

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

PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 10,203,101

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PETITIONER’S EXHIBIT LIST

EX1001	U.S. Patent No. 10,203,101 (the “’101 Patent”)
EX1002	Prosecution History of the ’101 Patent
EX1003	Declaration of P Morgan Pattison, dated September 16, 2024
EX1004	U.S. Patent No. 9,743,010 to Edwards (“Edwards”)
EX1005	U.S. Patent Application Publication No. 2005/0275626 to Mueller et al. (“Mueller”)
EX1006	Complaint for Patent Infringement, <i>Rotolight Limited v. Aputure Imaging Indust. Co., Ltd.</i> , No. 4:23-cv-00508-ALM (E.D. Tex.) (Dkt. 1, filed June 5, 2023)
EX1007	First Amended Complaint for Patent Infringement, <i>Rotolight Limited v. Aputure Imaging Indust. Co., Ltd.</i> , No. 4:23-cv-00508-ALM (E.D. Tex.) (Dkt. 25, filed April 29, 2024)
EX1008	Docket Report for <i>Rotolight Limited v. Aputure Imaging Indust. Co., Ltd.</i> , No. 4:23-cv-00508-ALM (E.D. Tex.)
EX1009	Time to Trial Report for the Eastern District of Texas from docketnavigator.com, captured June 13, 2024.
EX1010	Time to Trial Report for the Central District of California from docketnavigator.com, captured June 13, 2024.
EX1011	The Astera Manual
EX1012	Declaration of Mr. Simon Canins from <i>Arnold Richter Cine Technik GmbH & Co. Betriebs KG v. Rotolight Ltd.</i> , IPR2021-01498 (P.T.A.B.)

I. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Party-in-Interest

Aputure Imaging Industries Co., Ltd. is the Petitioner and a real party-in-interest.

B. Related Matters

U.S. Patent No. 10,203,101 (the “’101 Patent”) is one of multiple patents asserted in *Rotolight Limited v. Aputure Imaging Industries Co., Ltd.*, No. 4:23-00508-ALM (E.D. Tex.), filed June 5, 2023. The ’101 Patent has also been asserted or challenged in the following litigations and *inter partes* review proceedings:

- *Rotolight Limited v. ARRI Inc.*, No. 1:22-cv-00983 (D. Del.), filed July 27, 2022;
- *Arnold & Richter Cine Technik GmbH & Co. Betriebs KG v. Rotolight Limited*, No. IPR2021-01498 (P.T.A.B.), filed September 3, 2021.

C. Lead and Back-up Counsel and Service Information

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II. GROUNDS FOR STANDING

Petitioner certifies that the '101 Patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting IPR challenging the patent claims on the grounds identified in this Petition.

III. REQUESTED RELIEF

Petitioner asks that the Board review the accompanying prior art and analysis, institute a trial for an IPR of claims 1-21 of the '101 Patent (the "Challenged Claims") and cancel those claims.

IV. REASONS FOR THE REQUESTED RELIEF

The Challenged Claims of the '101 Patent were anticipated by the prior art or would have been obvious to a person of ordinary skill in the art ("POSITA") and are unpatentable. The '101 Patent claims recite known and obvious combinations of lighting systems, lighting system components, and processes for the use of such systems that had been used by POSITAs prior to the filing of the '101 Patent.

This Petition's showing that the cited art renders the claims unpatentable is supported by the Declaration of P. Morgan Pattison, PhD. (EX1003). Dr. Pattison is familiar with the state of the cinematic and videographic lighting arts before the '101 Patent was filed and agrees with and supports the showing herein that the claims at issue merely recite long-known aspects of such lighting systems.

The Board should institute trial and cancel the Challenged Claims.

A. Summary of the '101 Patent

Claims 1, 11, and 17 recite a method, controller, and computer program 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.

"Rolling shutter" cameras include an image sensor typically made up of rows or bands of sensors that each capture a pixel. EX1003, ¶40. These sensors are not all exposed to light at the same time. *Id.* Instead, each row is exposed sequentially corresponding with an open shutter for that row. *Id.*

The time shift in acquisition of the image can cause unwanted artifacts if the lighting changes while the shutter is open for each row of sensors to capture the camera frame of the full image. *Id.*, ¶41. If the light changes during acquisition, some bands may not have the same illumination as others, resulting in unwanted dark bands or distortions. *Id.*

To compensate for this, it has long been known to adjust lights so they provide consistent illumination during the time the shutter is open to record the entire image frame. *Id.*, ¶43-44. 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 bands. *Id.* It has also long been known to adjust the lighting refresh rate so that it does not closely match the frame rate of the camera. *Id.* 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. *Id.*

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

a lighting device to simulate the effect compensated for the rolling shutter artifact. *Id.*, 12:8-11, 12:61-61, 14:4-8.

The '101 Patent describes how 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.

B. The Prosecution History of the '101 Patent.

The '101 Patent issued on February 19, 2019, from U.S. Application No. 15/849,793, which is a continuation of U.S. Application No. 15/481,460, and claims priority to U.S. Provisional Application No. 62/319,809, filed April 8, 2016. In an Office Action dated March 22, 2018, the Examiner rejected the claims under 35 U.S.C. § 112 but made no rejections relating to prior art. EX1002, 225-233. The claims were amended to overcome the Examiner’s § 112 rejections, and a Notice of Allowance was sent on October 2, 2018. The Examiner indicated that the prior art fails to teach or suggest elements of the amended independent claims. *Id.*, 51-52. The '101 Patent issued thereafter.

C. Priority Date.

The '101 Patent claims priority to a provisional patent application filed on April 8, 2016. EX1001, Cover. That date is the assumed priority date for purposes

of this Petition. All of the references cited in the instant Petition qualify as prior art based on that priority date.

D. Discretionary Denial under § 325(d) or § 314(a) Is Not Warranted.

Aputure has not been involved in any review of the '101 Patent. Additionally, the Office has not considered the combinations of references forming the grounds for this Petition, and the combinations are not redundant to any considered during prosecution. Additionally, the instant Petition provides the analysis of Dr. Pattison, which has not been presented to the Office. As the same or similar arguments have not been previously considered, discretionary denial under § 325(d) is not warranted.

1. Institution should not be denied under the *General Plastic* Factors

The factors articulated by the Board in *General Plastic Industrial Co., Ltd v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (P.T.A.B Sept. 6, 2017), do not support denial of institution. Though prior Petitions for IPR challenging the '101 have been filed by third parties, Petitioner has not previously filed a petition directed, nor does Petitioner have a significant relationship with any prior petitioner. “[W]here, as here, the first and second petitioners are neither the same party, nor possess a significant relationship under *Valve [Corp. v. Electronic Scripting Products, Inc.]*, IPR2019-0062, Paper 11 (P.T.A.B. Apr. 2, 2019)], *General Plastic* factor one necessarily outweighs the other *General Plastic* factors.” *Videndum*

Production Solutions, Inc. v. Rotolight Ltd., IPR2023-01218, Paper 12 at 6 (P.T.A.B. Apr. 19, 2024) (Director Vidal vacating Board decision denying institution). The fact that Petitioner has not previously sought IPR of the '101 Patent and does not have a significant relationship with any previous petitioner is dispositive on the issue.

Even if the Board considers the additional *General Plastic* factors, however, such consideration would not warrant denying institution. There has been no time between the filing of a prior Petition from Petitioner and the present Petition (Factor 5). Moreover, Petitioner was not aware of the prior art asserted in this Petition prior to the filing third party ARRI's 2021 petition filed against the '101 Patent (Factor 2). Each of these factors weighs against denying institution.

The remaining factors are, at most, neutral or, in view of the fact that Petitioner has not previously challenged any claims of the '101 Patent, not applicable to the present Petition. Though Petitioner learned of the prior art asserted in the ARRI petition shortly after it was sued by Patent Owner in the district court on June 5, 2023 (EX1008) (Factor 4), there is no evidence on which Patent Owner could rely that Petition has improperly delayed in filing the present Petition, the district court litigation remains at the pleading stage, and this Petition is brought well within the one-year time limit set forth in 35 U.S.C. § 315(b).¹ And because Patent Owner

¹ Patent Owner did not serve the Complaint in the district court litigation until October 17, 2023. EX1008.

waived its Patent Owner's Preliminary Response to ARRI's petition, no time has elapsed since Petitioner's receipt of such a response (Factor 3). And there is no evidence that the Board's finite resources (Factor 6) will prevent the Board from issuing a final determination within the timing requirements of 35 U.S.C. § 316(a)(11) (Factor 7).

2. Institution should not be denied under the *Finitiv* Factors.

The Petition should not be denied under the factors set out in *Apple v. Finitiv, Inc.*, IPR2020-00019, Paper 11, at 6 (PTAB Mar. 20, 2020) and reinforced in the June 21, 2022 Interim Procedure for Discretionary Denials in AIA Post-Grant Proceeding with Parallel District Court litigation Memorandum.

Regarding Factor 1, no stay of the district court litigation has been requested, though a stay would be appropriate under the applicable standard. *See, e.g., Vill. Green Techs., LLC v. Samsung Elecs. Co.*, No. 2:22-CV-00099-JRG, 2023 US. Dist. LEXIS 12794, at *9-10 (E.D. Tex. Jan 25, 2023). Patent Owner waited years after the '101 Patent issued before filing its Complaint on June 5, 2023, EX1006, and the litigation is in its early stages, and a stay pending IPR would be appropriate. Given that a motion to stay has not yet been filed, however, the Board should not infer the outcome of that motion. *Intel Corp. v. VLSI Tech. LLC*, IPR2020-00158, Paper 16, at 7 (PTAB May 20, 2020). This factor is neutral.

Regarding Factor 2, trial in the litigation is not scheduled. EX1008. In the Eastern District of Texas, average time to trial is 24-27 months. EX1009. In the Central District of California, to which Petitioner seeks transfer, average time to trial is 29-32 months. EX1010. That the case remains in the early stages means it is unlikely the litigation will be ready for trial before the Board enters a final written decision. This factor weighs against discretionary denial.

Regarding Factor 3, investment in the litigation has been minimal. Patent Owner has filed its Complaint, which it has amended. EX1008. This Factor weighs against discretionary denial.

Regarding Factor 4, no deadline requiring Petitioner to articulate its invalidity positions in the litigation is imminent. Instituting a proceeding will allow the Board to address the art, and the issues will be narrowed in the litigation due to the estoppel provisions of 35 U.S.C. § 315(e)(2). To reduce potential overlap, if the Board institutes trial, Petitioner will decline to assert in the related litigation the prior art combinations on which trial is instituted while trial is instituted. The most efficient course is for the Board to address the issues before it. This factor weighs against discretionary denial.

Regarding Factor 5, Petitioner is a defendant in the litigation. EX1008. That is true of many Petitioners in IPR proceedings and is consistent with one purpose of

IPRs as a process available to defendants. This factor is not a basis for denying institution.

Regarding Factor 6, the prior art discussed herein demonstrates that Claims 1-21 are unpatentable as anticipated or obvious. The merits of Petitioner's argument are strong, and this factor weighs against discretionary denial.

V. Claim Construction

In *inter partes* review, claims are “construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). Claim must be given their ordinary and customary meaning as understood by a POSITA at the time of the invention in light of the specification and the prosecution history pertaining to the patent. *Id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2015) (*en banc*).

Petitioner believes the '101 Patent's claim terms do not require construction for the purpose of evaluating the prior art in this Petition. Petitioner, however, may pursue constructions of additional claim terms, including that certain terms are indefinite in the related litigation concerning the '101 Patent to help the jury understand the relevant technical terms.

VI. STATUTORY GROUNDS FOR CHALLENGES AND REFERENCES USED

Ground #1: Claims 1-21 of the '101 Patent are obvious under 35 U.S.C. § 103 over Mueller in view of Edwards.

Ground #2: Claims 1, 2, 5-17, and 21 of the '101 Patent are anticipated by Astera under 35 U.S.C. § 102 or are obvious under 35 U.S.C. § 103 over Astera.

Ground #2a: Claims 3, 4, and 18-20 are obvious under 35 U.S.C. § 103 over Astera in view of Edwards.

VII. LEVEL OF ORDINARY SKILL IN THE ART

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. EX1003, ¶47. He or she 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. *Id.* The more education one has, the less experience needed to attain an ordinary level of skill. *Id.* Similarly, more experience in the field may serve as a substitute for formal education. *Id.*

VIII. CLAIMS 1-21 ARE UNPATENTABLE.

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

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

Mueller describes creation and modification of lighting effects. Mueller describes processor 102 configured to output one or more control signals to drive light sources 104 to generate various intensities of light from each light source 104. EX1005, [0168]. Processor 102 may be programmed to provide control signals to one or more light sources 104 to generate static or time-varying (dynamic) multi-color lighting effects. *Id.*, [0170]. Processor's control of light sources 104 could be based on user signals provided through an interface 118. *Id.*, [0183]. Such user signals could be user-selectable settings or functions, including, generally controlling the light output of lighting unit 100, changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, and changing and/or selecting various parameters of selected lighting effects. *Id.*, [0182].

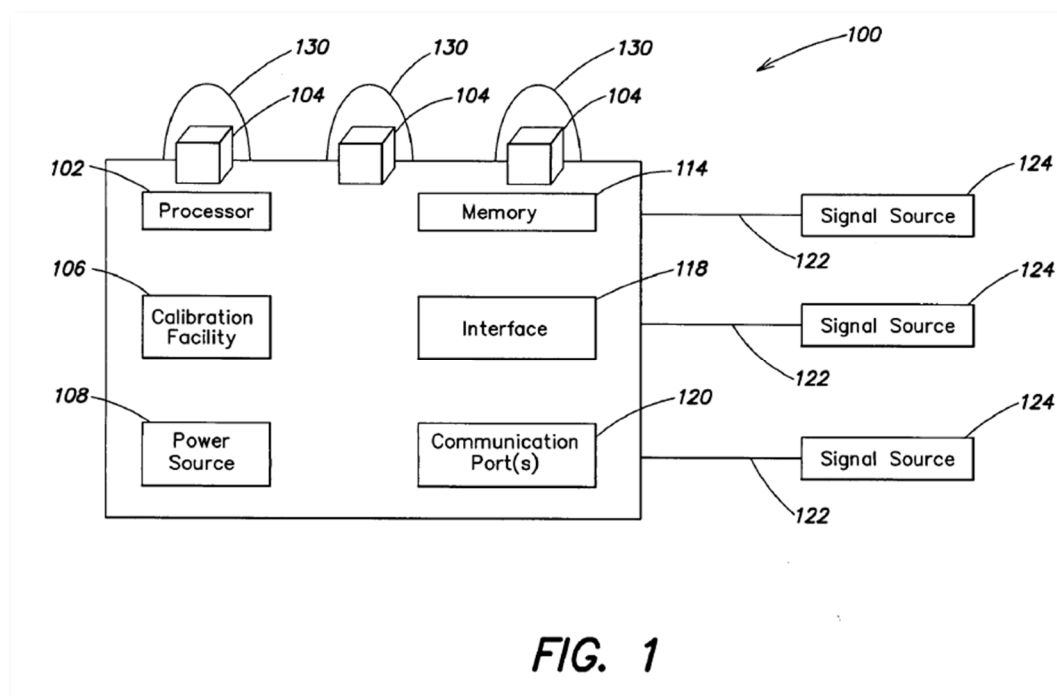


FIG. 1

Id., Figure 1.

Mueller discloses a number of alternative embodiments utilizing the general concepts disclosed therein in a variety of specific devices and settings. EX1003, ¶52. A POSITA would understand that the concepts discussed in the context of each of these embodiments are applicable to Mueller's other embodiments. *Id.* 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. *Id.* A POSITA would thus be motivated, where required, to combine the teachings of Mueller's various embodiments with those of other embodiments. *Id.*

2. Overview of Edwards

Edwards was filed as U.S. 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. Edwards is prior art under at least 35 U.S.C. § 102(a)(2).

Edwards discloses a system and method for synchronizing LED light fixtures to digital camera shutters. EX1004, Abstract. The system controls the LEDs so "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.*

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. 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.

The LEDs are synchronized to 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 EX1003, ¶56.

3. Motivation to combine Mueller and Edwards

Mueller and Edwards are in the same field of art, namely entertainment lighting methods and systems. Mueller provides 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. EX1003, ¶57. Mueller does not specifically provide specific 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. *Id.* 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. *Id.* 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. *Id.*

4. Claim 1

Mueller in view of Edwards renders Claim 1 obvious. EX1003, ¶¶58-88.

a. Claim Element 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:

It is Petitioner's position that the preamble to Claim 1 is not limiting and need not be analyzed for purposes of determining Claim 1's validity. Should the Board determine the preamble is limiting, Mueller in view of Edwards teaches Claim Element 1p. EX1003, ¶¶59-66.

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]. 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].

Control of the lightning unit 100 includes producing user-customizable lightning effects. Specifically, “controlling the light output of lighting unit 100, changing and/or selecting various pre-programmed lighting effects to be generated by the lighting unit, [and] changing and/or selecting various parameters of selected lighting effects” *Id.*, [0182].

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.

The “lighting systems have the benefit of being synchronized to the start of the frame. Therefore, a DMX² 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,

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.

It would have been obvious to a POSITA to apply Edwards’s teachings to Mueller. EX1003, ¶66. Both include controllers allowing a user to select and customize lighting effects. *Id.* 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. *Id.*

b. Claim Element 1a

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

² “DMX” is a standard communication protocol used in entertainment lighting to provide commands and data relating to lighting values and effects. EX1003, ¶65 n.3.

Mueller teaches Claim Element 1a. EX1003, ¶¶67-73.

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

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].

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];

- “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].

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. EX1003, ¶¶72.

A POSITA would have understood that 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 simulation parameter in the manner disclosed in multiple these multiple embodiments of Mueller. EX1003, ¶73.

c. Claim Element 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;

Mueller in view of Edwards teaches Claim Element 1b. EX1003, ¶¶74-81.

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. EX1003, ¶76.

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.

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.”).

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.

Camera shutter speed and frame rate define the period when the shutter is closed, EX1003, ¶80, 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 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. *Id.*

A POSITA would have well understood the benefits of incorporating the method of Edwards into the teachings of Mueller to compensate for rolling shutter artifacts and would have understood how to do so. *See supra* Claim Element 1p.

d. Claim Element 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.

Mueller in view of Edwards teaches Claim Element 1c. EX1003, ¶¶82-88.

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.*

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.

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.

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.

It would have been obvious to a POSITA to apply Edwards’s teachings of compensating for rolling shutter artifacts produced by a camera to Mueller. EX1003,

¶88. Mueller and Edwards are analogous art—both disclose systems for producing lighting effect. *Id.* 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. *Id.*

5. Claims 11 and 17

For this Petition, there are no substantive differences between Claim 1 and Claims 11 and 17, and Mueller in view of Edwards renders obvious Claims 11 and 17 for the same reasons as Claim 1. *See supra* Claim 1; *see also* EX1003, ¶¶58-88, 126-152, 172-198.

A matching of each limitation in Claim 1, to the corresponding limitation in Claims 11 and 17, is as follows, with differences shown in red and underlined:

Claim 1	Claim 11	Claim 17
<u>A method for</u> controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, <u>the method comprising:</u>	<u>A controller adapted to</u> control a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, <u>the controller comprising:</u>	<u>A computer program comprising software code for</u> controlling a lighting device to produce user customisable lighting effects while compensating for rolling shutter artefacts produced by a camera, <u>the computer program adapted to perform, when executed, the steps of:</u>

Claim 1	Claim 11	Claim 17
calculating, <u>using</u> an effect simulator, a time varying lighting value	an effect simulator <u>adapted to</u> calculate a time varying lighting value	calculating, <u>using</u> an effect simulator, a time varying lighting value
compensating for the rolling shutter artefacts <u>produced by the camera, the time varying lighting value being calculated</u> 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	compensating for the rolling shutter artefacts <u>produced by the camera</u> 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	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
outputting, <u>from</u> 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.	<u>wherein the</u> effect simulator <u>is adapted to</u> output said calculated time varying lighting value to <u>the</u> lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.	<u>wherein the</u> effect simulator <u>is adapted to</u> output, <u>from said effect simulator</u> , said calculated time varying lighting value to said lighting device thereby to simulate a lighting effect compensated for rolling shutter artefacts.

The only differences are that while Claim 1 is directed to a “method” for controlling a lighting device, Claim 11 is directed to a “controller” implementing

this same method and Claim 17 is directed to “a computer program” performing the same method.

With respect to Claim 11, Mueller discloses that the method of Claim 1 is implemented on a system that includes the lighting unit 100 as controlled by processor 102. *See supra* Claim 1.

Moreover, Mueller discloses the method of Claim 1 can be performed by a “software program” as in Claim 17. “In 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.” EX1005, [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. EX1003, ¶176.

Thus, Mueller in view of Edwards renders obvious each limitation in Claims 11 and 17 for the same reasons discussed above with respect to the corresponding limitation in Claim 1.

6. Claim 2

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.

Mueller in view of Edwards renders Claim 2 obvious. EX1003, ¶¶89-91.

In connection with an embodiment in which multiple lighting units 100 are employed together, Mueller describes a stroboscopic lighting effect. EX1005, [0215]. Such stroboscopic effects are short time-period lighting effects. EX1003, ¶91. 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. *Id.*

7. Claims 3, 4, and 19

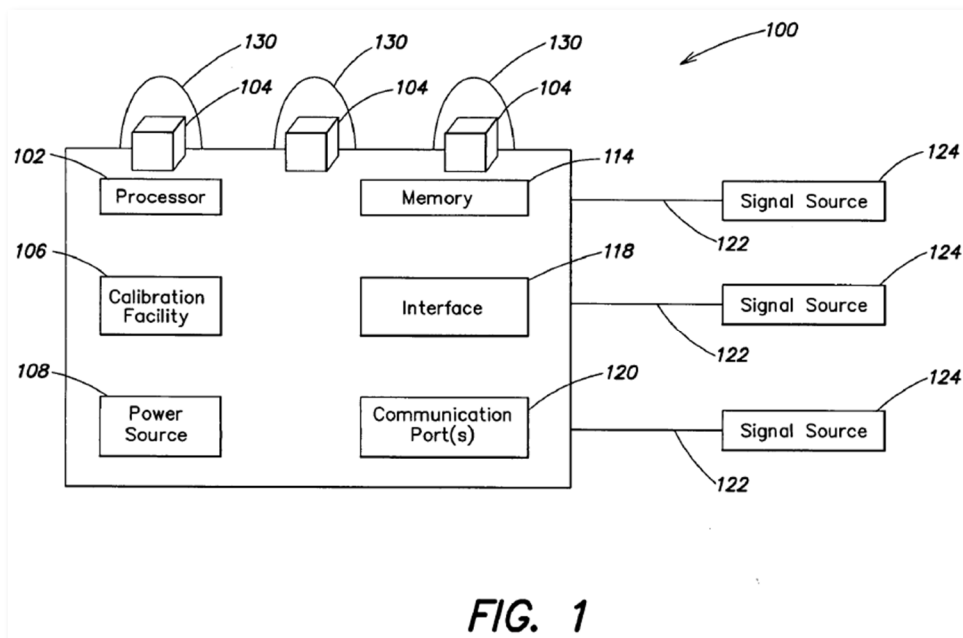
[3] The method according to claim 1 wherein the time varying lighting value is calculated so as to vary at a rate equivalent to at least one of: said camera recording frequency; and said camera frame rate.

[4] 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.

[19] 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.

Mueller in view of Edwards renders Claims 3, 4, and 19 obvious. EX1003, ¶¶92-102, 205-209.

Mueller discloses that lighting unit 100 “may be configured to receive one or more signals 122 from one or more other signal sources 124.” EX1005, [0185].



Id., Figure 1. These signals 122 can be used by 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]. The signal source 124 can be, among other things, a camera. *Id.*, [0187], [0188].

A POSITA 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. EX1003, ¶¶95, 100, 208. 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. *Id.* A POSITA would understand how to use such data from a camera to avoid the

production of such undesired effects. *Id.*

That such techniques used to prevent flicker artifacts were well known is demonstrated by 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.*; *see also* EX1003, ¶¶95, 100, 208

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; *see also* EX1003, ¶¶102, 209. 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. 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; EX1003, ¶¶102, 209.

8. Claim 5

[5] 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.

Mueller in view of Edwards renders Claim 5 obvious. EX1003, ¶¶103-107.

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

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).

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

[6] 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.

Mueller in view of Edwards renders Claim 6 obvious. EX1003, ¶¶108-110.

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. EX1003, ¶110.

10. Claims 7, 8, and 14

[7] The method according to claim 1, wherein the lighting value comprises at least one of: brightness; and colour data.

[8] 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.

[14] 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.

Mueller in view of Edwards renders Claim 7, 8, and 14 obvious. EX1003, ¶¶111-117, 162-165.

Mueller includes multiple disclosures of lighting values which comprises brightness/intensity and/or color data. For instance, “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]. 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].

Mueller 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. A user may interact with one or more interfaces 118, which “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]. 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.*

11. Claims 9 and 21

[9] The method according to claim 1 further comprising storing said at least one user input simulation parameter corresponding to said user customisable lighting effect.

[21] 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.

Mueller in view of Edwards renders Claims 9 and 21 obvious. EX1003, ¶¶118-122, 217-221.

Mueller describes “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.* Such functions as include, “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, [and] changing and/or selecting various parameters of selected lighting effects” *Id.*, [0182].

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.

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. EX1003, ¶¶122, 221. 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]; *see also* EX1003, ¶¶122, 221.

Mueller also discloses recalling the stored simulation parameter for execution: “[t]he 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 light sources.” EX1005, [0172].

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. EX1003, ¶222. 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]; EX1003, ¶222.

12. Claim 10

[10] The method according to claim 1, wherein the controlling is for a lighting system for at least one of: broadcast, cinematography, studio filming and location filming.

Mueller in view of Edwards renders Claim 10 obvious. EX1003, ¶¶123-125.

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.

EX1003, ¶125.

13. Claim 12

[12] 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.

Mueller in view of Edwards renders Claim 12 obvious. EX1003, ¶¶153-155.

Mueller's processor 102 controls a plurality of LEDs to produce a user's desired output. EX1005, [0170]-[0171]. In particular, "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].

14. Claim 13

[13] 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.

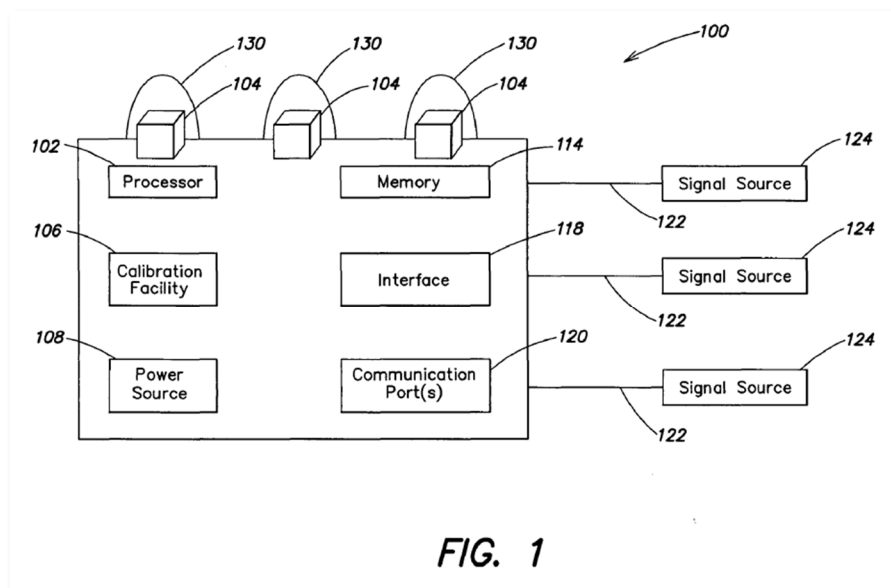
Mueller in view of Edwards renders Claim 13 obvious. EX1003, ¶¶156-161.

Mueller discloses input interface 118. EX1005, [0182]. "The 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].

“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.*

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], Figure 1.



Id., Figure 1.

Communication port(s) 120 can be integrated into the processor 102, as Mueller 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].

15. Claim 15

[15] 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.

Mueller in view of Edwards renders Claim 15 obvious. EX1003, ¶¶166-168.

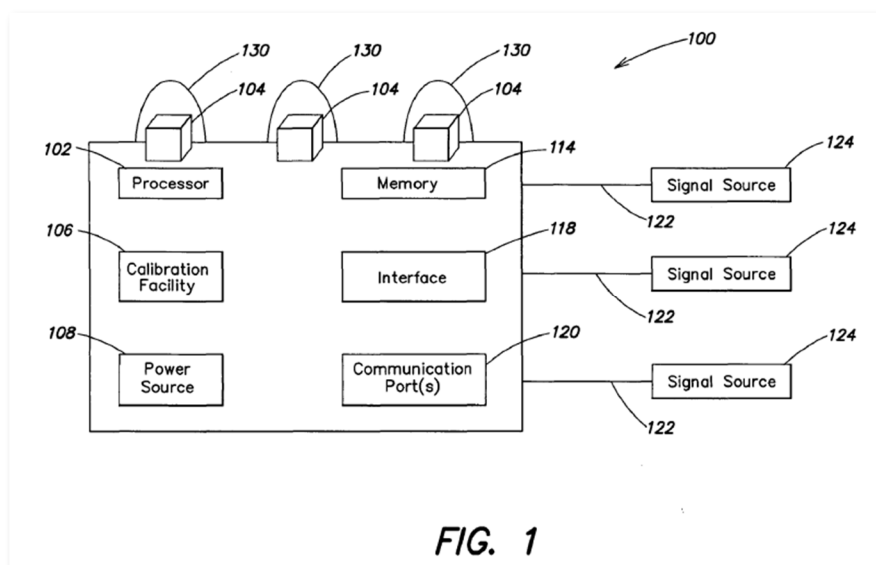
Mueller discloses that lighting unit 100 comprises one or more light sources 104 that may be light emitting diodes. EX1005, [0167].

16. Claim 16

[16] The lighting system according to claim 15 wherein said controller and said lighting device are integrated in a combined unit.

Mueller in view of Edwards renders Claim 16 obvious. EX1003, ¶¶169-171.

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.

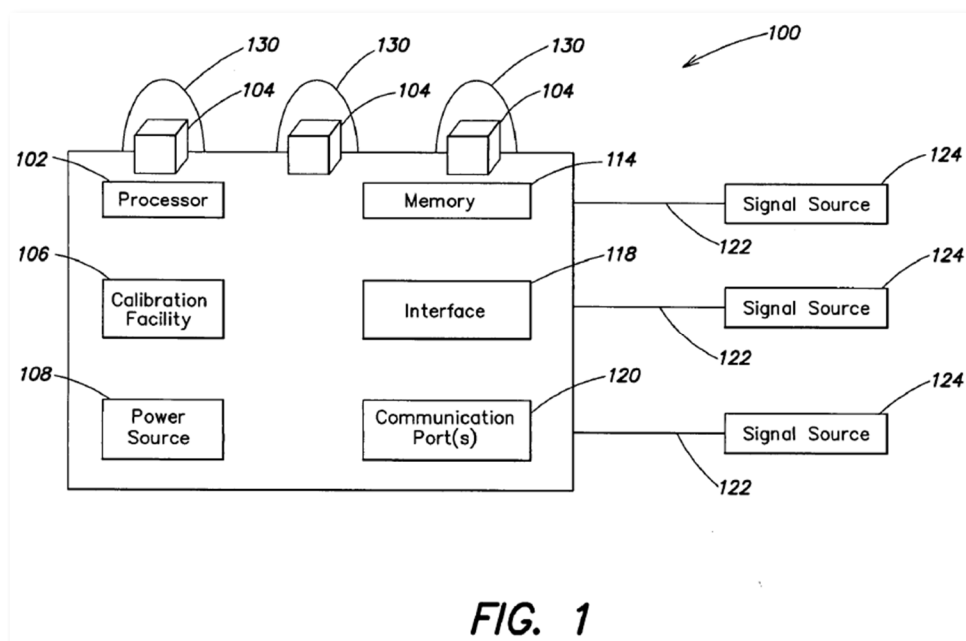
17. Claims 18 and 20

[18] *The method according to claim 1, further comprising controlling said time varying lighting value to illuminate evenly a camera frame.*

[20] *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.*

Mueller in view of Edwards renders Claims 18 and 20 obvious. EX1003, ¶¶199-204, 210-216.

Mueller teaches that lighting unit 100 may be configured to receive signals from one or more external signal sources 124. *See supra* Claims 3, 4, and 19; *see also* EX1005, [0185], Figure 1.



Id., Figure 1.

Mueller teaches that such signal source 124 can be a camera. *Supra* Claims 3, 4, and 19; EX1005, [0187], [0188].

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. EX1003, ¶¶203, 214. 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; *see also* EX1003, ¶¶204, 214.

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; *see also* EX1003, ¶215. 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. 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 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* EX1003, ¶216; *supra* Claim Elements 1a-1b.

B. Ground 2: Claims 1-21 are invalid under 35 U.S.C. §102(a)(1) or 35 U.S.C. § 103 as obvious over Astera, alone or in view of Edwards.

1. Overview of Astera

Astera is a user manual for the AX10, a controllable lighting device used in studio filming and entertainment lighting. EX1003, ¶223; 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.*

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 (annotated), 7.

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 “AsteraApp” (an app for mobile devices), and (d) CRMX wireless DMX. *Id.*, 9-10.



Id., 9, 11, 23.

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. 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.

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

Astera anticipates Claim 1. EX1003, ¶¶228-254.

a. Claim Element 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:

Astera discloses Claim Element 1p. EX1003, ¶¶229-238.

Astera discloses the features and functionality of the AX10 with its 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).

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



Id., 9, 11, 23.

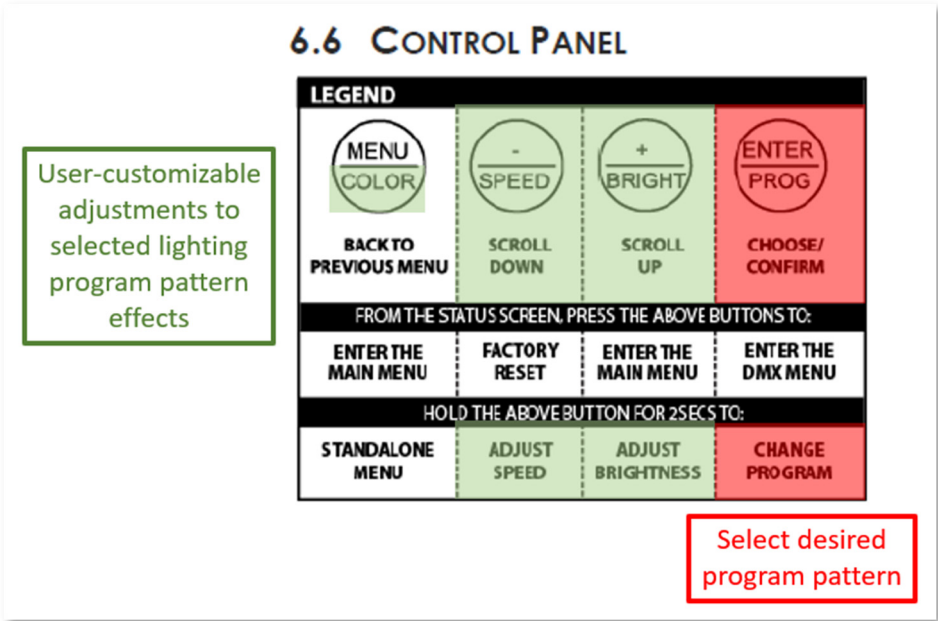
The AX10 can produce user-customizable lighting effects and compensate for rolling shutter effects through an “anti-flicker” adjustment. *Id.*, 23-24, 27-28, 32; *see also* EX1003, ¶234.

“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.

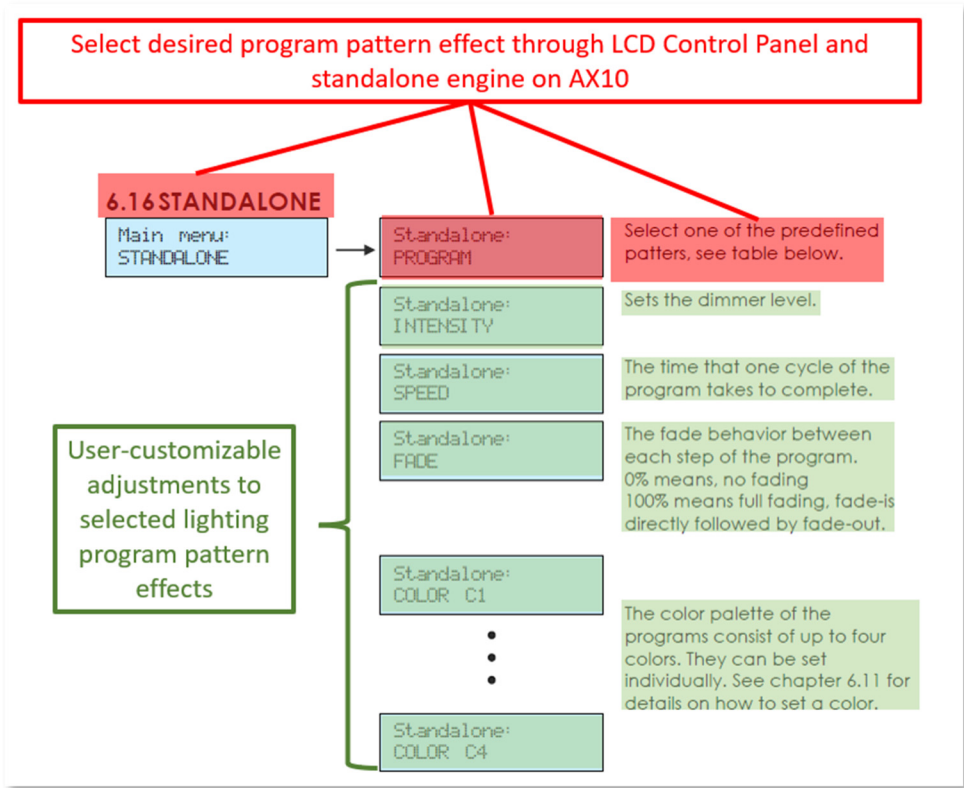
Name	Pattern
ONE COLOR STATIC	A static color is displayed on the whole virtual light.
TWO COLOR STATIC	The virtual light is split into two halves and two colors are displayed.
THREE COLOR STATIC	The virtual light is split into three parts and three colors are displayed.
FOUR COLOR STATIC	The virtual 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.

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.

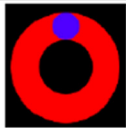


Id., 11 (annotated).



Id., 20 (annotated).

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

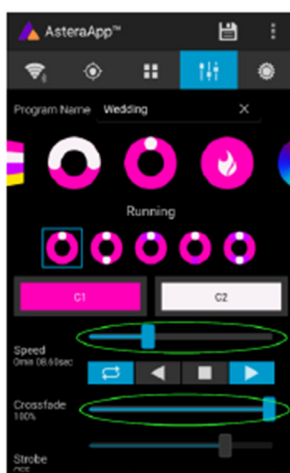
7.7 LIST OF EFFECTS The effects' patterns are pre-defined and cannot be modified by the user. They are pre-programmed inside of each light. Still they can be parameterized. These effects are:	
	Several variations of running lights are available.
	The Fire effect shows a random flickering effect. The 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”:

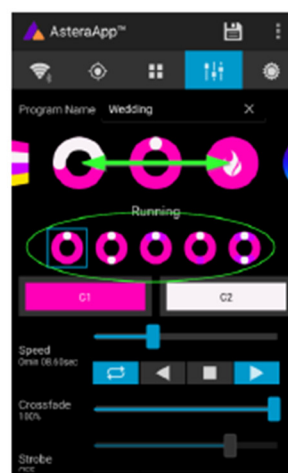
7.6 CHANGING THE EFFECT



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

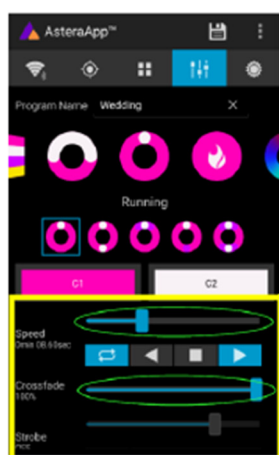


Set "Crossfade" to 0% and "Speed" to around 2 seconds. You should see a clean running light now. The White light will run over a pink background.

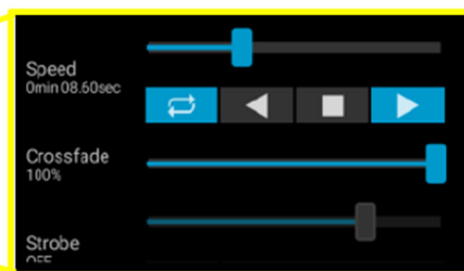


The effect can be changed by sliding the effect picker and choosing a sub-effect below it. Again the colors can be adjusted, too.

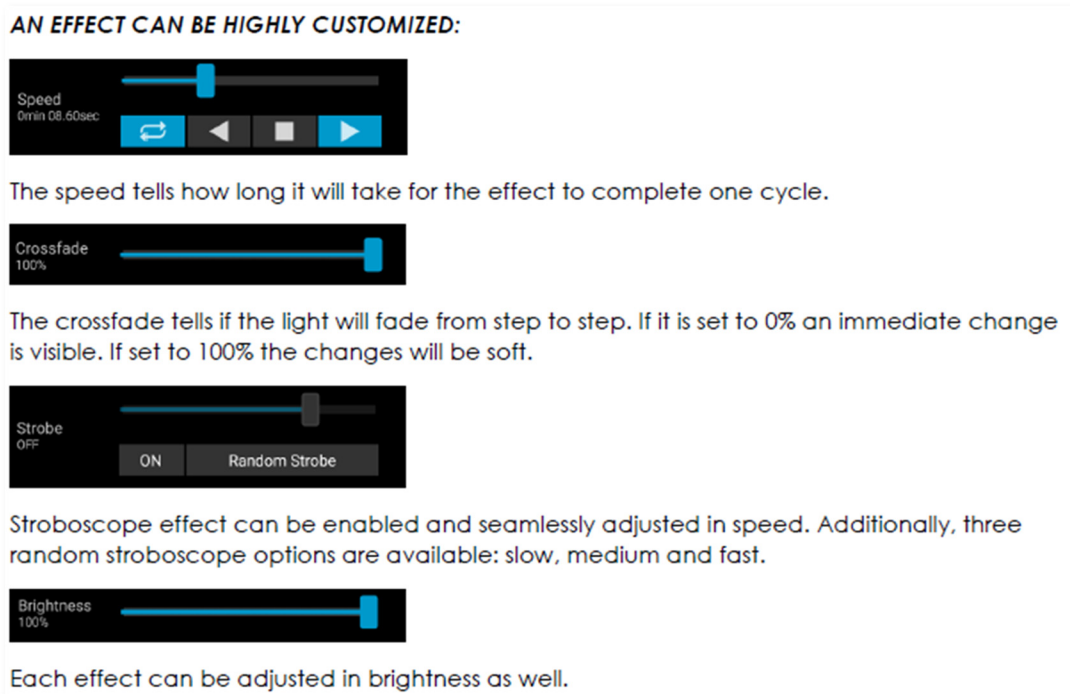
Id., 27.



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.

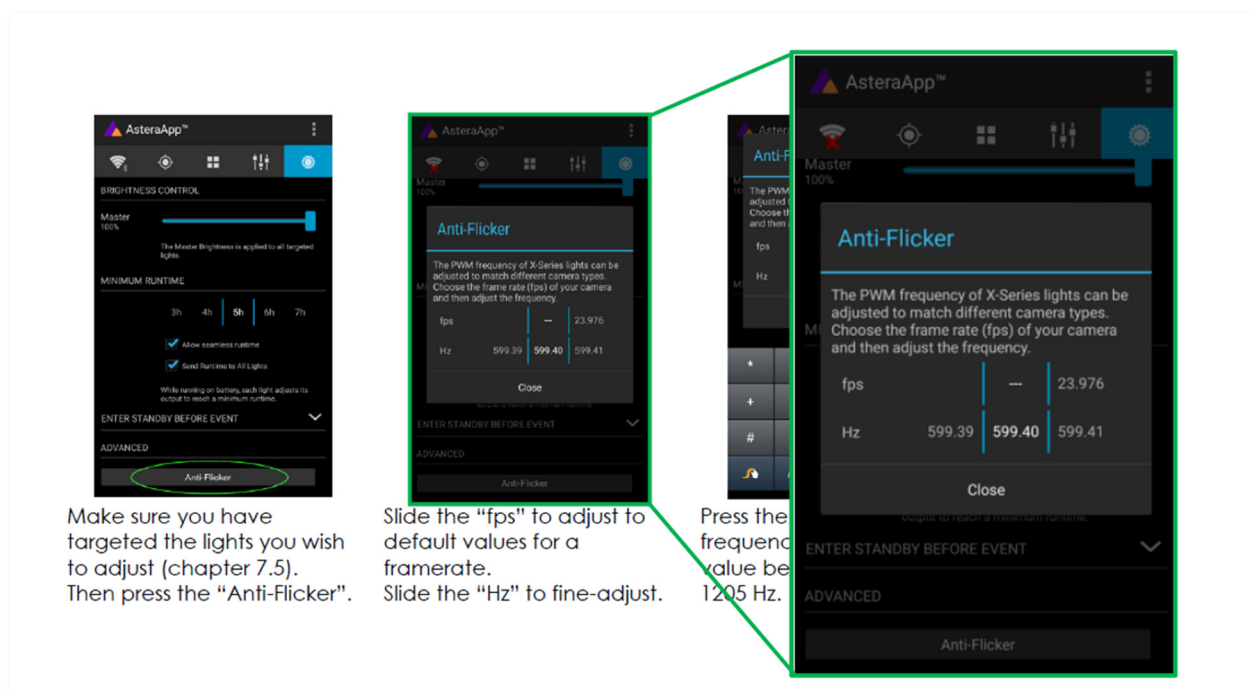


Id. (annotated).



Id.

Further, Astera discloses how the AX10 can compensate for rolling shutter artifacts 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; *see also* EX1003, ¶238. 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. EX1011, 32.



Id. (annotated).

b. Claim Element 1a

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

Astera discloses Claim Element 1p. EX1003, ¶¶239-245.

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.

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

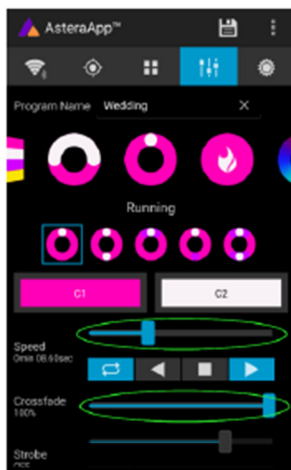
the form of values and settings for the LEDs to “display these effects properly with [the] light.” *Id.*, 17, 20-21; *see also* EX1003, ¶242.

Similarly, in AsteraApp, users can select from a variety of lighting effects, such as “fire,” “chasers,” “rainbow” and “stroboscope.” EX1011, 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.

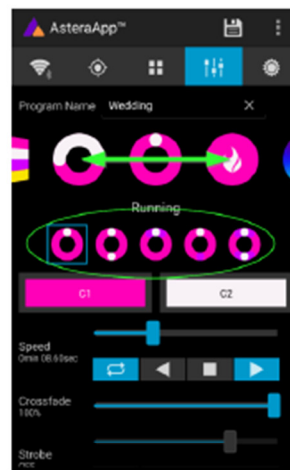
7.6 CHANGING THE EFFECT



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.

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.”

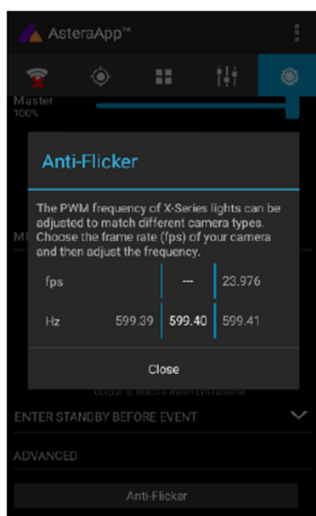
Id., 32; *see also* EX1003, ¶244.

7.12 ANTI-FLICKER

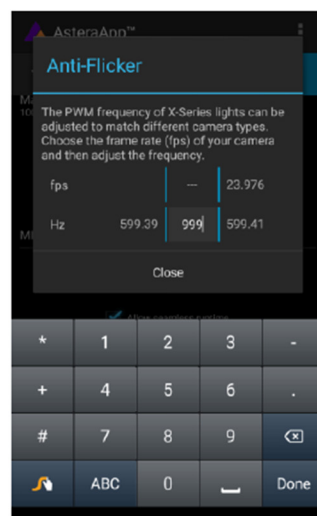
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



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

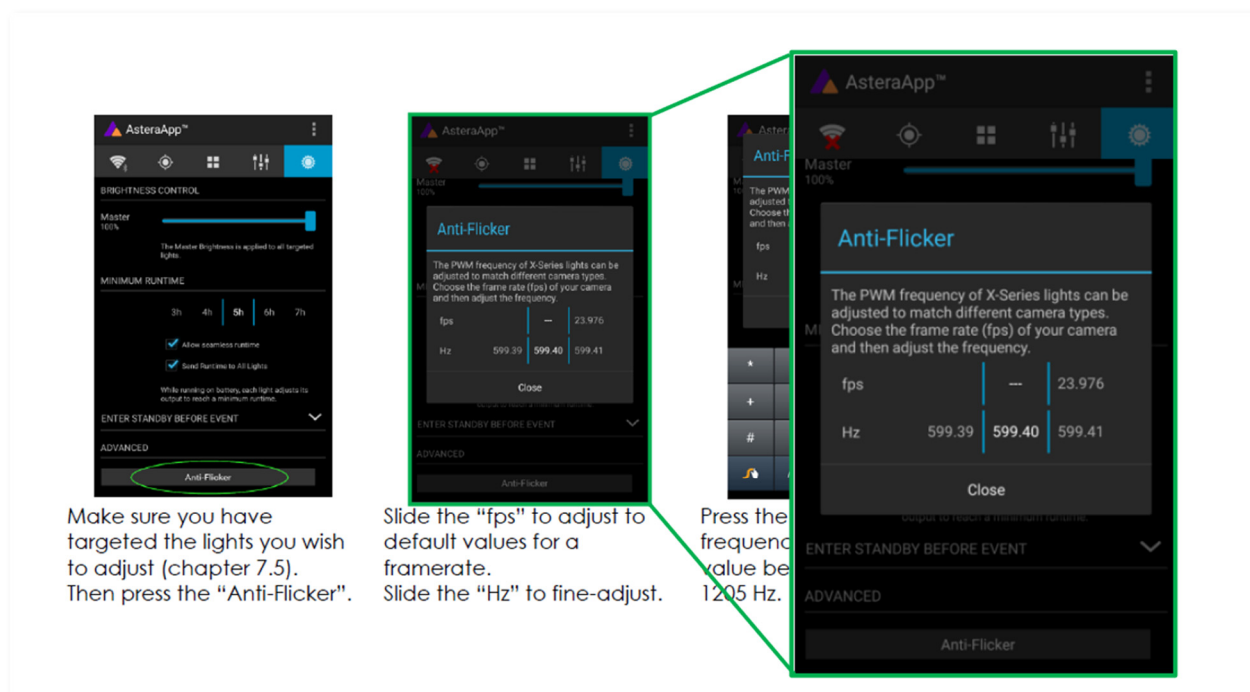


Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



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

EX1011, 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).

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; *see also* EX1003, ¶245. 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). EX1011, 23; *see also* EX1003, ¶245. 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. EX1011, 24.

c. Claim Element 1b

[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

Astera discloses Claim Element 1b. EX1003, ¶¶246-250.

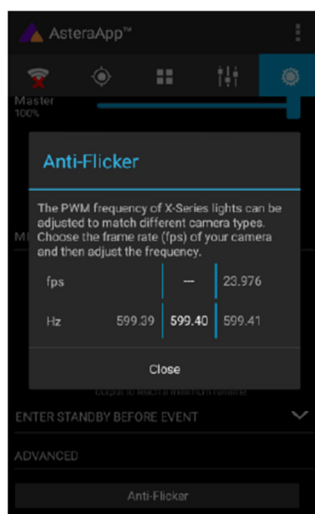
Astera discloses compensating for rolling shutter artifacts, in the form of “flicker,” by calculating lighting values based on user inputs indicative of at least the camera frame rate. EX1011, 32. Users can select an “Anti-Flicker” option to compensate for rolling shutter artifacts in the form of unwanted “flicker” that would otherwise be produced if the PWM refresh frequency of the light did not fit the camera’s frame rate. *Id.*, see also EX1003, ¶248.

7.12 ANTI-FLICKER

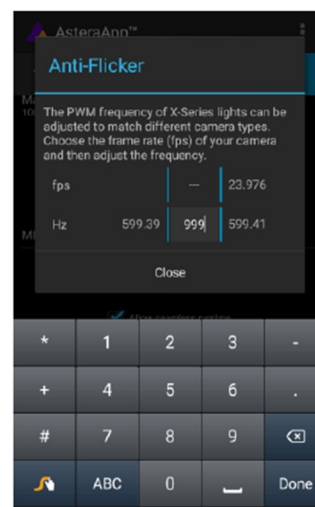
The PWM refresh rate of this light is 599.4 Hz by default. This frequency can be freely adjusted between 200 Hz and 1205 Hz to fit different camera's frame rates.



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



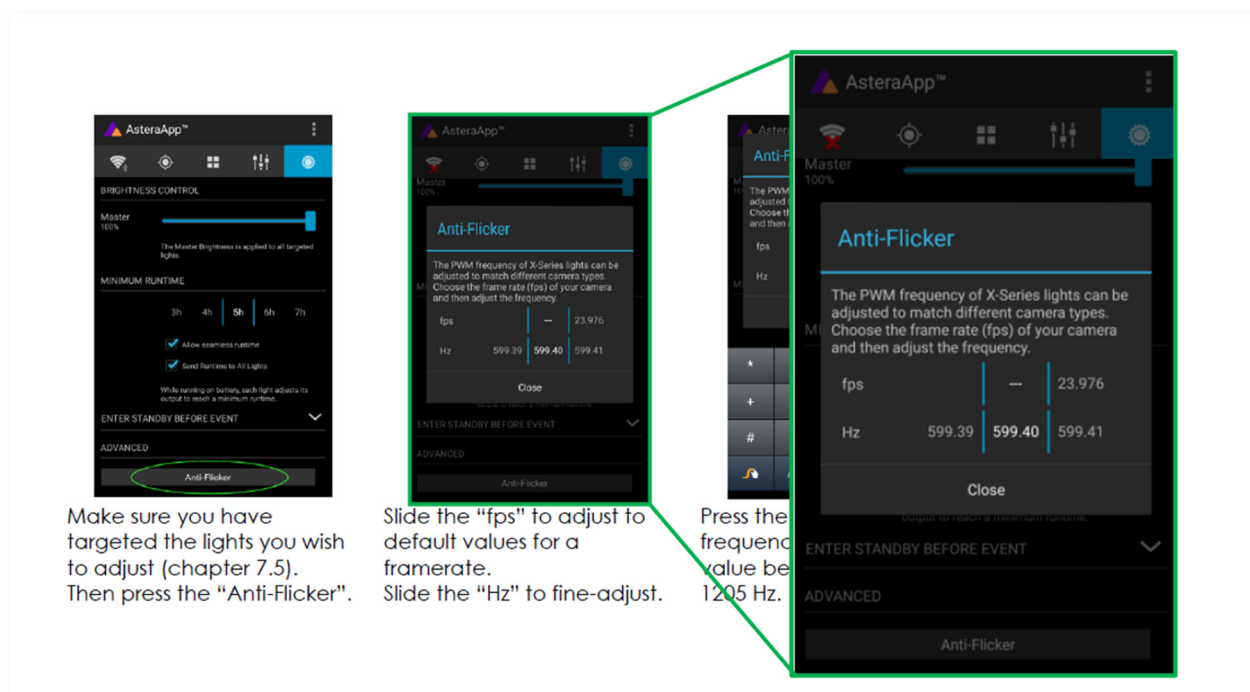
Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



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

EX1011, 32 (annotated).

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.*

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. EX1003, ¶250.

d. Claim Element 1c

[1(d)] 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.

Astera discloses Claim Element 1c. EX1003, ¶¶251-254.

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.

Based on these user-customized effects and “Anti-Flicker” inputs, the AX10 calculates time varying lighting values including brightness and color information, adjusted or matched to camera frame rate to avoid rolling shutter artifacts (e.g., flicker). EX1011, 23-29, 32; *see also* EX1003, ¶254. 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. EX1011, 24. AsteraApp outputs the lighting values representing the adjusted effect created in AsteraApp to the AX10. EX1003, ¶254. When the lighting values are received by

the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” EX1011, 24.

3. Claims 11 and 17

For this Petition, there are no substantive differences between Claim 1 and Claims 11 and 17, *see supra* Ground 1, Claims 11 and 17, and Astera anticipates Claims 11 and 17 for the same reasons as Claim 1. EX1003, ¶¶228-254, 291-317, 340-367.

Moreover, as discussed in Claim 1, Astera expressly discloses the claimed method can be performed on a “controller” or a “software program.”

With respect to Claim 11, Astera discloses the AX10 can be controlled via various controllers including an effect simulator, including the Control Panel and AsteraApp. EX1011, 8-9, 11-13, 17, 20-29.



EX1005, 9, 11, 23.

With respect to Claim 17, the Control Panel and AsteraApp perform the functions based on computer software program code. EX1003, ¶344. 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. EX1003, ¶344.

4. Claim 2

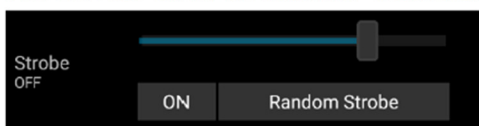
[2] The method according to claim 1, wherein the lighting effect comprises a short time-period (e.g. stroboscopic) lighting effect with a user adjustable minimum pulse width.

Astera anticipates or renders obvious Claim 2. EX1003, ¶¶255-260.

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.

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. EX1003, ¶258.

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.

EX1011, 27 (annotated). By enabling a user to adjust speed of the strobe, Astera allows users to adjust minimum pulse width. EX1003, ¶258. 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. *Id.* A user can select from “three random stroboscope options are available: slow, medium and fast.” EX1011, 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. EX1003, ¶258.

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).

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. EX1003, ¶260. 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. *Id.* 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. EX1011, 17, 20, 27-28; *see also* EX1003, ¶260.

5. Claim 5

[5] *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.*

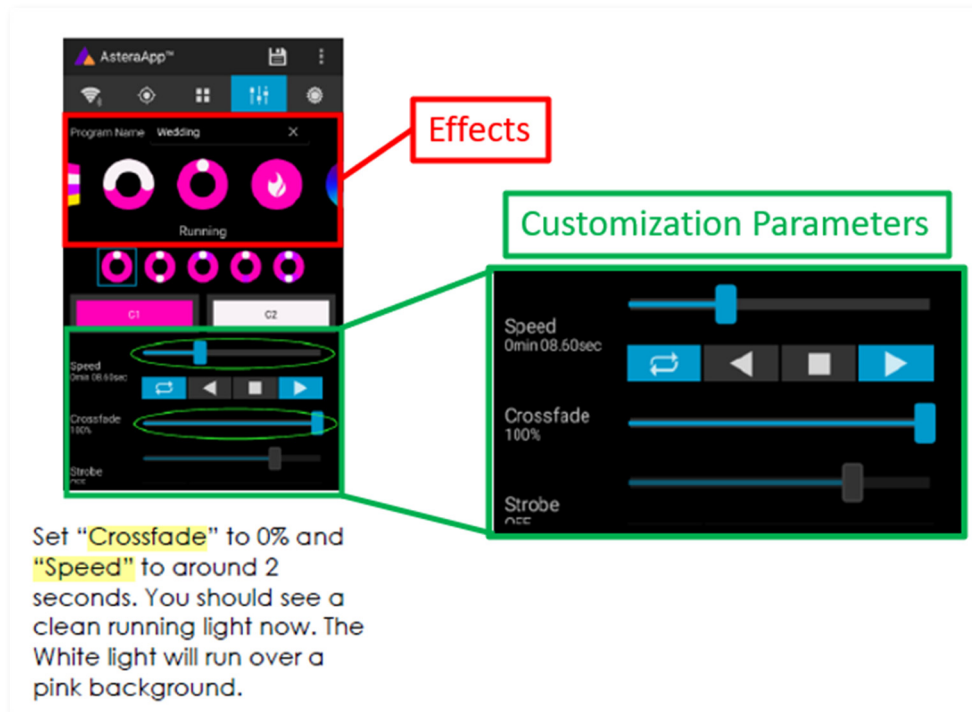
Astera anticipates Claim 5. EX1003, ¶¶261-265

The AX10 has multiple user interfaces:



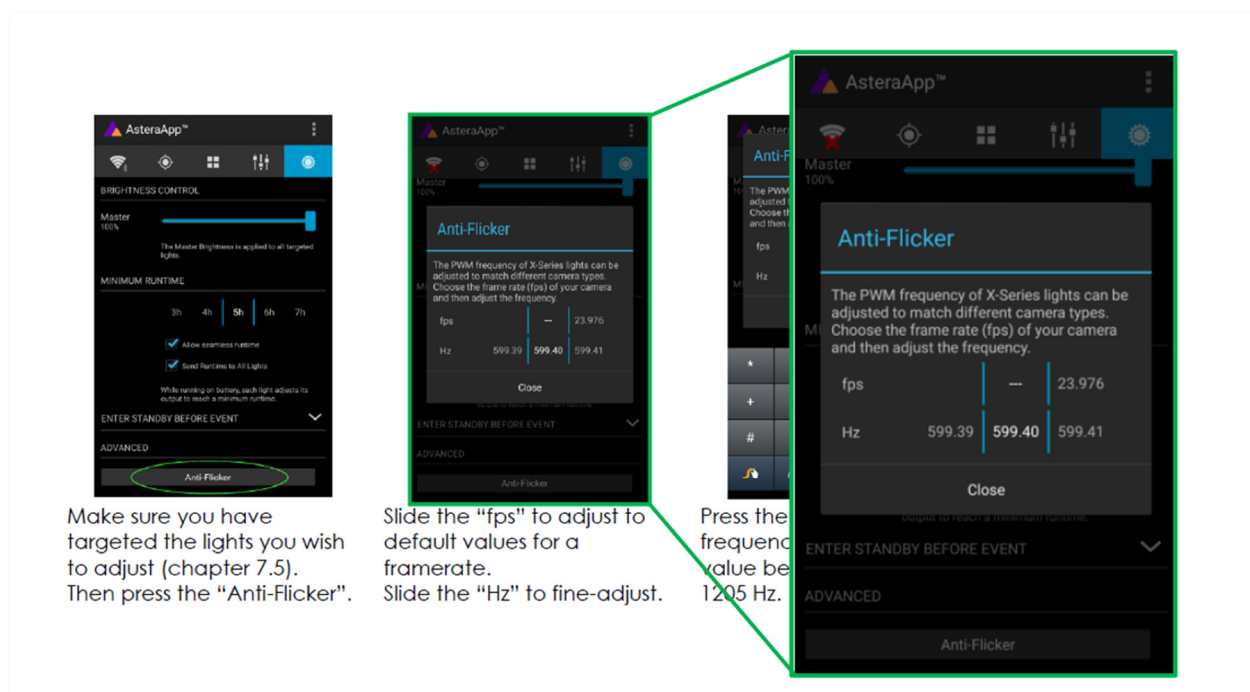
EX1011, 9, 11, 23. Users can select from various desired effects and parameters through interfaces on the Control Panel or Astera App. *Id.*, 8, 11, 13, 20, 24-29, 32.

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



Id., (annotated).

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.



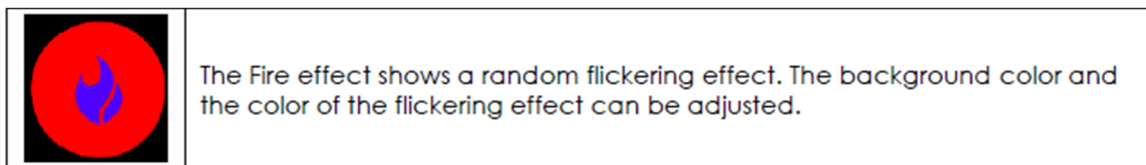
EX1011, 32 (annotated).

6. Claim 6

[6] 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.

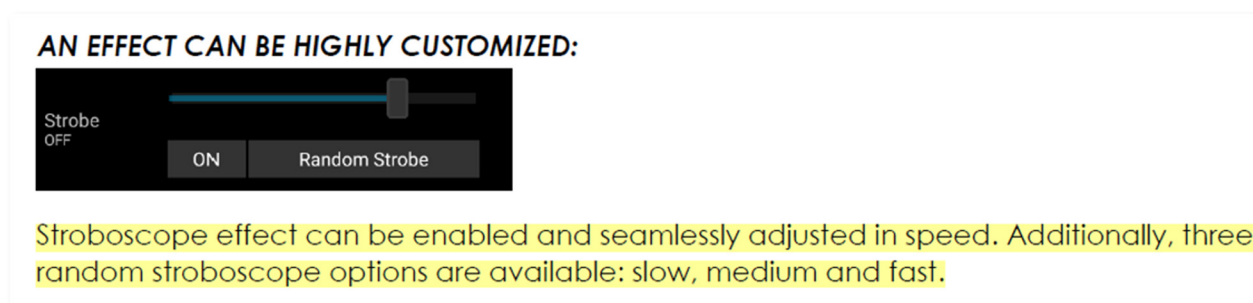
Astera anticipates Claim 6. EX1003, ¶¶266-270.

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



EX1011, 28.

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



Id., 27 (annotated).

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; EX1003, ¶270. 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. EX1003, ¶270.

7. Claims 7, 8, and 14

[7] The method according to claim 1, wherein the lighting value comprises at least one of: brightness; and colour data.

[8] 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.

[14] 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.

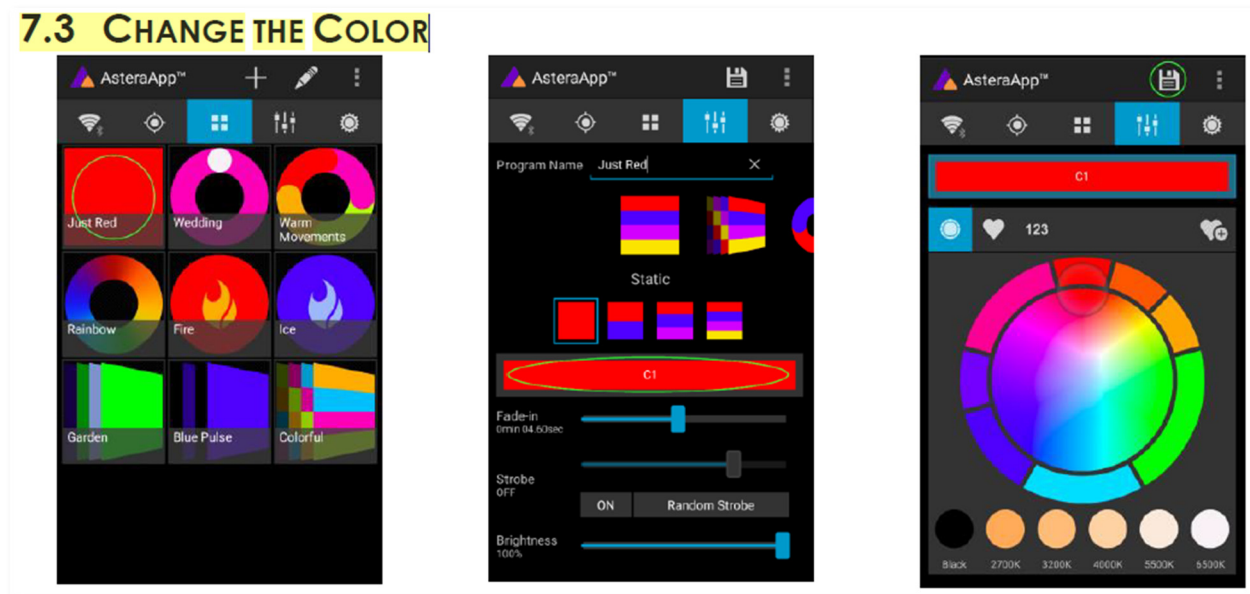
Astera anticipates or renders obvious Claims 7, 8, and 14. EX1003, ¶¶271-280, 326-331.

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. 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; *see also* EX1003, ¶¶273, 277, 328.

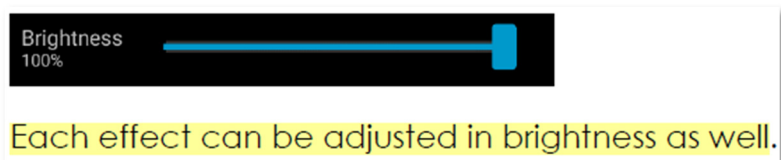
For example, “fire” is a random flickering between a “background color and the color of the flickering effect,” both of which colors can be adjusted. EX1011, 17,

20-21, 23-29, 32; *see also* EX1003, ¶¶274, 278, 329. Moreover, users can adjust brightness and color for selected effects. EX1011, 20, 24-28.

7.3 CHANGE THE COLOR



Id., 24 (annotated).



Id., 27 (annotated).

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; *see also* EX1003, ¶¶279, 330. 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. EX1011, 17; *see also* EX1003, ¶¶279,330.

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. EX1003, ¶¶280, 331. When the lighting values are received by the standalone engine, the AX10 “replays [the effect] autonomously until a new effect is received.” EX1011, 24.

8. Claims 9 and 21

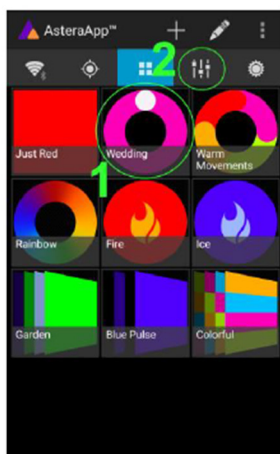
[9] The method according to claim 1, wherein a pulse duration of said time varying lighting value is based on at least one of: said camera recording frequency; said camera shutter speed; and said camera frame rate.

[21] 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.

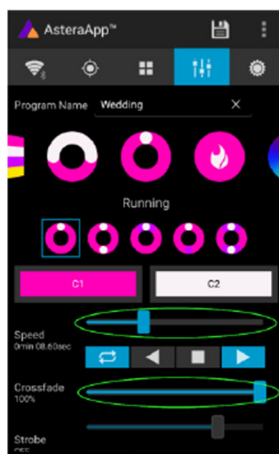
Astera anticipates Claims 9 and 21. EX1003, ¶¶281-285, 368-372.

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.

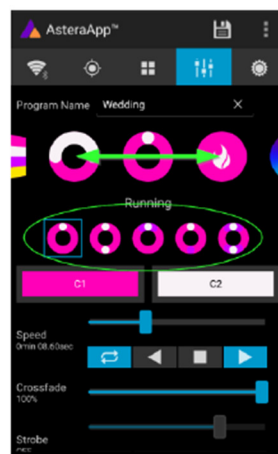
7.6 CHANGING THE EFFECT



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).

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

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. EX1003, ¶¶285, 372.

9. Claim 10

[10] 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.

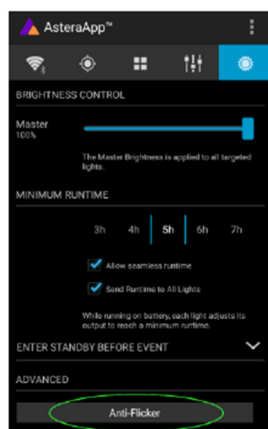
Astera anticipates or renders obvious Claim 10. EX1003, ¶¶286-290.

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.” EX1003, ¶288. 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”); EX1003, ¶288. Further, as was also well-known, the AX10 was designed and sold for such uses. EX1012, ¶2; EX1003, ¶288.

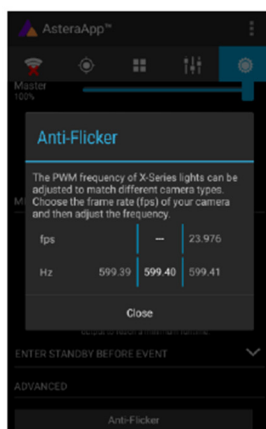
Moreover, Astera expressly teaches the AX10 produce effects captured by video cameras (used in videography, broadcasting, cinematography, and studio/location filming). EX1003, ¶289. The AX10 has an “Anti-Flicker” adjustment, so the light settings will “fit different camera’s frame rates.” EX1011, 32.

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".

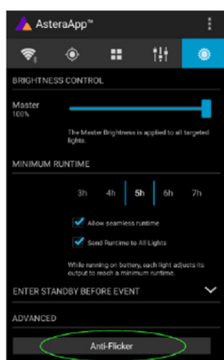


Slide the "fps" to adjust to default values for a framerate. Slide the "Hz" to fine-adjust.



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

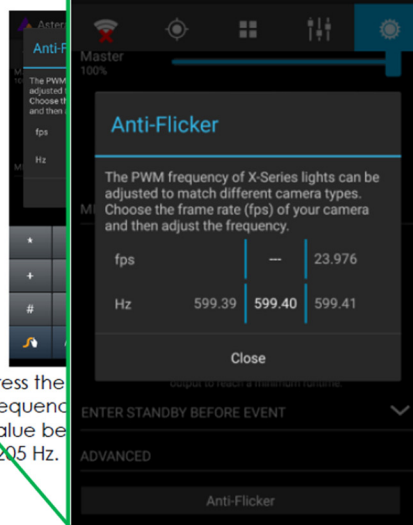
Id. (annotated).



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. EX1003, ¶289.

Further, a POSITA would understand references to DMX control in Astera, *see, e.g.*, EX1011, 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. EX1003, ¶290.

10. Claim 12

[12] 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.

Astera anticipates Claim 12. EX1003, ¶318-321.

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.

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.

6.4 CONTROL BY THE ASTERAAPP™

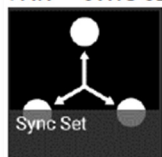
Your light has a built in standalone engine. It can display static colors or replay a number of predefined effect patterns with a customizable color palette.

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. (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:

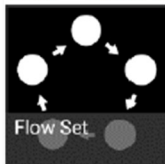
7.4.1 SYNC SET



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.

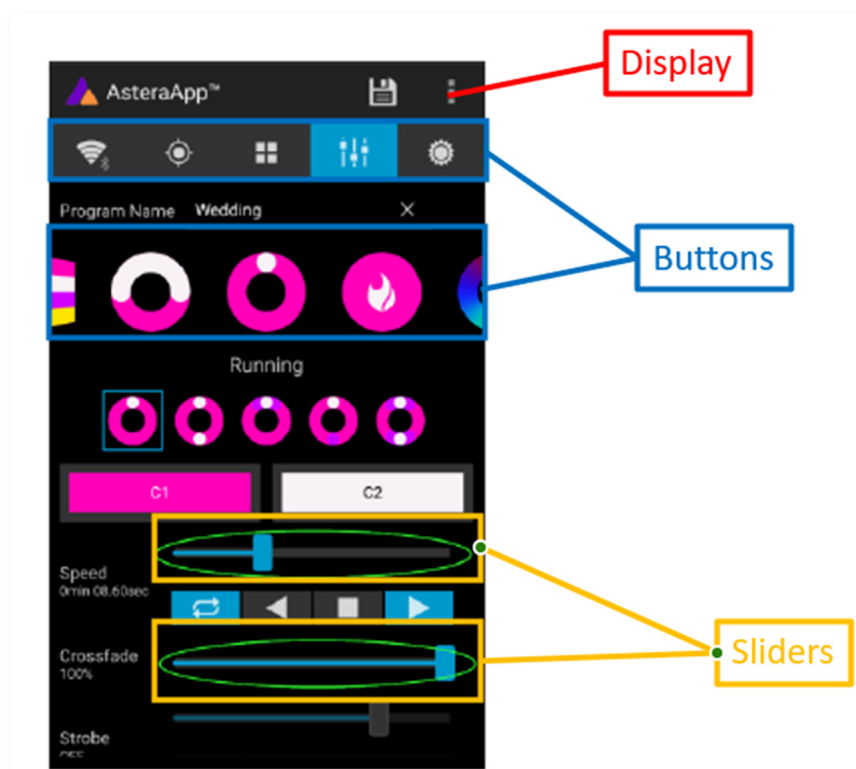
Id., 26.

11. Claim 13

[13] 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.

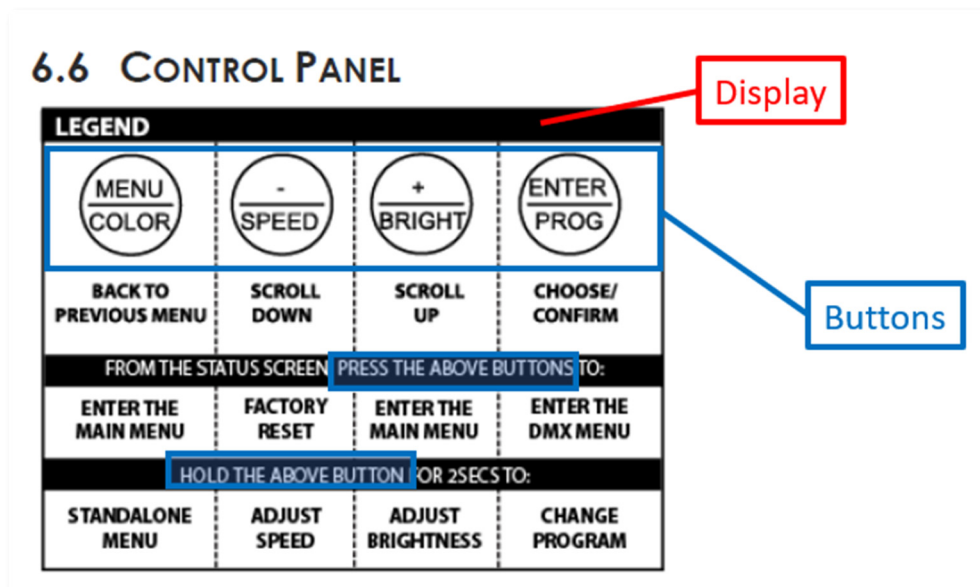
Astera anticipates Claim 13. EX1003, ¶¶322-325.

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).

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



Id., 11 (annotated).

12. Claim 15

[15] 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.

Astera anticipates Claim 15. EX1003, ¶¶332-334.

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

4 SPECIFICATION

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

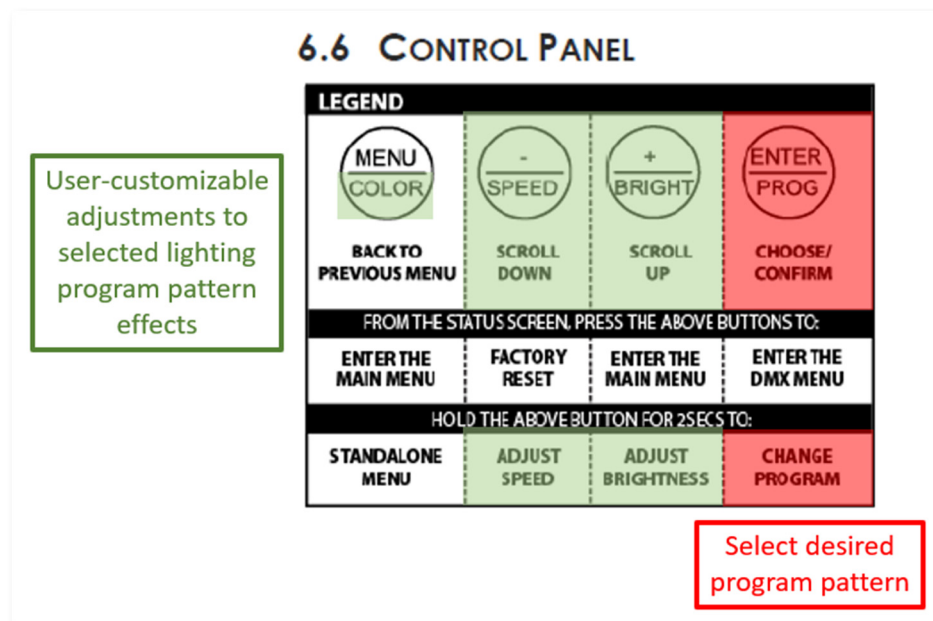
Id. (annotated).

13. Claim 16

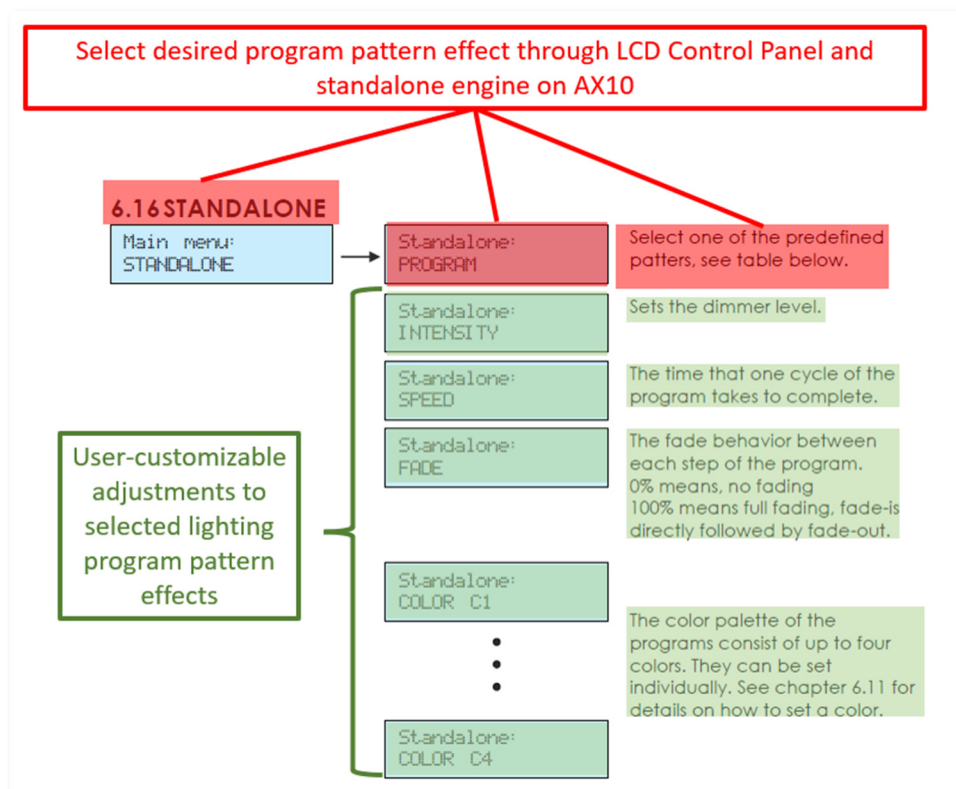
[16] The lighting system according to claim 15 wherein said controller and said lighting device are integrated in a combined unit.

Astera anticipates or renders obvious Claim 16. EX1003, ¶¶335-339.

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:



Id., 11 (annotated).



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

Further, it would have been obvious to a POSITA to provide the “Anti-Flicker” adjustment option on AsteraApp directly on the Control Panel. EX1003, ¶338. A POSITA would have recognized that, as explained in Astera, the Control Panel and AsteraApp are two ways of controlling the same AX10 light. EX1011, 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. EX1003, ¶338. 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. *Id.* 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. *Id.*

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. *Id.*, ¶339. 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. *Id.*

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

1. Claims 3-4, 19

[3] 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.

[4] 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.

[19] 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.

Astera in view of Edwards renders Claims 3, 4, and 19 obvious. EX1003, ¶¶373-388, 395-402.

Astera discloses compensating for unwanted camera artifacts by making adjustments to a PWM refresh frequency, based on the camera frame rate. EX1003, ¶¶375, 383, 397.

Edwards discloses that 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. Ground 1, Claim Element 1b; Ground 1, Claims 3-4, 19-20; EX1003, ¶¶376, 384, 398.

It would have been obvious to a POSITA to apply Edwards's additional teachings of avoiding unwanted camera artifacts to Astera. EX1003, ¶¶377, 385, 399. 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. *Id.*

Astera and Edwards are analogous art—both disclose systems for producing lighting effects, such as fire and strobing. *Id.*, ¶¶378, 386, 400. 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. *Id.* 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. *Id.*

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; *see also* EX1003, ¶¶379, 387, 401. 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. EX1011, 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. EX1003, ¶¶379, 387, 401.

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. *Id.*, ¶¶380, 388, 402. 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. *Id.*

3. Claims 18 and 20

[18] The method according to claim 1, further comprising controlling said time varying lighting value to illuminate evenly a camera frame.

[20] 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.

Astera in view of Edwards renders Claims 18 and 20 obvious. EX1003, ¶¶389-394, 403-408.

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. *Id.*; see also EX1003, ¶¶391, 405. 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.

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.*; *see also* EX1003, ¶392, 406.

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. EX1003, ¶393, 407.

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. EX1003, ¶¶394, 408. 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. *Id.*

IX. CONCLUSION

Aputure respectfully request that a trial be instituted. Claims 1-21 should be cancelled.

Dated: September 16, 2024

Respectfully submitted,

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APPENDIX A – CLAIM LISTING

U.S. Patent No. 10,203,101

Claim or Element #	Claim Language
<i>Claim 1</i>	
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.
<i>Claim 2</i>	
[2]	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.
<i>Claim 3</i>	
[3]	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.
<i>Claim 4</i>	
[4]	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.
<i>Claim 5</i>	

[5]	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.
Claim 6	
[6]	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.
Claim 7	
[7]	The method according to claim 1, wherein the lighting value comprises at least one of: brightness; and colour data.
Claim 8	
[8]	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.
Claim 9	

[9]	The method according to claim 1 further comprising storing said at least one user input simulation parameter corresponding to said user customisable lighting effect.
Claim 10	
[10]	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.
Claim 11	
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.
Claim 12	
[12]	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.
Claim 13	
[13]	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.
Claim 14	
[14]	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.
Claim 15	

[15]	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.
Claim 16	
[16]	The lighting system according to claim 15 wherein said controller and said lighting device are integrated in a combined unit.
Claim 17	
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.
Claim 18	
[18]	The method according to claim 1, further comprising controlling said time varying lighting value to illuminate evenly a camera frame.
Claim 19	
[19]	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.
Claim 20	
[20]	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.
Claim 21	

[21]	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.
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APPENDIX B

Certificate of Word Count

I certify that, in accordance with 37 C.F.R. § 42.24(d), the total word count for the forgoing Petition is 13,989. This is less than the permitted total under 37 C.F.R. 42.24(a)(1)(i).

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APPENDIX C

Certificate of Service

I certify that on September 16, 2024, a copy of this Petition for *Inter Partes Review* and supporting documents were served on Patent Owner via Federal Express at the following address:

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