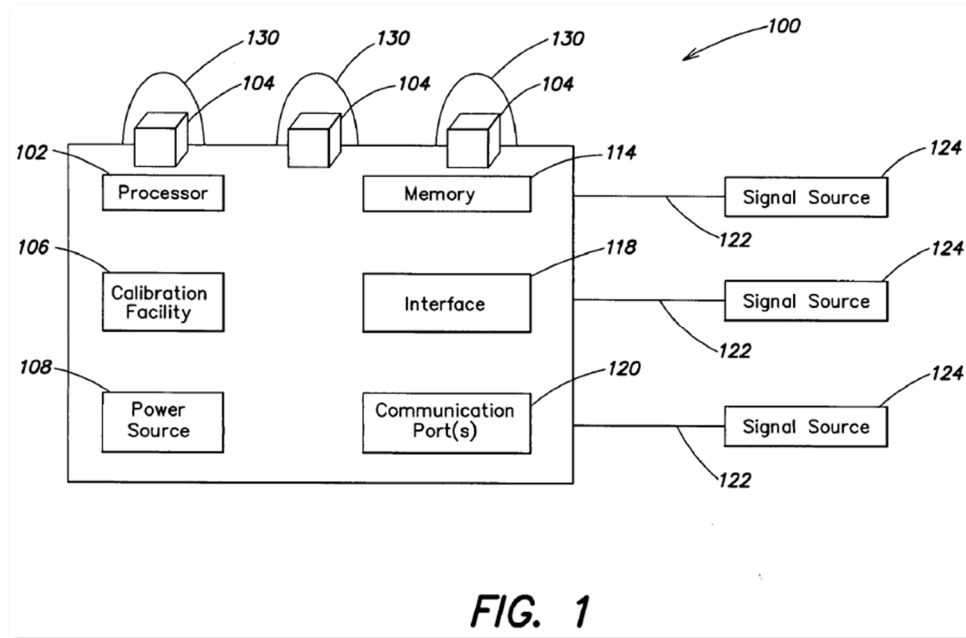
shutter speed and frame rate. *See supra* Claims 3-4, 19. By controlling lights in this way, with the lights being “on” when the shutter is open and a frame is being captured, the captured camera frames are evenly illuminated. EX1004, 3:18-28, 5:18-31.

22. Claim 19

205. Claim 19 recites “The method according to claim 1, wherein a pulse duration of said time varying lighting value is based on at least one of: said camera recording frequency; said camera shutter speed; and said camera frame rate.” EX1001, 14:12-15.

206. It is my opinion that Mueller in view of Edwards renders Claim 19 obvious.

207. Mueller discloses that the lighting unit 100 described therein “may be configured to receive one or more signals 122 from one or more other signal sources 124.” EX1005, [0185]; *see also id.*, Figure 1.



Id., Figure 1. Mueller further explains that these signals 122 can be used by the processor 102, “either alone or in combination with other control signals (e.g., signals generated by executing a lighting program), to control one or more of the light sources 104 . . . in connection with the interface 118.” *Id.*, [0185]. Mueller discloses that the signal source 124 can be, among other things, a camera. *Id.*, [0187], [0188].

208. A POSITA as of the priority date of the '101 Patent would have understood the advantages of lighting unit 100 receiving signals such as camera recording frequency, camera shutter speed, and camera frame rate as the signals 122 received from a camera as a signal source 124. Such information would enable the lighting system to operate in a way that avoids flicker or other undesired effects that can result from dynamic lighting effects that are executed without utilizing such data

from a camera. A POSITA would understand how to use such data from a camera to avoid the production of such undesired effects. That such techniques used to prevent flicker artifacts were well known in the art is demonstrated by, among other things, Edwards. Edwards's lighting controller, based on the received camera "sync signal," calculates the lighting control signals so that they vary at a rate equivalent to the camera shutter speed and frame rate. *See supra* Claim Element 1b. Varying the lighting values so that the pulse width of the light, which is the amount of time the light is "on," is matched to the camera shutter speed and camera frame rate. *Id.*

209. The minimum pulse width or duration of the light, which is the amount of time the light is "on," is controlled based on the camera shutter speed and frame rate. *See supra* Claim Element 1b. For example, "the changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame." EX1004, 3:18-28; *see also id.*, Abstract, 1:25-48, 3:18-28, 4:47-52, 11:19-12:1. The lighting controller "holds the commands until the next vertical frame sync pulse," so that the "lighting transitions for each frame are preferably timed to occur during the closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture." *Id.*, 5:18-31. That is, the lights are changed (or varied) only when the camera shutter is closed, so that they are "on"

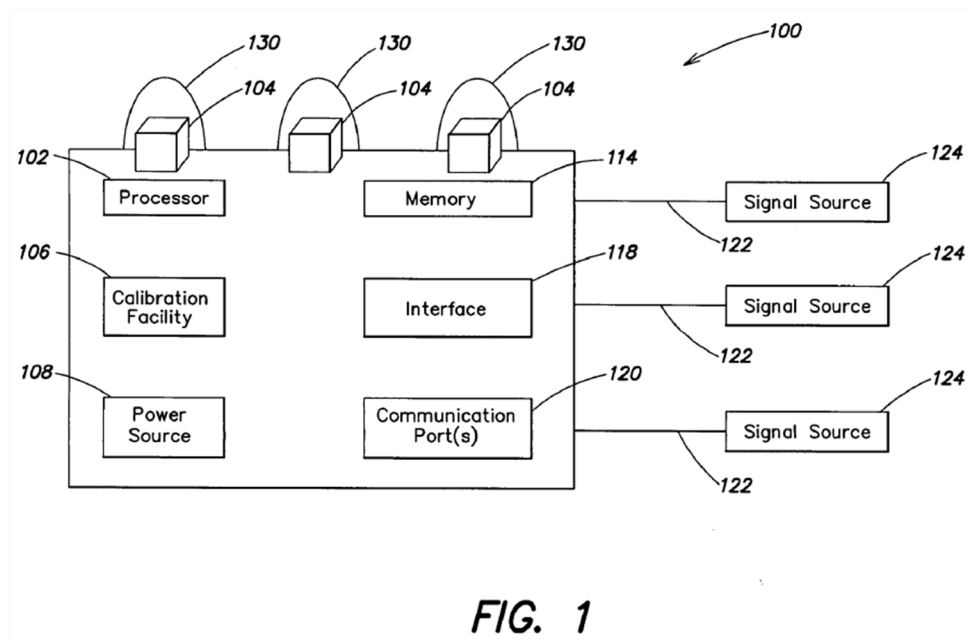
when the camera shutter is open, and all captured frames are complete and without visual artifacts. *Id.*; *see also supra* Claim Elements 1a-1b.

23. Claim 20

210. Claim 20 recites “The method according to claim 1, further comprising controlling a minimum pulse width of said time varying lighting value based on at least one of: said camera recording frequency; said camera shutter speed; and said camera frame rate, to illuminate evenly a camera frame.” EX1001, 14:16-20.

211. It is my opinion that Mueller in view of Edwards renders Claim 20 obvious.

212. Mueller teaches that lighting unit 100 described therein may be configured to receive signals from one or more external signal sources 124. *See supra* Claims 3 and 4; *see also* EX1005, ¶¶ [0185], Figure 1.



Id., Figure 1.

213. Mueller further teaches that such signal source 124 can be, among other things, a camera. *Supra* Claims 3 and 4; EX1005, [0187], [0188].

214. It would have been obvious to a POSITA to combine the teachings of Mueller with those of Edwards to control lighting unit 100 based on recording frequency, camera shutter speed, and/or camera frame rate to ensure even illumination of every camera frame. Edwards discloses that time varying lighting values can be controlled so that the minimum pulse width, or time the light is “on,” matches the camera shutter speed and frame rate. *See supra* Claims 3-4, 19. By controlling lights in this way, with the lights being “on” when the shutter is open and a frame is being captured, the captured camera frames are evenly illuminated. EX1004, 3:18-28, 5:18-31.

215. The minimum pulse width or duration of the light, which is the amount of time the light is “on,” is controlled based on the camera shutter speed and frame rate. EX1004, 3:18-28, 5:18-31. For example, “the changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame.” EX1004, 3:18-28; *see also id.*, Abstract, 1:25-48, 3:18-28, 4:47-52, 11:19-12:1. The lighting controller “holds the commands until the next vertical frame sync pulse,” so that the “lighting transitions for each frame are preferably timed to occur during the

closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31.

216. That is, the lights are changed (or varied) only when the camera shutter is closed, so they have a minimum pulse width and duration keeping them “on” when the camera shutter is open and all captured frames are complete with stable lighting (*e.g.*, evenly illuminated) and without visual artifacts. *Id.*; *see also supra* Claim Elements 1a-1b.

24. Claim 21

217. Claim 21 recites “The method according to claim 9 further comprising recalling said at least one stored user input simulation parameter corresponding to said user customisable lighting effect.” EX1001, 14:21-24.

218. It is my opinion that Mueller in view of Edwards renders Claim 21 obvious.

219. Mueller describes, associated with the processor disclosed therein, “one or more storage media generically referred to . . . as ‘memory[.]’” EX1005, [0064]. “[T]he storage media may be encoded with one or more programs that, when executed on one or more processors, perform at least some of the functions discussed herein.” *Id.* Mueller describes such functions as including, “generally controlling the light output of the lighting unit 100, changing and/or selecting various pre-

programmed lighting effects to be generated by the lighting unit, changing and/or selecting *various parameters of selected lighting effects*, setting particular identifiers such as addresses or serial numbers for the lighting unit.” *Id.*, [0182] (emphasis added).

220. Mueller further provides that

[t]he lighting unit 100 also may include a *memory* 114 to *store* various information. For example, the memory 114 may be employed to *store one or more lighting programs* for execution by the processor 102 (e.g., to generate one or more control signals for the lights sources, as well as various types of data useful for generating variable color radiation

Id. (emphasis added).

221. A POSITA would understand that a lighting program stored in memory 114 could include a user input simulation parameter depending on a selected lighting effect to be simulated. This is particularly true because, in connection with another embodiment, Mueller describes storing at least one simulation parameter in memory: “the lighting control interface allows for the storage and downloading of new functions and new parameter settings.” EX1005, [0380].

222. A POSITA would understand that the purpose for storing in memory a lighting program, comprising lighting effects and their parameters, was to later recall the lighting program and run it. This is particularly true given that Mueller, in the context of a separate embodiment describes that lighting functions and parameters

can be stored for “user modification and implementation” of lighting effects. EX1005, [0380].

B. Ground 2: Claims 1, 2, 5-17, and 21 are invalid under 35 U.S.C. § 102(a)(1) and anticipated by Astera or under 35 U.S.C. § 103 as obvious over Astera.

1. Overview of Astera

223. Astera is a user manual for the AX10, a controllable lighting device used in studio filming and entertainment lighting. EX1012. Astera is prior art under at least 35 U.S.C. § 102(a)(1). The AX10 was sold to customers beginning in 2014 in Germany, and the first orders from customers in the United States were in March 2015. EX1012, ¶¶4-8. Astera bears a date of May 7, 2015, and was made publicly available, including to distributors and purchasers of the AX10, beginning at least in June of 2015 in the U.S., including via a Quick Start guide included in the product packaging and via Astera’s website. *Id.*

224. Astera describes the operation and use of the AX10, a controllable lighting fixture with an array of nine “RGBAW” (*i.e.*, red, green, blue, amber, white) LEDs:



EX1011, cover; *see also id.*, 7.

225. The AX10 can be controlled by various controllers, including (a) an LCD Control Panel (with a “standalone engine”) on the AX10 (the “Control Panel”), (b) a remote control, (c) the “AsterApp” (an app for mobile devices), and (d) CRMX wireless DMX. *Id.*, 9-10.

Control Panel on AX10 Light	Remote Control	AsteraApp																				
LEGEND <table><tr><td> MENU COLOR BACK TO PREVIOUS MENU </td><td> - SPEED SCROLL DOWN </td><td> + BRIGHT SCROLL UP </td><td> ENTER PROG CHOOSE/ CONFIRM </td></tr><tr><td colspan="4">FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:</td></tr><tr><td> ENTER THE MAIN MENU </td><td> FACTORY RESET </td><td> ENTER THE MAIN MENU </td><td> ENTER THE DMX MENU </td></tr><tr><td colspan="4">HOLD THE ABOVE BUTTON FOR 2SECS TO:</td></tr><tr><td> STANDALONE MENU </td><td> ADJUST SPEED </td><td> ADJUST BRIGHTNESS </td><td> CHANGE PROGRAM </td></tr></table>	MENU COLOR BACK TO PREVIOUS MENU	- SPEED SCROLL DOWN	+ BRIGHT SCROLL UP	ENTER PROG CHOOSE/ CONFIRM	FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:				ENTER THE MAIN MENU	FACTORY RESET	ENTER THE MAIN MENU	ENTER THE DMX MENU	HOLD THE ABOVE BUTTON FOR 2SECS TO:				STANDALONE MENU	ADJUST SPEED	ADJUST BRIGHTNESS	CHANGE PROGRAM		
MENU COLOR BACK TO PREVIOUS MENU	- SPEED SCROLL DOWN	+ BRIGHT SCROLL UP	ENTER PROG CHOOSE/ CONFIRM																			
FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:																						
ENTER THE MAIN MENU	FACTORY RESET	ENTER THE MAIN MENU	ENTER THE DMX MENU																			
HOLD THE ABOVE BUTTON FOR 2SECS TO:																						
STANDALONE MENU	ADJUST SPEED	ADJUST BRIGHTNESS	CHANGE PROGRAM																			

Id., 9, 11, 23.

226. The AX10 produces customized lighting effects, *id.*, 23-24, 27-28, 32, run through the Control Panel, remote, AsteraApp, and DMX control. *Id.*, 21, 28; *see also id.*, 17. The effects include: fire with a “random” flickering; fast, medium, and slow strobes; random color chaser effects; color fades; spiral colors; and rainbow. *Id.*, 17, 21. Users can customize these effects by adjusting parameters including speed, crossfade, stroboscope, and brightness. *Id.*, 27; *see also id.*, 20, 24-29.

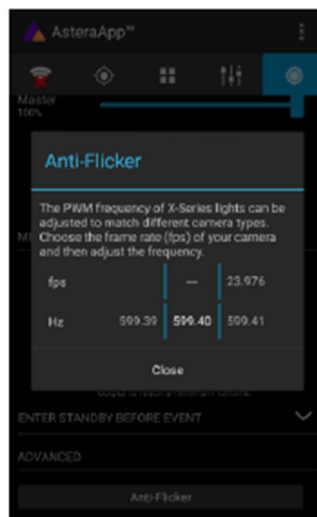
227. Further, to avoid unwanted camera artifacts, such as flicker, users may also make “anti-flicker” adjustments to the PWM refresh rate frequency of the LEDs to “fit different camera’s frame rates”:

7.12 ANTI-FLICKER

The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.



Slide the “fps” to adjust to default values for a framerate. Slide the “Hz” to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated).

2. Claim 1

228. It is my opinion that Astera anticipates Claim 1.

a. Claim Element 1p

229. Claim Element 1p recites “A method for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the method comprising:” EX1001, 11:59-62.

230. For the purposes of this declaration, I assume that the preamble of Claim 1, and the preambles of independent Claims 11 and 17, are limiting and must be considered for the purposes of evaluating the validity of these claims.

231. Regardless, Astera discloses Claim Element 1p.

232. Astera discloses the features and functionality of the AX10, a controllable lighting fixture with an array of nine “RGBAW” (i.e., red, green, blue, amber, white) LEDs. EX1011, 7.



Id., cover (annotated).

4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emittance*:	10,350lx (at 2m; White 4000K)
CRI*:	up to 92

Id., 7 (annotated).

233. The AX10 can be controlled via various controllers, including the Control Panel and AsteraApp. *Id.*, 9.



Id., 9, 11, 23.

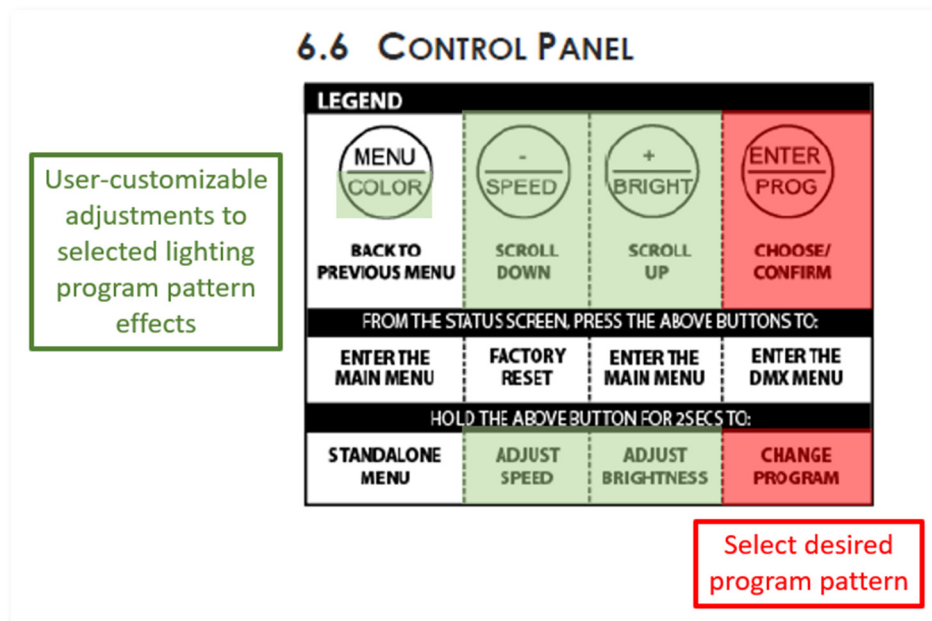
234. The AX10 can produce user-customizable lighting effects and compensate for rolling shutter effects through an “anti-flicker” adjustment. *Id.*, 23-24, 27-28, 32.

235. “Effect modes” offer “a comprehensive control of the built in standalone engine,” to implement “predefined programs” for effects including fire, strobe, static colors, color fades, rainbow, spiral colors. EX1011, 17, 21.

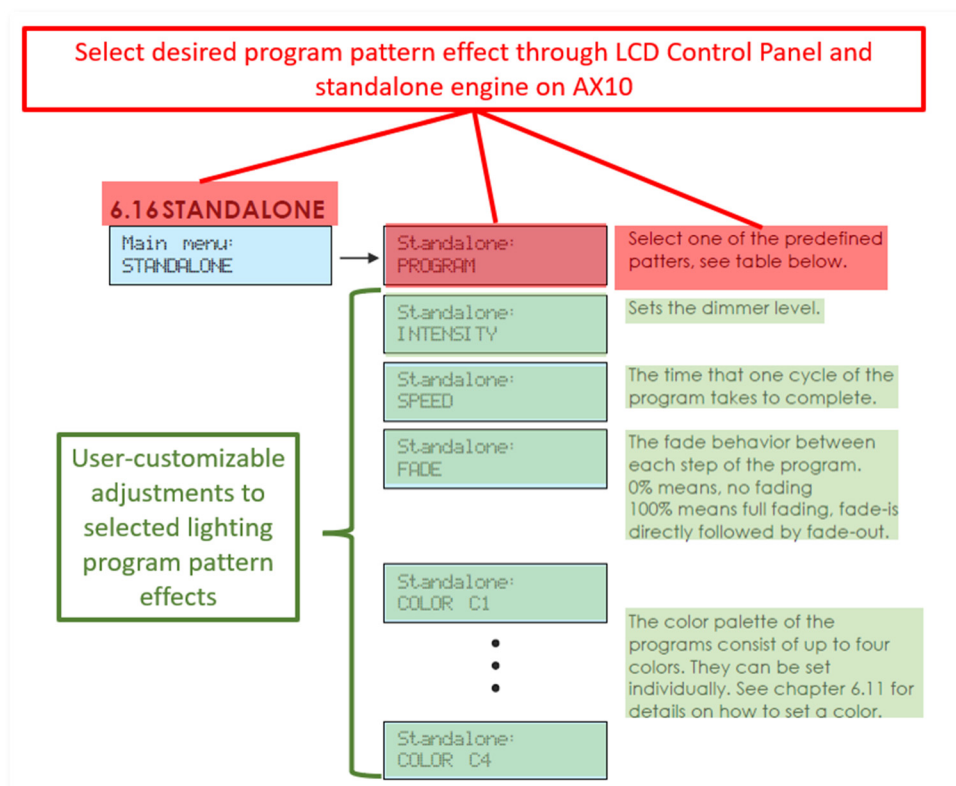
Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
FOUR COLOR STATIC	The virtual light is split into four parts and four colors are displayed.
ONE COLOR FADE	For all FADE programs, the whole color palette of four colors is used. Those colors are faded in and out one by one. Here, the whole virtual light shows the same color.
TWO COLOR FADE	The virtual light is split and shows two colors at a time.
THREE COLOR FADE	The virtual light is split and shows three colors at a time.
FOUR COLOR FADE	The virtual light is split and shows four colors at a time.
SIMPLE RUNNING	A running light; the background and the running pixels color can be set.
DOUBLE RUNNING	Two pixels are running in opposite direction.
TWO COL RUNNING	The two pixels are of different color even.
FLAG RUNNING	A three color flag is running over the background color.
DOUBLE FLAG RUNNING	Two flags are running over background in opposite direction.
SPIRAL 4 COLORS	The color is changed pixel by pixel. All four colors are used one after the other.
SPIRAL 2 COLORS	The color changes between color 1 and 2 from the outside to the inside, pixel by pixel.
RAINBOW	A rainbow effect is displayed.
FIRE	The fire effect is a random flicker between two colors, background and flickering color.

Id., 21.

236. Users can customize these effects. *Id.*, 8, 11, 13, 20, 24-29. The Control Panel allows users to “select” one of the above effects and then modify it by adjusting: (i) intensity to set a dimmer level; (ii) speed to change the time to complete one cycle of the program; (iii) fade time between program steps; and (iv) color. *Id.*, 20.

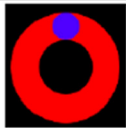


Id., 11 (annotated).



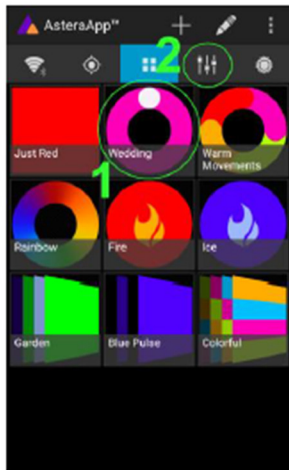
Id., 20 (annotated).

237. Similarly, users can select and customize effects, including “running lights,” “fire,” “rainbow,” “chaser effects,” and “stroboscope,” through AsteraApp. *Id.*, 27-28.

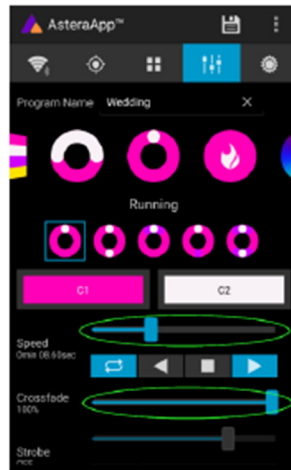
7.7 LIST OF EFFECTS The effects' patterns are pre-defined and cannot be modified by the user. They are pre-programmed inside of each light. Still they can be parameterized. These effects are:	
	Several variations of running lights are available.
	The Fire effect shows a random flickering effect. The background color and the color of the flickering effect can be adjusted.
	The rainbow effect shows a color change through all colors. Only its speed can be adjusted.
	Chaser effects provide an efficient means to create dancefloor lighting. The static chaser exchanges the color of the lights according to the tapped-in beat. The colors are randomly chosen. The effect can be adjusted to show up to 4 different colors at a time.
	The Moving Chasers overlay the static chaser by a second movement of the four displayed colors over the available positions of a Flow-Set. This gets mostly interesting if the Moving Strobe is chosen. Then, only some of the positions strobe and they are moving. So the strobe effect moves over the Flow-Set.

Id., 28 (annotated). Selected effects can be customized by adjusting parameters including: (i) “speed” of how long it will take for “the effect to complete one cycle,” (ii) “crossfade” between steps, (iii) “speed” of a “stroboscope” effect, and (iv) “brightness”:

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).

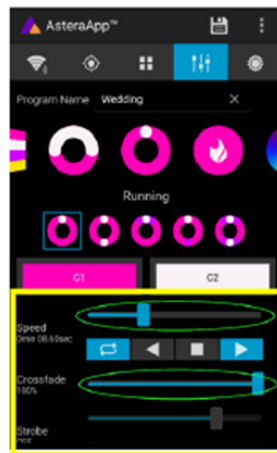


Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

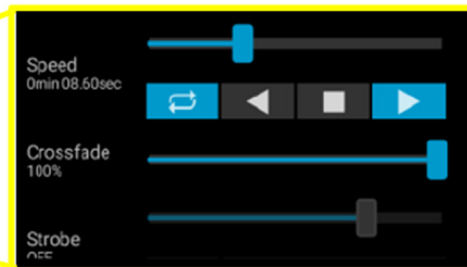


The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

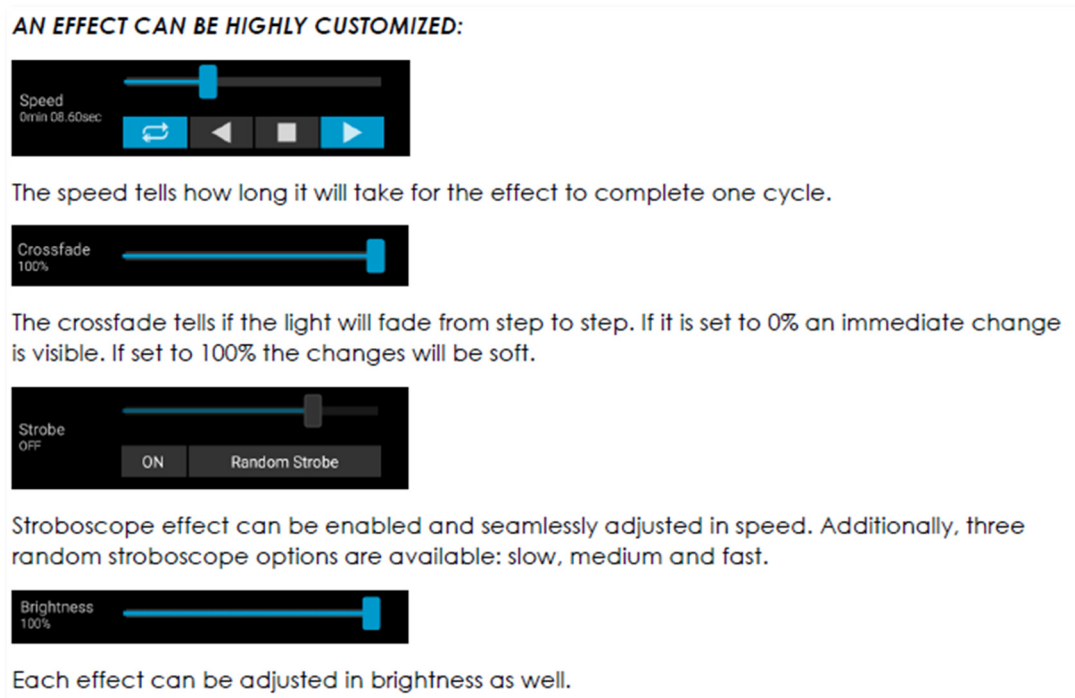
Id., 27.



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

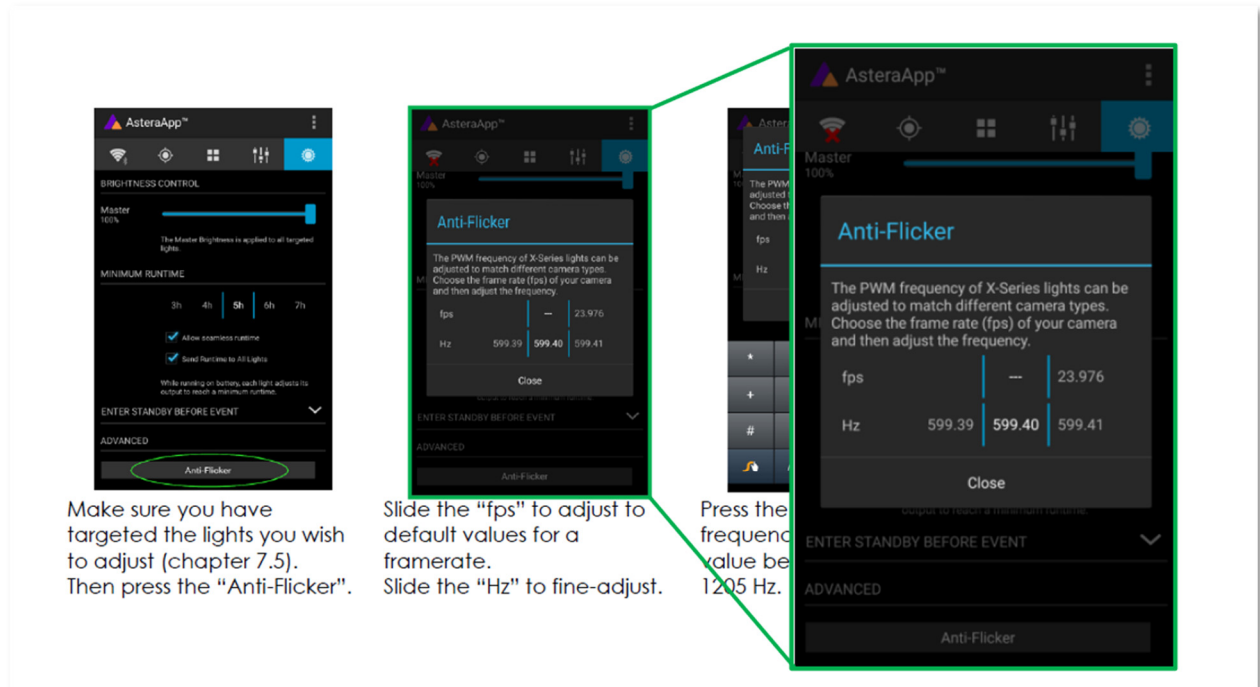


Id. (annotated).



Id.

238. Further, Astera discloses how the AX10 can compensate for rolling shutter artifacts, caused by the interaction between the frequency of the LED light output and the camera frame rate, by making “Anti-Flicker” adjustments—adjusting the PWM refresh frequency of the light output and selected effect to “fit different camera’s frame rates.” *Id.*, 32. Users can choose the frame rate (in frames per second) of the camera being used, and then adjust the PWM refresh rate frequency to a value that will avoid flicker. *Id.*



Id. (annotated).

b. Claim Element 1a

239. Claim Element 1a recites “calculating, using an effect simulator, a time varying lighting value;” EX1001, 11:63-64.

240. Astera discloses Claim Element 1a.

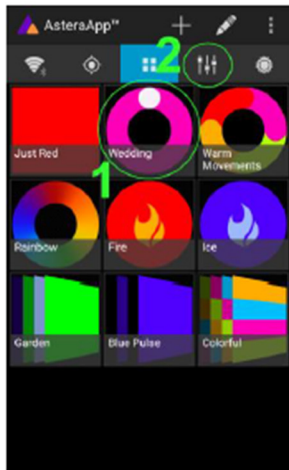
241. The Control Panel and AsteraApp controllers calculate time varying lighting values for generating special effects based on user-input simulation parameters. EX1011, 9-11, 13, 17, 21.

242. The AX10 Control Panel allows users to “select” from predefined effects, and then adjust parameters including intensity (to set a dimmer level), speed (to change the time to complete one cycle), fade time, and color. *Id.*, 20. Based on

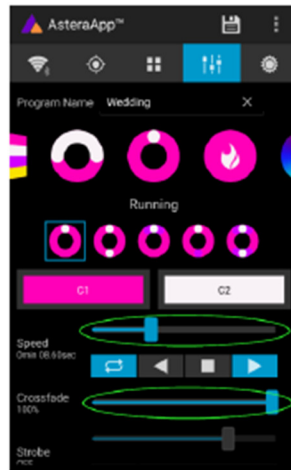
these selections, Control Panel creates data characterizing the adjusted lighting effect, in the form of values and settings for the LEDs to “display these effects properly with [the] light.” *Id.*, 17, 20-21.

243. Similarly, in AsteraApp, users can select from a variety of lighting effects, such as “fire,” “chasers,” “rainbow” and “stroboscope.” *Id.*, 23-24, 27-28; *see supra* Claim Element 1p. Effects selected from AsteraApp can then “be highly customized,” to adjust parameters including: (i) “speed” of how long it will take to complete one cycle, (ii) “crossfade” between steps, (iii) random “stroboscope” speed, and (iv) “brightness.” EX1011, 27. Users can also select and customize colors for effects “with a customizable color palette,” and certain effects, like “fire,” allow a user to “adjust” colors making up the effect. *Id.*, 24, 28.

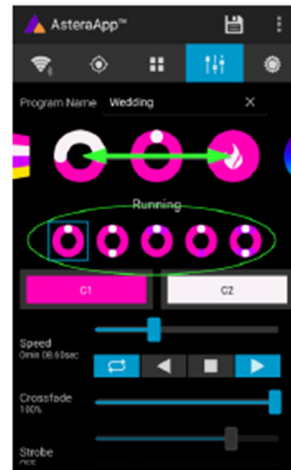
7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

Id., 27.

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id.

244. Users can adjust the PWM refresh rate of the lighting values via “Anti-Flicker” selections, so that the output light will “fit different camera’s frame rates.”

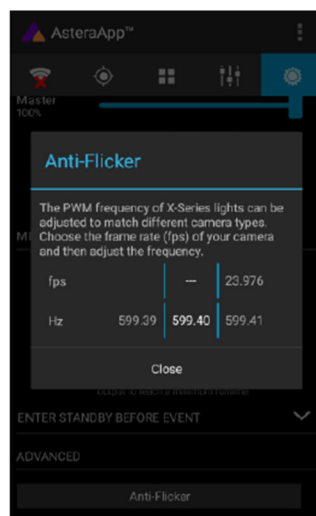
Id., 32.

7.12 ANTI-FLICKER

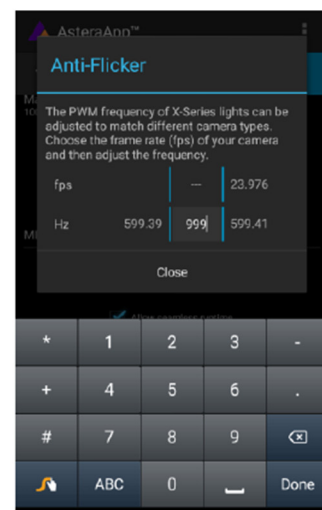
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.

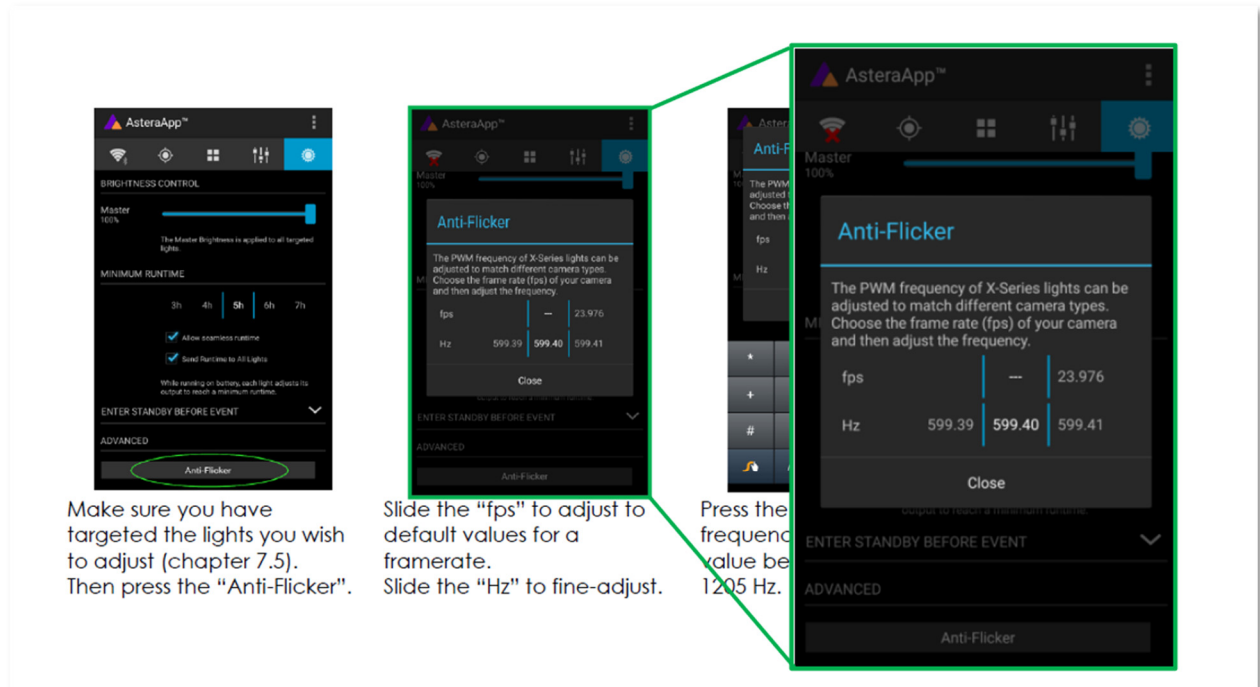


Slide the “fps” to adjust to default values for a framerate. Slide the “Hz” to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated). A user can input the “frame rate (fps) of [her] camera,” and AsteraApp adjusts the PWM refresh to a default value for that particular fps. *Id.* Users can “fine-adjust” by sliding a “Hz” value of the frequency. *Id.*



Id. (annotated).

245. AsteraApp calculates time varying lighting values, including brightness and color information, and, when selected, anti-flicker fps and frequency fine-adjustment inputs for the user-customized effects. *Id.*, 23-29, 32. AsteraApp can “send complex effects” to the lights and can be “used to adjust the lights settings remotely” by sending controls (which are lighting values). *Id.*, 23. Based on user selections, “effects can be created and be sent to the light by the built in UHF receiver,” where the effects are “triggered” and replayed at each light. *Id.*, 24.

c. Claim Element 1b

246. Claim Element 1b recites

compensating for the rolling shutter artefacts produced by the camera, the time varying lighting value being calculated based on at least one

user input simulation parameter input by a user, said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera,
a camera shutter speed of the camera, and
a camera frame rate of the camera;

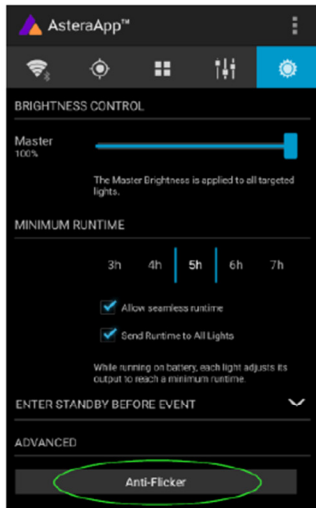
EX1001, 11:65-12:7.

247. Astera discloses Claim Element 1b.

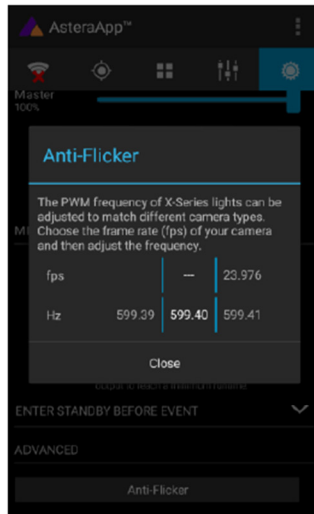
248. Astera discloses compensating for rolling shutter artifacts, in the form of “flicker,” by calculating lighting values based on user inputs indicative of at least the camera frame rate. EX1011, 32. Users can select an “Anti-Flicker” option to compensate for rolling shutter artifacts in the form of unwanted “flicker” that would otherwise be produced if the PWM refresh frequency of the light did not fit the camera’s frame rate. *Id.*

7.12 ANTI-FLICKER

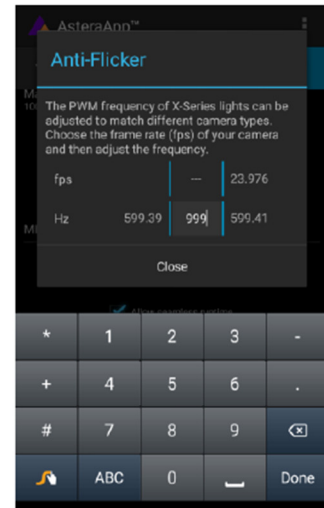
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".



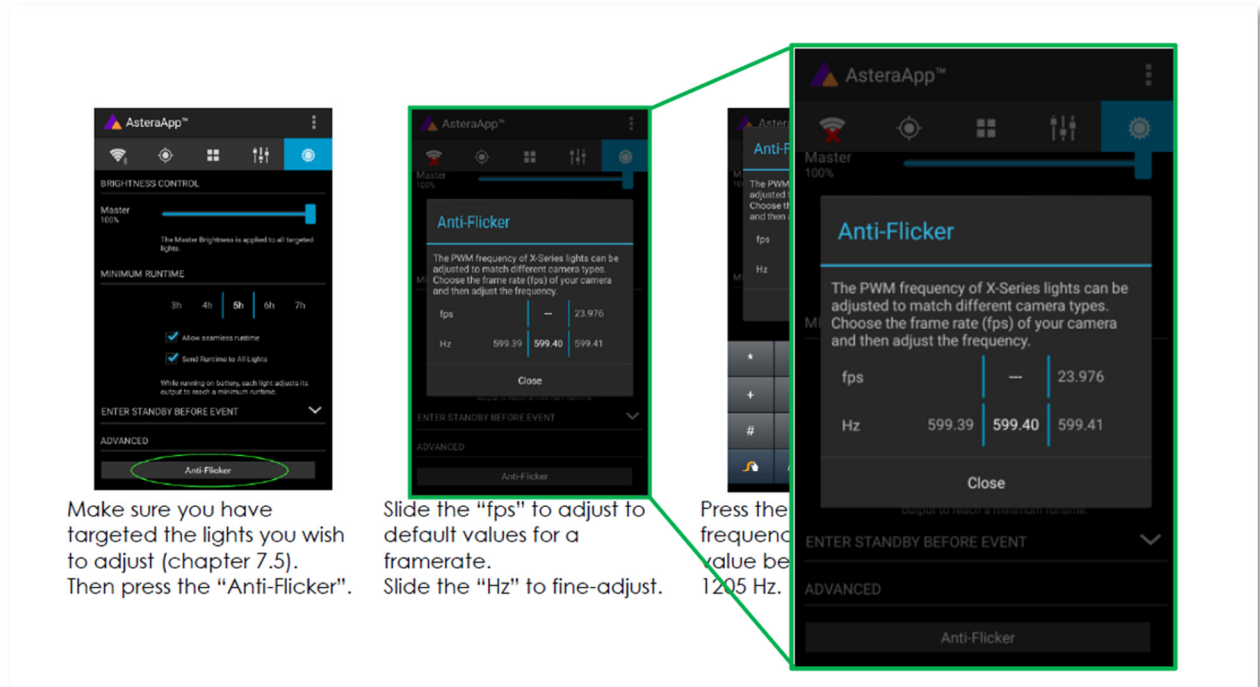
Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated).

249. In the Anti-Flicker menu, users may input and adjust a value for the "frame rate (fps)" of a camera, with AsteraApp suggesting default PWM refresh values for that particular frame rate. *Id.* The Anti-Flicker menu also gives users the option to "slide the 'Hz' to fine-adjust," allowing users to refine the PWM refresh frequency to compensate for the particular frame rate of the camera. *Id.*



Id. (annotated). “[T]he [PWM refresh] frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera’s frame rates.” *Id.*

250. By calculating a PWM frequency based on user inputs of at least camera frame rate, and further allowing fine adjustment of the PWM frequency in view of the camera frame rate, rolling shutter “flickering” artifacts caused by interaction between the frequency of the LED light output and the camera frame rate are avoided.

d. Claim Element 1c

251. Claim Element 1c recites “outputting, from said effect simulator, said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for the rolling shutter artefacts.” EX1001, 12:8-11.

252. Astera discloses Claim Element 1c.

253. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize them (e.g., adjust color, speed, crossfade, stroboscope, brightness). *See supra* Claim Element 1a. Users can input parameters, such as camera frame rate, to compensate for rolling shutter “flicker” artifacts, in an Anti-Flicker option that adjusts the PWM frequency of the lights to match camera frame rate. *See supra* Claim Element 1b.

254. Based on these user-customized effects and “Anti-Flicker” inputs, the AX10 calculates time varying lighting values including brightness and color information for the desired effects, adjusted or matched to camera frame rate to avoid rolling shutter artifacts (e.g., flicker). EX1011, 23-29, 32. For example, “[w]ith the AsteraApp these effects can be created and be sent to the light by the built in UHF receiver,” where they are received by the standalone engine in the AX10. *Id.*, 24; *see also id.*, 10, 17. AsteraApp outputs the lighting values representing the adjusted effect created in AsteraApp to the AX10. When the lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” *Id.*, 24.

3. Claim 2

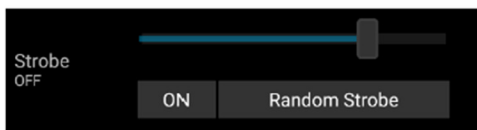
255. Claim 2 recites “The method according to claim 1, wherein the lighting effect comprises a short time-period (e.g. stroboscopic) lighting effect with a user adjustable minimum pulse width.” EX1001, 12:12-14.

256. It is my opinion that Astera anticipates or renders obvious Claim 2.

257. Astera discloses both a “stroboscope” effect and the ability to create a short-time alteration between pulses of lights with a color fade or “chaser” effect, each customizable for minimum pulse width. EX1011, 27-28.

258. With respect to the “stroboscope effect,” this can be “enabled and seamlessly adjusted in speed.” *Id.*, 27. The stroboscopic effect is an effect of flashes with a short-time period between flashes.

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.

Id., 27 (annotated). By enabling a user to adjust speed of the strobe, Astera allows users to adjust minimum pulse width. For example, a slower strobe would have a longer duration, and thus a longer pulse width, and adjustments to increase the speed of the strobe would result in the duration and thus pulse width becoming smaller. A user can select from “three random stroboscope options are available: slow, medium

and fast.” *Id.*, 27. By selecting between these speeds, a user again can adjust minimum pulse width, as a random slow stroboscope effect would have a greater pulse width than a random fast stroboscope effect that comprises more flashes.

259. Both the Control Panel and AsteraApp provide for control of “crossfade” between steps in an effect program, and “speed” of how “long it will take for the effect to complete one cycle.” EX1011, 17, 20, 27-28.



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.

Id., 27 (annotated).

260. Using this, a user may select a simple program of, for example, “one color fade,” creating a cycle which involves one color fading from maximum brightness to 0% brightness in one step, or a simple “chaser effect” of alternating between two colors. *Id.*, 17, 20, 27-28. By adjusting the speed of how long it takes the light to complete this cycle of fading down to 0% brightness, the user will adjust the pulse width of the light. Setting the speed to complete the effect cycle of fading down to 0% brightness in five seconds, for example, will create a longer duration pulse than setting a speed for the same effect to fade down to 0% brightness in one

second. Thus, by creating effects with a light pulse, and adjusting fade of the light and speed of the cycle in which the light fades, Astera teaches a user can create short-time period lighting effects with adjustable pulse width. *Id.*, 17, 20, 27-28.

4. Claim 5

261. Claim 5 recites “The method according to claim 1, wherein said user input of said user selectable parameter comprises a user selecting the at least one user input simulation parameter, via a user interface.” EX1001, 12:25-28.

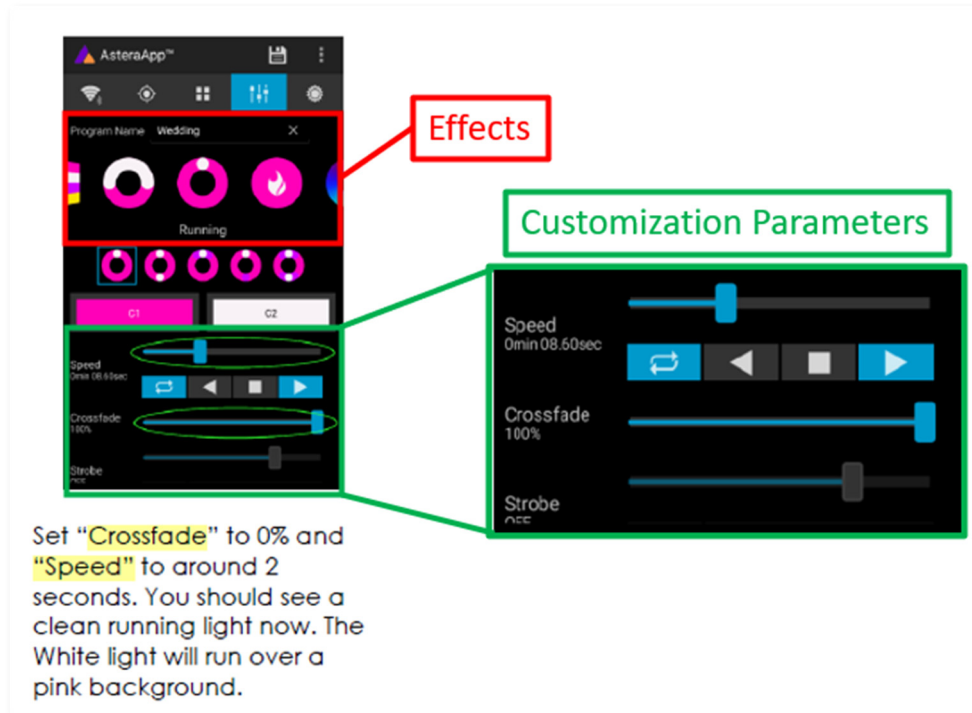
262. It is my opinion that Astera anticipates Claim 5.

263. The AX10 has multiple user interfaces:



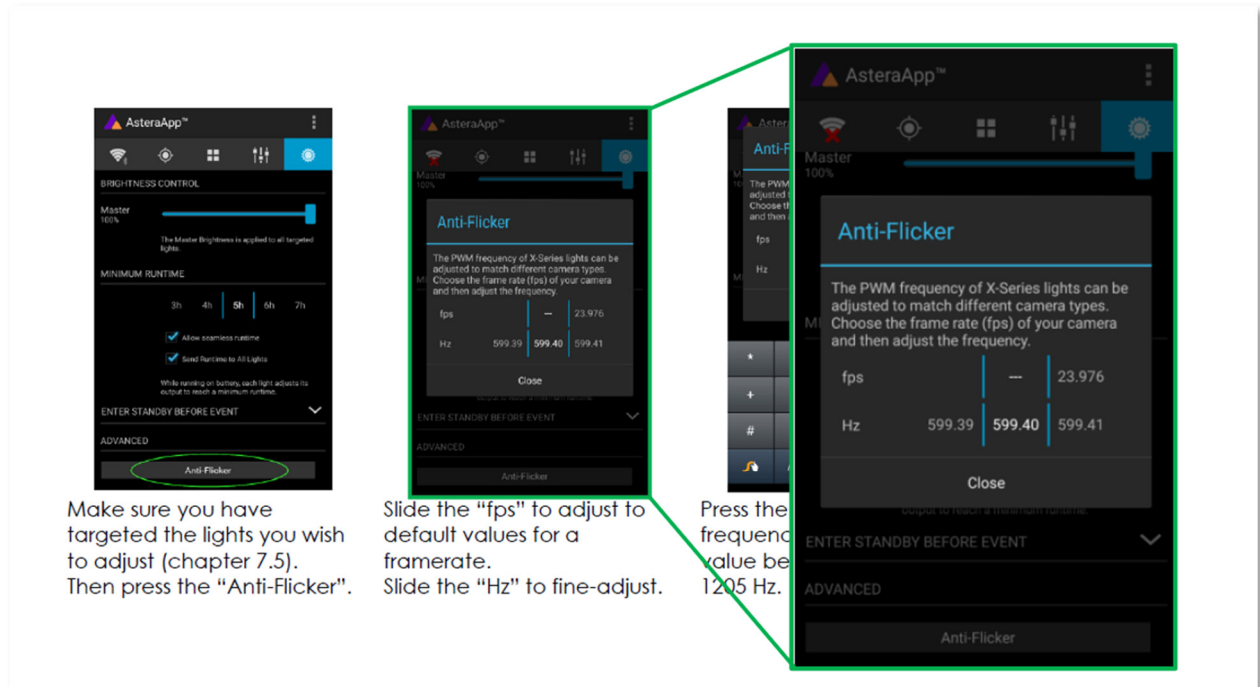
EX1011, 9, 11, 23. Users can select from various desired effects and parameters through interfaces on the Control Panel or Astera App. *Id.*, 8, 11, 13, 20, 24-29, 32.

264. In AsteraApp, lighting effects may be selected and “highly customized” via the app’s user interfaces. *Id.*, 27.



Id., 27 (annotated).

265. AsteraApp further provides for user input of the camera “frame rate” parameter in the “Anti-Flicker” menu interface. *Id.*; *see also supra* Claim Element 1b.



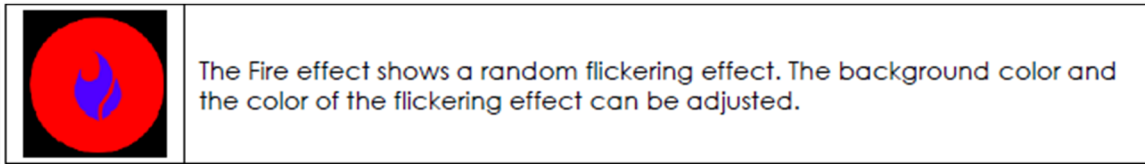
EX1011, 32 (annotated).

5. Claim 6

266. Claim 6 recites “The method according to claim 1, wherein the lighting effect is designed to mimic at least one of fire; lightning; police car light; television; a neon flickering sign; a candle; muzzle (gunshot); welding; spark/short circuit; a scan (e.g. fingerprint scanner); paparazzi flashes; fireworks; flashes (strobe); a propeller; a (nuclear) explosion; and a wormhole.” EX1001, 12:29-34.

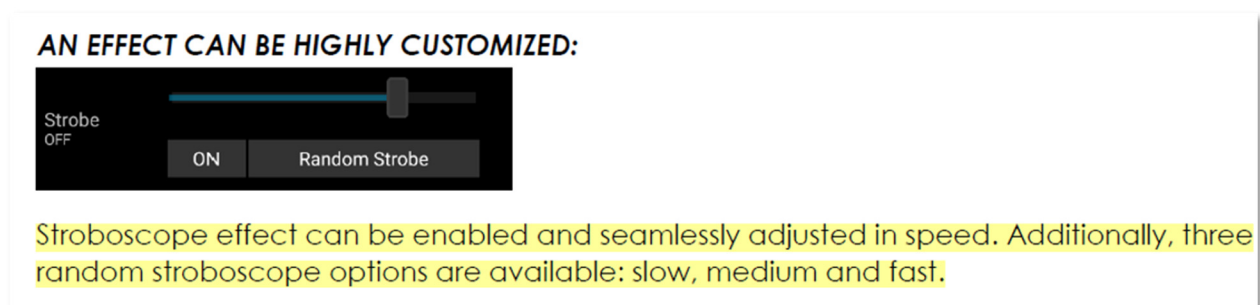
267. It is my opinion that Astera anticipates Claim 6.

268. The AX10 can produce many lighting effects, including “fire,” which mimics a fire flickering:



EX1011, 28; *see also id.*, 22.

269. Moreover, a “stroboscope effect” (producing a strobe of flashes) can be added to selected effects:



Id., 27 (annotated); *see also id.*, 17.

270. Further, a POSITA would understand from Astera that the AX10 would produce other claimed effects (such as effects that mimic at least lightning, welding, sparking, paparazzi flashes, fireworks, or a police light), based on the effects it offers and the ability generate various colors, alternate between colors, and add strobing/flashing. *Id.*, 17, 21, 27-28. For example, flashing blue and red lights simulates police lights. Similarly, stroboscope flash effects that are irregularly timed can create the impression of lightning, paparazzi flashes, welding, and spark/short circuit effects.

6. Claim 7

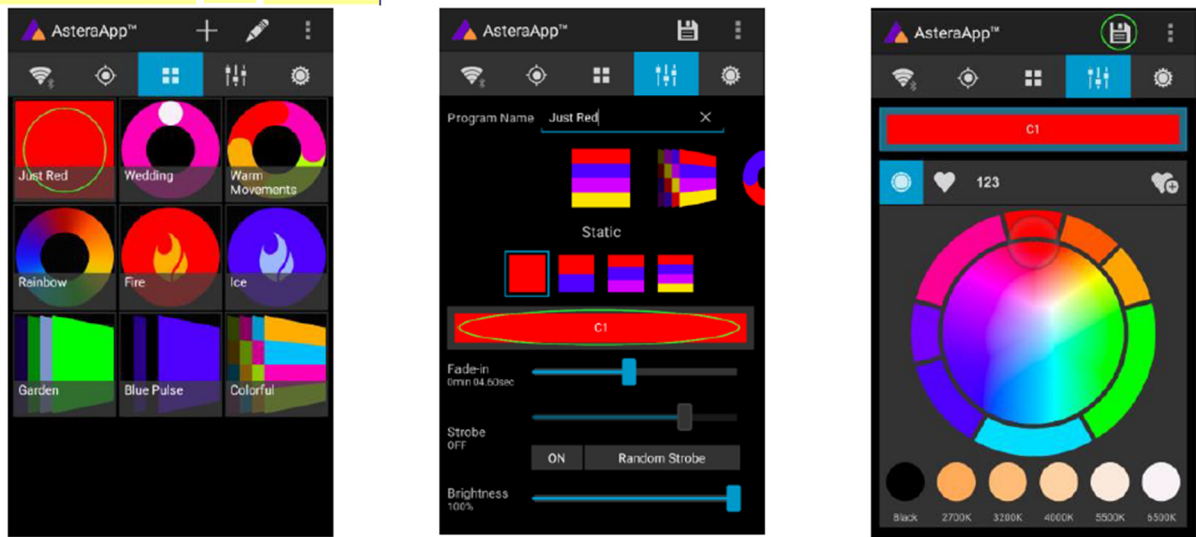
271. Claim 7 recites “The method according to claim 1, wherein the lighting value comprises at least one of: brightness; and colour data.” EX1001, 12:35-36.

272. It is my opinion that Astera anticipates or renders obvious Claim 7.

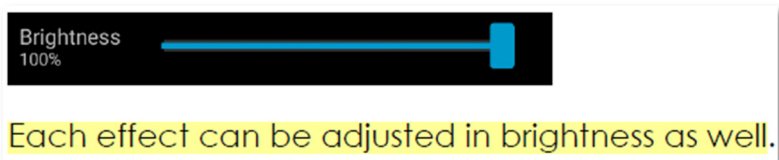
273. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize those effects (e.g., adjust speed, crossfade, stroboscope, brightness), resulting in lighting value data representing the effect. *See supra* Claim Elements 1a, 1c. Again, based on these user-selected, customized effects, the AX10 system calculates time varying lighting values including brightness and color information to run the desired effects. EX1011, 17, 20-21, 23-29, 32.

274. For example, “fire” is a random flickering between a “background color and the color of the flickering effect,” both of which colors can be adjusted. *Id.*, 17, 20-21, 23-29, 32. Moreover, users can adjust brightness and color for selected effects. *Id.*, 20, 24-28.

7.3 CHANGE THE COLOR



Id., 24 (annotated); *see also id.* (stating that effect patterns can be “played with a customizable color palate.”).



Id., 27 (annotated).

7. Claim 8

275. Claim 8 recites “The method according to claim 7, further comprising converting said at least one of: brightness; and colour data into lighting signals and outputting the lighting signal data.” EX1001, 12:37-39.

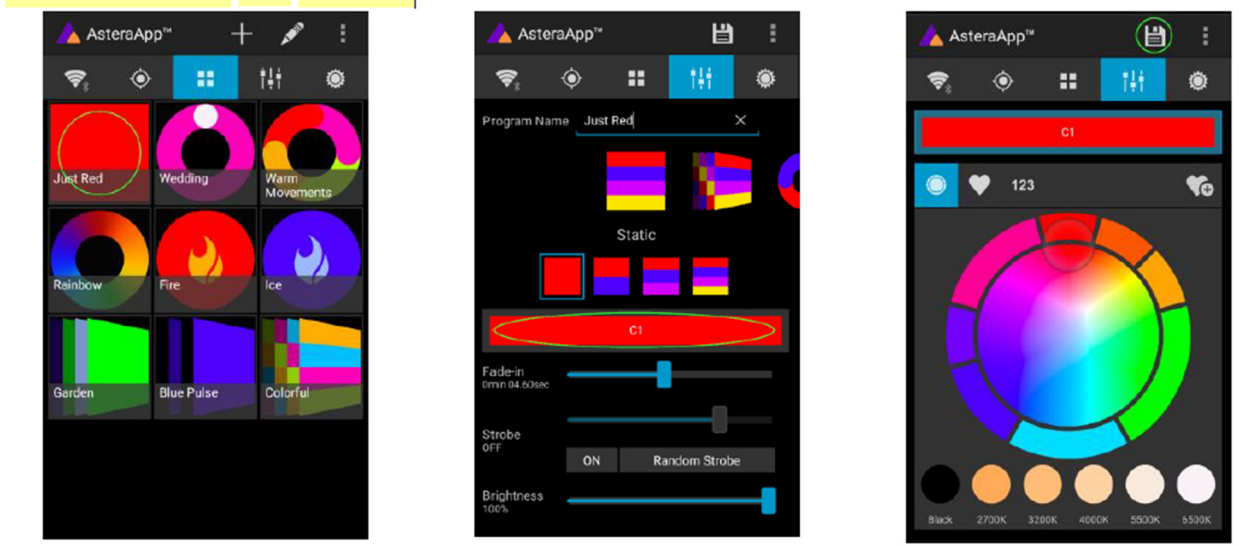
276. It is my opinion that Astera anticipates or renders obvious Claim 8.

277. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize those effects (e.g., adjust speed, crossfade,

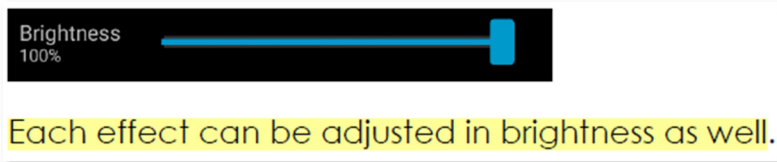
stroboscope, brightness), resulting in lighting value data representing the effect. *See supra* Claim Elements 1a, 1c. Again, based on these user-selected, customized effects, the AX10 system calculates time varying lighting values including brightness and color information to run the desired effects. EX1011, 17, 20-21, 23-29, 32.

278. For example, “fire” is a random flickering between a “background color and the color of the flickering effect,” both of which colors can be adjusted. *Id.*, 17, 20-21, 23-29, 32. Moreover, users can adjust brightness and color for selected effects. *Id.*, 20, 24-28.

7.3 CHANGE THE COLOR



Id., 24 (annotated); *see also id.* (stating that effect patterns can be “played with a customizable color palate.”).



Id., 27 (annotated).

279. Further, the Control Panel includes a “converter” in “Standalone” mode that converts the selected effects and parameters into values that are sent to the standalone engine that outputs signals to the LEDs. *Id.*, 12, 17. In particular, the Control Panel offers “comprehensive control of the built in standalone engine,” and thus converts the brightness and color data into control signals that it outputs to this standalone engine. *Id.*, 17.

280. AsteraApp similarly includes a “converter” that converts data relating to user-selected brightness and color parameters for the lighting effects into signals that can be sent to the standalone engine in the AX10. As noted above for Claims 1a-1c, the data values for color and brightness of an effect can be input in AsteraApp, which converts these values into signals representing the effect that can “be sent to the light by the built in UHF receiver,” where they are received by the standalone engine in the AX10. EX1011, 24; *see also id.*, 10, 17. That is, AsteraApp converts the brightness and color data for an effect into lighting values representing the effect created in AsteraApp, and outputs these lighting values to the AX10. When the

lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” *Id.*, 24.

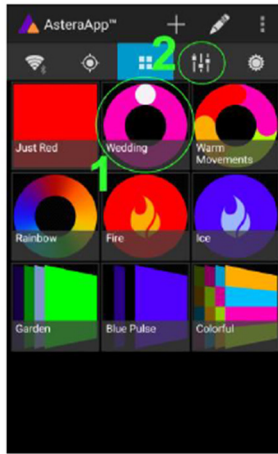
8. Claim 9

281. Claim 9 recites “The method according to claim 1 further comprising storing said at least one user input simulation parameter corresponding to said user customisable lighting effect.” EX1001, 12:40-42.

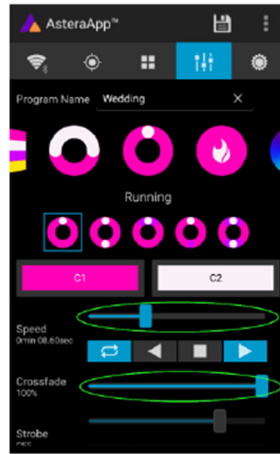
282. It is my opinion that Astera anticipates Claim 9.

283. The user-selectable lighting effects, and user adjustments made to those effects, may be “saved back to the main screen by pressing the save button.” EX1011, 27. Users may select an effect (like “fire” or “wedding”) and modify it, by changing simulation parameters that adjust the effect (like “speed,” “stroboscope,” and “brightness”). *Id.* When the user is done, she can click the disk icon in AsteraApp, saving the modified effect. *Id.*, 27.

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

After the effect is adjusted, it may be saved back to the main screen by pressing the save button.

Id. (annotated).

284. Once saved to the main screen, these stored effects (with modified parameters) can be recalled and played later. *Id.*, 10, 24, 30.

285. Astera further discloses that a user's adjustments for "Anti-Flicker" are preserved, or saved, once entered into AsteraApp:

The Anti-Flicker adjustment is preserved in case the lamp is powered off. It is set back to the default 599.4Hz once a Reset Settings (chapter 6.19) is done. The adjusted frequency is used no matter what input source is currently active. Also during DMX operation.

Id., 32 (annotated). By "preserving" the Anti-Flicker adjustments, these settings are also saved and recalled when the lamps are powered back on.

9. Claim 10

286. Claim 10 recites “The method according to claim 1, wherein the controlling is for a lighting system for at least one of: videography, broadcast, cinematography, studio filming and location filming.” EX1001, 12:43-46.

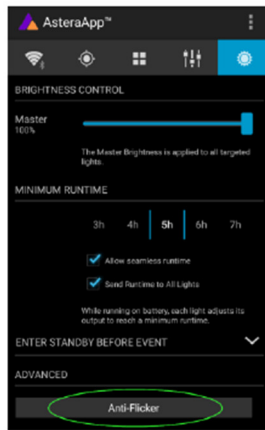
287. It is my opinion that Astera anticipates or renders obvious Claim 10.

288. The AX10 can produce a plurality of lighting effects (such as “fire,” “rainbow,” “stroboscope,” and “chase effects”). *See supra* Claim Element 1p. These effects can be used for “videography, broadcasting, cinematography, studio filming, and location filming.” As was well-known to a POSITA, Astera manufactures luminaires for film, TV, and theatrical use. EX1012 ¶2 (noting the AX10 is one of Astera’s “production lighting products” and that it was shown at a “Prolight and Sound Exhibition”). Further, as was also well-known, the AX10 was designed and sold for such uses. *Id.*

289. Moreover, Astera expressly teaches the AX10 produce effects captured by video cameras (used in videography, broadcasting, cinematography, and studio/location filming). The AX10 has an “Anti-Flicker” adjustment, so the light settings will “fit different camera’s frame rates.” EX1011, 32.

7.12 ANTI-FLICKER

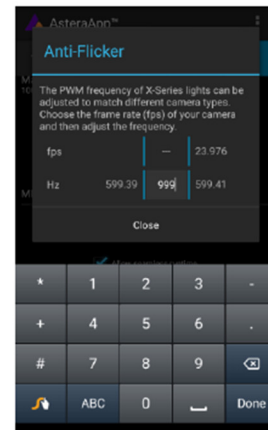
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".

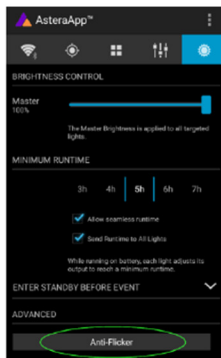


Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

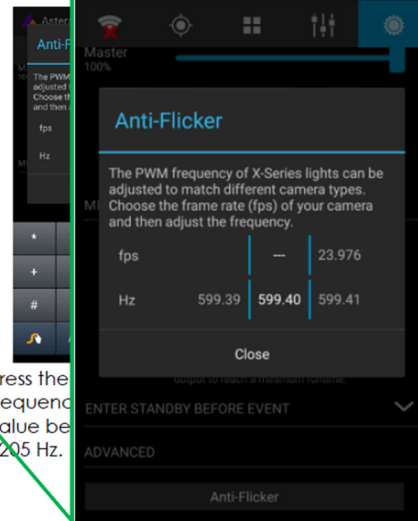
Id. (annotated).



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".



Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the frequency value between 200 and 1205 Hz.

Id. (annotated). Fitting lights to a camera's frame rates indicates the lighting effects are intended to be captured on video camera (as opposed to a still camera), as the

“flicker” avoided is an unwanted artifact that would otherwise appear on captured video.

290. Further, a POSITA would understand references to DMX control in Astera, *see, e.g., id.*, 9-10, indicate the AX10 was developed for TV, cinematography, and studio filming, as DMX is a common communication standard created by and for the entertainment lighting industry.

10. Claim 11

291. It is my opinion that Astera anticipates Claim 11.

a. Claim Element 11p

292. The preamble of Claim 11, designated Claim Element 11p herein, recites “A controller adapted to control a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the controller comprising:” EX1001, 12:47-50.

293. For the purposes of this Declaration, I assume that the preamble of Claim 11 is limiting and must be considered for the purposes of evaluating the validity of the claim.

294. Regardless, Astera discloses Claim Element 11p.

295. Astera discloses that the method of Claim 1 is implemented on a system that includes an array of nine “RGBAW” (i.e., red, green, blue, amber, white) LEDs. EX1011, 7.



Id., cover (annotated).

4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emittance*:	10,350lx (at 2m; White 4000K)
CRI*:	up to 92

Id., 7 (annotated).

296. The AX10 can be controlled via various controllers, including the Control Panel and AsteraApp. *Id.*, 9.



Id., 9, 11, 23.

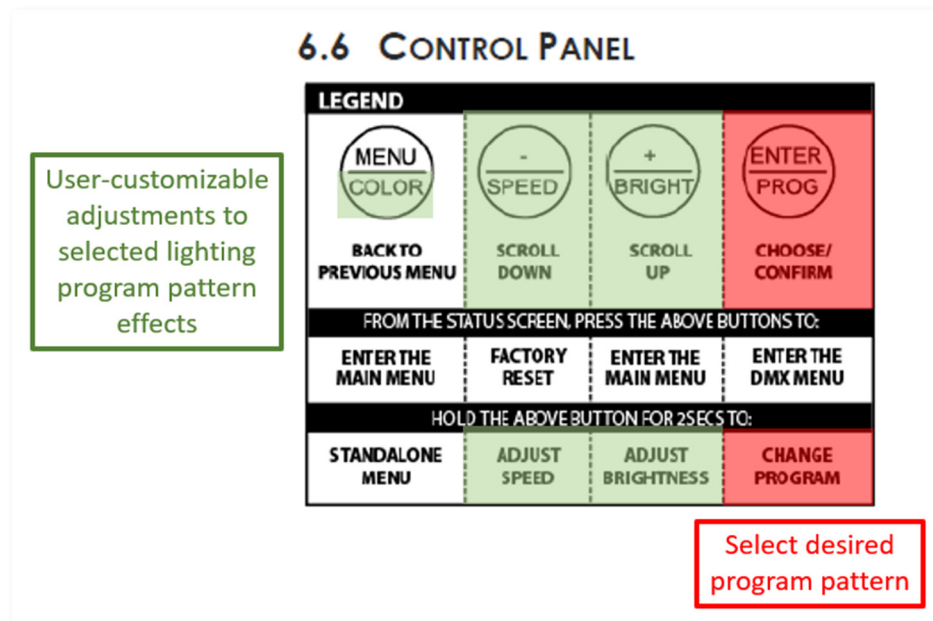
297. The AX10 can produce user-customizable lighting effects and compensate for rolling shutter effects through an “anti-flicker” adjustment. *Id.*, 23-24, 27-28, 32.

298. “Effect modes” offer “a comprehensive control of the built in standalone engine,” to implement “predefined programs” for effects including fire, strobe, static colors, color fades, rainbow, spiral colors. EX1011, 17, 21.

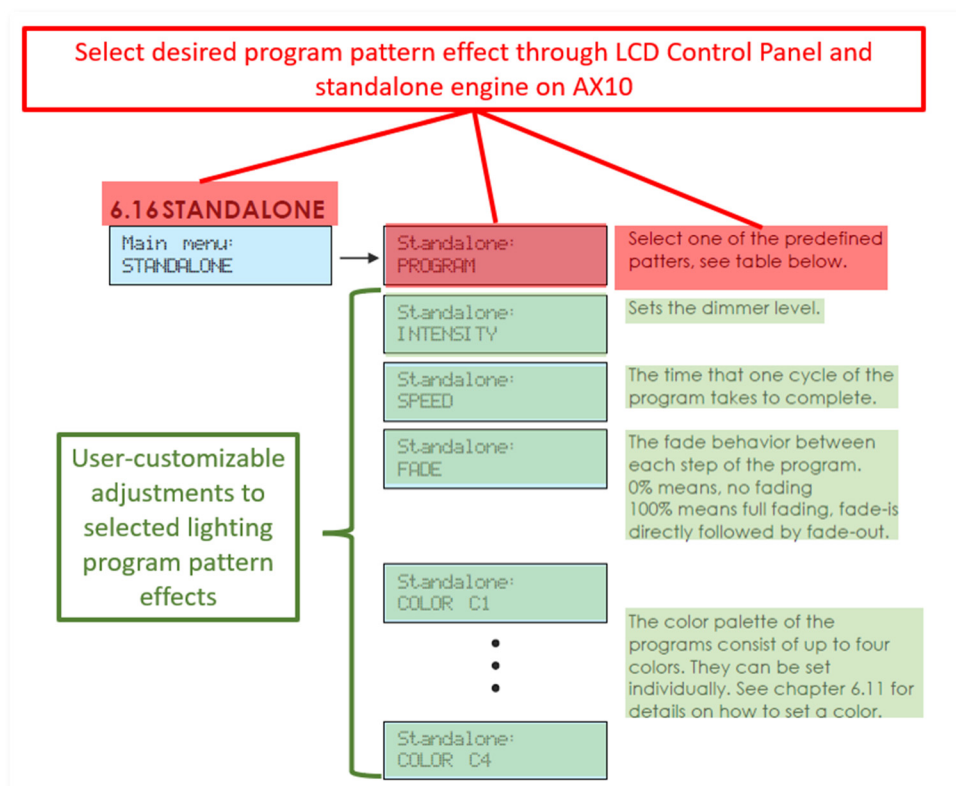
Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
FOUR COLOR STATIC	The virtual light is split into four parts and four colors are displayed.
ONE COLOR FADE	For all FADE programs, the whole color palette of four colors is used. Those colors are faded in and out one by one. Here, the whole virtual light shows the same color.
TWO COLOR FADE	The virtual light is split and shows two colors at a time.
THREE COLOR FADE	The virtual light is split and shows three colors at a time.
FOUR COLOR FADE	The virtual light is split and shows four colors at a time.
SIMPLE RUNNING	A running light; the background and the running pixels color can be set.
DOUBLE RUNNING	Two pixels are running in opposite direction.
TWO COL RUNNING	The two pixels are of different color even.
FLAG RUNNING	A three color flag is running over the background color.
DOUBLE FLAG RUNNING	Two flags are running over background in opposite direction.
SPIRAL 4 COLORS	The color is changed pixel by pixel. All four colors are used one after the other.
SPIRAL 2 COLORS	The color changes between color 1 and 2 from the outside to the inside, pixel by pixel.
RAINBOW	A rainbow effect is displayed.
FIRE	The fire effect is a random flicker between two colors, background and flickering color.

Id., 21.

299. Users can customize these effects. *Id.*, 8, 11, 13, 20, 24-29. The Control Panel allows users to “select” one of the above effects and then modify it by adjusting: (i) intensity to set a dimmer level; (ii) speed to change the time to complete one cycle of the program; (iii) fade time between program steps; and (iv) color. *Id.*, 20.



Id., 11 (annotated).



300. Similarly, users can select and customize effects, including “running lights,” “fire,” “rainbow,” “chaser effects,” and “stroboscope,” through AsteraApp. *Id.*, 27-28.

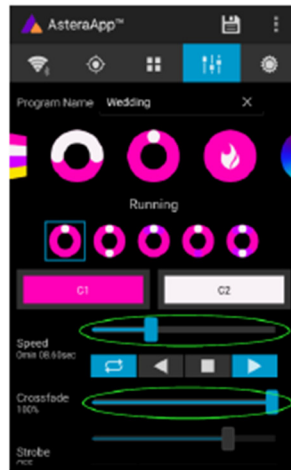
7.7 LIST OF EFFECTS The effects' patterns are pre-defined and cannot be modified by the user. They are pre-programmed inside of each light. Still they can be parameterized. These effects are:	
	Several variations of running lights are available.
	The Fire effect shows a random flickering effect. The background color and the color of the flickering effect can be adjusted.
	The rainbow effect shows a color change through all colors. Only its speed can be adjusted.
	Chaser effects provide an efficient means to create dancefloor lighting. The static chaser exchanges the color of the lights according to the tapped-in beat. The colors are randomly chosen. The effect can be adjusted to show up to 4 different colors at a time.
	The Moving Chasers overlay the static chaser by a second movement of the four displayed colors over the available positions of a Flow-Set. This gets mostly interesting if the Moving Strobe is chosen. Then, only some of the positions strobe and they are moving. So the strobe effect moves over the Flow-Set.

Id., 28 (annotated). Selected effects can be customized by adjusting parameters including: (i) “speed” of how long it will take for “the effect to complete one cycle,” (ii) “crossfade” between steps, (iii) “speed” of a “stroboscope” effect, and (iv) “brightness”:

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).

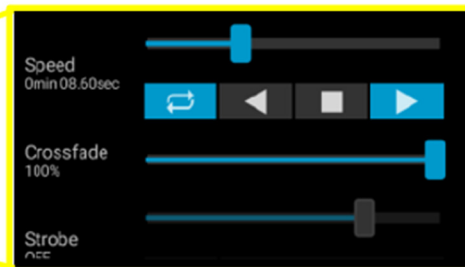
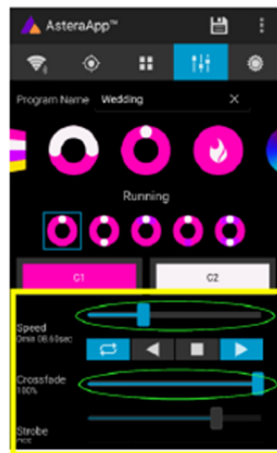


Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



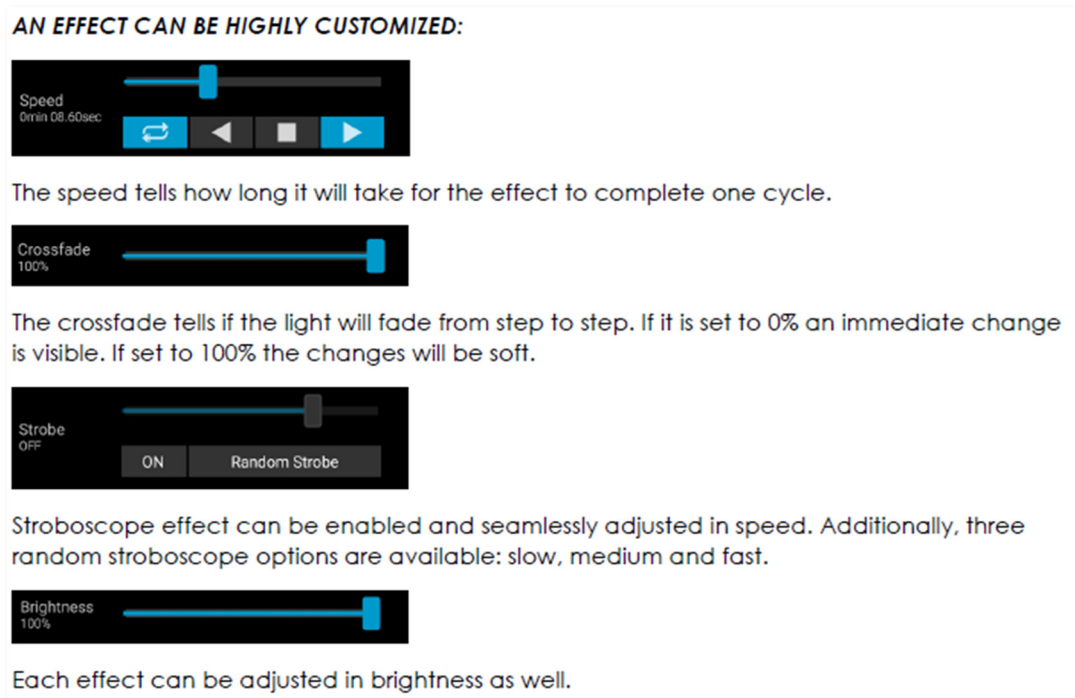
The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

Id., 27.



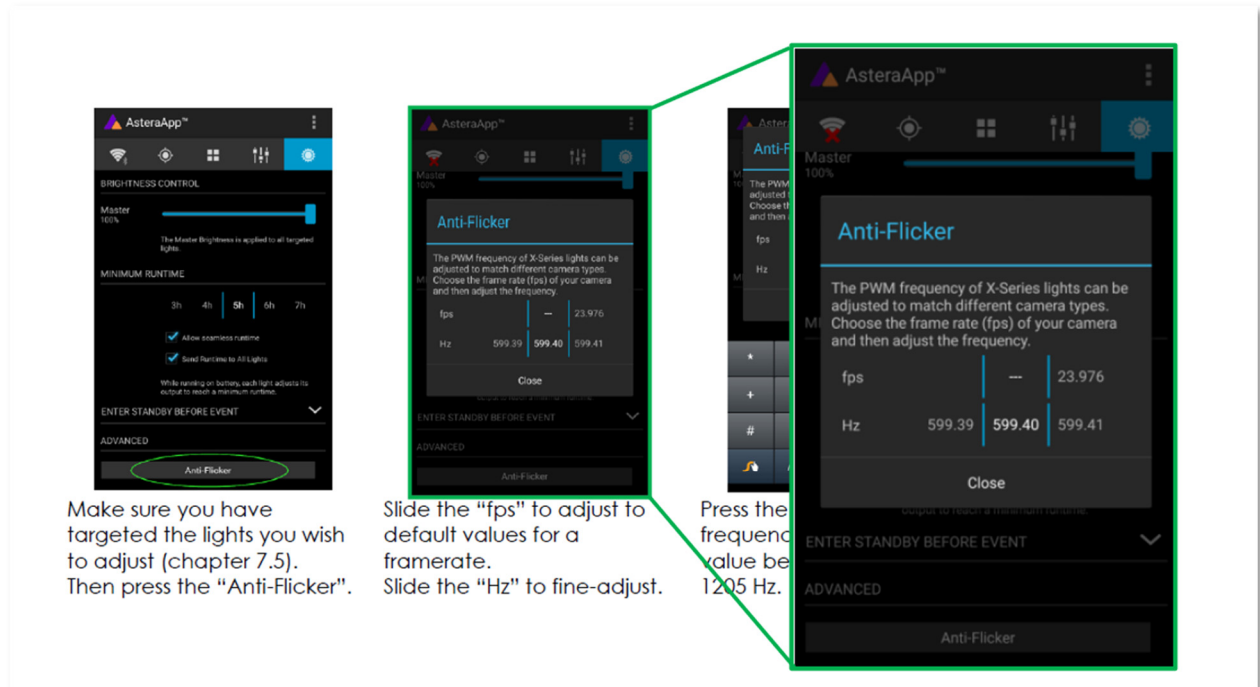
Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

Id. (annotated).



Id.

301. Further, Astera discloses how the AX10 can compensate for rolling shutter artifacts, caused by the interaction between the frequency of the LED light output and the camera frame rate, by making “Anti-Flicker” adjustments—adjusting the PWM refresh frequency of the light output and selected effect to “fit different camera’s frame rates.” *Id.*, 32. Users can choose the frame rate (in frames per second) of the camera being used, and then adjust the PWM refresh rate frequency to a value that will avoid flicker. *Id.*



Id. (annotated).

b. Claim Element 11a

302. Claim Element 11a recites “an effect simulator adapted to calculate a time varying lighting value”. EX1001, 12:51-52.

303. Astera discloses Claim Element 11a.

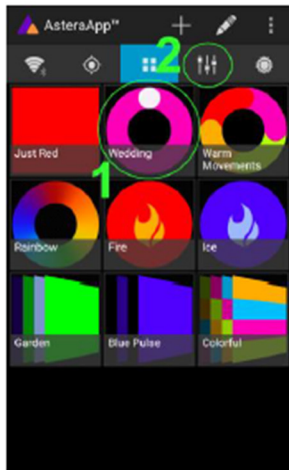
304. The Control Panel and AsteraApp controllers calculate time varying lighting values for generating special effects based on user-input simulation parameters. EX1011, 9-11, 13, 17, 21.

305. The AX10 Control Panel allows users to “select” from predefined effects, and then adjust parameters including intensity (to set a dimmer level), speed (to change the time to complete one cycle), fade time, and color. *Id.*, 20. Based on

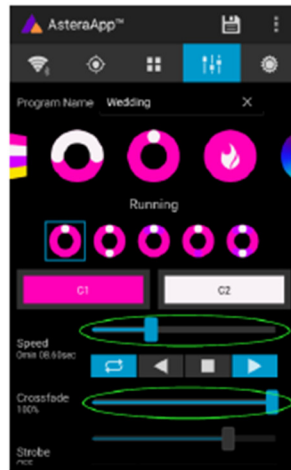
these selections, Control Panel creates data characterizing the adjusted lighting effect, in the form of values and settings for the LEDs to “display these effects properly with [the] light.” *Id.*, 17, 20-21.

306. Similarly, in AsteraApp, users can select from a variety of lighting effects, such as “fire,” “chasers,” “rainbow” and “stroboscope.” *Id.*, 23-24, 27-28; *see supra* Claim Element 11p. Effects selected from AsteraApp can then “be highly customized,” to adjust parameters including: (i) “speed” of how long it will take to complete one cycle, (ii) “crossfade” between steps, (iii) random “stroboscope” speed, and (iv) “brightness.” EX1011, 27. Users can also select and customize colors for effects “with a customizable color palette,” and certain effects, like “fire,” allow a user to “adjust” colors making up the effect. *Id.*, 24, 28.

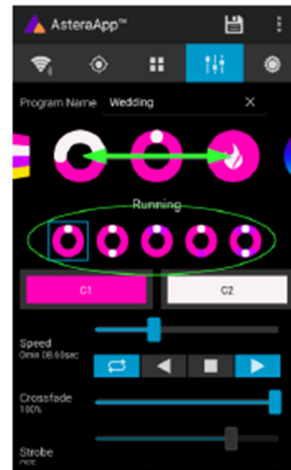
7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

Id., 27.

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id.

307. Users can adjust the PWM refresh rate of the lighting values via “Anti-Flicker” selections, so that the output light will “fit different camera’s frame rates.”

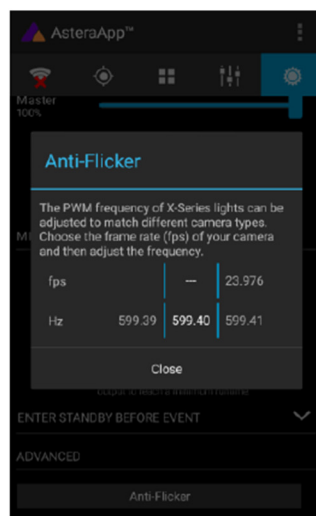
Id., 32.

7.12 ANTI-FLICKER

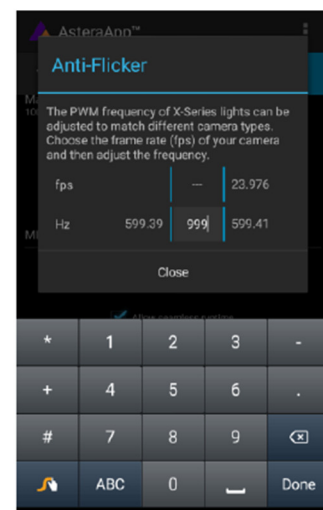
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.

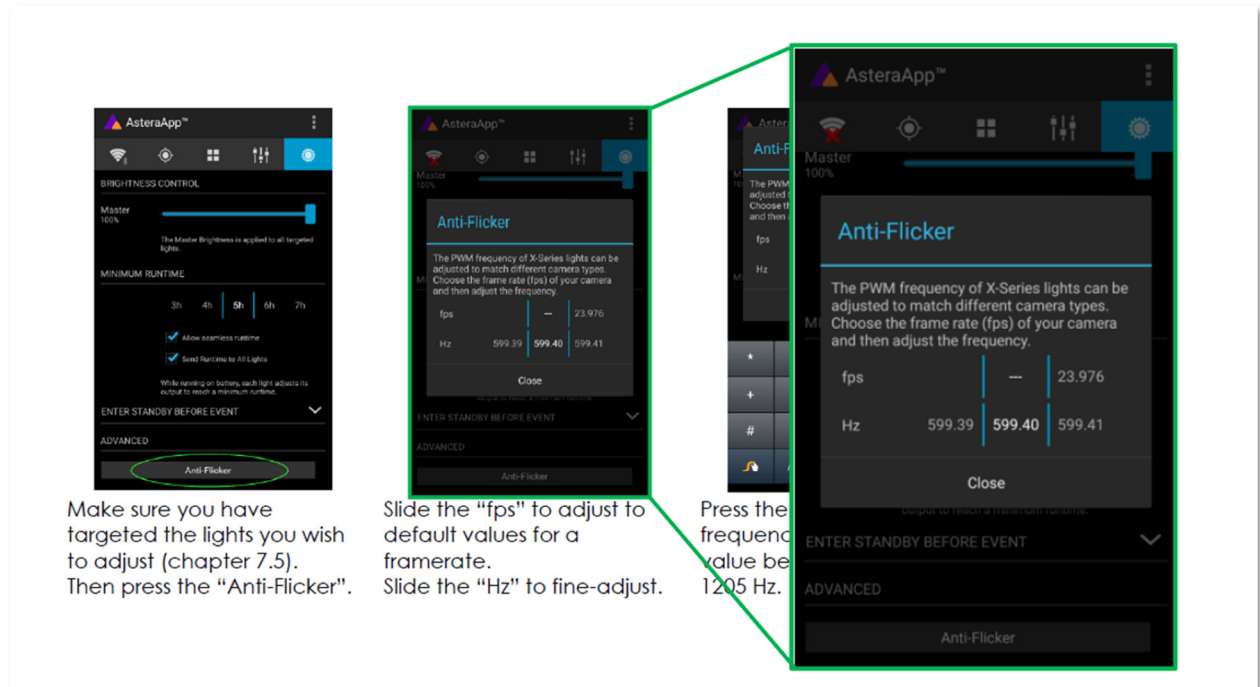


Slide the “fps” to adjust to default values for a framerate. Slide the “Hz” to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated). A user can input the “frame rate (fps) of [her] camera,” and AsteraApp adjusts the PWM refresh to a default value for that particular fps. *Id.* Users can “fine-adjust” by sliding a “Hz” value of the frequency. *Id.*



Id. (annotated).

308. AsteraApp calculates time varying lighting values, including brightness and color information, and, when selected, anti-flicker fps and frequency fine-adjustment inputs for the user-customized effects. *Id.*, 23-29, 32. AsteraApp can “send complex effects” to the lights and can be “used to adjust the lights settings remotely” by sending controls (which are lighting values). *Id.*, 23. Based on user selections, “effects can be created and be sent to the light by the built in UHF receiver,” where the effects are “triggered” and replayed at each light. *Id.*, 24.

c. Claim Element 11b

309. Claim Element 11b recites

compensating for the rolling shutter artefacts produced by the camera based on at least one user input simulation parameter input by a user,

said at least one user input simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera;
a camera shutter speed of the camera; and
a camera frame rate of the camera; and

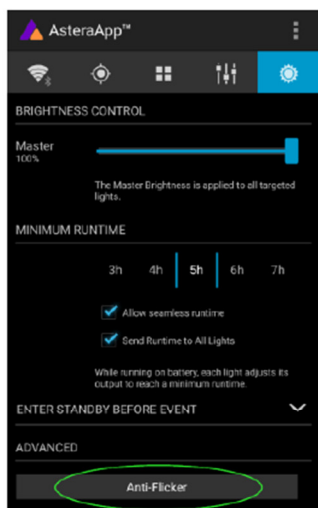
EX1001, 12:52-60.

310. Astera discloses Claim Element 11b.

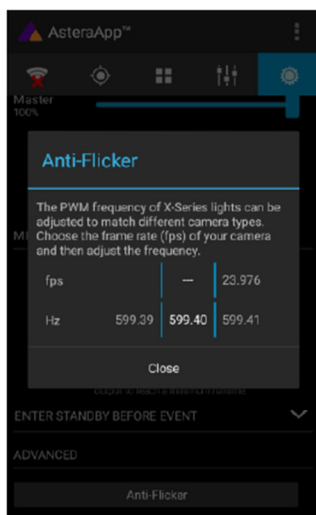
311. Astera discloses compensating for rolling shutter artifacts, in the form of “flicker,” by calculating lighting values based on user inputs indicative of at least the camera frame rate. EX1011, 32. Users can select an “Anti-Flicker” option to compensate for rolling shutter artifacts in the form of unwanted “flicker” that would otherwise be produced if the PWM refresh frequency of the light did not fit the camera’s frame rate. *Id.*

7.12 ANTI-FLICKER

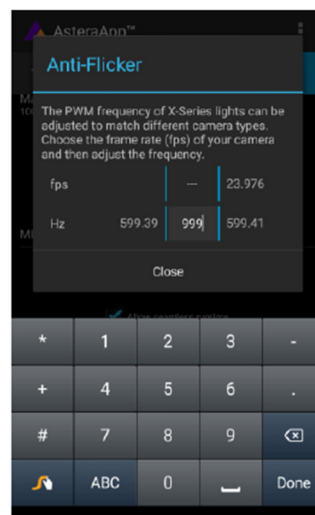
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".



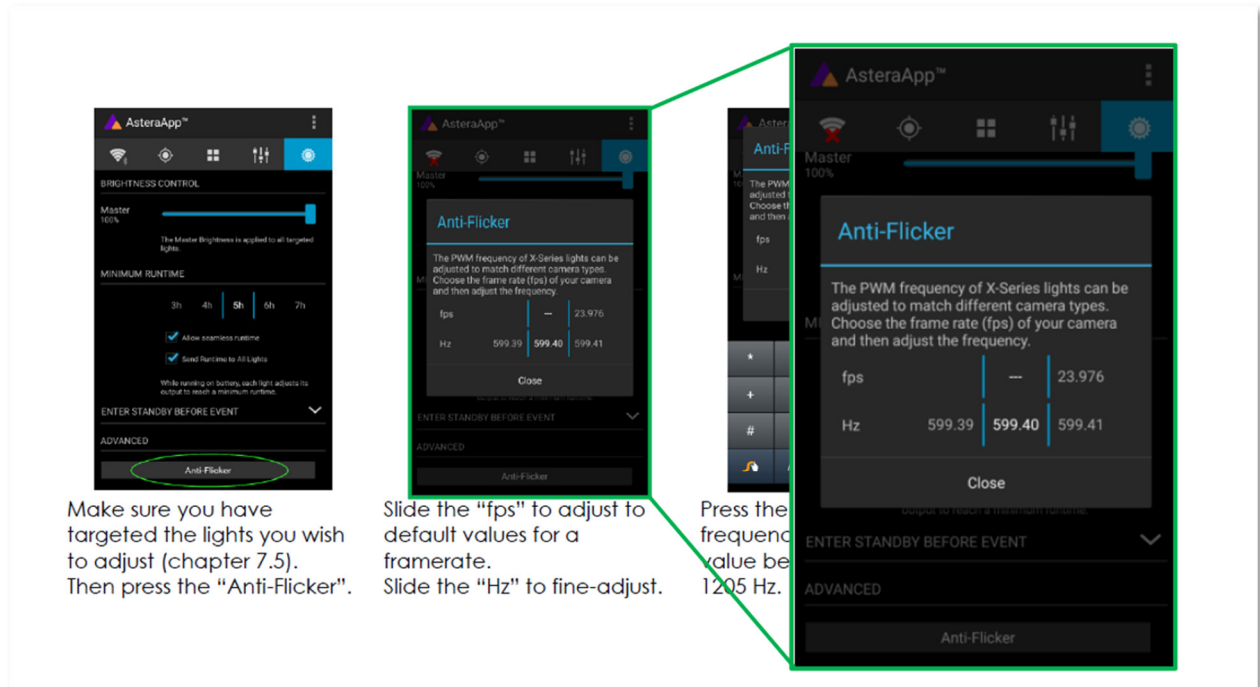
Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated).

312. In the Anti-Flicker menu, users may input and adjust a value for the “frame rate (fps)” of a camera, with AsteraApp suggesting default PWM refresh values for that particular frame rate. *Id.* The Anti-Flicker menu also gives users the option to “slide the ‘Hz’ to fine-adjust,” allowing users to refine the PWM refresh frequency to compensate for the particular frame rate of the camera. *Id.*



Id. (annotated). “[T]he [PWM refresh] frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera’s frame rates.” *Id.*

313. By calculating a PWM frequency based on user inputs of at least camera frame rate, and further allowing fine adjustment of the PWM frequency in view of the camera frame rate, rolling shutter “flickering” artifacts caused by interaction between the frequency of the LED light output and the camera frame rate are avoided.

d. Claim Element 11c

314. Claim Element 11c recites “wherein the effect simulator is adapted to output said calculated time varying lighting value to the lighting device thereby to

simulate a lighting effect compensated for rolling shutter artefacts.” EX1001, 12:61-64.

315. Astera discloses Claim Element 11 c.

316. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize them (e.g., adjust color, speed, crossfade, stroboscope, brightness). *See supra* Claim Element 11a. Users can input parameters, such as camera frame rate, to compensate for rolling shutter “flicker” artifacts, in an Anti-Flicker option that adjusts the PWM frequency of the lights to match camera frame rate. *See supra* Claim Element 11b.

317. Based on these user-customized effects and “Anti-Flicker” inputs, the AX10 calculates time varying lighting values including brightness and color information for the desired effects, adjusted or matched to camera frame rate to avoid rolling shutter artifacts (e.g., flicker). EX1011, 23-29, 32. For example, “[w]ith the AsteraApp these effects can be created and be sent to the light by the built in UHF receiver,” where they are received by the standalone engine in the AX10. *Id.*, 24; *see also id.*, 10, 17. AsteraApp outputs the lighting values representing the adjusted effect created in AsteraApp to the AX10. When the lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” *Id.*, 24.

11. Claim 12

318. Claim 12 recites “The controller according to claim 11, wherein the controller is adapted to control a plurality of lighting devices in dependence on the time varying lighting value.” EX1001, 12:65-67.

319. It is my opinion that Astera anticipates Claim 12.

320. The AX10 is comprised of nine “RGBAW” LEDs. EX1011, 7. The Control Panel and AsteraApp (e.g., controllers) control this plurality of nine LED “lighting devices.” *See supra* Claim Elements 1p-1c.

321. In addition, when AX10 lights are controlled by AsteraApp, the “[l]ights can be grouped into sets,” so that a user-created effect “can stretch over up to 32 lights. EX1011, 10; *see also id.*, 23.

6.4 CONTROL BY THE ASTERAAPP™

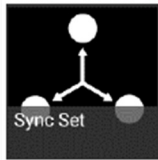
Your light has a built in standalone engine. It can display static colors or replay a number of predefined effect patterns with a customizable color palette.

With the AsteraApp™ these effects can be created and be sent to the light by the built in UHF receiver. The effects are just triggered and then each light replays it autonomously until it receives a new effect.

Lights can be grouped into sets. This way they can be controlled separately and also effects can stretch over up to 32 lights.

Id., 10 (annotated). For example, lights can be grouped together such that all lights in the same “Sync-Set” play the same effect simultaneously, based on control signals from AsteraApp:

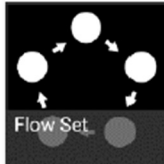
7.4.1 SYNC SET



All lights that are assigned to a Sync-Set can be controlled together. They will do exactly the same.

Id., 25. Alternatively, lights can be grouped into a “Flow-Set,” where lights are “positions” within the Flow-Set, and the lights will play the same lighting effect but offset to each other, in order of their positions:

7.4.2 FLOW SET



By using a Flow-Set, lights can also be controlled together. But additionally, they are assigned to positions inside the Flow-Set and so form a virtual light with several pixels. All effects, like a running light, are stretched over this virtual light.

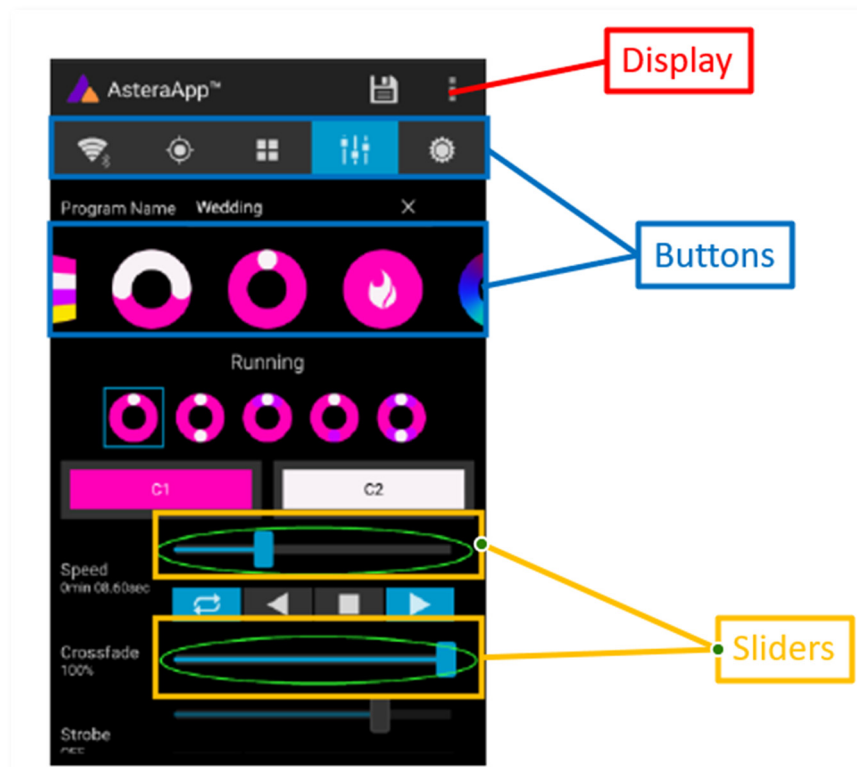
Id., 26.

12. Claim 13

322. Claim 13 recites “The controller according to claim 11, wherein the controller comprises an input interface adapted to receive a user input, and wherein the input interface comprises at least one of: a wireless communication interface; a dial; a slider; a display; and buttons.” EX1001, 13:1-5.

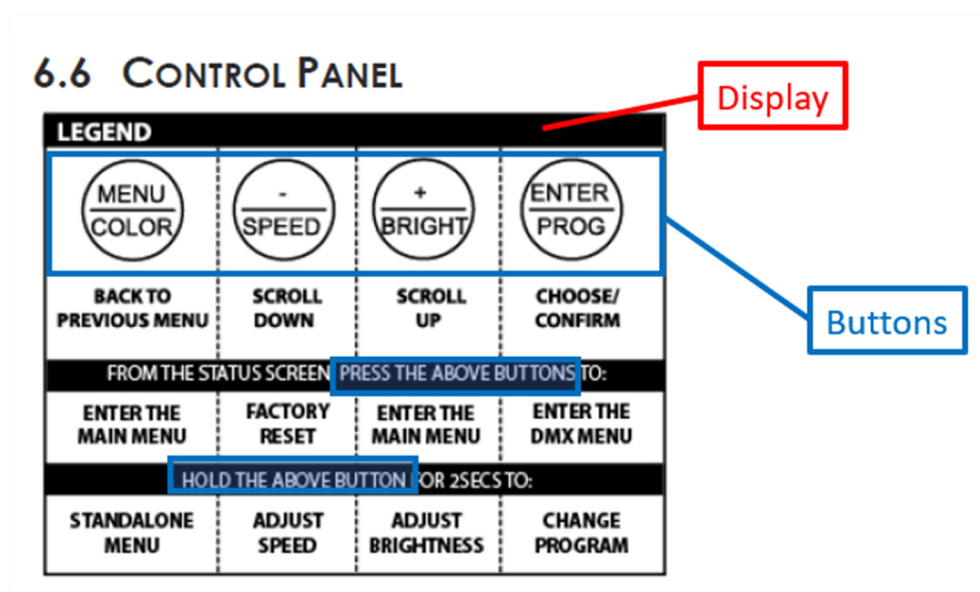
323. It is my opinion that Astera anticipates Claim 13.

324. The AX10 has multiple user interfaces, including the Control Panel and AsteraApp, to receive user inputs. *See supra* Claim 5. AsteraApp comprises a wireless interface, EX1011, 24, as well a display, sliders, and buttons:



Id., 27 (annotated).

325. The Control Panel interface on the AX10 also includes a user interface having a display and buttons:



Id., 11 (annotated).

13. Claim 14

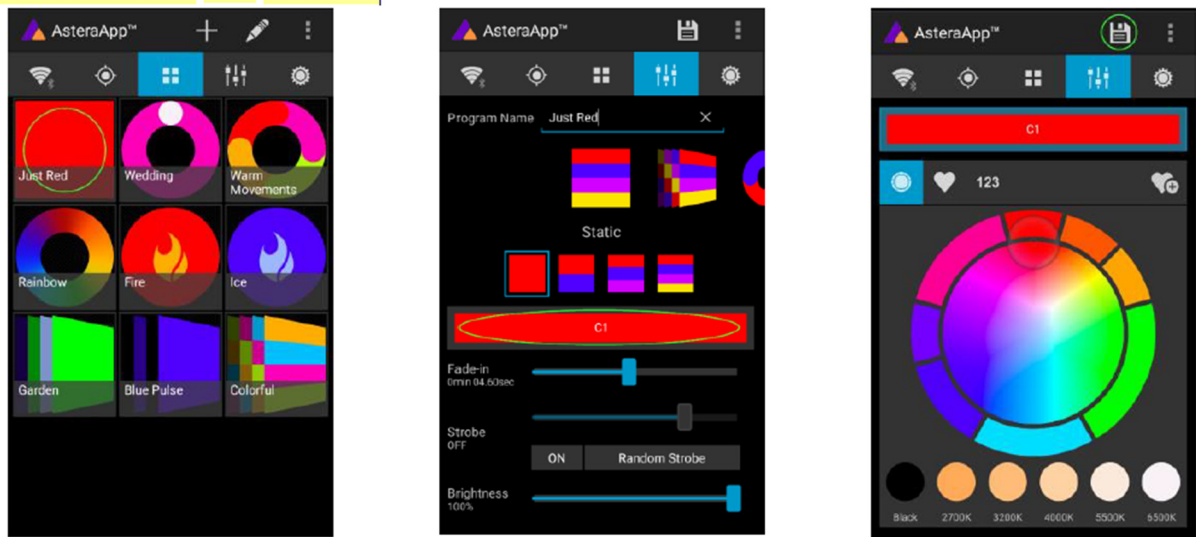
326. Claim 14 recites “The controller according to claim 11, further comprising a converter adapted to convert at least one of: brightness; and colour data from the simulator into lighting signals.” EX1001, 13:6-9.

327. It is my opinion that Astera anticipates or renders obvious Claim 14.

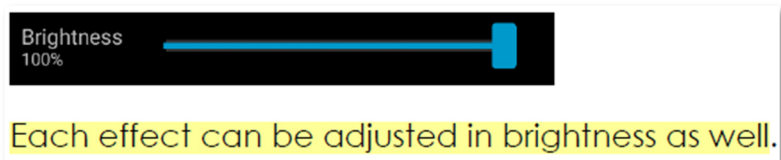
328. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize those effects (e.g., adjust speed, crossfade, stroboscope, brightness), resulting in lighting value data representing the effect. *See supra* Claim Elements 1a, 1c. Again, based on these user-selected, customized effects, the AX10 system calculates time varying lighting values including brightness and color information to run the desired effects. EX1011, 17, 20-21, 23-29, 32.

329. For example, “fire” is a random flickering between a “background color and the color of the flickering effect,” both of which colors can be adjusted. *Id.*, 17, 20-21, 23-29, 32. Moreover, users can adjust brightness and color for selected effects. *Id.*, 20, 24-28.

7.3 CHANGE THE COLOR



Id., 24 (annotated); *see also id.* (stating that effect patterns can be “played with a customizable color palate.”).



Each effect can be adjusted in brightness as well.

Id., 27 (annotated).

330. Further, the Control Panel includes a “converter” in “Standalone” mode that converts the selected effects and parameters into values that are sent to the standalone engine that outputs signals to the LEDs. *Id.*, 12, 17. In particular, the Control Panel offers “comprehensive control of the built in standalone engine,” and thus converts the brightness and color data into control signals that it outputs to this standalone engine. *Id.*, 17.

331. AsteraApp similarly includes a “converter” that converts data relating to user-selected brightness and color parameters for the lighting effects into signals that can be sent to the standalone engine in the AX10. As noted above for Claims 1a-1c, the data values for color and brightness of an effect can be input in AsteraApp, which converts these values into signals representing the effect that can “be sent to the light by the built in UHF receiver,” where they are received by the standalone engine in the AX10. EX1011, 24; *see also id.*, 10, 17. That is, AsteraApp converts the brightness and color data for an effect into lighting values representing the effect created in AsteraApp, and outputs these lighting values to the AX10. When the lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” *Id.*, 24.

14. Claim 15

332. Claim 15 recites “The lighting system comprising a controller according to claim 11 and at least one lighting device; wherein said lighting device comprises at least one light emitting diode.” EX1001, 13:10-12.

333. It is my opinion that Astera anticipates Claim 15.

334. The AX10 includes at least one lighting device, specifically having “9 x 15W RGBAW Philips LEDs. EX1011, 7.

4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs

Id. (annotated).

15. Claim 16

335. Claim 16 recites “The lighting system according to claim 15 wherein said controller and said lighting device are integrated in a combined unit.” EX1001, 13:13-15.

336. It is my opinion that Astera anticipates or renders obvious Claim 16.

337. The AX10 includes LED lights. EX1011, 7. The AX10 “can be controlled in several ways,” including a Control Panel and standalone engine on the AX10 itself. *Id.*, 9. More specifically, the AX10 “has a built in standalone engine. It can display static colors or replay a number of predefined effect patterns with a customizable color palette.” *Id.*, 10. Additionally, using the Control Panel, a user can “adjust speed,” “adjust brightness,” and select a new lighting effect program (“change program”), among other things:

6.6 CONTROL PANEL

User-customizable adjustments to selected lighting program pattern effects

LEGEND			
			
BACK TO PREVIOUS MENU	SCROLL DOWN	SCROLL UP	CHOOSE/CONFIRM
FROM THE STATUS SCREEN, PRESS THE ABOVE BUTTONS TO:			
ENTER THE MAIN MENU	FACTORY RESET	ENTER THE MAIN MENU	ENTER THE DMX MENU
HOLD THE ABOVE BUTTON FOR 2SECS TO:			
STANDALONE MENU	ADJUST SPEED	ADJUST BRIGHTNESS	CHANGE PROGRAM

Select desired program pattern

Id., 11 (annotated).

Select desired program pattern effect through LCD Control Panel and standalone engine on AX10

6.16 STANDALONE

Main menu: STANDALONE

Standalone: PROGRAM

Select one of the predefined patterns, see table below.

Standalone: INTENSITY

Sets the dimmer level.

Standalone: SPEED

The time that one cycle of the program takes to complete.

Standalone: FADE

The fade behavior between each step of the program. 0% means, no fading. 100% means full fading, fade-in directly followed by fade-out.

Standalone: COLOR C1

The color palette of the programs consist of up to four colors. They can be set individually. See chapter 6.11 for details on how to set a color.

•
•
•

Standalone: COLOR C4

User-customizable adjustments to selected lighting program pattern effects

Id., 20 (annotated). Thus, the AX10 LED lights, together with the Control Panel and standalone engine, are “integrated in a combined unit.”

338. Further, it would have been obvious to a POSITA to provide the “Anti-Flicker” adjustment option on AsteraApp directly on the Control Panel. A POSITA would have recognized that, as explained in Astera, the Control Panel and AsteraApp are two ways of controlling the same AX10 light. *Id.*, 9. Astera expressly discloses a user can make many of the same selections and adjustments, such as selecting effects and modifying speed, intensity, and fade of those effects. *Id.*, 11, 17, 20-21, 27-28. A POSITA would have recognized that adjusting PWM refresh frequency of the lights is a similar type of adjustment that could be implemented through the Control Panel, in the same way speed, fade, and intensity for an effect are adjusted. Thus, modifying the Control Panel to include the “anti-flicker” frequency adjustment would have been trivial, simply adding to the Control Panel an additional parameter adjustment, in the same way it allows for adjustments to, for example, speed and intensity parameters. Such modification would yield a predictable result, as only the source of the instructions (coming from the Control Panel rather than the AsteraApp) would change; the content and result of those instructions as implemented by the standalone engine would not.

339. A POSITA would have been motivated to add AsteraApp functionality to the interface on the AX10, given the need for ease of transport and to minimize

need for additional equipment and controllers when filming. Including AsteraApp functionality would allow a user operating the device with the Control Panel, rather than through a smartphone, to make necessary adjustments during operation without having to use additional controllers. *Id.* Moreover, adding this feature to the Control Panel would allow different users to operate the same light and make necessary adjustments and selections, including “anti-flicker,” without each separate user having to download and use AsteraApp.

16. Claim 17

340. It is my opinion that Astera anticipates Claim 17.

a. Claim Element 17p

341. The preamble of Claim 17, designated Claim Element 17p herein, recites “A computer program comprising software code for controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, the computer program adapted to perform, when executed, the steps of:” EX1001, 13:16-20.

342. For purposes of this Declaration, I assume that the preamble of Claim 17 is limiting and must be considered for the purposes of evaluating the validity of the claim.

343. Regardless, Astera discloses Claim Element 17p.

344. Astera’s Control Panel and AsteraApp perform the functions based on computer software program code. AsteraApp is a mobile application, in the form of software code, that is downloaded and run on a user’s mobile device. *Id.* The Control Panel is implemented through software-based programming in the AX10 itself. *Id.* Astera notes the lights include “firmware version 5.2.20,” and the information menu displays “the firmware version and hardware version of the light.” EX1011, 2, 12, 22. A POSITA would understand that firmware is software programmed into a read-only memory, and that this firmware implements the programming and control of the AX10.

345. Astera discloses the features and functionality of the AX10, a controllable lighting fixture with an array of nine “RGBAW” (i.e., red, green, blue, amber, white) LEDs. EX1011, 7.



Id., cover (annotated).

4 SPECIFICATION

LED power:	135W
Illuminants:	9 x 15W RGBAW Philips LEDs
Luminous Flux*:	3,350lm (at White 4000K)
Emittance*:	10,350lx (at 2m; White 4000K)
CRI*:	up to 92

Id., 7 (annotated).

346. The AX10 can be controlled via various controllers, including the Control Panel and AsteraApp. *Id.*, 9.



Id., 9, 11, 23.

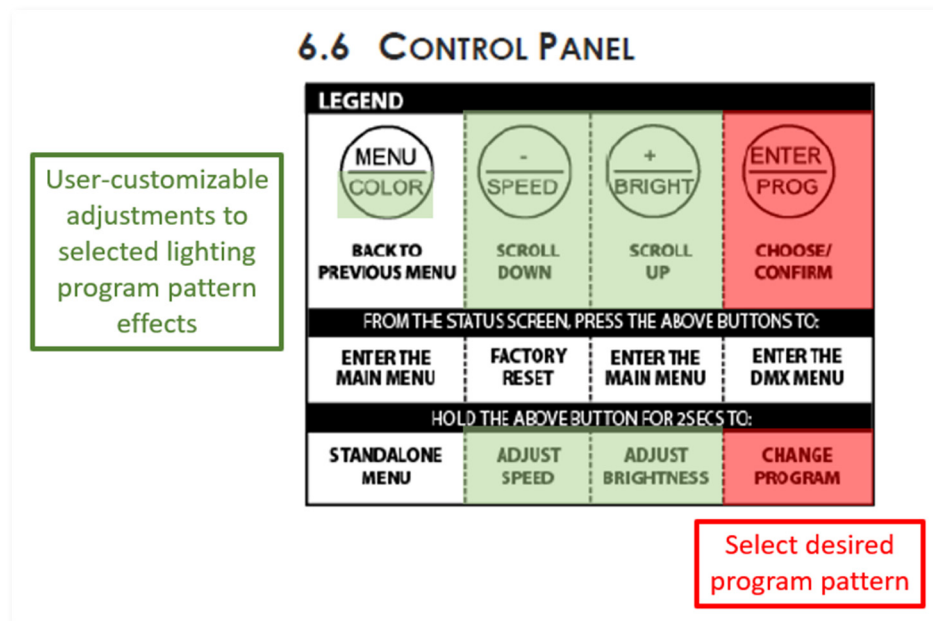
347. The AX10 can produce user-customizable lighting effects and compensate for rolling shutter effects through an “anti-flicker” adjustment. *Id.*, 23-24, 27-28, 32.

348. “Effect modes” offer “a comprehensive control of the built in standalone engine,” to implement “predefined programs” for effects including fire, strobe, static colors, color fades, rainbow, spiral colors. EX1011, 17, 21.

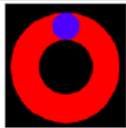
Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
FOUR COLOR STATIC	The virtual light is split into four parts and four colors are displayed.
ONE COLOR FADE	For all FADE programs, the whole color palette of four colors is used. Those colors are faded in and out one by one. Here, the whole virtual light shows the same color.
TWO COLOR FADE	The virtual light is split and shows two colors at a time.
THREE COLOR FADE	The virtual light is split and shows three colors at a time.
FOUR COLOR FADE	The virtual light is split and shows four colors at a time.
SIMPLE RUNNING	A running light; the background and the running pixels color can be set.
DOUBLE RUNNING	Two pixels are running in opposite direction.
TWO COL RUNNING	The two pixels are of different color even.
FLAG RUNNING	A three color flag is running over the background color.
DOUBLE FLAG RUNNING	Two flags are running over background in opposite direction.
SPIRAL 4 COLORS	The color is changed pixel by pixel. All four colors are used one after the other.
SPIRAL 2 COLORS	The color changes between color 1 and 2 from the outside to the inside, pixel by pixel.
RAINBOW	A rainbow effect is displayed.
FIRE	The fire effect is a random flicker between two colors, background and flickering color.

Id., 21.

349. Users can customize these effects. *Id.*, 8, 11, 13, 20, 24-29. The Control Panel allows users to “select” one of the above effects and then modify it by adjusting: (i) intensity to set a dimmer level; (ii) speed to change the time to complete one cycle of the program; (iii) fade time between program steps; and (iv) color. *Id.*, 20.

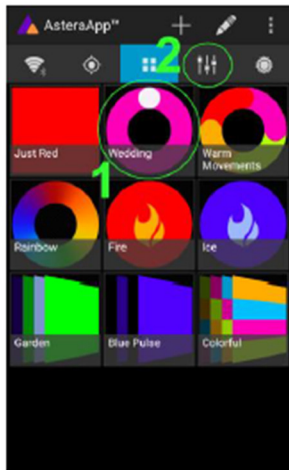


350. Similarly, users can select and customize effects, including “running lights,” “fire,” “rainbow,” “chaser effects,” and “stroboscope,” through AsteraApp. *Id.*, 27-28.

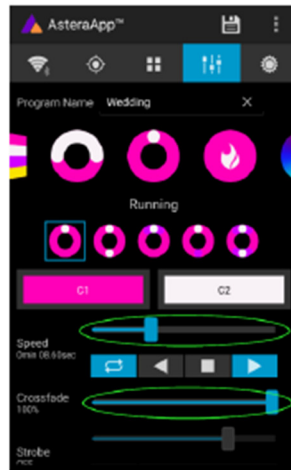
7.7 LIST OF EFFECTS The effects' patterns are pre-defined and cannot be modified by the user. They are pre-programmed inside of each light. Still they can be parameterized. These effects are:	
	Several variations of running lights are available.
	The Fire effect shows a random flickering effect. The background color and the color of the flickering effect can be adjusted.
	The rainbow effect shows a color change through all colors. Only its speed can be adjusted.
	Chaser effects provide an efficient means to create dancefloor lighting. The static chaser exchanges the color of the lights according to the tapped-in beat. The colors are randomly chosen. The effect can be adjusted to show up to 4 different colors at a time.
	The Moving Chasers overlay the static chaser by a second movement of the four displayed colors over the available positions of a Flow-Set. This gets mostly interesting of the Moving Strobe is chosen. Then, only some of the positions strobe and they are moving. So the strobe effect moves over the Flow-Set.

Id., 28 (annotated). Selected effects can be customized by adjusting parameters including: (i) “speed” of how long it will take for “the effect to complete one cycle,” (ii) “crossfade” between steps, (iii) “speed” of a “stroboscope” effect, and (iv) “brightness”:

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).

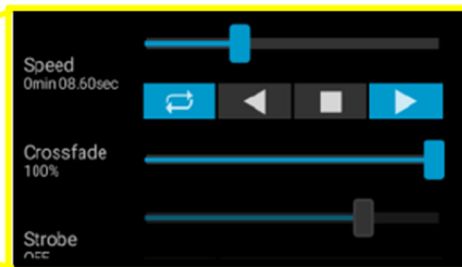
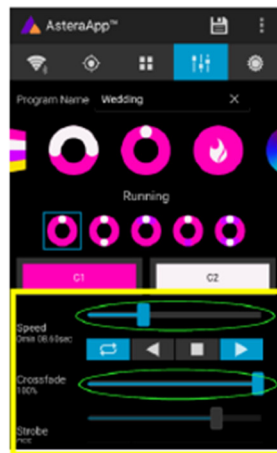


Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



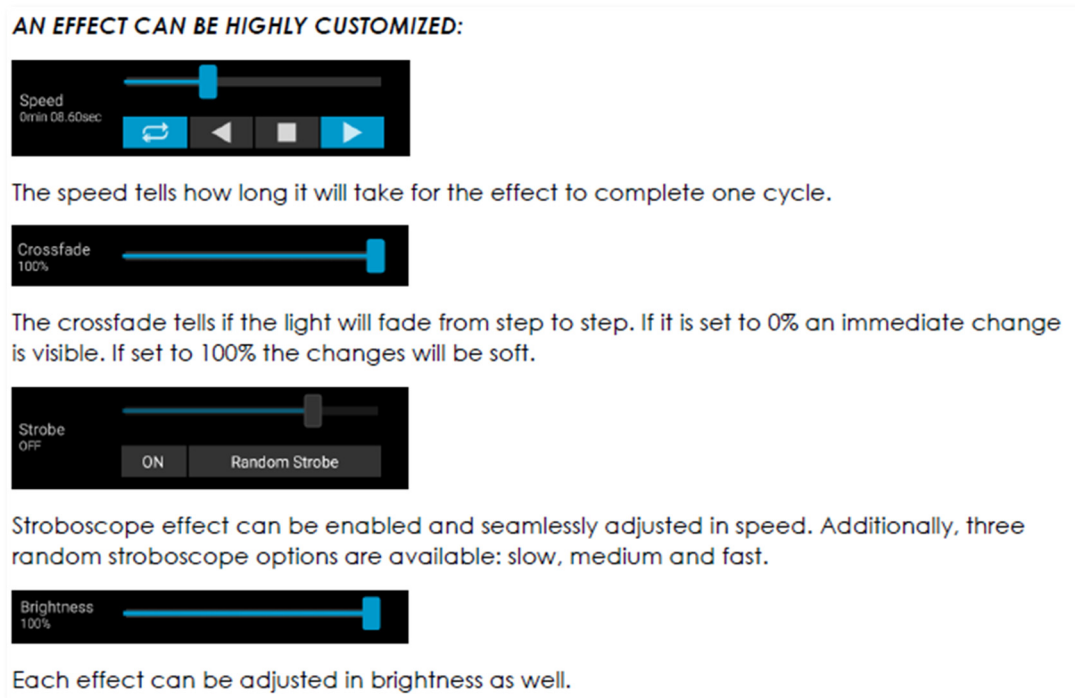
The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

Id., 27.



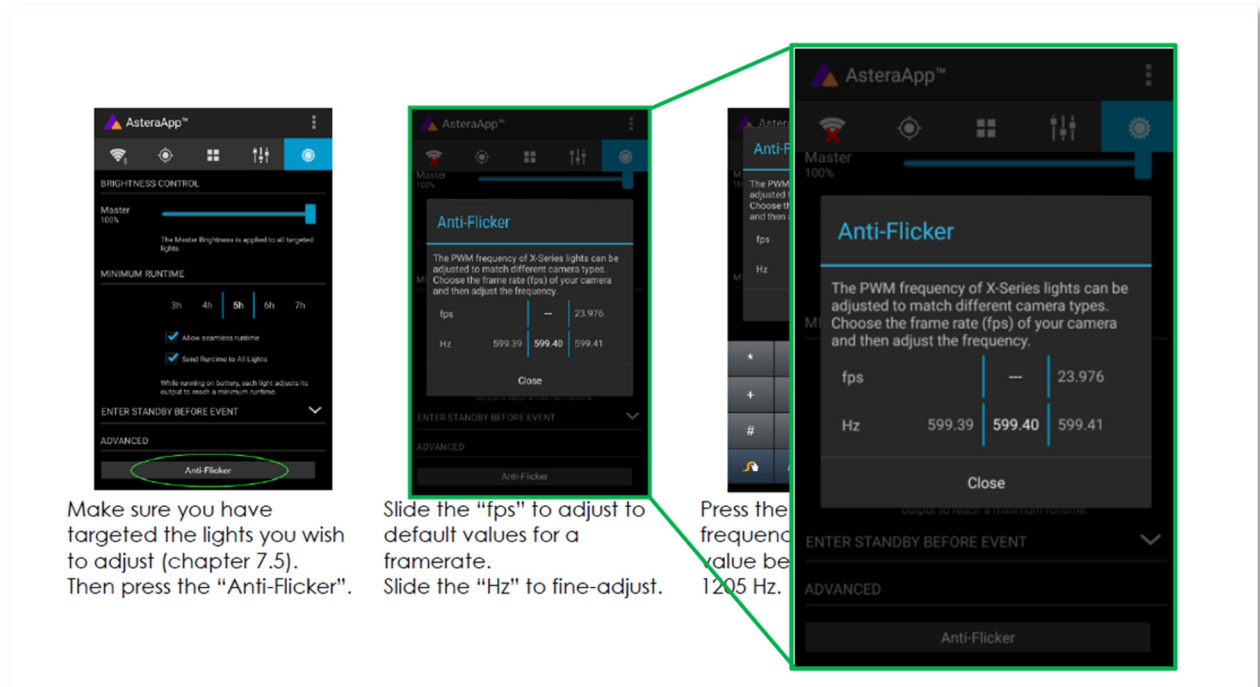
Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

Id. (annotated).



Id.

351. Further, Astera discloses how the AX10 can compensate for rolling shutter artifacts, caused by the interaction between the frequency of the LED light output and the camera frame rate, by making “Anti-Flicker” adjustments—adjusting the PWM refresh frequency of the light output and selected effect to “fit different camera’s frame rates.” *Id.*, 32. Users can choose the frame rate (in frames per second) of the camera being used, and then adjust the PWM refresh rate frequency to a value that will avoid flicker. *Id.*



Id. (annotated).

b. Claim Element 17a

352. Claim Element 17a recites “calculating, using an effect simulator, a time varying lighting value”. EX1001, 13:21-22.

353. Astera discloses Claim Element 17a.

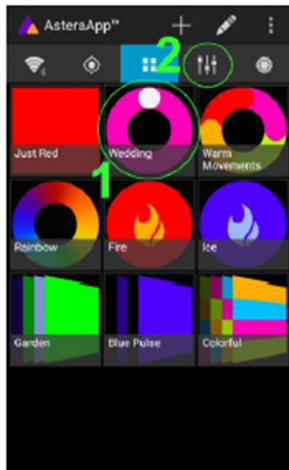
354. The Control Panel and AsteraApp controllers calculate time varying lighting values for generating special effects based on user-input simulation parameters. EX1011, 9-11, 13, 17, 21.

355. The AX10 Control Panel allows users to “select” from predefined effects, and then adjust parameters including intensity (to set a dimmer level), speed (to change the time to complete one cycle), fade time, and color. *Id.*, 20. Based on

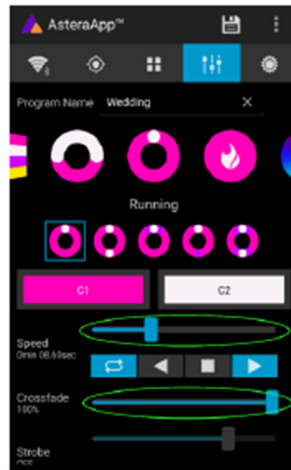
these selections, Control Panel creates data characterizing the adjusted lighting effect, in the form of values and settings for the LEDs to “display these effects properly with [the] light.” *Id.*, 17, 20-21.

356. Similarly, in AsteraApp, users can select from a variety of lighting effects, such as “fire,” “chasers,” “rainbow” and “stroboscope.” *Id.*, 23-24, 27-28; *see supra* Claim Element 17p. Effects selected from AsteraApp can then “be highly customized,” to adjust parameters including: (i) “speed” of how long it will take to complete one cycle, (ii) “crossfade” between steps, (iii) random “stroboscope” speed, and (iv) “brightness.” EX1011, 27. Users can also select and customize colors for effects “with a customizable color palette,” and certain effects, like “fire,” allow a user to “adjust” colors making up the effect. *Id.*, 24, 28.

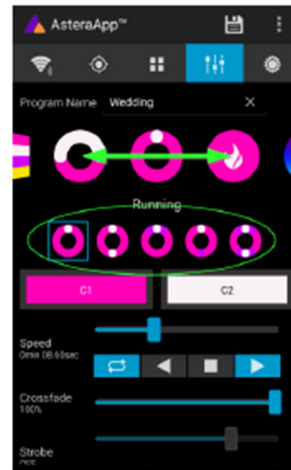
7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

Id., 27.

AN EFFECT CAN BE HIGHLY CUSTOMIZED:



The speed tells how long it will take for the effect to complete one cycle.



The crossfade tells if the light will fade from step to step. If it is set to 0% an immediate change is visible. If set to 100% the changes will be soft.



Stroboscope effect can be enabled and seamlessly adjusted in speed. Additionally, three random stroboscope options are available: slow, medium and fast.



Each effect can be adjusted in brightness as well.

Id.

357. Users can adjust the PWM refresh rate of the lighting values via “Anti-Flicker” selections, so that the output light will “fit different camera’s frame rates.”

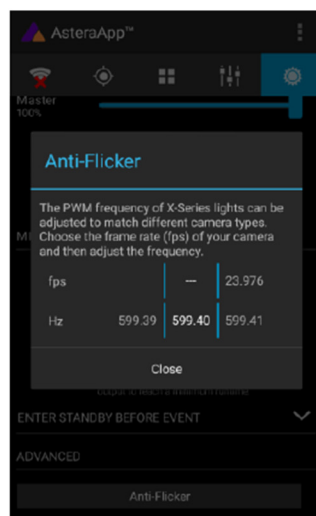
Id., 32.

7.12 ANTI-FLICKER

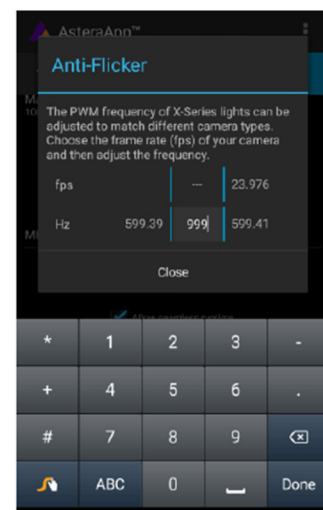
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the “Anti-Flicker”.

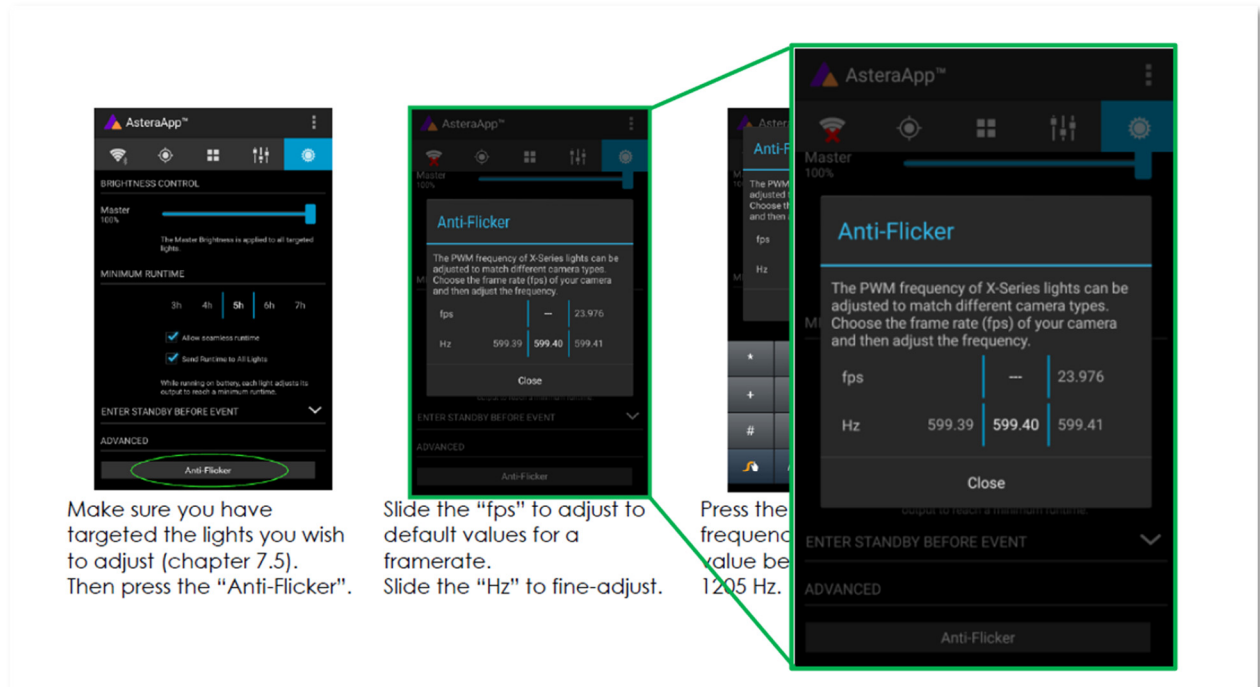


Slide the “fps” to adjust to default values for a framerate. Slide the “Hz” to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated). A user can input the “frame rate (fps) of [her] camera,” and AsteraApp adjusts the PWM refresh to a default value for that particular fps. *Id.* Users can “fine-adjust” by sliding a “Hz” value of the frequency. *Id.*



Id. (annotated).

358. AsteraApp calculates time varying lighting values, including brightness and color information, and, when selected, anti-flicker fps and frequency fine-adjustment inputs for the user-customized effects. *Id.*, 23-29, 32. AsteraApp can “send complex effects” to the lights and can be “used to adjust the lights settings remotely” by sending controls (which are lighting values). *Id.*, 23. Based on user selections, “effects can be created and be sent to the light by the built in UHF receiver,” where the effects are “triggered” and replayed at each light. *Id.*, 24.

c. Claim Element 17b

359. Claim Element 17b recites

compensating for the rolling shutter artefacts based on at least one user input simulation parameter input by a user, said at least one user input

simulation parameter comprising a user selectable parameter indicative of a member of a group consisting of:
a camera recording frequency of the camera,
a camera shutter speed of the camera, and
a camera frame rate of the camera; and

EX1001, 13:22-14:3.

360. Astera discloses Claim Element 17b.

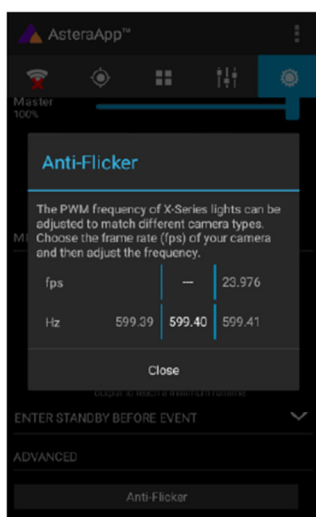
361. Astera discloses compensating for rolling shutter artifacts, in the form of “flicker,” by calculating lighting values based on user inputs indicative of at least the camera frame rate. EX1011, 32. Users can select an “Anti-Flicker” option to compensate for rolling shutter artifacts in the form of unwanted “flicker” that would otherwise be produced if the PWM refresh frequency of the light did not fit the camera’s frame rate. *Id.*

7.12 ANTI-FLICKER

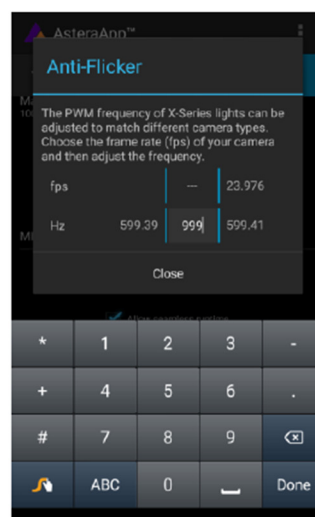
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



Make sure you have targeted the lights you wish to adjust (chapter 7.5). Then press the "Anti-Flicker".



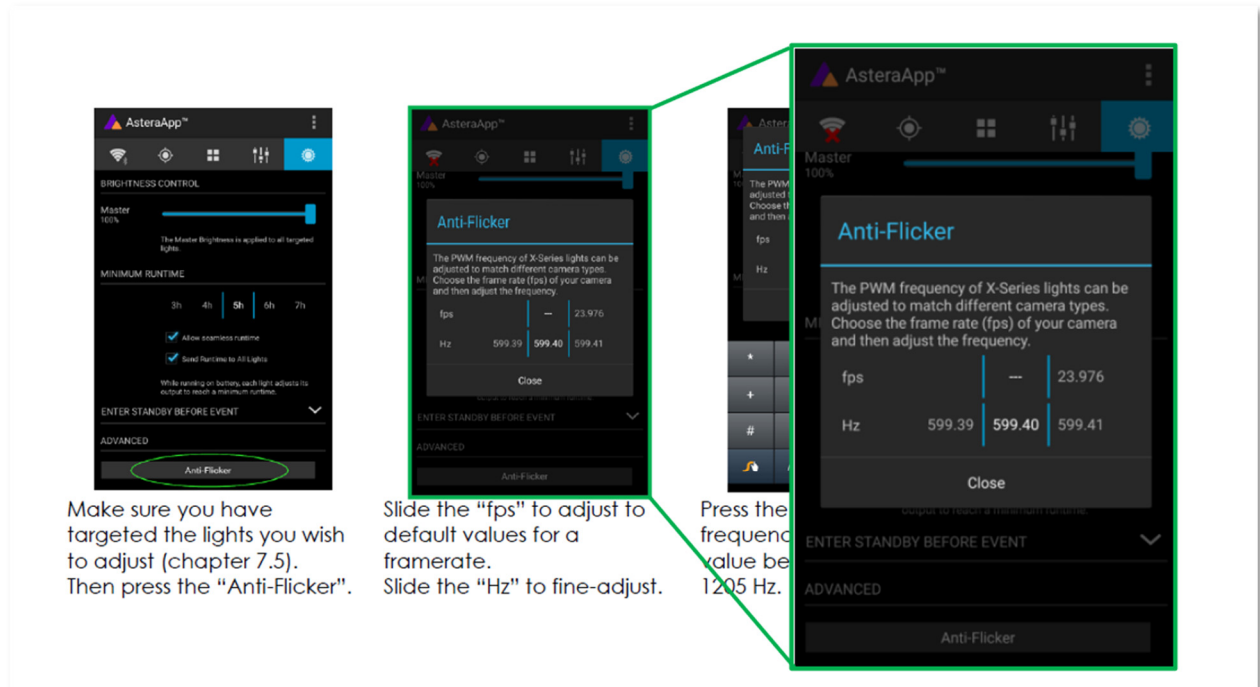
Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



Press the highlighted frequency to enter a custom value between 200 and 1205 Hz.

Id., 32 (annotated).

362. In the Anti-Flicker menu, users may input and adjust a value for the “frame rate (fps)” of a camera, with AsteraApp suggesting default PWM refresh values for that particular frame rate. *Id.* The Anti-Flicker menu also gives users the option to “slide the ‘Hz’ to fine-adjust,” allowing users to refine the PWM refresh frequency to compensate for the particular frame rate of the camera. *Id.*



Id. (annotated). “[T]he [PWM refresh] frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera’s frame rates.” *Id.*

363. By calculating a PWM frequency based on user inputs of at least camera frame rate, and further allowing fine adjustment of the PWM frequency in view of the camera frame rate, rolling shutter “flickering” artifacts caused by interaction between the frequency of the LED light output and the camera frame rate are avoided.

d. Claim Element 17c

364. Claim Element 17c recites “wherein the effect simulator is adapted to output, from said effect simulator, said calculated time varying lighting value to said

lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.” EX1001, 14:4-8.

365. Astera discloses Claim Element 17c.

366. Users can select from different lighting effects (e.g., fire, chasers, rainbow) and then customize them (e.g., adjust color, speed, crossfade, stroboscope, brightness). *See supra* Claim Element 17a. Users can input parameters, such as camera frame rate, to compensate for rolling shutter “flicker” artifacts, in an Anti-Flicker option that adjusts the PWM frequency of the lights to match camera frame rate. *See supra* Claim Element 17b.

367. Based on these user-customized effects and “Anti-Flicker” inputs, the AX10 calculates time varying lighting values including brightness and color information for the desired effects, adjusted or matched to camera frame rate to avoid rolling shutter artifacts (e.g., flicker). EX1011, 23-29, 32. For example, “[w]ith the AsteraApp these effects can be created and be sent to the light by the built in UHF receiver,” where they are received by the standalone engine in the AX10. *Id.*, 24; *see also id.*, 10, 17. AsteraApp outputs the lighting values representing the adjusted effect created in AsteraApp to the AX10. When the lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” *Id.*, 24.

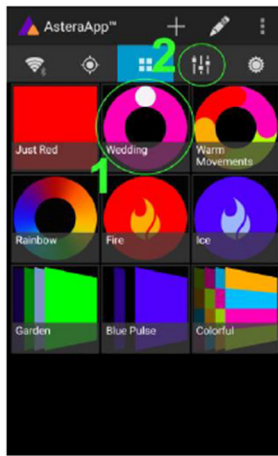
17. Claim 21

368. Claim 21 recites “The method according to claim 9 further comprising recalling said at least one stored user input simulation parameter corresponding to said user customisable lighting effect.” EX1001, 14:21-24.

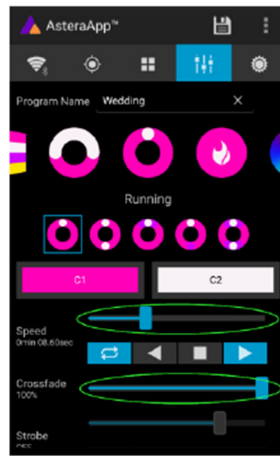
369. It is my opinion that Astera anticipates Claim 21.

370. The user-selectable lighting effects, and user adjustments made to those effects, may be “saved back to the main screen by pressing the save button.” EX1011, 27. Users may select an effect (like “fire” or “wedding”) and modify it, by changing simulation parameters that adjust the effect (like “speed,” “stroboscope,” and “brightness”). *Id.* When the user is done, she can click the disk icon in AsteraApp, saving the modified effect. *Id.*, 27.

7.6 CHANGING THE EFFECT



On the AsteraApp™ main screen, press "Wedding" (1), then enter the editor (2).



Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.



The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

After the effect is adjusted, it may be saved back to the main screen by pressing the save button.

Id. (annotated).

371. Once saved to the main screen, these stored effects (with modified parameters) can be recalled and played later. *Id.*, 10, 24, 30.

372. Astera further discloses that a user's adjustments for "Anti-Flicker" are preserved, or saved, once entered into AsteraApp:

The Anti-Flicker adjustment is preserved in case the lamp is powered off. It is set back to the default 599.4Hz once a Reset Settings (chapter 6.19) is done. The adjusted frequency is used no matter what input source is currently active. Also during DMX operation.

Id., 32 (annotated). By "preserving" the Anti-Flicker adjustments, these settings are also saved and recalled when the lamps are powered back on.

C. Ground 2a: Astera in view of Edwards renders Claims 3, 4, and 18-20 obvious.

1. Claim 3

373. Claim 3 recites “The method according to claim 1 wherein the time varying lighting value is calculated so as to vary at a rate equivalent to at least one of: said camera recording frequency; and said camera frame rate.” EX1001, 12:15-18.

374. It is my opinion that Astera in view of Edwards renders Claim 3 obvious.

375. Astera discloses compensating for unwanted camera artifacts by making adjustments to a PWM refresh frequency, based on the camera frame rate.

376. Edwards discloses other known ways to avoid unwanted camera artifacts, including calculating lighting values for effects, such that the lighting values vary at a rate equivalent to the camera frame rate, with a minimum pulse width of the lighting values for the effect matching the camera shutter speed and frame rate. *See supra* Ground 1, Claim Element 1b; Ground 1, Claims 3-4, 19-20.

377. It would have been obvious to a POSITA to apply Edwards’s additional teachings of avoiding unwanted camera artifacts to Astera. Specifically, it would have been obvious to a POSITA to control lighting effects in Astera to vary at a rate equivalent to the camera frame rate, such that a minimum pulse width matches the camera frame rate and shutter speed, as taught in Edwards.

378. Astera and Edwards are analogous art—both disclose systems for producing lighting effects, such as fire and strobing. Both include controllers allowing a user to select and customize these effects, where the controller can be remote from the lights or on the lights themselves. And both disclose that not only are the effects intended to be captured on video with a camera, but that lights should be controlled based on the camera settings to avoid flicker or other unwanted camera artifacts.

379. Further, Astera provides controls for the speed, duration, and fade of its effects, and thus already offers controls that would allow it to provide lighting effects that remain “on” while the camera shutter is open, as disclosed in Edwards. EX1011, 20, 27. And Astera already provides for an input of camera frame rate, similar to the synchronization signal and frame rate settings of Edwards that provide for compensation of camera artifacts. *Id.*, 32. A POSITA would have thus understood that adding the camera synchronization signal features of Edwards, to ensure lighting effects to do not change mid-frame and cause unwanted artifacts, would simply be the addition of a known method to a compatible system.

380. A POSITA would have also been motivated to include the selectable camera synchronization signals that match the lighting values to camera frame rate and shutter speed disclosed in Edwards in Astera. Providing the camera artifact compensation methods from Edwards in Astera would provide additional options

for making adjustments to ensure video of the effects, captured with a camera, would be free from unwanted artifacts, such as artifacts from lighting changes occurring mid-frame.

2. Claim 4

381. Claim 4 recites “The method according to claim 1, further comprising matching a minimum pulse width of the time varying lighting value to a member of the group consisting of: said camera recording frequency of the camera; said camera shutter speed of the camera; and said camera frame rate of the camera.” EX1001, 12:19-24.

382. It is my opinion that Astera in view of Edwards renders Claim 4 obvious.

383. Astera discloses compensating for unwanted camera artifacts by making adjustments to a PWM refresh frequency, based on the camera frame rate.

384. Edwards discloses other known ways to avoid unwanted camera artifacts, including calculating lighting values for effects, such that the lighting values vary at a rate equivalent to the camera frame rate, with a minimum pulse width of the lighting values for the effect matching the camera shutter speed and frame rate. *See supra* Ground 1, Claim Element 1b; Ground 1, Claims 3-4, 19-20.

385. It would have been obvious to a POSITA to apply Edwards’s additional teachings of avoiding unwanted camera artifacts to Astera. Specifically, it would

have been obvious to a POSITA to control lighting effects in Astera to vary at a rate equivalent to the camera frame rate, such that a minimum pulse width matches the camera frame rate and shutter speed, as taught in Edwards.

386. Astera and Edwards are analogous art—both disclose systems for producing lighting effects, such as fire and strobing. Both include controllers allowing a user to select and customize these effects, where the controller can be remote from the lights or on the lights themselves. And both disclose that not only are the effects intended to be captured on video with a camera, but that lights should be controlled based on the camera settings to avoid flicker or other unwanted camera artifacts.

387. Further, Astera provides controls for the speed, duration, and fade of its effects, and thus already offers controls that would allow it to provide lighting effects that remain “on” while the camera shutter is open, as disclosed in Edwards. EX1011, 20, 27. And Astera already provides for an input of camera frame rate, similar to the synchronization signal and frame rate settings of Edwards that provide for compensation of camera artifacts. *Id.*, 32. A POSITA would have thus understood that adding the camera synchronization signal features of Edwards, to ensure lighting effects to do not change mid-frame and cause unwanted artifacts, would simply be the addition of a known method to a compatible system.

388. A POSITA would have also been motivated to include the selectable camera synchronization signals that match the lighting values to camera frame rate and shutter speed disclosed in Edwards in Astera. Providing the camera artifact compensation methods from Edwards in Astera would provide additional options for making adjustments to ensure video of the effects, captured with a camera, would be free from unwanted artifacts, such as artifacts from lighting changes occurring mid-frame.

3. Claim 18

389. Claim 18 recites “The method according to claim 1, further comprising controlling said time varying lighting value to illuminate evenly a camera frame.” EX1001, 14:9-11.

390. It is my opinion that Astera in view of Edwards renders Claim 18 obvious.

391. Edwards teaches that frames can be evenly illuminated to avoid unwanted camera artifacts, such as the “flickering” discussed in Astera. Edwards discloses that the minimum pulse width or duration of the light, which is the amount of time the light is “on,” is controlled based on camera shutter speed and frame rate. For example, as discussed above, “the changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame.” EX1004, 3:18-28; *see also id.*,

Abstract, 1:25-48, 3:18-28, 4:48-52 (“[T]he active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open”), 11:19-12:1. The lighting controller “holds the commands until the next vertical frame sync pulse,” so that the “lighting transitions for each frame are preferably timed to occur during the closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31.

392. That is, the lights are changed (or varied) only when the camera shutter is closed, so that they have a minimum pulse width and duration keeping them “on” when the camera shutter is open, and all captured frames are complete with stable lighting and without visual artifacts. *Id.*

393. It would have been obvious to modify Astera to include synchronization control, such that lighting transitions are timed to occur during the closed shutter period, as taught in Edwards, to ensure the lighting is stable throughout each frame without unwanted artifacts.

394. A POSITA would recognize that Astera and Edwards are analogous art and further would have been motivated to apply the teachings of Edwards to Astera to avoid creating artifacts by turning off lights mid-frame. *See supra* Claims 3-4. Further, Astera already provides for “Anti-Flicker” compensation to avoid the

appearance of unevenly lit frame, EX1011, 32, and a POSITA would recognize that modifying Astera to also include the synchronization control of Edwards, and thereby illuminate frames evenly, would simply be the use of a similar known camera artifact compensation method for its intended purposes. Providing the camera artifact compensation methods from Edwards in Astera would also provide additional options for making adjustments to ensure video of the effects captured with a camera was free from unwanted artifacts, such as artifacts from lighting changes occurring mid-frame.

4. Claim 19

395. Claim 19 recites “The method according to claim 1, wherein a pulse duration of said time varying lighting value is based on at least one of: said camera recording frequency; said camera shutter speed; and said camera frame rate.” EX1001, 14:12-15.

396. It is my opinion that Astera in view of Edwards renders Claim 19 obvious.

397. Astera discloses compensating for unwanted camera artifacts by making adjustments to a PWM refresh frequency, based on the camera frame rate.

398. Edwards discloses other known ways to avoid unwanted camera artifacts, including calculating lighting values for effects, such that the lighting values vary at a rate equivalent to the camera frame rate, with a minimum pulse

width of the lighting values for the effect matching the camera shutter speed and frame rate. *See supra* Ground 1, Claim Element 1b; Ground 1, Claims 3-4, 19-20.

399. It would have been obvious to a POSITA to apply Edwards's additional teachings of avoiding unwanted camera artifacts to Astera. Specifically, it would have been obvious to a POSITA to control lighting effects in Astera to vary at a rate equivalent to the camera frame rate, such that a minimum pulse width matches the camera frame rate and shutter speed, as taught in Edwards.

400. Astera and Edwards are analogous art—both disclose systems for producing lighting effects, such as fire and strobing. Both include controllers allowing a user to select and customize these effects, where the controller can be remote from the lights or on the lights themselves. And both disclose that not only are the effects intended to be captured on video with a camera, but that lights should be controlled based on the camera settings to avoid flicker or other unwanted camera artifacts.

401. Further, Astera provides controls for the speed, duration, and fade of its effects, and thus already offers controls that would allow it to provide lighting effects that remain “on” while the camera shutter is open, as disclosed in Edwards. EX1011, 20, 27. And Astera already provides for an input of camera frame rate, similar to the synchronization signal and frame rate settings of Edwards that provide for compensation of camera artifacts. *Id.*, 32. A POSITA would have thus understood

that adding the camera synchronization signal features of Edwards, to ensure lighting effects to do not change mid-frame and cause unwanted artifacts, would simply be the addition of a known method to a compatible system.

402. A POSITA would have also been motivated to include the selectable camera synchronization signals that match the lighting values to camera frame rate and shutter speed disclosed in Edwards in Astera. Providing the camera artifact compensation methods from Edwards in Astera would provide additional options for making adjustments to ensure video of the effects, captured with a camera, would be free from unwanted artifacts, such as artifacts from lighting changes occurring mid-frame.

5. Claim 20

403. Claim 20 recites “The method according to claim 1, further comprising controlling a minimum pulse width of said time varying lighting value based on at least one of: said camera recording frequency; said camera shutter speed; and said camera frame rate, to illuminate evenly a camera frame.” EX1001, 14:16-20.

404. It is my opinion that Astera in view of Edwards renders Claim 20 obvious.

405. Edwards teaches that frames can be evenly illuminated to avoid unwanted camera artifacts, such as the “flickering” discussed in Astera. Edwards discloses that the minimum pulse width or duration of the light, which is the amount

of time the light is “on,” is controlled based on camera shutter speed and frame rate. For example, as discussed above, “the changing of lighting can be synchronized with the times when the shutter is closed so that all frames are complete and are without the visual artifact of the light changing mid frame.” EX1004, 3:18-28; *see also id.*, Abstract, 1:25-48, 3:18-28, 4:48-52 (“[T]he active lighting is synchronized to the camera shutter, so a special effect such as a gun shot flash can be synchronized with the exact time pulse when the camera shutter is open”), 11:19-12:1. The lighting controller “holds the commands until the next vertical frame sync pulse,” so that the “lighting transitions for each frame are preferably timed to occur during the closed shutter period prior to the frame being captured by the camera. In this way lighting is stable throughout the frame and there are preferably no asynchronous lighting events that can impact the image capture.” *Id.*, 5:18-31.

406. That is, the lights are changed (or varied) only when the camera shutter is closed, so that they have a minimum pulse width and duration keeping them “on” when the camera shutter is open, and all captured frames are complete with stable lighting and without visual artifacts. *Id.*

407. It would have been obvious to modify Astera to include synchronization control, such that lighting transitions are timed to occur during the closed shutter period, as taught in Edwards, to ensure the lighting is stable throughout each frame without unwanted artifacts.

408. A POSITA would recognize that Astera and Edwards are analogous art and further would have been motivated to apply the teachings of Edwards to Astera to avoid creating artifacts by turning off lights mid-frame. *See supra* Claims 3-4, 19. Further, Astera already provides for “Anti-Flicker” compensation to avoid the appearance of unevenly lit frame, EX1011, 32, and a POSITA would recognize that modifying Astera to also include the synchronization control of Edwards, and thereby illuminate frames evenly, would simply be the use of a similar known camera artifact compensation method for its intended purposes. Providing the camera artifact compensation methods from Edwards in Astera would also provide additional options for making adjustments to ensure video of the effects captured with a camera was free from unwanted artifacts, such as artifacts from lighting changes occurring mid-frame.

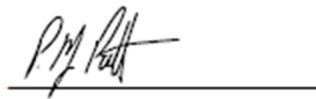
CERTIFICATION

I reserve the right to supplement my opinions as appropriate if the Patent Owner alleges or offers any purported evidence of any secondary considerations of non-obviousness.

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

Executed this 16th day of September, 2024

Respectfully submitted,



APPENDIX A

P. Morgan Pattison
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(805)217-3878

Experience

Solid State Lighting Services, Inc. **November 2007 - Present**
Founder/President- Provide technical, strategic, and market expertise in the areas of LEDs, OLEDs, Lighting, Solid State Lighting (SSL), displays, and optoelectronic materials and devices. LED device, lighting, and materials product development. Horticultural lighting research and strategy. Light pollution measurement, evaluation, and mitigation. LED and lighting product failure and reliability evaluation. Manage research on human and animal physiological responses to light. Scout and evaluate new technologies for investment.

U.S. Department of Energy **January 2006 – November 2007**
National Energy Technology Laboratory, Morgantown WV
Project Manager- Managed DOE funded R&D projects in SSL including LED and OLED lighting technologies. Managed solicitation and selection of new funded R&D projects. Identified priority areas of research necessary for advancement of SSL efficiency, performance, and price.

University of California, Santa Barbara **September 2000 – January 2006**
Graduate Student Researcher- Doctoral thesis research under Professor Shuji Nakamura (Nobel Prize in Physics 2014) on GaN based micro-cavity light emitting diodes. Research included: epitaxial structure design and growth by MOCVD, semiconductor process development, materials characterization, and electro-optical device characterization. Additional areas of research included UV LEDs, vertical cavity surface emitting laser (VCSEL), and edge emitting laser diodes.

Cymer Laser, San Diego **November 1996 – May 2000**
Laser Test Engineer- Tested and developed test methodology for production and prototype KrF and ArF excimer lasers used in deep UV photolithography for manufacturing of advanced semiconductor products. Testing included optical characterization and full system troubleshooting. Test development of new electrical and optical test methodologies to improve test cycle, Labview automation of test procedures, and development of test documentation.

Education

Ph.D. Materials Science, Electronic and Photonic Materials
University of California, Santa Barbara, 2006
Thesis: *Fabrication and Characterization of Gallium Nitride Based Micro-Cavity LEDs*
M.S. Electrical Engineering, Electronics and Photonics
University of California, Santa Barbara, 2003
B.S. Electrical Engineering, Electronic Devices and Materials
University of California, San Diego, 1996

Expertise

Optoelectronic materials and devices, lighting, LED, OLED, UV-LEDs, Germicidal UV application, R&D and technology evaluation, μ LED-LED-OLED-Quantum Dot display technology, medical lighting, SSL product evaluation and selection, LED lighting product development, R&D Management, technology roadmapping, technical meeting moderation, technical writing, IP evaluation, trial expert witness, lighting color evaluation and selection, advanced lighting performance evaluation, Energy Star LED lighting testing, photometric characterization and testing, R&D Management, Federal R&D funding processes, R&D Proposal review and evaluation, ESCO contracts and performance measurement & verification (M&V), horticultural lighting, wildlife responses to light, human physiological responses to light

Accreditations, Affiliations, and Professional Societies

Fellow - Illuminating Engineering Society (IES)

Chair – Outdoor Nighttime Environments (ONE) Committee

Voting Member – IES Horticultural Lighting Committee

Oregon State University, Civil and Construction Engineering, Courtesy Faculty

Lighting Certified (LC) by National Council on Qualifications for Lighting Professionals

Member - International Society of Horticultural Scientists (ISHS)

Member – International Dark-Sky Association (IDA)

Member – International Society for Optics and Photonics (SPIE)

Member – American Society of Agricultural and Biological Engineers (ASABE)

Project Management Professional (PMP) *Lapsed*, Project Management Institute (2006)

U.S. Government Contracting Officer's Representative (COR) (2006)

Leadership

Senior Technical and Strategic Advisor to DOE SSL R&D Program

Lead writer of DOE SSL R&D Opportunities, R&D Plan, and Multi-Year Program Plan

Technical content supervisor of annual DOE SSL R&D Workshops

Manage organization of DOE SSL topical R&D meetings on: LED devices and materials, OLEDs, luminaire integration, roadway lighting, germicidal ultraviolet (UV) LEDs, human physiological responses to light, domesticated and wild animal responses to light, roadway and area lighting, and horticultural lighting

New business creation/development – *Action Spectrum*, *Ultra-Yield Solutions*, *Guidance LED*, *Zuli*, *Canvas*, *Intellilight/Next*, *SSLS, Inc.*, *Diel Lighting Science*, *Blue Laser Fusion*

Scientific Advisory Board member to *GLASE (Greenhouse Lighting and System Engineering)*, NYSERDA funded controlled environment agriculture R&D program

Technical Advisory Committee of Resource Innovation Institute

Advisory Board Member of *Phosphor Global Summit* annual meeting

Advisor to *Cyclotron Road* – Clean Technology Incubator at Lawrence Berkeley National Lab

Project sponsor for Senior Design Course at UCSB (2011-2012)

1. Design and development of spectro-goniophotometer
2. Design and development of smartphone light controller (co-founder and original board member of resulting company renamed *Zuli*)

Designed, fabricated, and characterized world's first gallium nitride microcavity LED

Fabricated and characterized world's first gallium nitride semipolar LED

Publications

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Presentations

U.S. Fish & Wildlife Service Light Pollution & Bird Collisions expert panel, Workshop on Disorder in Semiconductor Physics and Devices 2024, University of Cincinnati IRIS 2023 Working Group, IES Raleigh Section “Horticultural Lighting – A Growing Opportunity”, IES Street and Area Lighting Conference 2022, National Park Service Science and Technology – Skyglow Measurements at Channel Islands National Park 2022, UCSB Nitride Seminar 2022, International SSL Alliance 2021 General Assembly, The Limits of Food Production – Vertical Farming 2021, Horticonn 2020, U.C. Davis Energy and Efficiency Institute, California Energy Administration, 2020 DOE Lighting R&D Workshop, Charleston Catholic High School STEM Seminar, East Tennessee State University Physics and Astronomy Seminar, IES Rocky Mountain Section – CU Boulder, 2019 DOE SSL R&D Workshop, Harvard ES-173 Guest Lecture, U.S. DOE Building Technologies Office Brown Bag Seminar, U.C. Santa Barbara Nitrides Seminar 2018, Phosphor Global Summit 2018, West Virginia State University – Biology Seminar, East Tennessee State University Entrepreneur Club 2018, IES Aviation

Lighting Committee Meeting 2017 (Best Technical Paper), ICCEA Panama 2017, NCERA 101 Controlled Environment Agriculture meeting, DOE SSL R&D Workshop 2017, The College of New Jersey Physics Colloquium, DOE SSL R&D Workshop 2017, NREL 2016, Harvard University Engineering Seminar, LightSym 2016, DOE SSL R&D Workshop 2016, DOE SSL Technology development Workshop 2015, DOE SSL R&D Workshop 2015, IDTechX Internet of Things Applications, Phosphor Global Summit 2014, International Conference on Nitride Semiconductors 2013, IES Illuminate Philadelphia 2012, Strategies in Light 2012, Energy Efficiency Expo 2011, Tennessee Association of Physical Plant Administrators 2011, East Tennessee State University Faculty Development Sustainability Seminar 2011, LED Discovery 2010, Think Tomorrow Today 2008, International Conference on Nitride Semiconductors 2005, International Symposium on Blue Lasers and Light Emitting Diodes 2004, Fall Materials Research Society 2001.

Patents

Technique for growth and fabrication of semipolar (Ga, Al, In, B) N thin films, heterostructures, and devices. #9793435, #9231376, #8686466, #7846757, #10529892

Lighting unit having lighting strips with lighting elements and a remote luminescent material. #8491165

Lighting unit with heat dissipating chimney #8360607

Lighting unit with indirect light source #8684566 B2

System for monitor and control of equipment. #9432210

Semiconductor light emitting device #8227820, #8643036

Etching technique for the fabrication of thin (Al, In, Ga) N layers. #7795146

Semiconductor micro-cavity light emitting diode. Application # 11/510,240 (abandoned), WO2007025122