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Application Number	
Filing Date	December 21, 2020
First Named Inventor	Peter Angelo DallePezze
Title	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
Art Unit	Unassigned
Examiner Name	Unassigned
Attorney Docket Number	AGSL:0002

SIGNATURE of Applicant or Patent Practitioner

Signature	/Jim Thomas/	Date (Optional)	December 21, 2020
Name	Jim Thomas	Registration Number	71,6111
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	AGS Lighting Management, LLC		

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Peter DaliePazze

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**CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR
LED FIXTURES**

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from and the benefit of U.S. Provisional Application Serial No. 63/040,585, entitled “LIGHTING APPARATUS AND METHOD OF USE,” filed June 18, 2020, which is hereby incorporated by reference in its entirety for all purposes.

BACKGROUND

[0002] The present disclosure relates generally to light fixtures. More specifically, the present disclosure relates to controlling a color temperature and luminance in a light fixture.

[0003] Traditional incandescent light bulbs provide a warm, yellow-colored light at a certain luminance (e.g., lumen output, amount of light). The color temperature of light produced by incandescent lights, which may be seen in home settings, generally falls within a certain range of color temperatures (e.g., 2000K-300K). Alternatively, fluorescent tubes, as commonly seen in warehouse and office settings, generally provide light with color temperatures (e.g., 5000K) that are relatively higher than incandescent lighting.

[0004] Light-emitting diodes (LEDs) use less energy and may be more energy efficient than incandescent lights and fluorescent lights. However, the light fixtures that employ LEDs may still be limited to a particular color temperature like their incandescent and fluorescent counterparts. As such, LED lighting systems that use light fixtures with LEDs tend to be custom manufactured to produce light at a specific color temperature and at a particular lumen output. That is, after the custom manufactured LED light fixtures are installed, the light produced from these fixtures is limited to a particular color temperature and one lumen output.

[0005] This section is intended to introduce the reader to various aspects of art that may be related to various aspects of the present techniques, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with background information to facilitate a better understanding of the various aspects of the present disclosure. Accordingly, it should be understood that these statements are to be read in this light, and not as admissions of prior art.

BRIEF DESCRIPTION

[0006] A summary of certain embodiments disclosed herein is set forth below. It should be understood that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

[0007] In one embodiment, a linear light-emitting diode (LED) lighting apparatus may include an array of light emitting diodes (LEDs) that may include a first plurality of LEDs that produces a first light having a first color temperature. The first plurality of LEDs aligns within a first linear shape. The second plurality of LEDs may produce a second light having a second color temperature different from the first color temperature. The second plurality of LEDs aligns within a second linear shape. The lighting apparatus may also include a driver circuit that outputs a plurality of currents and a switch assembly that may couple to the driver circuit. The switch assembly may include a first switch that may cause the driver circuit to output one of the plurality of currents and a second switch that may cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both.

[0008] In another embodiment, a linear light-emitting diode (LED) lighting system may include a first modular lighting apparatus traversing a first linear distance. The first modular lighting apparatus may include a first plurality of light-emitting diodes (LEDs) arranged within a first linear form factor and having a first number of LEDs, each LED of

the first plurality of LEDS associated with a first color temperature. The first modular lighting apparatus may include a first driver circuit that may output a first plurality of currents and a first switch assembly and a first extender port. The first switch assembly may cause the first circuit to output one of the first plurality of currents and couple the one of the first plurality of currents to the first plurality of LEDs. The system may also include a second modular lighting apparatus traversing a second linear distance that is longer than the first linear distance, wherein the second lighting apparatus comprises a second plurality of light-emitting diodes (LEDs) arranged within a second linear form factor and having a second number of LEDs, each LED of the second plurality of LEDs associated with the first color temperature, such that the second number is greater than the first number by a scale factor. The second modular lighting apparatus may include a second driver circuit that may output a second plurality of currents and a second switch assembly. The second switch assembly may cause the second circuit to output one of the second plurality of currents and couple the one of the second plurality of currents to the second plurality of LEDs, such that the one of the second plurality of currents is greater than the one of the first plurality of currents by the scale factor. The second modular lighting apparatus may also include a second extender port that may couple with the first extender port to combine the first modular lighting apparatus and the second modular lighting apparatus to traverse the first linear distance and the second linear distance

[0009] In yet another embodiment, a system may include a first modular lighting apparatus that may include a first array of light emitting diodes (LEDs). The first array of LEDs may include a first plurality of LEDs associated with a first color temperature. The first plurality of LEDs aligns within a first linear shape. The first lighting apparatus may also include a second plurality of LEDs associated with a second color temperature different from the first color temperature, such that the second plurality of LEDs aligns within a second linear shape. The first plurality of LEDs may include a first driver circuit that may output a first plurality of currents and a first switch assembly that may couple to the first circuit. The first switch assembly may include a first switch that may cause the first driver circuit to output one of the first plurality of currents and a second switch that

may cause a first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs, cause the first portion of the one of the first plurality of currents to couple to each LED of the second plurality of LEDs, and cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs. The system may include a second modular lighting apparatus that may electrically couple to the first modular lighting apparatus. The second modular lighting apparatus may include a second array of the array of light emitting diodes (LEDs). The second array of LEDs may include a third plurality of LEDs associated with a third color temperature, such the third plurality of LEDs aligns within a third linear shape and the third color temperature matches the first color temperature. The third plurality of LEDs is longer than the first plurality of LEDs. The second modular lighting apparatus may include a fourth plurality of LEDs that may produce a fourth light having a fourth color temperature matching the second color temperature. The fourth plurality of LEDs aligns within a fourth linear shape, and the fourth plurality of LEDs is longer than the second plurality of LEDs. The second lighting apparatus may include a second driver circuit that may output a second plurality of currents and a second switch assembly that may couple to the second circuit. The second switch assembly may include a third switch that may cause the second circuit to output one of the second plurality of currents and a fourth switch. The fourth switch may cause a second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs, cause the second portion of the one of the second plurality of currents to couple to each LED of the fourth plurality of LEDs, and cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs.

DRAWINGS

[0010] These and other features, aspects, and advantages of the present disclosure will become better understood when the following detailed description is read with reference

to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

[0011] FIG. 1 is a perspective view of a linear light-emitting diode (LED) light fixture that includes a light-emitting diode (LED) array, in accordance with an embodiment of the disclosure;

[0012] FIG. 2 is a block diagram of electrical connections between a driver circuit, a switch assembly, and the LED array within the light fixture of FIG. 1, in accordance with an embodiment of the disclosure;

[0013] FIG. 3 is a block diagram of electrical connections between a driver circuit, a switch assembly, and two LED arrays within the light fixture of FIG. 1, in accordance with an embodiment of the disclosure;

[0014] FIG. 4 illustrates several configurations for different modules of the light fixture of FIG. 1, in accordance with an embodiment of the disclosure;

[0015] FIG. 5 is an expanded perspective view of a switch assembly within the light fixture of FIG. 1, in accordance with an embodiment of the disclosure; and

[0016] FIG. 6 is a perspective view and a top view of the switch assembly of FIG. 5 positioned within a housing assembly of the light fixture of FIG. 1, in accordance with an embodiment of the disclosure.

DETAILED DESCRIPTION

[0017] One or more specific embodiments of the present disclosure will be described below. In an effort to provide a concise description of these embodiments, all features of an actual implementation may not be described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and

business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0018] When introducing elements of various embodiments of the present disclosure, the articles “a,” “an,” “the,” and “said” are intended to mean that there are one or more of the elements. The terms “comprising,” “including,” and “having” are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0019] As described above, light fixtures with LEDs may be limited in that they produce light at one particular color temperature and one particular luminance or lumen output level. For certain environments or settings, linear LED light fixtures (e.g., light fixtures that include LEDs disposed in a linear shape) are desired to produce efficient light for large spaces. For example, in factory or office settings, linear light fixtures are fixed on a ceiling and linearly traverse the setting to produce light within the space below. To ensure that the light provided in the space below is uniform in color and luminance, each light fixture may be custom manufactured according to a desired color temperature and luminance level. In addition, since every setting has unique dimensions and lengths, the custom-manufactured linear light fixture may use a custom number of LEDs (e.g., each LED having desired color temperature) positioned in a custom-length LED array powered by a custom-built driver circuit to provide a sufficient amount of current to each LED of the LED array, thereby producing the desired luminance level. Manufacturing these linear LED light fixtures involves designing a different version of the linear LED light fixtures with specially designed components for each different setting.

[0020] With this in mind, the present disclosure describes a linear light fixture including a switch assembly that may control the color temperature and the luminance output of an array or collection of light-emitting diodes (LEDs) within the light fixture. As described herein, the linear light fixture, which may be formed from an assembly of multiple light fixture modules, may include an array of LEDs that may facilitate provision of an

uninterrupted and continuous illuminated linear surface. As such, the LED array within the linear LED light fixture may include a number of LED chips or circuits positioned in a linear manner. In addition, each LED chip may receive current from one or more driver circuits that provides each LED chip with a substantially equal amount of current to cause each LED to illuminate at the same luminance level.

[0021] To control the color temperature output of the linear LED light fixture, the light fixture may include multiple strings of LEDs in the LED array that produce light at multiple color temperatures. That is, for example, the linear LED light fixture may include two distinct linear strings of LEDs, such that one linear string of LEDs has a first color temperature, meaning it produces light at one color temperature (e.g., 3000 Kelvin), and a second linear string of LEDs has a second color temperature, meaning it produces light at another color temperature (e.g., 4000 Kelvin). Reference to producing light at a particular color temperature generally means producing light within a range approximate a color temperature value. For example, a color temperature of 4000 Kelvin refers to a range of values that approximate 4000 Kelvin within tolerances. In some embodiments, a switch assembly coupled to the array of LEDs may direct current from the driver circuit to one of the two linear strings of LEDs to cause the linear LED light fixture to produce light with the corresponding color temperature. That is, the switch assembly may include a switch that causes current output by the driver circuit to be directed to a particular linear string of LEDs within the linear LED light fixture based on a correspondence between a desired color temperature of light to be provided and a color temperature range of the particular linear string of LEDs. For example, a first string of LEDs may have a color temperature of 3000 Kelvin and a second string of LEDs may have a color temperature of 4000 Kelvin, and the first string may be selected for activation while the second string remains idle because the desired lighting color temperature is 3000 Kelvin.

[0022] In addition to controlling the color temperature of the light produced by the linear LED light fixture, in some embodiments, the switch assembly may include an additional switch to control a luminance or a lumen level output by the linear LED light

fixture. The lumen level output of an LED may depend on the amount of current it receives. That is, as the current provided to the LED increases, the amount of luminance produced by the light output by the respective LED increases. With this in mind, the additional switch may cause the driver circuit to output a certain amount of current, which may be directed to each LED in the linear array of LEDs of the linear LED light fixture.

[0023] By including the ability to control the color temperature and luminance of the LED arrays, the linear LED light fixtures may be manufactured as light fixture modules with various lengths such that each module may coordinate with other modules to form larger modules or operate separately as independent light fixtures. Indeed, each light fixture module and the components (e.g., LED array, driver circuit) therein may be manufactured according to a scale factor (e.g., $\frac{1}{2}$, 1, 2, 3) of a base light fixture module having a certain length or a having a different number of LEDs in the LED array. For example, an 8-ft light fixture module may be similar to that of a 4-ft light fixture module in that the components that make up the 4-ft light fixture module are scaled by a factor of 2 in the 8-ft light fixture module because the 8-ft fixture module may include twice as many LEDs in its respective LED array 16 as compared to the 4-ft light fixture module. With this example in mind, the driver circuit of the 8-ft linear LED light fixture module may output twice the amount of current that the driver circuit of the 4-ft linear LED light fixture module may output. In the same manner, the number of LEDs in the LED array 16 of the 8-ft linear LED light fixture module may be twice the number of LEDs in the LED array 16 of the 4-ft linear LED light fixture module. In this way, a ratio of the current output by the driver circuit of the 4-ft light fixture module to the current output by the driver circuit of the 8-ft light fixture module may match a ratio of the number of LEDs in the 4-ft light fixture module to the number of LEDs in the 8-ft light fixture module. As a result, the linear LED light fixture modules may be manufactured at fixed lengths and then assembled or used individually to provide lighting solutions for different spaces of different sizes, while providing consistent light properties with the same color temperature and luminance properties regardless of the sizes or combinations of the linear LED light fixture modules used in the space. In this way, manufacturers may efficiently produce linear LED light

fixtures at various fixed scales to accommodate different sized spaces without customizing components for linear LED light fixtures for every different space. Additional details with regard to controlling the color temperature and luminance properties of light produced by linear LED light fixtures will be discussed in more detail below with reference to FIGS. 1-6.

[0024] By way of introduction, FIG. 1 illustrates a perspective exploded view of a linear LED light fixture 10 and components that make up the linear LED light fixture 10, in accordance with an embodiment of the present disclosure. The linear light fixture 10 may represent an assembly of multiple light fixture modules or a single light fixture module. As shown in FIG. 1, the linear LED light fixture 10 may include a housing 12 that may be fixed to or suspended from a ceiling or other part of a structure to secure the linear LED light fixture 10. The housing 12 may be composed of aluminum, such as an extruded aluminum, a stamped aluminum, and the like. It should be noted that the housing may be composed of another metal (e.g., steel) other than aluminum, a suitable plastic, carbon fiber, a polycarbonate material, a composite material, and other materials that may form the desired shape and house the depicted components. In a particular embodiment, the housing 12 may be designed to securely hold an illumination surface (e.g., a translucent panel configured to be backlit by LEDs) that is less than or equal to six inches wide and greater than or equal to 24 inches in length.

[0025] The housing 12 may include an interior volume 14 in which various components of the linear LED light fixture 10 may be stored or placed within. For example, an LED array 16 may be positioned within the interior volume 14 to produce light directed away from a base 18 of the housing 12. The LED array 16 may include a number of LED chips or circuits disposed on one or more strips (e.g., LED strip), each of which includes one or more LEDs that receives electricity (e.g., current) and produces light that may be distributed to areas underneath the linear LED light fixture 10. To enable the housing 12 to contain an illuminated surface that is less than or equal to six inches wide and greater than or equal to 24 inches in length, the LED strips disposed in the housing may be greater

than or equal to 24 inches in length to match that of the housing 12. In one embodiment, the LEDs of the LED array 16 may be disposed on one or more strips of LEDs, such that each LED is of the same type (e.g., color temperature) and equally spaced from each other. For instance, the LEDs of a particular strip of LEDs in the LED array 16 may produce light having the same color temperature. The LED strip may be arranged to form the shape of a line that extends along a length of the housing 12. In some embodiments, each LED strip may include at least one connector such that an additional LED strip may be added at one or either side of the respective LED strip. One or both sides of the housing 12 may include an electrical connector to provide power to the components of the linear LED light fixture 10 or to adjacently connected linear LED light fixtures (e.g., light fixture modules) in accordance with the embodiments described herein.

[0026] The LED array 16 may receive electricity via a driver circuit 20 and/or a switch assembly 22. In one embodiment, the driver circuit 20 may be a constant current mode output driver that produces multiple levels of current for output using a current regulator circuit or the like. By way of example, the driver circuit 20 may receive an input voltage (e.g., 120-277VAC) and output currents at 803 mA, 1250 mA, or 1660 mA based on an input signal provided by the switch assembly 22. That is, the switch assembly 22 may send a control signal (e.g., resistance signal, light signal, electrical signal) that causes the driver circuit 20 to output a certain amount of current. Although the driver circuit 20 is described as operating at certain input voltages and providing certain output currents, it should be noted that the provided values are exemplary values and the driver circuit 20 may receive and output voltage and current at various levels and values.

[0027] The switch assembly 22 may provide a signal to the driver circuit 20 to cause the driver circuit 20 to output a current that may be directed to the LED strings within the LED array 16. As shown in FIG. 1, the switch assembly 22 may be inserted into the housing 12 and maintained in place by a receptacle 24 (e.g., an edge formed in the housing 12 about a hole) sized to house the switch assembly 22. In addition to the receptacle 24, two plugs 26 (e.g., 7/8-inch diameter) and a single plug 28 (e.g., 5/8-inch diameter) may

be positioned at each end of the housing 12. The plugs 26 and 28 may be used to route wires and/or cable to the interior volume 14 of the housing 12. For example, a wire for providing power to the driver circuit 20 may be routed through one of the plugs 26 or 28. In addition, wires that may provide voltage for a number of other linear LED light fixtures that may be positioned adjacent to each other and may be routed between each other via the plugs 26 or 28.

[0028] The interior volume 14 may also include a lens 30 that may control the distribution of beams of light produced by the LEDs of the LED array 16. The lens 30 may include retaining or coupling components, such that the lens 30 can be pressure fit within the housing 12 with no further mechanical attachments. In addition, the interior volume 14 may also include a reflector 32 positioned above the LED array 16 to alter, reflect, or diffuse the beams of light produced by the LEDs of the LED array 16.

[0029] As will be discussed with reference to FIG. 4, the linear LED light fixture 10 may be manufactured according to a modular type design. Thus, two of the linear LED light fixtures 10 may be connected together to make a longer linear continuous run. In accordance with present embodiments, any suitable number of linear LED light fixtures 10 (or light fixture modules 10) can be added together (e.g., attached end to end) to accommodate a corresponding length for a desired completed light fixture.

[0030] With the foregoing in mind, FIG. 2 illustrates a block diagram of an electrical assembly 40 depicting interconnections between components of the linear LED light fixture 10. As shown in FIG. 2, the electrical assembly 40 may include the driver circuit 20, the switch assembly 22, and the LED array 16. The driver circuit 20, as discussed above, may receive an input voltage (V_{in}) and output multiple direct current (DC) currents. The switch assembly 22 may provide a control signal to the driver circuit 20 to cause the driver circuit 20 to output a particular DC current. By way of example, the driver circuit 20 may output three different DC currents depending on the control signal received from the switch assembly 22.

[0031] The switch assembly 22 may include an output switch 42 and a color switch 44. In one embodiment, the output switch 42 may be a mechanical switch that moves to three different positions. When the output switch 42 is positioned at a particular position, a control signal may be provided to the driver circuit 20, which may include a processor or other suitable control circuitry, to cause the driver circuit 20 to output a corresponding DC current value. For example, the output switch 42 may have three different positions associated with causing the driver circuit 20 (e.g., via the processor or control circuitry) to output three different DC current values. Thus, the output switch 42 may coordinate with the driver circuit 20 to provide any of the three different DC current values depending on the desired operation.

[0032] The switch assembly 22 may be electrically coupled to the LED array 16. The LED array 16 may include one or more LED strings 48, each of which form a linear shape and is composed of a number of LEDs that produce light at a particular color temperature. By way of example, the LED array 16 may include a first set of LED strings 48 that include LEDs 50 producing light at a color temperature of 3000K and a second set of LED strings 52 positioned parallel to or interlaced with the first set of LED strings that include LEDs 54 producing light at a color temperature of 4000K. Although the LED array 16 is illustrated and described herein as including two sets of LED strings, it should be noted that the LED array 16 may include any suitable number of LED strings to provide a variety of different color temperatures in accordance with the embodiments described herein.

[0033] Referring to the block diagram of FIG. 2, the switch assembly 22 may include a terminal 46 that may include one positive terminal 58 and two negative terminals 60 and 62. The positive terminal 58 may be electrically coupled to (e.g., via wire, circuit trace) positive terminals 64 and 66 of terminal blocks 68 and 70, respectively. The negative terminal 60 may be electrically coupled to terminal 72 of the terminal block 70, and the negative terminal 62 may be electrically coupled to terminal 74 of the terminal block 68.

[0034] By way of operation, the driver circuit 20 may provide a DC current at the selected level (e.g., according to the output switch 42) to the switch assembly 22. The

switch assembly 22 may, in turn, direct the DC current to the LED strings 48 or the LED strings 52 depending on a position of the color switch 44. That is, the color switch 44 may include multiple selectable positions that correspond to different color temperatures. By way of example, the color switch 44 may include three positions that respectively correspond to color temperatures of 3000K, 3500K, and 4000K. Depending on the position of the color switch 44, the switch assembly 22 may direct the DC current output by the driver circuit 20 to the LED strings 48, the LED strings 52, or both LED strings 48 and 52 to cause the linear LED light fixture 10 to produce light at 3000K, 4000K, or 3500K, respectively.

[0035] For instance, if the color switch 44 is positioned at the 3000K level, the switch assembly 22 may direct the DC current output by the driver circuit 20 to the LED strings 48 via the terminals 64 and 74 of terminal block 68. If the color switch 44 is positioned at the 4000K level, the switch assembly 22 may direct the DC current output by the driver circuit 20 to the LED strings 52 via the terminals 66 and 72 of terminal block 70. By directing the DC current to the LED strings 48 or the LED strings 52, the linear LED light fixture 10 may produce light at a color temperature of 3000K or 4000K, respectively. With the foregoing in mind, to produce light at a color temperature of 3500K, the switch assembly 22 may direct the DC current output by the driver circuit 20 to both of the LED strings 48 and 52. That is, half of the DC current output by the driver circuit 20 may be provided to the LED strings 48 and the other half of the DC current output by the driver circuit 20 may be provided to the LED strings 52. As a result, the color temperature of the resulting light output by the LEDs 50 and 54 of the LED strings 48 and 52 may be 3500K or the average of 4000K and 3000K.

[0036] In addition, depending on the position of the output switch 42, the linear LED light fixture 10 may produce light with different luminance values depending on the DC current level output by the driver circuit 20. That is, the particular LED string 48 or 52 or combination of LED strings 48 and 52 that receives the DC current may illuminate to a particular luminance level depending on the DC current provided by the driver circuit 20,

but the color properties of the respective LEDs 50 and 54 do not change based on the different received DC currents. Moreover, when the DC current output by the driver circuit 20 is split between the LED strings 48 and 52, half of the DC current output by the driver circuit 20 is provided to twice as many LEDs, as compared to when all of the DC current is provided to one LED string. As a result, the luminance provided by the LEDs in the LED strings 48 and 52 receiving half of the DC current is the same as the luminance output by the LEDs of one of the LED strings 48 or 52 that receives all of the DC current from the driver circuit 20.

[0037] To produce the same color and luminance across each LED of a respective LED string, each of the LEDs in the LED strings is arranged or positioned in a manner to receive an equal amount of current. That is, the DC current received at the LED array 16 is evenly distributed across each LED of the respective LED string, such that each LED illuminates to a particular lumen level. Indeed, the LED strings 48 and 52 are disposed along corresponding circuits to split the current (e.g., via current dividers, voltage dividers) received from the driver circuit 20 equally among each LED of the respective LED string. As a result, the collective light produced by the LEDs of the respective LED string corresponds to a desired lumen level selected via the output switch 42. As such, the driver circuit 20 may be sized or selected based on the number of LEDs that are present in the LED array 16. For example, if the output switch 42 for the linear LED light fixture 10 is positioned (e.g., low level) such that the driver circuit 20 outputs 415 mA, and if the LED array 16 includes 6 LED strings 48 and each LED string 48 includes 16 LEDs 50 (i.e., 96 total LEDs), each LED 50 of the LED strings 48 may receive approximately 4.32 mA.

[0038] Keeping this in mind, to produce a linear LED light fixture 10 that is twice as long as provided in the example above, the driver circuit 20 may be scaled by 2 to provide twice the DC current output and the number of LED strings may be doubled, such that twice as many LEDs (e.g., 192 total LEDs) is included in the respective LED array 16. As a result, the driver circuit 20 may be scaled to provide 830 mA of DC current at the same position (e.g., low level) that the switch assembly 22 is positioned in the previous example.

In turn, each LED 50 of the 192 total LEDs may receive 4.32 mA of DC current, thereby producing the same amount of luminance as provided in the LEDs described in the example above.

[0039] With this in mind, FIG. 3 illustrates a block diagram of an electrical assembly 80 depicting the interconnections between component parts of the linear LED light fixture 10 that includes twice as many LEDs as the electrical assembly 40 illustrated in FIG. 2. As shown in FIG. 3, the LED array 16 is electrically coupled to the switch assembly 22 in the same manner as provided in the electrical assembly 40 of FIG. 2. In addition to the LED array 16, the switch assembly 22 may also be electrically coupled to an LED array 82, which may be similar to the LED array 16. In this way, the DC current received by the LED array 82 may be equally distributed to LED strings 84 and 86, as well as LEDs 88 and 90, respectively.

[0040] Referring to the wiring of the electrical assembly 80, the LED array 82 and the LED array 16 are connected to the switch assembly 22 such that the DC current received from the driver circuit 20 is split equally between two respective LED strings depending on the setting of the color switch 44. That is, if the color switch 44 is set at the 3000K setting, the DC current may be provided to terminal blocks 64 and 92, thereby illuminating the LED strings 48 and 84. When connected to the LED arrays 16 and 82, the DC current output by the driver circuit 20 will be split equally between the LED array 16 and the LED array 82. As such, to ensure that the color and luminance properties of the linear LED light fixture 10 having one LED array and the linear LED light fixture 10 having two LED arrays match each other, the power rating (e.g., wattage) of the driver circuit 20 of the electrical assembly 80 may be scaled by 2. If the driver circuit 20 of the electrical assembly 40 outputs 415 mA when the output switch 42 is set at a particular position, the driver circuit 20 of the electrical assembly 80 may be designed to output 830 mA when the output switch 42 is set at the same position. By scaling the number of LEDs and the DC current output of the driver circuit 20 in the linear LED light fixture 10 depicted in the electrical assembly 40 in the manner described above, various modules of linear LED light fixtures can be

manufactured, such that each module may provide the same color and luminance properties regardless of the size (e.g., length) of the module. As a result, manufacturing operations related to producing the linear LED light fixtures may be simplified. That is, manufacturers may supply a number of linear LED light fixtures to accommodate a desired length by connecting multiple linear LED light fixture modules together while maintaining a consistent color temperature and luminance across the collection of linear LED light fixture modules.

[0041] Keeping this in mind, FIG. 4 illustrates various combinations of 4-ft and 8-ft linear LED light fixture modules that enable a user to achieve 4-ft (94), 8-ft (96), 12-ft (98), and 16-ft lengths (100) using just two types of linear LED light fixtures (94 and 96). In some embodiments, the housing 12 of each linear LED light fixture module may be positioned adjacent to each other and may include coupling features that allow each housing to physically and electrically connect to each other. In addition, in some embodiments, each end of the linear LED light fixture modules may include electrical connections that allow input voltage provided at one electrical connection to be distributed in parallel to another electrical connection at the other end of the linear LED light fixture module. In this way, the same input voltage may be provided to each linear LED light fixture module via an adjacently connected linear LED light fixture module.

[0042] In addition to the lengths of the linear LED light fixture modules depicted in FIG. 3, it should be understood that other linear LED light fixture modules having other lengths may also be manufactured according to the scale factors described above. As such, the embodiments described herein may be used to manufacture linear LED light fixture modules to fit any desired length.

[0043] Returning to the figures, FIG. 5 illustrates an exploded view of the switch assembly 22, which may be incorporated into a linear LED light fixture in accordance with present embodiments. In some embodiments, the switch assembly may include a top portion 102, a bottom portion 104, a switch circuit 106, and a connecting mechanism 108. By way of example, the switch circuit 106 may include the output switch 42 and the color

switch 44 described above. In one embodiment, the switch circuit 106 may include two adjustable pins, where each pin may move to a number of fixed positions. In the illustrated example, the switch circuit 106 may include slide switches that move to fixed positions. It should be noted that the switch circuit 106 may use any suitable form of switch configuration, such as a push button switch, rotary switch, toggle switch, a dip switch, and the like. In some embodiments, the switch circuit 106 may include a processor, a transceiver, and other circuit components that may enable the switch circuit 106 to receive electrical or wireless signals to control the operation of the switch circuit 106.

[0044] By way of example, a first adjustable switch of the switch circuit 106 may adjust a color temperature level between a low level, a medium level, or a high level. As mentioned above, the levels may be adjusted between 3000K, 3500K, and 4000K, as per the electrical assemblies described above. Again, it should be noted that such levels are merely examples and the linear LED light fixture 10 may be modified to provide a variety of color temperatures by using different LEDs that provide light with different color temperatures.

[0045] As discussed above, the switch circuit 106 may provide a control signal to the driver circuit 20 to actuate the LED array 16 based on a position of the output switch 42. After sending the control signal to the driver circuit 20, the switch circuit 106 may receive electrical energy from the driver circuit 20 and route the electrical energy to the LED array 16 in accordance with the selection of the color switch 44. As such, the switch circuit 106 may include circuit components that adjust the path of the electrical energy output by the switch circuit 106 depending on the position of the color switch 44.

[0046] The connecting mechanism 108 may represent any suitable coupling component that may secure the switch circuit 106 to the top portion 102, such as a pan head screw. In some embodiments, the top portion 102 and the bottom portion 104 may be secured to each other using coupling features 110 that may snap or attach to hooks (not shown) disposed in the top portion 102. It should be noted that the top portion 102, the bottom portion 104,

and the switch circuit 106 may be coupled to each other using any suitable fastener or technique.

[0047] Referring back to FIG. 1, the switch assembly 22 may be positioned in the receptacle 24 of the housing 12. For example, FIG. 6 illustrates a perspective view and a top view of the switch assembly 22 placed in a hole defined by the receptacle 24. As shown in FIG. 6, the switch assembly 22 may be fixed within the receptacle 24, such that it is flush or level with the surface of the housing 12. The output switch 42 and the color switch 44 may thus be accessible on the outside of the housing 12 to allow users to move the selectable switches of the output switch 42 and the color switch 44.

[0048] Keeping the foregoing in mind, in some embodiments, the driver circuit 20 may automatically adjust its output current to provide a consistent luminance across connected linear LED light fixtures. Thus, present embodiments may adjust to a number of assembled modules. For instance, the driver circuit 20 may include an adjustable current regulator that provides a range of DC current outputs. As such, the driver circuit 20 may be used to control the luminance of a variety of lengths of the linear LED light fixtures having a variety of number of LEDs. For example, in one embodiment, the driver circuit 20 may include a processor or other suitable processing core complex that may automatically adjust the DC current output to the switch assembly 22 using the current regulator based on the number of LED strings or LEDs present on the LED array(s) 16 within the respective linear LED light fixture 10 and the other linear LED light fixtures 10 that may be connected to the respective linear LED light fixture 10. For instance, in one embodiment, the processor of a first driver circuit 20 may receive a first dataset indicative of a number of LEDs that are part of a first linear LED light fixture 10 of which the first driver circuit 20 is used to power. The first dataset may be stored in a memory or storage component that may be part of the first linear LED light fixture 10. The storage may include data regarding manufacturing details regarding the linear LED light fixture 10, such as the number of LEDs, the color temperature of each LED, the power characteristics of the respective driver circuit, a serial number, other identifying information, and the like.

[0049] After receiving the first dataset, the processor may broadcast a request for data to other processors that are part of other linear LED light fixtures. In some embodiments, each linear LED light fixture may electrically connect to an adjacent linear LED light fixture to facilitate distribution of power and to facilitate communications therebetween. Each driver circuit 20 may include a processor and a communication component that may allow data to be exchanged between each other.

[0050] The request for data may include a request for information regarding a number of LEDs that are part of other linear LED light fixtures 10 that may be electrically and/or communicatively connected (e.g., wired, network, wireless) to the first driver circuit 20. In addition to data regarding the number of LEDs that are part of the other LED light fixtures 10, the processor may also request data regarding the power (e.g., current output, wattage) capabilities of other driver circuits.

[0051] After receiving datasets indicative of the number of LEDs and power capabilities of the other linear LED light fixtures, the processor may determine output settings for each driver circuit in each connected linear LED light fixture to provide a consistent luminance across each of the connected linear LED light fixtures. That is, if each driver circuit includes a current regulator, the processor may determine a DC current value that each LED of all of the connected linear LED light fixtures may receive to provide a consistent luminance across all of the connected linear LED light fixtures. After determining the DC current value, the processor may send a signal to the current regulator of the driver circuit 20 and to each of the other driver circuits in the other linear LED light fixtures that cause the respective driver circuits to output a DC current value that causes the respective LEDs of the respective linear LED light fixtures to receive the same current value. In this way, the processor may automatically calibrate the luminance of the connected linear LED light fixtures to maintain a consistent luminance regardless of the length of the respective linear LED light fixture.

[0052] By employing the various systems and techniques described above, a user of the linear LED light fixture may modify a lumen output and/or color temperature of a string of

LEDs based upon a user's preferences. In addition, by employing multiple linear LED light fixtures (light fixture modules) assembled together, a user may provide the ability to equip a certain setting with an uninterrupted, continuous surface of light that has consistent color and luminance properties at a variety of lengths. Moreover, manufacturers of the linear LED light fixture modules may efficiently produce linear LED light fixtures to allow their customers to create custom length linear LED light fixtures that have the same lumen output and/or color temperature selectable by the customer.

[0053] It should be noted that, as used in the present document, terms such as “linear”, “equal”, “parallel”, “half” and “same” should not be interpreted in a rigid or purely mathematical manner. For example, “linear” should not be interpreted to require a perfect geometric line, “parallel” should not be interpreted in strict geometric sense, and “equal” should not be interpreted to be perfectly mathematically equal. Rather, these terms should be interpreted within tolerances that would be understood by one of ordinary skill in the art.

[0054] While only certain features of the disclosure have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the disclosure.

[0055] The techniques presented and claimed herein are referenced and applied to material objects and concrete examples of a practical nature that demonstrably improve the present technical field and, as such, are not abstract, intangible or purely theoretical. Further, if any claims appended to the end of this specification contain one or more elements designated as “means for [perform]ing [a function]...” or “step for [perform]ing [a function]...”, it is intended that such elements are to be interpreted under 35 U.S.C. 112(f). However, for any claims containing elements designated in any other manner, it is intended that such elements are not to be interpreted under 35 U.S.C. 112(f).

CLAIMS:

1. A linear light-emitting diode (LED) lighting apparatus, comprising:
 - an array of light emitting diodes (LEDs) comprising:
 - a first plurality of LEDs configured to produce a first light having a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
 - a second plurality of LEDs configured to produce a second light having a second color temperature different from the first color temperature, wherein the second plurality of LEDs align within a second linear shape;
 - a driver circuit configured to output a plurality of currents;
 - a switch assembly configured to couple to the driver circuit, wherein the switch assembly comprises:
 - a first switch configured to cause the driver circuit to output one of the plurality of currents;
 - a second switch configured to cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both.
2. The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions.
3. The linear LED lighting apparatus of claim 2, wherein the plurality of selectable positions comprises:
 - a first position configured to cause the switch assembly to couple the one of the plurality of currents to the first plurality of LEDs;
 - a second position configured to cause the switch assembly to couple the one of the plurality of currents to the second plurality of LEDs; and

a third position configured to cause the switch assembly to couple a first portion of the one of the plurality of currents to the first plurality of LEDs and a second portion of the one of the plurality of currents to the second plurality of LEDs.

4. The linear LED lighting apparatus of claim 1, wherein the first color temperature corresponds to 3000 Kelvin and the second color temperature corresponds to 4000 Kelvin.

5. The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions, wherein each of the plurality of selectable positions is configured to cause the switch assembly to send a respective signal to the driver circuit, wherein the respective signal is configured to cause the driver circuit to output the one of the plurality of currents that corresponds to a current position of the plurality of selectable positions.

6. The linear LED lighting apparatus of claim 1, comprising a housing comprising an interior volume configured to hold the driver circuit, the first plurality of LEDs, and the second plurality of LEDs.

7. The linear LED lighting apparatus of claim 6, wherein the housing comprises a length greater than or equal to 24 inches.

8. The linear LED lighting apparatus of claim 6, wherein the switch assembly is configured to be positioned in a receptacle of the housing, and wherein the switch assembly is configured to be flush with a surface of the housing when positioned in the receptacle.

9. The linear LED lighting apparatus of claim 1, comprising at least one electrical connection configured to transmit electricity from the lighting apparatus to at least one other lighting apparatus.
10. A linear light-emitting diode (LED) lighting system, comprising:
a first modular lighting apparatus traversing a first linear distance, wherein the first modular lighting apparatus comprises:
a first plurality of light-emitting diodes (LEDs) arranged within a first linear form factor and having a first number of LEDs, each LED of the first plurality of LEDs associated with a first color temperature;
a first driver circuit configured to output a first plurality of currents;
a first switch assembly configured to:
cause the first driver circuit to output one of the first plurality of currents; and
couple the one of the first plurality of currents to the first plurality of LEDs; and
a first extender port; and
a second modular lighting apparatus traversing a second linear distance that is longer than the first linear distance, wherein the second modular lighting apparatus comprises:
a second plurality of light-emitting diodes (LEDs) arranged within a second linear form factor and having a second number of LEDs, each LED of the second plurality of LEDs associated with the first color temperature, wherein the second number is greater than the first number by a scale factor;
a second driver circuit configured to output a second plurality of currents;
a second switch assembly configured to:
cause the second driver circuit to output one of the second plurality of currents; and

couple the one of the second plurality of currents to the second plurality of LEDs, wherein the one of the second plurality of currents is greater than the one of the first plurality of currents by the scale factor; and

a second extender port configured to couple with the first extender port to combine the first modular lighting apparatus and the second modular lighting apparatus to traverse the first linear distance and the second linear distance.

11. The linear LED lighting system of claim 10, wherein the first switch assembly is configured to receive a signal to cause the first driver circuit to output the one of the first plurality of currents.
12. The linear LED lighting system of claim 11, wherein the signal is received via a wired connection.
13. The linear LED lighting system of claim 11, wherein the signal is received via a mechanical switch.
14. The linear LED lighting system of claim 11, wherein the signal comprises a wireless signal.
15. The linear LED lighting system of claim 10, wherein the first driver circuit comprise a current regulator.
16. The linear LED lighting system of claim 10, wherein the first extender is configured to electrically couple the first lighting apparatus to the second lighting apparatus.

17. The linear LED lighting system of claim 10, wherein each LED of the first plurality of LEDs receives a same amount of current via the one of the first plurality of currents that each LED of the second plurality of LEDs receives via the one of the second plurality of currents.
18. A linear light-emitting diode (LED) system, comprising:
a first modular lighting apparatus comprising:
a first array of light emitting diodes (LEDs) comprising:
a first plurality of LEDs associated with a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
a second plurality of LEDs associated with a second color temperature different from the first color temperature, wherein the second plurality of LEDs aligns within a second linear shape;
a first driver circuit configured to output a first plurality of currents;
a first switch assembly configured to couple to the first driver circuit, wherein the first switch assembly comprises:
a first switch configured to cause the first driver circuit to output one of the first plurality of currents;
a second switch configured to:
cause a first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs;
cause the first portion of the one of the first plurality of currents to couple to each LED of the second plurality of LEDs; or
cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs; and
a second modular lighting apparatus configured to electrically couple to the first lighting apparatus, wherein the second lighting apparatus comprises:
a second array of light emitting diodes (LEDs) comprising:

a third plurality of LEDs associated with a third color temperature, wherein the third plurality of LEDs aligns within a third linear shape, wherein the third color temperature matches the first color temperature, and wherein the third plurality of LEDs is longer than the first plurality of LEDs;

a fourth plurality of LEDs associated with a fourth color temperature matching the second color temperature, wherein the fourth plurality of LEDs aligns within a fourth linear shape, and wherein the fourth plurality of LEDs is longer than the second plurality of LEDs; a second driver circuit configured to output a second plurality of currents; a second switch assembly configured to couple to the second driver circuit, wherein the second switch assembly comprises:

a third switch configured to cause the second driver circuit to output one of the second plurality of currents; and

a fourth switch configured to:

cause a second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs;

cause the second portion of the one of the second plurality of currents to couple to each LED of the fourth plurality of LEDs;

or

cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs.

19. The linear LED system of claim 18, wherein the first modular lighting apparatus comprises a first connector configured to couple to a second connector part of the second modular lighting apparatus, wherein the first connector and second connector are configured to transmit data between the first modular light apparatus and the second modular lighting apparatus.

20. The linear LED system of claim 18, wherein a first ratio of the one of the second plurality of currents to the one of the first plurality of currents matches a second ratio of a first number of LEDs in the first plurality of LEDs to a second number of LEDs in the third plurality of LEDs.

ABSTRACT

A linear light-emitting diode (LED) lighting apparatus may include an array of light emitting diodes (LEDs) that may include a first plurality of LEDs that produces a first light having a first color temperature. The first plurality of LEDs aligns within a first linear shape. The second plurality of LEDs may produce a second light having a second color temperature different from the first color temperature. The second plurality of LEDs aligns within a second linear shape. The lighting apparatus may also include a driver circuit that outputs a plurality of currents and a switch assembly that may couple to the driver circuit. The switch assembly may include a first switch that may cause the driver circuit to output one of the plurality of currents and a second switch that may cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

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	Peter	Angelo	DallePezze			
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City	Houston	State/Province	TX	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	307 Greenbelt					
Address 2						
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City	Lakewood	State/Province	CO	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	12790 W 6th Place					
Address 2						
City	Lakewood	State/Province	CO			
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For further information see 37 CFR 1.33(a).

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
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Application Information:

Title of the Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		
Attorney Docket Number	AGSL:0002	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

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☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		

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This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

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Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Claims benefit of provisional	63040585	2020-06-18
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This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove
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Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. ☐ NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

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B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		

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Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
Remove				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1				
Address 2				
City		State/Province		
Country i		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add				

Signature:[Remove](#)

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Jim Thomas/		Date (YYYY-MM-DD)	2020-12-21
First Name	Jim	Last Name	Thomas	Registration Number
				71,611
Additional Signature may be generated within this form by selecting the Add button. Add				

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	AGSL:0002
		Application Number	
Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		
First Named Inventor/Applicant Name:		Peter Angelo DallePezze		
Filer:		Jim Thomas/Cynthia Todd		
Attorney Docket Number:		AGSL:0002		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	80	80
UTILITY SEARCH FEE	2111	1	350	350
UTILITY EXAMINATION FEE	2311	1	400	400
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				830

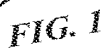
Electronic Acknowledgement Receipt	
EFS ID:	41447219
Application Number:	17129228
International Application Number:	
Confirmation Number:	1012
Title of Invention:	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
First Named Inventor/Applicant Name:	Peter Angelo DallePezze
Customer Number:	37106
Filer:	Jim Thomas
Filer Authorized By:	
Attorney Docket Number:	AGSL:0002
Receipt Date:	21-DEC-2020
Filing Date:	
Time Stamp:	17:04:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$830
RAM confirmation Number	E2020BKH04524837
Deposit Account	061315
Authorized User	Jim Thomas
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.21 (Miscellaneous fees and charges) 37 CFR 1.20 (Post Issuance fees)	

37 CFR 1.19 (Document supply fees)					
37 CFR 1.17 (Patent application and reexamination processing fees)					
37 CFR 1.16 (National application filing, search, and examination fees)					
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Drawings-only black and white line drawings	AGSL0002_Formal_Drawings.pdf	476681	no	5
			81b8a66c407fe17a9e4f0c95c591be4a41abe89d		
Warnings:					
Information:					
2	Oath or Declaration filed	AGSL0002_Declarations_.pdf	1206374	no	2
			2992d4c5fe57c95b1fa87fcd80d434077e95c3e		
Warnings:					
Information:					
3	Power of Attorney	AGSL0002_POA_.pdf	876473	no	2
			f5f0b22d09476b73df5efa29fca95e2621955699		
Warnings:					
Information:					
4		AGSL0002_Patent_Application.pdf	174203	yes	28
			26a0868f99bdc9d302f9eec5fc7231edc6cbfad1		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Specification		1	20	
	Claims		21	27	
	Abstract		28	28	
Warnings:					
Information:					
5	Application Data Sheet	AGSL0002_Application_Data_Sheet.pdf	1256121	no	8
			82102c7187b591348dd1e7978506480fb3192dc		

Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	34865	no	2
			f28897c6b6e8f06c918173f9dc451943b8356fe3		
Warnings:					
Information:					
Total Files Size (in bytes):			4024717		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



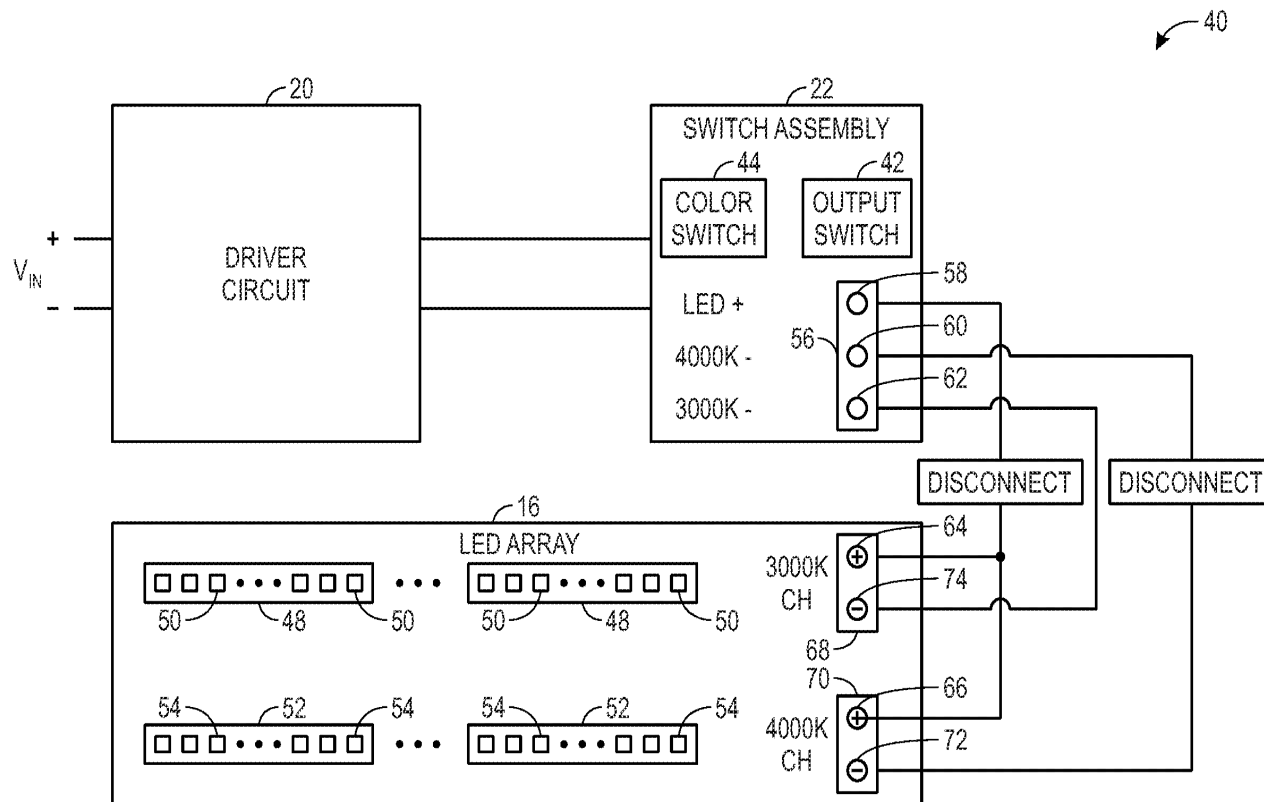


FIG. 2

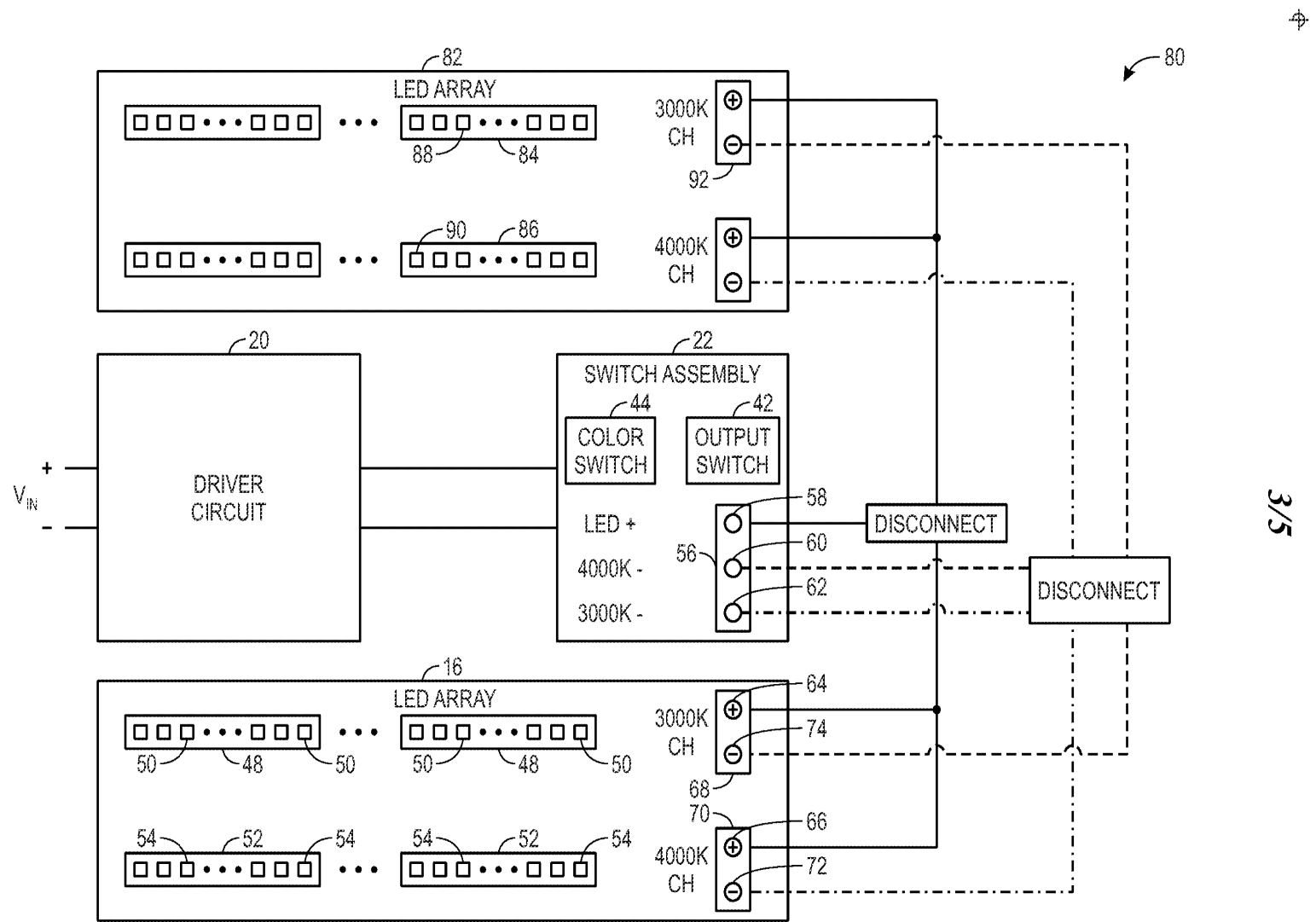


FIG. 3

4

4/5

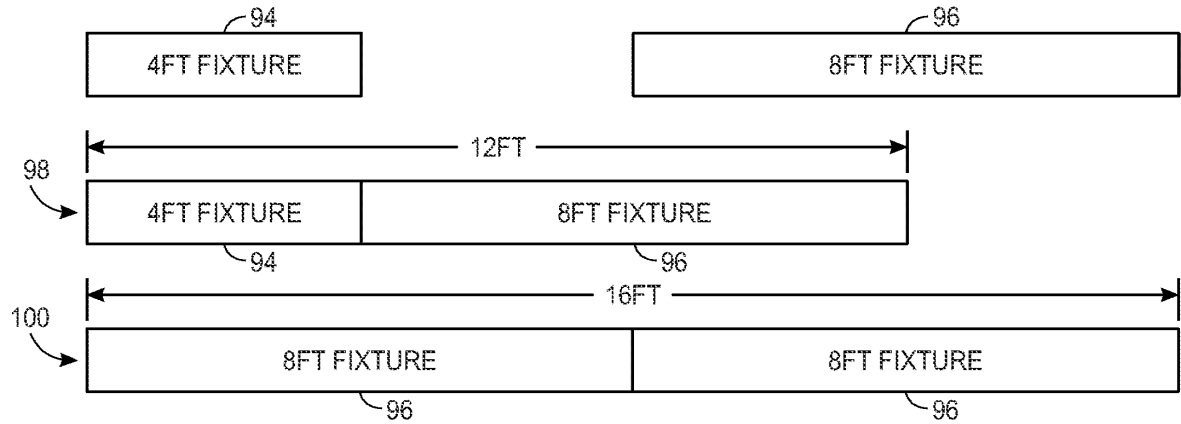
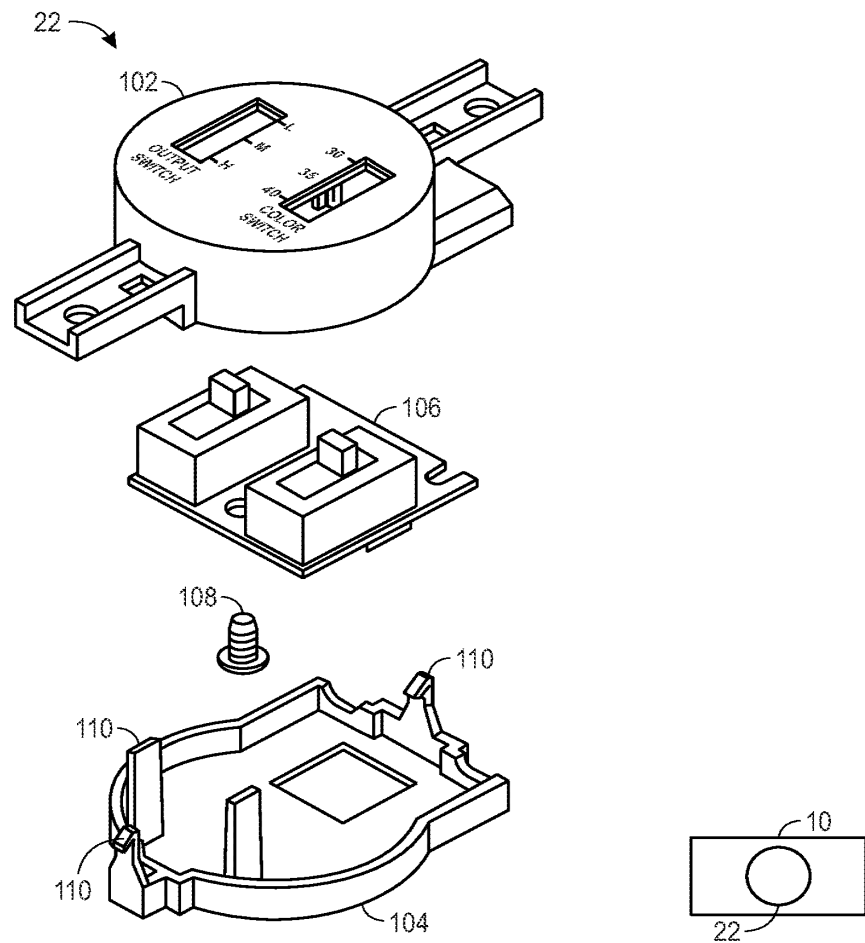


FIG. 4

FIG. 5



4

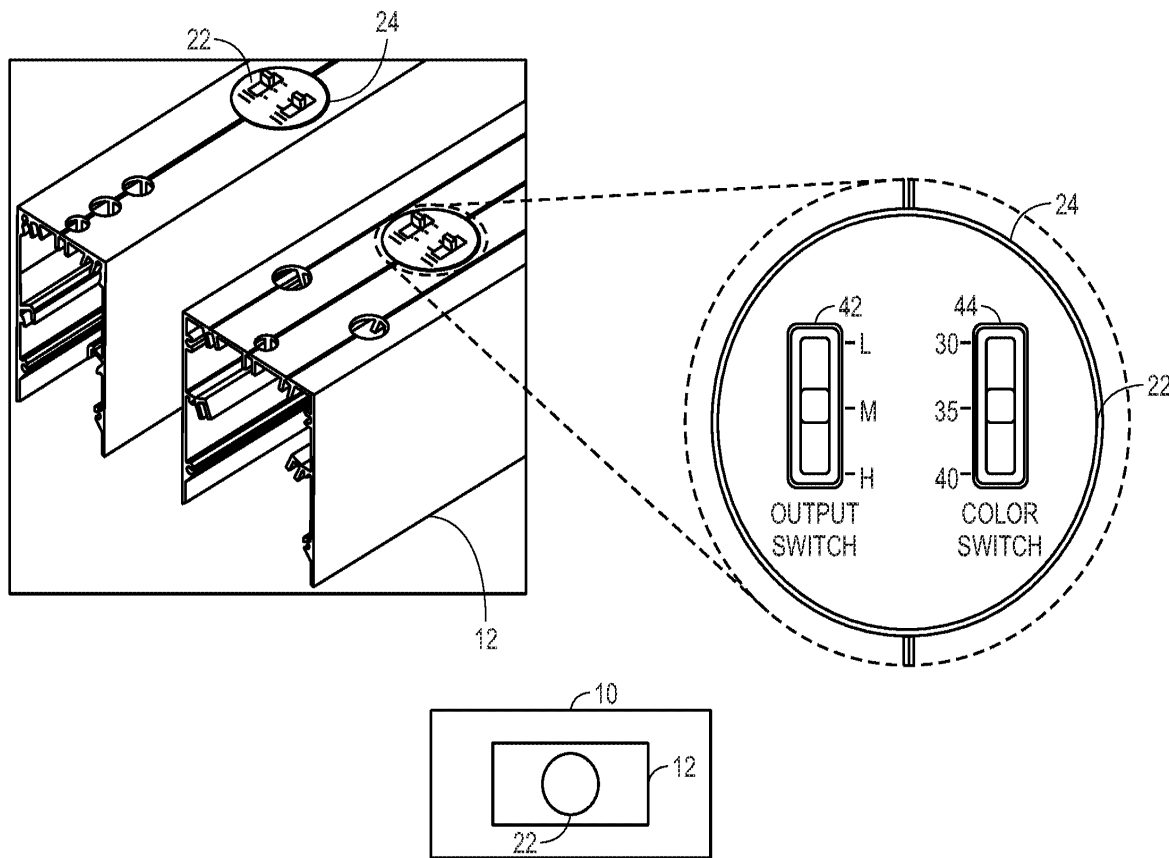


FIG. 6

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. LEGAL NAME OF INVENTOR Inventor: <u>Peter VallePezze</u> Date (Optional): _____ Signature: <u>Pat VallePezze</u> Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
As the below named inventor, I hereby declare that: This declaration is directed to: ☒ The attached application, or ☐ United States application or PCT international application number _____ filed on _____ The above-identified application was made or authorized to be made by me. I believe that I am the original inventor or an original joint inventor of a claimed invention in the application. I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both. WARNING: Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.	
LEGAL NAME OF INVENTOR Inventor: <u>Andrew Svenson</u> Date (Optional): _____ Signature: <u>[Signature]</u>	
Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 17/129,228	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	80		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	350		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	400		N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	20	minus 20 = *	x 50 =	0.00	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 240 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	
				830			
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		OTHER THAN SMALL ENTITY
	Total (37 CFR 1.16(i))	*	Minus **	=	x =		RATE(\$)
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =		ADDITIONAL FEE(\$)
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
				TOTAL ADD'L FEE		TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		OTHER THAN SMALL ENTITY
	Total (37 CFR 1.16(i))	*	Minus **	=	x =		RATE(\$)
	Independent (37 CFR 1.16(h))	*	Minus ***	=	x =		ADDITIONAL FEE(\$)
	Application Size Fee (37 CFR 1.16(s))						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
				TOTAL ADD'L FEE		TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.							



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United States Patent and Trademark Office
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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
17/129,228	12/21/2020		830	AGSL:0002	20	3

CONFIRMATION NO. 1012

FILING RECEIPT



0000000122418902

37106
FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289

Date Mailed: 01/05/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Peter Angelo DallePezze, Houston, TX;
Andrew Michael Svendsen, Lakewood, CO;

Applicant(s)

AGS Lighting Management, LLC, Houston, TX;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 63/040,585 06/18/2020

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 01/04/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/129,228**

Projected Publication Date: 12/23/2021

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002

37106
FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289

CONFIRMATION NO. 1012
IMPROPER CPOA LETTER



Date Mailed: 01/05/2021

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 12/21/2020. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney you provided did not comply with the power of attorney rules that became effective on June 25, 2004. See 37 CFR 1.32 and 69 Fed. Reg. 29865.

/qtran/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	17/129,228
Filing Date	December 21, 2020
First Named Inventor	Peter Angelo DallePezze
Title	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
Art Unit	Unassigned
Examiner Name	Unassigned
Attorney Docket Number	AGSL:0002

SIGNATURE of Applicant or Patent Practitioner			
Signature	/Jim Thomas/	Date (Optional)	January 6, 2021
Name	Jim Thomas	Registration Number	71,6111
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)	AGS Lighting Management, LLC		
NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.			
☒ *Total of 1 forms are submitted.			

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

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☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

OR

37106

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Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

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I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

AGS Lighting Management, LLC

☐ Inventor or Joint Inventor (title not required below)

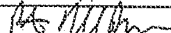
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature 

Date (Optional)

Name Peter DallePezza

Title President

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

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EFS ID:	41567821
Application Number:	17129228
International Application Number:	
Confirmation Number:	1012
Title of Invention:	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
First Named Inventor/Applicant Name:	Peter Angelo DallePezze
Customer Number:	37106
Filer:	Jim Thomas
Filer Authorized By:	
Attorney Docket Number:	AGSL:0002
Receipt Date:	06-JAN-2021
Filing Date:	21-DEC-2020
Time Stamp:	17:16:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	AGSL0002_POA_.pdf	3486970	no	2
			8d19597491418ea4798605f200f72a8b4fd8674d		

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002

CONFIRMATION NO. 1012

POA ACCEPTANCE LETTER

37106
FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289



Date Mailed: 01/11/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/06/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002

CONFIRMATION NO. 1012

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PUBLICATION NOTICE



Title:CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES

Publication No.US-2021-0400780-A1

Publication Date:12/23/2021

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The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	17129228
	Filing Date	2020-12-21
	First Named Inventor	Peter Angelo DallePezze
	Art Unit	2844
	Examiner Name	HAMMOND, CRYSTAL L
	Attorney Docket Number	AGSL:0002

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	17129228
	Filing Date	2020-12-21
	First Named Inventor	Peter Angelo DallePezze
	Art Unit	2844
	Examiner Name	HAMMOND, CRYSTAL L
	Attorney Docket Number	AGSL:0002

	1	20190108511	KR	A	2019-09-24	Infineon Technologies AG	×
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	International Search Report and Written Opinion for PCT/US2021/061419, dated March 24, 2022, 10 pages	

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EXAMINER SIGNATURE

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¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

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	Filing Date	2020-12-21
	First Named Inventor	Peter Angelo DallePezze
	Art Unit	2844
	Examiner Name	HAMMOND, CRYSTAL L
	Attorney Docket Number	AGSL:0002

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jim Thomas/	Date (YYYY-MM-DD)	2022-06-23
Name/Print	Jim Thomas	Registration Number	71,611

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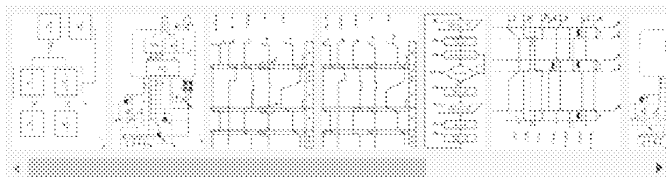
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
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Light emitting diode driver for load changes

Abstract

The present invention relates to a light emitting diode (LED) driver for changing a load, to control voltage, current, or power supplied to a load such as an LED string. According to the present invention, a device for adjusting current or power comprises a first branch switch, a second branch switch, and a control module. The control module is designated to determine a command for changing a first state into a second state. In response to the command, the control module activates the second branch switch, operates a power module to supply power for activating a second LED set to increase the supply voltage, operates the first branch switch to supply a target power for activating the first LED set in response to determination that the amount of current in the second branch switch does not exceed a threshold current value to dissipate a part of the supply power, and inactivates the first branch switch in response to a determination that the current in the second branch switch exceeds the threshold current value.

Images (11)



Classifications

⚙️ H05B35/10 Controlling the intensity of the light

[View 11 image classification details](#)

Claims (20)

As a method for regulating current or power,

Determining a command to change from a first state to a second state, wherein, during the first state, a first branch switch is activated to power a first set of light emitting diodes (LEDs) and power a second set of LEDs; The second branch switch is deactivated to prohibit the operation, and during the second state, the first branch switch is deactivated to prohibit powering the first LED set and the power is supplied to the second LED set. A second branch switch is activated-- and;

In response to a command to change from the first state to the second state:

Activating the second branch switch;

Driving a power module to increase supply voltage to supply supply power to activate the second set of LEDs;

in response to determining that the current at the second branch switch does not exceed a current threshold, driving the first branch switch to dissipate a portion of the supply power to provide a target power for activating the first set of LEDs, dissipate step; And

Inactivating the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

Way.

The method of claim 1,

Driving the first branch switch to dissipate a portion of supply power includes modifying a resistance of the first branch switch based on a difference between the target power and the supply power.

Way.

The method of claim 1,

Determining a time delay for changing from the first state to the second state;

In response to a command to change from the second state to the first state:

Prohibiting changing from the second state to the first state before the time delay; And

Changing from the second state to the first state after the time delay.

Way.

The method of claim 3, wherein

Determining the time delay includes incrementing a count value after activating the second branch switch and before deactivating the first branch switch.

Way.

The method of claim 1,

The second branch switch is coupled in series with the sensing element,

The method,

Determining a current at the second branch switch based on the indication of the voltage at the sense element.

Way.

The method of claim 5,

Determining that the current at the second branch switch exceeds the current threshold when the current value indicated by the voltage at the sense element exceeds the current threshold.

Way.

The method of claim 5,

The sense element is a second sense element and the first branch switch is coupled in series with the first sense element.

Way.

The method of claim 7, wherein

The first sense element comprises a resistive element and the second sense element comprises a resistive element.

KR20190108511A

Patent Form

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Inventor: 박미호, 박지기, 이보은, 박우희, 박지호, 김재호, 박종호, 임희태, 오대훈, 오영진, 안민호, 안민호, 오대훈

Worldwide applications

2018 - US 2019 - KR ON DE

Application KR1020190028598A events ②

2018-03-14 * Priority to US15/321,406

2018-03-14 * Priority to US15/321,406

2019-03-13 * Application filed by 에스케이이노베이션 주식회사

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Info: Patent citations (3), Cited by (1), Legal events, Similar documents, Priority and Related Applications

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translated from Korean

Way.

The method of claim 1,

Receiving a first command pulse width modulated (PWM) signal to deactivate the first set of LEDs;

Receiving a second command PWM signal to activate the second set of LEDs,

The first command PWM signal and the second command PWM signal indicate a command to change from the first state to the second state.

Way.

The method of claim 1,

The first branch switch includes a switching element

Way.

A device for regulating current or power;

A first branch switch configured to selectively supply power output by the power module to the first set of light emitting diodes (LEDs);

A second branch switch configured to selectively supply power output by the power module to a second set of LEDs;

including a control module,

The control module is:

Determining a command to change from a first state to a second state, wherein during the first state, the first branch switch is activated to power the first set of LEDs and powers the second set of LEDs. The second branch switch is deactivated to prohibit, and during the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and the power is applied to the second set of LEDs. A second branch switch is activated--and;

In response to a command to change from the first state to the second state:

Activating the second branch switch;

Driving the power module to increase supply voltage to supply supply power to activate the second set of LEDs;

In response to determining that the current at the second branch switch does not exceed a current threshold, driving the first branch switch to dissipate a portion of the supply power to supply a target power for activating the first set of LEDs. To do; And

And deactivate the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

device.

The method of claim 11,

To dissipate a portion of the supply power, the first branch switch is configured to modify the resistance of the first branch switch.

device.

The method of claim 11,

The control module is:

Determining a time delay corresponding to the difference between activating the second branch switch and deactivating the first branch switch,

in response to a command to change from the second state to the first state:

Prohibiting changing from the second state to the first state before the time delay; And

Further configured to change from the second state to the first state after the time delay.

device

The method of claim 11,

in order to determine the time delay, the control module,

Increase the count value after activating the second branch switch and before deactivating the first branch switch.

device.

The method of claim 11,

The second branch switch is coupled in series with the sensing element,

The control module,

And determine a current at the second branch switch based on the indication of the voltage at the sense element.

device.

The method of claim 15,

The control module,

And configured to determine that the current at the second branch switch exceeds the current threshold when the current value indicated by the voltage at the sensing element exceeds the current threshold.

device.

The method of claim 15,

The sense element is a second sense element and the first branch switch is coupled in series with the first sense element

device.

The method of claim 17,

The first sense element comprises a resistive element and the second sense element comprises a resistive element

device.

The method of claim 11,

The first branch switch includes a switching element

device.

A system for regulating current or power,

A power module configured to output power,

A first set of light emitting diodes (LEDs);

A second set of LEDs;

A first branch switch configured to selectively supply at least a portion of the power output by the power module to the first LED set;

A second branch switch configured to selectively supply at least a portion of the power output by the power module to the second LED set;

including a control module,

The control module is:

Determining a command to change from a first state to a second state, wherein during the first state, the first branch switch is activated to power the first set of LEDs and powers the second set of LEDs. The second branch switch is deactivated to prohibit, and during the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and the power is applied to the second set of LEDs. A second branch switch is activated--and;

In response to a command to change from the first state to the second state:

Activating the second branch switch;

Driving the power module to increase supply voltage to supply supply power to activate the second set of LEDs;

When the current at the second branch switch does not exceed a current threshold, driving the first branch switch to dissipate a portion of the supply power to supply a target power for activating the first set of LEDs; And

Deactivate the first branch switch when the current at the second branch switch exceeds the current threshold.

system.

Description

translated from English

LIGHT EMITTING DIODE DRIVER FOR LOAD CHANGES)

The present disclosure relates to a driver, such as a light emitting diode driver, configured to control voltage, current, or power supplied to a load, such as a string of light emitting diodes.

The driver can control voltage, current, or power at the load. For example, the LED driver can control the power supplied to the LED string. Some drivers may include a DC-DC converter, such as a buck-boost, buck, boost or other DC-DC converter. Such a DC-DC converter may be required to change the power at the load based on the characteristics of the load. For example, when operating the front lighting of a car in a high beam setting, the stream of light emitting diodes may require higher power than when operating in a low beam setting. Can be.

In general, the present disclosure relates to techniques for reducing overshoot and undershoot of current in light emitting diode sets (LEDs). For example, in an exemplary automotive application, the LED driver may be configured for high beam lighting longer than the first LED string from activating the first LED string for day light running lighting. It can be changed by activating the 2 LED string. In light of the modification of the LED, the power module may increase the voltage output to power the second LED string for high beam illumination. However, the second LED string for high beam illumination may not necessarily be active until the power module has sufficiently increased the voltage, resulting in a lack of output current. Instead of immediately deactivating the first LED string for daylight running light, the technology described herein deactivates the first LED string for daylight running light after activating the second LED string for daylight high beam illumination. Moreover, the technology herein can maintain a constant power on the LED string for daylight running lighting while dissipating the power output while the power module voltage is increasing to prevent damage to the LED. In this way, the techniques described herein can help to reduce the lack of output current and can help to accurately provide the target duty cycle.

In one example, the system includes a method of regulating current or power. The method includes determining a command to change from a first state to a second state. During the first state, the first branch switch is activated to power the first set of LEDs, and the second branch switch is deactivated to prohibit powering the second set of LEDs. During the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and the second branch switch is activated to power the second set of LEDs. The method responds to a command to change from the first state to the second state, activating the second branch switch and driving a power module to provide supply power for activating the second set of LEDs. Increasing the supply voltage, and in response to determining that the current at the second branch switch does not exceed a current threshold, the first branch switch is provided to provide a target power for activating the first set of LEDs. Driving to dissipate a portion of the supply power, and deactivating the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

In another example, a device for regulating current or power includes a first branch switch, a second branch switch, and a control module. The first branch switch is configured to selectively provide at least a portion of the power output by the power module to the first LED set. The second branch switch is configured to selectively provide at least a portion of the power output by the power module to the second LED set. The control module is configured to determine an instruction to change from the first state to the second state. During the first state, the first branch switch is activated to power the first set of LEDs and the second branch switch is deactivated to prohibit powering the second set of LEDs. During the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and the second branch switch is activated to power the second set of LEDs. In response to a command to change from the first state to the second state, the control module drives the power module to activate the second branch switch and provide supply power for activating the second set of LEDs. Drive the first branch switch to increase the supply voltage and provide a target power for activating the first set of LEDs in response to determining that the current at the second branch switch does not exceed a current threshold. Dissipate a portion of the supply power and deactivate the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

In another example, the system includes a power module, a first set of LEDs, a second set of LEDs, a first branch switch, a second branch switch, and a control module. The power module is configured to output power. The first branch switch is configured to selectively provide at least a portion of the power output by the power module to the first LED set. The second branch switch is configured to selectively provide at least a portion of the power output by the power module to the second LED set. The control module is configured to determine an instruction to change from the first state to the second state. During the first state, the first branch switch is activated to power the first set of LEDs and the second branch switch is deactivated to prohibit powering the second set of LEDs. During the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and the second branch switch is activated to power the second set of LEDs. In response to a command to change from the first state to the second state, the control module drives the power module to activate the second branch switch and provide supply power for activating the second set of LEDs. Drive the first branch switch to increase the supply voltage and provide a target power for activating the first set of LEDs in response to determining that the current at the second branch switch does not exceed a current threshold. Dissipate a portion of the power supply and deactivate the first branch switch when the current in the second branch switch exceeds the current threshold.

Details of these and other examples are listed in the accompanying drawings and the description below. Other features, objects, and advantages will be apparent from the description and drawings, and from the claims.

1 is a block diagram illustrating an example system configured to mitigate a lack of output current upon change between a first set of light emitting diodes (LEDs) and a second set of light emitting diodes (LEDs) in accordance with one or more techniques of this disclosure.

2 is a conceptual diagram illustrating a first example circuit configured to mitigate a lack of output current upon change between a first set of LEDs and a second set of LEDs in accordance with one or more techniques of this disclosure.

3 shows the performance of a system that is changed between a first set of LEDs and a second set of LEDs.

4 illustrates the ability of a system to mitigate a lack of output current upon change between a first set of LEDs and a second set of LEDs in accordance with one or more techniques of this disclosure.

5 is a flowchart consistent with the techniques that may be performed by the example system of FIG. 1, in accordance with the present disclosure.

6 is an illustration of the performance of a system implementing the technique of FIG. 5, in accordance with one or more techniques of this disclosure.

7 is a conceptual diagram illustrating a second example circuit configured to mitigate a lack of output current upon change between a first set of LEDs and a second set of LEDs in accordance with one or more techniques of this disclosure.

8 shows a performance diagram of a system that is changed between a first set of LEDs and a second set of LEDs.

9 illustrates a first performance diagram of a system that mitigates a lack of output current upon change between a first set of LEDs and a second set of LEDs, in accordance with one or more techniques of this disclosure.

10 illustrates a second performance diagram of a system that mitigates the lack of output current upon change between a first set of LEDs and a second set of LEDs, in accordance with one or more techniques of this disclosure.

11 is a flowchart consistent with the techniques that may be performed by the example system of FIG. 1, in accordance with the present disclosure.

In a multifunction system that jumps from fewer LEDs to more LEDs, a rapid voltage increase may be needed to activate more LEDs. However, many systems require time to increase the output voltage to activate a larger number of LEDs. As such, some systems may result in a lack of output current because of the time required to increase the output voltage. This lack of output current can cause a gap between the imposed duty cycle of the logical pulse width modulation (PWM) dimming signal and the effective duty cycle of the output current, resulting in inaccuracy of the average current of each function. .

To compensate for pulse width modulation dimming current inaccuracies in a cost-optimized system, some systems require continuous monitoring of the output current (to measure the gap between the target average current and the realized output current) and between the target average current and the realized output current. To compensate for this gap, a microcontroller can be used that provides a higher duty cycle signal to the LED driver controller. These systems inevitably can continuously monitor output current and voltage, use a microcontroller to manage the control of the LED driver, and use complex software to collect and refine the data needed to properly set the duty cycle. Can manage. In addition, such a system may not provide current when switching from a smaller set of LEDs (eg fewer LEDs, smaller LEDs, etc.) to a larger LED set, which is the maximum manageable by the system. The duty cycle can be limited.

Some systems independently bypass each LED set and independently exceed the target power for operating each LED set, rather than relying on a microcontroller or microprocessor to compensate for pulse width modulation dimming current inaccuracies. It may include a branch switch configured to dissipate. For example, the first branch switch can operate to increase the resistance of the first branch switch such that power exceeding the target power for operating the first set of LEDs can be dissipated in the first branch switch. As such, branch switches can help mitigate the lack of output current in other systems, for example, by effectively introducing a delay when deactivating a set of LEDs. Moreover, the control module may be configured to delay the turn off of the PWM dimming signal to reduce or eliminate the gap between the charged duty cycle of the logic PWM dimming signal and the effective duty cycle of the output current.

1 is a block diagram illustrating an example system 100 configured to mitigate a lack of output current upon change between a first set of LEDs 104 and a second set of LEDs 106, in accordance with one or more techniques of this disclosure. As shown in this example of FIG. 1, system 100 includes power module 102, a first set of LEDs 104, a second set of LEDs 106, a first branch switch 108, and a second branch switch 110 (these switches may collectively be referred to as a series module 112), and a control module 114. Although system 100 shows two LED sets (eg. first LED set 104 and second LED set 106), some examples may include more than two LED sets.

The power module 102 may be configured to output supply power to the series module 112. In some examples, power module 102 may be a DC-DC power converter or may include a DC-DC power converter. In some examples, power module 102 may be configured to generate supply power based on an indication of the target power. For example, the power module 102 may be configured to generate supply power based on the target power output by the control module 114. The power module 102 may include one or more switch mode power converters, including but not limited to flyback, buck-boost, buck, boost, and the like. The power module 102 may include one or more switching elements that switch on and out one or more energy storage components (eg. inductors, capacitors, or another energy storage component).

The first set of LEDs 104 can include any number of LEDs. In some examples, two or more LEDs of first LED set 104 may be coupled in series. Additionally, or alternatively, two or more LEDs of the first LED set 104 may be combined in parallel. Similarly, the second set of LEDs 106 can include any number of LEDs. In some examples, two or more LEDs of the second LED set 106 may be coupled in series. Additionally, or alternatively, two or more LEDs of the second LED set 106 may be combined in parallel.

In the example of FIG. 1, the second LED set 106 is associated with a higher voltage that activates the second LED set 106 than the voltage that activates the first LED set 104. For example, the second LED set 106 can include a greater amount of LEDs than the first LED set 104. Additionally, or in the alternative, the second LED set 106 may include one or more LEDs having a higher forward voltage than the LEDs of the first LED set 104. In some examples, the second LED set 106 may have a higher forward voltage than the first LED set 104. 1 shows two branches, 'n' branches may be used, where 'n' is any integer value greater than one. For example, some examples may include three branches, each coupled to a respective set of LEDs.

As used herein, an LED can refer to any semiconductor light source. In some examples, the LED may include a p-n junction configured to emit light when activated. In an exemplary application, the first LED set 104 and / or the second LED set 106 may be included in a headlight assembly for automotive application. For example, the first LED set 104 and / or the second LED set 106 can be an LED matrix that illuminates the road ahead of the vehicle. In some examples, the first LED set 104 and / or the second LED set 106 may be associated with one or more beam settings. For example, the first set of LEDs 104 can be configured to provide a low beam and / or a high beam. In some examples, second LED set 106 may be configured to provide daytime running lighting.

The first branch switch 108 is any device suitable for breaking current to the first set of LEDs 104 and dissipating the output output by the power module 102 for output to the first set of LEDs 104. It may include. In some examples, first branch switch 108 may include a switching element. Examples of switching elements may include, but are not limited to, silicon controlled rectifiers (SCRs), field effect transistors (FETs), and bipolar junction transistors (BJTs). Examples of FETs may include, but are not limited to, Junction Field Effect Transistors (JFETs), MOSFETs, dual gate MOSFETs, insulated gate bipolar transistors (IGBTs), any other type of FET, or any combination thereof. Examples of MOSFETs may include, but are not limited to, PMOS, NMOS, DMOS, or any other type of MOSFET, or any combination thereof. Examples of BJTs may include, but are not limited to, PNP, NPN, heterojunction, or any other type of BJT, or any combination thereof. It should be understood that the switching element may be a high side switch or a low side switch. In addition, the switching element may be voltage controlled and / or current controlled. Examples of current controlled switching elements may include, but are not limited to, gallium nitride (GaN) MOSFETs, BJTs or other current controlled elements.

The first branch switch 108 may be activated such that power ("Psupply") output from the power module 102 flows through the first branch switch 108 to the first set of LEDs 104. In some examples, the first branch switch 108 dissipates a portion of the power "Psupply" output from the power module 102 and activates to output the target power "Ptarget1" to the first set of LEDs 104. Can be. For example, the resistance of the first branch switch 108 dissipates a portion of the power "Psupply" output from the power module 102 so that the final power output to the first set of LEDs 104 is the target power (May be modified to correspond to "Ptarget1").

Similarly, the second branch switch 110 is suitable for interrupting the current to the second set of LEDs 106 and dissipating the output output by the power module 102 for output to the second set of LEDs 106. It can include any device. In some examples, second branch switch 110 may include a switching element.

The second branch switch 110 may be activated such that power ("Psupply") output from the power module 102 flows through the second branch switch 110 to the second set of LEDs 106. In some examples, the second branch switch 110 dissipates a portion of the power "Psupply" output from the power module 102 and activates to output the target power "Ptarget2" to the second LED set 106. Can be. For example, the resistance of the second branch switch 110 dissipates a portion of the power "Psupply" output from the power module 102 so that the final power output to the second LED set 106 is the target power (May be modified to correspond to "Ptarget2").

Control module 114 may be configured to control power module 102. For example, the control module 114, in response to receiving a command to activate the first set of LEDs 104 and deactivate the second set of LEDs 106, the target corresponding to the first set of LEDs 104. The power module 102 can be driven to output voltage, target current, and / or target power. Similarly, the control module 114, in response to receiving a command to deactivate the first LED set 104 and to activate the second LED set 106, corresponds to a target voltage corresponding to the second LED set 106. The power module 102 may be driven to output a target current, and / or a target power.

The control module 114 may be configured to control the first branch switch 108. For example, the control module 114 may switch the switching element of the first branch switch 108 to activate the first branch switch 108 such that power flows from the power module 102 to the first set of LEDs 104. Can drive the voltage at the control node (e.g., gate). The control module 114 controls the control node of the switching element of the first branch switch 108 to deactivate the first branch switch 108 to prevent power from flowing from the power module 102 to the first set of LEDs 104. For example, the voltage at the gate) can be driven. In some examples, the control module 114 dissipates a portion of the power output by the power module 102 and the remaining portion of the power output by the power module 102 ("Ptarget1") is the power module 102. May drive the voltage at the control node (eg. gate) of the switching element of the first branch switch 108 to flow to the first set of LEDs 104.

The control module 114 may be configured to control the second branch switch 110. For example, the control module 114 may switch the switching element of the second branch switch 110 to activate the second branch switch 110 such that power flows from the power module 102 to the second set of LEDs 106. Can drive the voltage at the control node (e.g., gate). The control module 114 controls the control node of the switching element of the second branch switch 110 to deactivate the second branch switch 110 to prevent power from flowing from the power module 102 to the second LED set 106. For example, the voltage at the gate) can be driven. In some examples, the control module 114 dissipates a portion of the power output by the power module 102 and the remaining portion of the power output by the power module 102 ("Ptarget2") is the power module 102. May drive the voltage at the control node (eg. gate) of the switching element of the second branch switch 110 to flow to the second set of LEDs 106.

In accordance with one or more techniques described herein, the power module 102 while the voltage output from the power module 102 increases to a threshold voltage value (eg. forward voltage) to activate the second LED set 106. Instead of outputting power or current from the first LED set 104 and the second LED set 106 to the control module 114, the control module 114 is configured when the current of the second branch switch 110 exceeds the current threshold. May delay the deactivation of the first branch switch 108.

For example, the control module 114 may receive a command to change from the first state to the second state. During the first state, the first branch switch 108 is activated to power the first set of LEDs 104, and the second branch switch 110 prohibits powering the second set of LEDs 106. Is deactivated. During the second state, the first branch switch 108 is deactivated to prohibit powering the first set of LEDs 104 and the second branch switch 110 is configured to power the second set of LEDs 106. Is activated.

In response to receiving the command to change from the first state to the second state, the control module 114 may activate the second branch switch 110. For example, the control module 114 activates the second branch switch 110 to allow power to flow from the power module 102 to the second set of LEDs 106.

In response to receiving a command to change from the first state to the second state, the control module 114 drives the power module 102 to increase the supply voltage to activate the second set of LEDs 106. It can be configured to provide. For example, the control module 114 outputs to the power module 102 based on an increase in the amount of LEDs to be activated in the second LED set 106 compared to the amount of LEDs activated in the first LED set 104. Can increase the reference signal. For example, the control module 114 outputs to the power module 102 based on an increase in the amount of LEDs to be activated in the second LED set 106 compared to the amount of LEDs activated in the first LED set 104. Can be reduced (eg, single sensed). In some examples, the control module 114 is connected to the power module 102 based on an increase in the amount of LEDs to be activated in the second LED set 106 compared to the amount of LEDs activated in the first LED set 104. The output reference signal may be maintained (for example, double sensed).

In response to receiving a command to change from the first state to the second state, the control module 114 drives the first branch switch 108 to dissipate a portion of the supply power, thereby causing the second branch switch 110 to dissipate. Provide a target power for activating the first set of LEDs 104 in response to determining that a current of does not exceed the current threshold. For example, the control module 114 dissipates a portion of the power output by the power module 102 and the remaining portion of the power output by the power module 102 ("Ptarget1") is the power module 102. May drive the voltage at the control node (eg, gate) of the switching element of the first branch switch 108 to flow to the first set of LEDs 104.

In response to receiving a command to change from the first state to the second state, the control module 114 responds to determining that the current at the second branch switch 110 exceeds the current threshold (the first branch switch (a 108) can be deactivated. For example, the control module 114 deactivates the first branch switch 108 to prevent power from flowing from the power module 102 to the first set of LEDs 104. In this manner, branch switches 108 and 110 can help to mitigate the lack of output current by, for example, effectively introducing a delay in deactivating first LED set 104.

2 is a conceptual diagram illustrating a first exemplary circuit configured to mitigate a lack of output current upon change between a first set of LEDs and a second set of LEDs, in accordance with one or more techniques of this disclosure. As shown, circuit 200 includes power module 202, first LED set 204, second LED set 206, first branch switch 208, and second branch switch 210 (these switches). (Collectively referred to as series module 212), control module 214, power source 216, bypass switch 220, sense element 222, and capacitors 226 and 228. The control module 214 may be an example of the control module 114 of FIG. 1.

In some examples, sensing element 222 may include a resistive element. As shown, the sense element 222 is coupled in series with the first branch switch 208. In addition, the sensing element 222 is coupled in series with the second branch switch 210. In the example of FIG. 2, there are two functions with different numbers of LED numbers (eg, activating the first LED set 204 and activating the second LED set 206). For example, as indicated by the larger sized LEDs of the second LED set 206 compared to the first LED set 204, the second LED set 206 is higher than the first LED set 204. Use power. In some examples, the second LED set 206 may use a lower voltage than the first LED set 204.

The control module 114 includes a logic module 236, a current monitor module 230, a PWM engine 232 and a driver module 234. The current monitor module 230 may determine the current at the first branch switch 208 and / or the second branch switch 210. For example, current monitor module 230 may determine the voltage at sense element 222. In this example, current monitor module 230 may determine the current flowing from power module 202 based on the voltage at sense element 222. When the first branch switch 208 is deactivated and the second branch switch 210 is activated, the current monitor module 230 causes the current at the second branch switch 210 to be proportional to the voltage at the sensing element 222. Can be estimated. Similarly, when the first branch switch 208 is activated and the second branch switch 210 is deactivated, the current monitor module 230 is proportional to the voltage at the sense element 222. We can estimate the current at. Similarly, when the first branch switch 208 is activated and the second branch switch 210 is activated, the current monitor module 230 is proportional to the voltage at the sensing element 222. And the current at the second branch switch 210 can be estimated. In some examples, current monitor module 230 may output an indication that the current at first branch switch 208 is below or above a threshold for first branch switch 208. In some examples, current monitor module 230 may output an indication that the current at second branch switch 210 is below or above a threshold for second branch switch 210. In some examples, current monitor module 230 is configured such that the current at first branch switch 208 and second branch switch 210 is below a threshold for first branch switch 208 and second branch switch 210, or You can output an indication that it is above it.

Logic module 236 may be configured to determine a target quantity of LEDs of first LED set 204 and second LED set 206 to be activated. Logic module 236 may receive an indication (eg, from user interaction with circuit 200) to change the beam setting of circuit 200 from the high beam setting to the low beam setting. For example, logic module 236 may receive an indication of the quantity of LEDs to activate and output an indication of the target power based on the quantity of LEDs. For example, from a hardware user interface, a low voltage (eg, logic 0) at a low beam (LB) input, a low voltage (eg, logic 0) at a high beam (HB) input, and daytime running lights (in response to receiving a high voltage (eg, logic 1) at the DRL) input, the logic module 236 causes the target power corresponding to the power to activate the LEDs 204A-204D of the first LED set 204. The display of can be output. However, from the hardware user interface, a high voltage (eg, logic 1) at low beam (LB) input, a high voltage (eg, logic 1) at high beam (HB) input, and daytime running light (DRL) in response to receiving the low voltage (eg, logic 0) at the input, the logic module 236 displays an indication of the target power corresponding to the power that activates the LEDs 206A-206B of the second set of LEDs 206. You can output

Additionally or alternatively, logic module 236 may determine to change the beam setting of circuit 200 from a high beam setting to a low beam setting in response to sensor data indicative of an oncoming vehicle. In any case, in response to determining the beam setting of the circuit 200, the logic module 236 may determine the quantity of load units corresponding to the beam setting. For example, logic module 236 may determine that the target quantity of LEDs is 1 when the low beam setting is related only to LED 206A, and logic module 236 may determine that the high beam setting is associated with LED 206B. The target quantity of LEDs can be determined to be 2. In some examples, logic module 236 may include analog circuitry. In some examples, logic module 236 may be digital circuitry that includes one or more logic elements and / or timing elements.

Logic module 236 may be configured to generate a reference signal (eg, compensation voltage) indicative of the target power based on the target quantity of LEDs. For example, logic module 236 may generate a reference signal based on the target quantity of LEDs to be activated. For example, the logic module 236 may increase the reference signal as the quantity of LEDs increases and decrease the reference signal as the quantity of LEDs decreases.

Additionally or alternatively, logic module 236 may generate a reference signal based on the power consumption, forward voltage, and / or average current of the LED to be activated. For example, the logic module 236 can increase the reference signal when switching to an LED having a higher power consumption, forward voltage, and / or average current of the LED compared to the previously activated LED, and previously activated The reference signal can be reduced when switching to an LED having low power consumption, forward voltage, and / or average current of the LED as compared to the LED.

Logic module 236 may generate a first command PWM signal to activate first LED set 204. For example, logic module 236 may determine the duty cycle for the first command PWM signal based on the target power. For example, the logic module 236 may perform a dimming function by reducing the duty cycle of the first command PWM signal to reduce the brightness of the first LED set 204. Similarly, logic module 236 may perform a brightening function by increasing the duty cycle of the first command PWM signal to increase the brightness of first set of LEDs 204. In either case, the logic module 236 may output the first command PWM signal to the PWM engine 232.

Similarly, logic module 236 can generate a second command PWM signal to activate second LED set 206. For example, the logic module 236 can determine the duty cycle for the second command PWM signal based on the target power. For example, the logic module 236 may perform a dimming function by reducing the duty cycle of

the second command PWM signal to reduce the brightness of the second LED set 206. Similarly, logic module 236 may perform a brightening function by increasing the duty cycle of the second command PWM signal to increase the brightness of second LED set 206. In either case, logic module 236 may output a second command PWM signal to PWM engine 232.

In some examples, logic module 236 may selectively generate a third command PWM signal for activating LED 206B of first LED set 204. For example, the logic module 236 can determine the duty cycle for the third command PWM signal based on the target power. For example, logic module 236 may perform a dimming function by reducing the duty cycle of the third command PWM signal to reduce the brightness of LED 206B. Similarly, logic module 236 may perform a brightening function by increasing the duty cycle of the third command PWM signal to increase the brightness of LED 206B. In either case, logic module 236 may output a third command PWM signal to PWM engine 232.

The PWM engine 232 may generate a first PWM signal "PWM1" based on the first command PWM signal output by the logic module 236. For example, the PWM engine 232 may generate a first PWM signal to compensate for undervoltage in the power module 202. As further described below, the PWM engine 232 is an effective duty cycle corresponding to (eg, identical, matching, etc.) the duty cycle of the first command PWM signal output by the logic module 236. The first PWM signal may be generated to have a:

Similarly, the PWM engine 232 may generate a second PWM signal "PWM2" based on the second command PWM signal output by the logic module 236. For example, the PWM engine 232 may generate a second PWM signal to compensate for the low voltage at the power module 202. As will be described further below, the PWM engine 232 has an effective duty cycle corresponding to (eg, identical, matching, etc.) the duty cycle of the second command PWM signal output by the logic module 236. The second PWM signal may be generated to have a:

In some examples, PWM engine 232 may selectively generate a third PWM signal "PWM3" based on the third command PWM signal output by logic module 236. For example, the PWM engine 232 may generate a third PWM signal to compensate for the low voltage at the power module 202. As will be described further below, the PWM engine 232 has an effective duty cycle corresponding to (eg, identical, matching, etc.) the duty cycle of the third command PWM signal output by the logic module 236. The third PWM signal may be generated to have a:

The driver module 234 may generate a driving signal for activating the first branch switch 208 based on the first PWM signal. For example, the driver module 234 may drive a drive signal to a control node (eg, a gate) of the first branch switch 208 to activate the first branch switch 208 during the rising edge of the first PWM signal. You can print The driver module 234 may output a drive signal to a control node (eg, a gate) of the first branch switch 208 to deactivate the first branch switch 208 during the falling edge of the first PWM signal.

Similarly, the driver module 234 may generate a drive signal for activating the second branch switch 210 based on the second PWM signal. For example, the driver module 234 may drive a drive signal to a control node (eg, a gate) of the second branch switch 210 to activate the second branch switch 210 during the rising edge of the second PWM signal. You can print The driver module 234 may output a drive signal to a control node (eg, a gate) of the second branch switch 210 to deactivate the second branch switch 210 during the falling edge of the second PWM signal.

The driver module 234 may generate a driving signal for activating the bypass switch 220 based on the third PWM signal. For example, the driver module 234 may output a drive signal to a control node (eg, a gate) of the bypass switch 220 to activate the bypass switch 220 during the rising edge of the third PWM signal. Can be. The driver module 234 may output a drive signal to a control node (eg, a gate) of the bypass switch 220 to deactivate the bypass switch 220 during the falling edge of the third PWM signal.

The driver module 234 outputs a drive signal to the control node (eg, gate) of the first branch switch 208 so that after the rising edge of the first PWM signal and before the subsequent falling edge of the first PWM signal. The first branch switch 208 may dissipate a portion of the power output by the power module 202. In some examples, driver module 234 drives first branch switch 208 to supply from power module 202 to provide a target power for activating first set of LEDs 204 based on a current threshold. Part of the power supply can be dissipated. For example, the driver module 234 may be configured to drive the first branch switch 208 to limit the maximum power in the first LED set 204. For example, the driver module 234 may drive the switching element of the first branch switch 208 at the first branch switch 208 when the power of the current in the first LED set 204 is greater than the current threshold. Can increase resistance. In some examples, the driver module 234 drives the switching element of the first branch switch 208 when the power in the first LED set 204 is less than the power threshold to reduce the resistance of the first branch switch 208. You can.

The driver module 234 outputs a drive signal to a control node (eg, a gate) of the first branch switch 210, such that after the rising edge of the second PWM signal and before the subsequent falling edge of the second PWM signal. The second branch switch 210 may dissipate a portion of the power output by the power module 202. In some examples, driver module 234 drives second branch switch 210 from power module 202 to provide a target power for activating second set of LEDs 206 based on a current threshold. Part of the power supply can be dissipated. For example, driver module 234 may be configured to drive second branch switch 210 to limit the maximum power in second LED set 206. For example, the driver module 234 may drive the switching element of the second branch switch 210 when the power of the current in the second LED set 206 is greater than the current threshold to cause the second branch switch 210 to operate at the second branch switch 210. Can increase resistance. In some examples, driver module 234 drives the switching element of second branch switch 210 when the power in second LED set 206 is less than a power threshold to reduce the resistance of second branch switch 210. You can.

3 shows the performance of a system that is changed between a first set of LEDs and a second set of LEDs. For purposes of illustration only, FIG. 3 is described below in the context of the system 100 of FIG. 1 and the circuit 200 of FIG. 2. The horizontal axis (eg, horizontal) of FIG. 3 represents time, and the vertical axis (eg, vertical) of FIG. 3 represents the output voltage 302 at power module 202, output by power module 202. Output current 304, output current 306 at LED 206A, output current 308 at LED 206B, and output current 310 at first LED set 204.

In the example of FIG. 3, at time 340, the logic module 236 activates the second set of LEDs 206 from activating the first set of LEDs 204 (denoted as "DRL"). $H8 + L8$). However, at time 340, the voltage output by power module 202 is lower than the forward voltage for activating second LED set 206 resulting in a shortage of output current 330. Similarly, at time 342, the voltage output by power module 202 is less than the forward voltage for activating first set of LEDs 204, resulting in a lack of output current 332.

4 illustrates the ability of a system to mitigate a lack of output current upon change between a first and a second set of LEDs, in accordance with one or more techniques of this disclosure. For purposes of illustration only, FIG. 4 is described below in the context of the system 100 of FIG. 1 and the circuit 200 of FIG. 2. The horizontal axis (eg, horizontal) of FIG. 4 represents time, and the vertical axis (eg, vertical) of FIG. 4 represents the output voltage 402 at the power module 202, output by the power module 202. Output current 404, output current 406 at LED 206A, output current 408 at LED 206B, and output current 410 at first LED set 204.

In the example of FIG. 4, at time 440, logic module 236 activates second LED set 206 from activating first LED set 204 (denoted as "DRL") ($H8 + L8$). However, instead of immediately deactivating the first LED set 204, the PWM engine 232 generates a PWM signal to activate both the first LED set 204 and the second LED set 206. As shown, at time 440, the voltage output by the power module 202 is lower than the forward voltage for activating the second LED set 206, resulting in no current in the second LED set 206. However, in the example of FIG. 4, at time 440, current is supplied to the first set of LEDs 204 while the power module 202 increases the voltage, which alleviates the lack of current shown in FIG. 3. To help

In addition, as discussed above, the first branch switch 208 may dissipate a portion of the power supplied by the power module 202 to limit the current and / or power supplied to the first LED set 204. have. Similarly, at time 442, current is supplied to LED 206A while power module 202 increases the voltage.

5 is a flowchart consistent with the techniques that may be performed by the example system of FIG. 1, in accordance with the present disclosure. For purposes of illustration only, FIG. 5 is described below in the context of the system 100 of FIG. 1 and the circuit 200 of FIG. 2. However, the techniques described below include the

power module 102, the first set of LEDs 104, the second set of LEDs 106, the first branch switch 108, and the second branch switch 110. In general, it may be used in any substitution and in any combination with the series module 112, and the control module 114. FIG. 5 is described with reference to FIG. 6.

6 is an illustration of the performance of a system implementing the technique of FIG. 5, in accordance with one or more techniques of this disclosure. The horizontal axis (eg, horizontal) of FIG. 6 represents time and the vertical axis (eg, vertical) of FIG. 6 represents a second command output by the logic module 236 to activate the second branch switch 210. Logic module 236 to activate PWM signal 602, second PWM signal 604 output by PWM engine 232 to activate second branch switch 210, first branch switch 208. At the first command PWM signal 606 output by the PWM engine 232 to activate the first branch switch 208, the second branch switch 210 Current 610, current 612 at first branch switch 208, and output voltage 614 at power module 202 are shown.

The PWM engine 232 activates the first set of LEDs 204 and, at a time 640, from a first state that deactivates the first set of LEDs 204 and activates the second set of LEDs 206. A command is received 502 to change to a second state that deactivates the LED set 206. For example, the PWM engine 232 receives the first command PWM signal 606 and the second command PWM signal 602 from the logic module 236. At time 640, PWM engine 232 activates first branch switch 208 and resets the count value to '0' (504). For example, the PWM engine 232 generates a first PWM signal 608 with a rising edge at time 640. PWM engine 232 increments the count value (506).

The current monitor module 230 determines 508 whether the current at the first branch switch 208 exceeds the current threshold. In response to determining that the current at the first branch switch 208 does not exceed the current threshold ("no" in 508), the PWM engine 232 occurs after activating the first branch switch 208. The count value is incremented 506 for each cycle.

However, in response to determining that the current at the first branch switch 208 exceeds the current threshold ("yes" at 508), the PWM engine 232 causes the second set of LEDs 206 in accordance with one or more techniques of this disclosure. . As shown, circuit 700 includes power module 702, first LED set 704, second LED set 706, first branch switch 708, and second branch switch 710 (these switches). Collectively referred to as series module 712), control module 714, power source 716, bypass switch 720, sense element 722, and capacitors 726 and 208. This may be similar to the components of circuit 200. However, circuit 700 further includes a sensing element 724.

At time 644, the PWM engine 232 deactivates the first LED set 204 and deactivates the second LED from the second state that activates the first LED set 204 and deactivates the second LED set 206. A command is received 512 to change to a first state that activates set 206. In response to the command to change from the second state to the first state, the PWM engine 232 prohibits changing from the second state to the first state until a time delay (514). For example, the PWM engine 232 prohibits changing from the second state to the first state until the count value. At time 646, the PWM engine 232 deactivates the first LED set 204 from the second state of activating the first LED set 204 and deactivating the second LED set 206 and the second LED set. Change 516 to the first state to activate 516, and the process repeats 502 at time 648.

7 is a conceptual diagram illustrating a second example circuit 700 configured to mitigate a lack of output current upon change between a first set of LEDs 704 and a second set of LEDs 706 in accordance with one or more techniques of this disclosure. . As shown, circuit 700 includes power module 702, first LED set 704, second LED set 706, first branch switch 708, and second branch switch 710 (these switches). Collectively referred to as series module 712), control module 714, power source 716, bypass switch 720, sense element 722, and capacitors 726 and 208. This may be similar to the components of circuit 200. However, circuit 700 further includes a sensing element 724.

In some examples, sensing element 722 may include a resistive element. As shown, the sense element 722 is connected in series with the first branch switch 708 and the sense element 724 is coupled in series with the second branch switch 710. In the example of FIG. 7, there are two functions with different numbers of LED numbers (eg, to activate the first LED set 704 and to activate the second LED set 706). For example, as indicated by the larger sized LEDs of the second LED set 706 compared to the first LED set 704, the second LED set 706 is higher than the first LED set 704. Use power. In some examples, the second LED set 706 may use a lower voltage than the first LED set 704.

In contrast to the circuit 200 of FIG. 2, in the example of FIG. 7, sense elements 722 and 724 provide independent sense paths. That is, the current monitor module 730 can determine the current at the first branch switch 708 using the indication (eg, proportional or step down value) of the voltage at the sensing element 722. Similarly, current monitor module 730 can determine the current at second branch switch 710 using an indication of the voltage at sense element 724 (eg, a proportional or step down value). As such, current monitor module 730 may determine that the current at first branch switch 708 exceeds the current threshold when the current value indicated by the voltage at sense element 722 exceeds the current threshold. . Similarly, current monitor module 730 may determine that the current at second branch switch 710 exceeds the current threshold when the current value indicated by the voltage at sense element 724 exceeds the current threshold. . In this manner, the current monitor module 730 may provide feedback for closing the control loop for operating the first LED set 704 and the second LED set 706.

As such, the control module 714 can induce a jump up of the power supplied by swapping each monitored path, while at the same time conducting one branch until another branch begins to conduct current. Can be maintained. As already described in FIGS. 5 and 6, the PWM engine 732 may adjust the first and second PWM signal duty cycles imposed to compensate for the additional current on the first set of LEDs 704.

8 illustrates the performance of a system that is changed between a first set of LEDs and a second set of LEDs. For purposes of illustration only, FIG. 8 is described below in the context of the system 100 of FIG. 1 and the circuit 200 of FIG. 2. However, the techniques described below include the power module 102, the first set of LEDs 104, the second set of LEDs 106, the first branch switch 108, and the second branch switch 110. In general, it may be used in any substitution and in any combination with the series module 112, and the control module 114. The horizontal axis (eg, horizontal) of FIG. 8 represents time, and the vertical axis (eg, vertical) of FIG. 8 represents the output voltage 802 at the power module 202, at the compensation capacitor of the control module 214. Of the compensated voltage 804, the output current 806 in the first set of LEDs 204, the output current 808 in the second set of LEDs 206, and the inductor current of the inductor of the power module 202 (810).

In the example of FIG. 8, at time 840, logic module 236 raises the compensated voltage 804, which drives output voltage 802 and inductor current 810. However, the output voltage 802 is less than the forward voltage for activating the first set of LEDs 204, resulting in a lack of output current 820.

9 illustrates a first performance diagram of a system that mitigates the lack of output current upon change between a first set of LEDs and a second set of LEDs in accordance with one or more techniques of this disclosure. For purposes of illustration only, FIG. 9 is described below in the context of the system 100 of FIG. 1, the circuit 200 of FIG. 2, and the circuit 700 of FIG. 7. However, the techniques described below include the power module 102, the first set of LEDs 104, the second set of LEDs 106, the first branch switch 108, and the second branch switch 110. In general, it may be used in any substitution and in any combination with the series module 112, and the control module 114. The horizontal axis (eg, horizontal) of FIG. 9 represents time, and the vertical axis (eg, vertical) of FIG. 9 represents the output voltage 902 at the power module 702, at the compensation capacitor of the control module 714. Compensated voltage 904, output current 906 in first LED set 704, output current 908 in second LED set 706, and inductor current of the inductor of power module 702 (910).

In the example of FIG. 9, at time 940, logic module 736 raises the compensated voltage 904, which drives output voltage 902 and inductor current 910. PWM engine 732 causes second branch switch 710 until voltage at sense element 722 exceeds output current 906 in first set of LEDs 704 above a threshold current (eg, 0.7 amps). is deactivated, which helps to alleviate the lack of current shown in FIG. In the example of FIG. 9, the PWM engine 732 determines a corresponding time delay 950 between activating the first branch switch 708 and deactivating the second branch switch 710 based on the count value. Can be.

FIG. 10 illustrates a second performance diagram of a system that mitigates the lack of output current upon change between a first set of LEDs and a second set of LEDs in accordance with one or more techniques of this disclosure. For illustrative purposes only, FIG. 10 is described below in the context of the system 100 of FIG. 1, the circuit 200 of FIG. 2, and the circuit 700 of FIG. 7. However, the techniques described below include the power module 102, the first set of LEDs 104, the second set of LEDs 106, the first branch switch 108, and the second branch switch 110. In general, it may be used in any substitution and in any combination with the series module 112, and the control module 114. The horizontal axis (eg, horizontal) of FIG. 10 represents time, and the vertical axis (eg, vertical) of FIG. 10 represents the output voltage 1002 at the power module 702, at the compensation capacitor of the control module 714. Compensated voltage 1004, output current 1006 in first LED set 704, output current 1008 in second LED set 706, and inductor current of the inductor of power module 702 (1010).

In the example of FIG. 10, the PWM engine 732 illustrates the corresponding estimated time delay 1050 between activating the first branch switch 708 and deactivating the second branch switch 710. The same delay can be applied to the next turn-on PWM edge as the current turn-on PWM edge. For example, the PWM engine 232 may determine an estimated time delay to correspond to the time delay 950 of FIG. 9. In this way, the PWM engine 732 can provide sufficient time for the power module to increase the voltage while accurately providing the target duty cycle.

11 is a flowchart consistent with the techniques that may be performed by the example system of FIG. 1, in accordance with the present disclosure. For illustrative purposes only, FIG. 11 is described below in the context of the system 100 of FIG. 1, the circuit 200 of FIG. 2, and the circuit 300 of FIG. 3. However, the techniques described below include the power module 102, the first set of LEDs 104, the second set of LEDs 106, the first branch switch 108, and the second branch switch 110. In general, it may be used in any substitution and in any combination with the series module 112, and the control module 114.

In accordance with one or more techniques of this disclosure, PWM engine 232 determines an instruction to change from a first state to a second state (1102). For example, the PWM engine 232 receives a command to change from the first state to the second state. In some examples, PWM engine 232 generates instructions to change from the first state to the second state. PWM engine 232 activates second branch switch 210 (1104). For example, the PWM engine 232 may generate a second PWM signal to activate the second LED set 206. Logic module 236 may drive power module 202 to increase supply voltage to provide supply power for activating second set of LEDs 206 (1106). For example, logic module 236 may increase the compensation voltage at the compensation capacitor for power module 202.

The driver module 234 may drive a first branch switch 208 to dissipate a portion of the supply power to provide a target power for activating the first set of LEDs 204 (1108). For example, the driver module 234 modifies the resistance of the first branch switch 208 to provide a target power for activating the first set of LEDs 204. The driver module 234 deactivates the first branch switch 208 in response to determining that the current at the second branch switch 210 exceeds the current threshold (1110).

The PWM engine 232 determines 1112 a time delay corresponding to the difference between activating the second branch switch 210 and deactivating the first branch switch 208. For example, the PWM engine 232 determines a count value that is incremented each cycle between activating the second branch switch 210 and deactivating the first branch switch 208. The PWM engine 232 receives a command to change from the second state to the first state (1114). PWM engine 232 changes from the second state to the first state after a time delay (1116).

The following examples may represent one or more aspects of the present disclosure.

Example 1. A method for regulating current or power, the method comprising: determining a command to change from a first state to a second state, wherein during the first state, a first to power a first set of light emitting diodes (LEDs); The second branch switch is deactivated to prohibit a branch switch from being activated and to power the second set of LEDs, and during the second state, the first branch switch is configured to prohibit powering the first set of LEDs. The second branch switch is deactivated and the second branch switch is activated to power the second set of LEDs; in response to a command to change from the first state to the second state: driving a power module to activate the second branch switch; increasing a supply voltage to supply supply power for activating the second set of LEDs; in response to determining that the current at the second branch switch does not exceed a current threshold, driving the first branch switch to dissipate a portion of the supply power to provide a target power for activating the first set of LEDs. step; And deactivating the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

Example 2. In the method of example 1, driving the first branch switch to dissipate a portion of supply power includes modifying a resistance of the first branch switch based on a difference between a target power and a supply power.

Example 3. The method of any combination of examples 1 or 2, comprising: determining a time delay for changing from the first state to the second state, in response to a command to change from the second state to the first state; prohibiting changing from the second state to the first state before the time delay; And changing from the second state to the first state after the time delay.

Example 4. The method of any combination of examples 1-3, wherein determining the time delay comprises increasing a count value after activating the second branch switch and before deactivating the first branch switch. It includes.

Example 5. The method of any combination of examples 1 to 4, wherein the second branch switch is coupled in series with the sensing element, the method based on the indication of the voltage at the sensing element at the second branch switch. Determining the current.

Example 6. The method of any combination of examples 1-5, wherein the current at the second branch switch exceeds the current threshold when the current value indicated by the voltage at the sensing element exceeds the current threshold. And determining to do.

Example 7. The method of any combination of any of Examples 1-6, wherein the sense element is a second sense element and the first branch switch is coupled in series with the first sense element.

Example 8. The method of any combination of examples 1-7, wherein the first sense element comprises a resistive element and the second sense element comprises a resistive element.

Example 9. The method of any combination of examples 1 to 8, further comprising: receiving a first command pulse width modulated (PWM) signal to deactivate the first set of LEDs; Receiving a second command PWM signal for activating the second set of LEDs, the first command signal and the second command signal indicating a command to change from a first state to a second state.

Example 10. The method of any combination of examples 1-9, wherein the first branch switch comprises a switching element.

Example 11. A device for regulating current or power, comprising: a first branch switch configured to selectively supply power output by a power module to a first set of light emitting diodes (LEDs); A second branch switch configured to selectively supply power output by the power module to a second set of LEDs; A control module, the control module: determining a command to change from a first state to a second state, during the first state, the first set of powers to power the first set of light emitting diodes (LEDs). The first branch switch is deactivated to prohibit a branch switch from being activated and to power the second set of LEDs, and during the second state, the first branch to prohibit powering the first set of LEDs. A switch is deactivated and the second branch switch is activated to power the second set of LEDs; In response to a command to change from the first state to the second state: driving the power module to activate the second branch switch; increasing a supply voltage to supply supply power for activating the second set of LEDs; in response to determining that the current at the second branch switch does not exceed a current threshold, driving the first branch switch to dissipate a portion of the supply power to supply a target power for activating the first set of LEDs. that, And deactivating the first branch switch in response to determining that the current at the second branch switch exceeds the current threshold.

Example 12. In the device of example 11, to dissipate a portion of the supply power, the first branch switch is configured to modify the resistance of the first branch switch.

Example 13. The device of any combination of examples 11 or 12, wherein the control module is further configured to: determine a delay time corresponding to a difference between activating the second branch switch and deactivating the first branch switch; In response to a command to change from the second state to the first state: prohibiting changing from the second state to the first state before the time delay; And changing from the second state to the first state after the time delay.

Example 14. The device of any combination of examples 11-13, wherein the control module is further configured to: determine a count value after activating the second branch switch and before deactivating the first branch switch. It is configured to increase.

Example 15 The device of any combination of examples 11-14, wherein the second branch switch is coupled in series with a sensing element, and wherein the control module is further configured to based on the indication of the voltage at the sensing element. And to determine the current at.

Example 16 The device of any combination of examples 11-15, wherein the control module is further configured to cause the current at the second branch switch to be exceeded when the current value indicated by the voltage at the sensing element exceeds the current threshold. Further determining to determine that the current threshold is exceeded

Example 17 The device of any combination of examples 11-16, wherein the sense element is a second sense element and the first branch switch is coupled in series with a first sense element.

Example 18 The device of any combination of examples 11-17, wherein the first sense element comprises a resistive element and the second sense element comprises a resistive element.

Example 19. The device of any combination of examples 11-18, wherein the first branch switch comprises a switching element.

Example 20 A system for regulating current or power, comprising: a power module configured to output power; A first set of light emitting diodes (LEDs); A second set of LEDs; A first branch switch configured to selectively supply at least a portion of the power output by the power module to the first LED set; A second branch switch configured to selectively supply at least a portion of the power output by the power module to the second LED set; A control module, the control module: determining a command to change from a first state to a second state, wherein during the first state, the first branch switch is activated to power the first set of LEDs. The second branch switch is deactivated to prohibit powering the second set of LEDs, and during the second state, the first branch switch is deactivated to prohibit powering the first set of LEDs and The second branch switch is activated to power the second set of LEDs, in response to a command to change from the first state to the second state: activating the second branch switch; Driving the power module to increase supply voltage to supply supply power to activate the second set of LEDs, Driving the first branch switch to dissipate a portion of the supply power to supply a target power for activating the first set of LEDs when the current at the second branch switch does not exceed a current threshold; And deactivating the first branch switch when the current at the second branch switch exceeds the current threshold.

Various aspects have been described in this disclosure. These and other aspects are within the scope of the following claims.

Patent Citations (8)

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KR192074607B1	2020-02-10	Apparatus for driving led for vehicle

Priority And Related Applications

Priority Applications (2)

Application	Priority date	Filing date	Title
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US15/921,406		2018-03-14	

Legal Events

Date	Code	Title	Description
2022-01-05	A201	Request for examination	

Concepts

machine-extracted

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 activating		claims,abstract,description	55	0.000
 corresponding		claims,description	14	0.000
 regulatory		claims,description	8	0.000
 modifying		claims,description	7	0.000
 inactivating		claims	1	0.000

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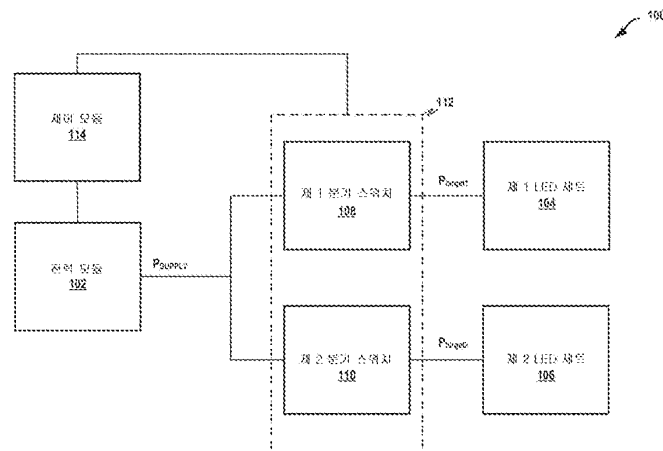
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(57) 요약

전류 또는 전력을 조절하기 위한 디바이스는 제 1 분기 스위치, 제 2 분기 스위치, 및 제어 모듈을 포함한다. 제어 모듈은 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하도록 구성된다. 명령에 응답하여, 제어 모듈은 제 2 분기 스위치를 활성화시키는 것과, 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 제공하기 위해 전류 모듈을 구동하여 공급 전압을 증가시키는 것과, 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 제 1 LED 세트를 활성화하기 위한 목표 전력을 제공하기 위해 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 것과, 제 2 분기 스위치에서의 전류가 전류 임계치를 초과한다는 결정에 응답하여 제 1 분기 스위치를 비활성화시키는 것을 수행하도록 구성된다.

도면



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(72) 발명자

밀라네시 파올로

이탈리아 파도바 35136 바야 컴보나 33

판조 로베르토

이탈리아 비곤자 (피디) 35010 16 바야 마첼렛

토나조 엔리코

이탈리아 밀라노바 디 캄포샘피예로 (피디) 35010

10 바야 포스콜로

명세서

청구범위

청구항 1

전류 또는 전력을 조절하기 위한 방법으로서,

제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 단계 - 상기 제 1 상태 동안, 제 1 발광 다이오드(LED) 세트에 전력을 공급하도록 제 1 분기 스위치가 활성화되고 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 과;

상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여:

상기 제 2 분기 스위치를 활성화하는 단계;

상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 전력 모듈을 구동하여 공급 전압을 증가시키는 단계;

상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 재공하기 위해 상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는(dissipate) 단계; 및

상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다고 결정한 것에 응답하여 상기 제 1 분기 스위치를 비활성화하는 단계를 포함하는

방법.

청구항 2

제 1 항에 있어서,

상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 단계는 상기 목표 전력과 상기 공급 전력 간의 차이에 기초하여 상기 제 1 분기 스위치의 저항을 수정하는 단계를 포함하는

방법.

청구항 3

제 1 항에 있어서,

상기 제 1 상태에서부터 상기 제 2 상태로 변경하기 위한 시간 지연을 결정하는 단계와;

상기 제 2 상태에서부터 상기 제 1 상태로 변경하라는 명령에 응답하여:

상기 시간 지연 전에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 금지하는 단계; 및

상기 시간 지연 후에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 단계를 더 포함하는

방법.

청구항 4

제 3 항에 있어서,

상기 시간 지연을 결정하는 단계는, 상기 제 2 분기 스위치를 활성화한 후 및 상기 제 1 분기 스위치를 비활성화하기 전에 카운트 값을 증가시키는 단계를 포함하는

방법.

청구항 5

제 1 항에 있어서,

상기 제 2 분기 스위치는 감지 엘리먼트와 직렬로 결합되며,

상기 방법은,

상기 감지 엘리먼트에서의 전압의 표시에 기초하여 상기 제 2 분기 스위치에서의 전류를 결정하는 단계를 포함하는

방법.

청구항 6

제 5 항에 있어서,

상기 감지 엘리먼트에서의 전압에 의해 표시되는 전류 값이 상기 전류 임계치를 초과할 때 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과하는 것으로 결정하는 단계를 더 포함하는

방법.

청구항 7

제 5 항에 있어서,

상기 감지 엘리먼트는 제 2 감지 엘리먼트이고, 상기 제 1 분기 스위치는 제 1 감지 엘리먼트와 직렬로 결합되는

방법.

청구항 8

제 7 항에 있어서,

상기 제 1 감지 엘리먼트는 저항성 엘리먼트를 포함하고, 상기 제 2 감지 엘리먼트는 저항성 엘리먼트를 포함하는

방법.

청구항 9

제 1 항에 있어서,

상기 제 1 LED 칩트를 비활성화시키기 위해 제 1 명령 펄스 폭 변조(PWM) 신호를 수신하는 단계와;

상기 제 2 LED 칩트를 활성화시키기 위해 제 2 명령 PWM 신호를 수신하는 단계를 더 포함하고,

상기 제 1 명령 PWM 신호 및 상기 제 2 명령 PWM 신호는 제 1 상태에서부터 제 2 상태로 변경하라는 명령을 나타내는

방법.

청구항 10

제 1 항에 있어서,

상기 제 1 분기 스위치는 스위칭 엘리먼트를 포함하는

방법.

청구항 11

전류 또는 전력을 조절하기 위한 디바이스로서,

전력 모듈에 의해 출력되는 전력을 제 1 발광 다이오드(LED) 세트에 선택적으로 공급하도록 구성되는 제 1 분기 스위치와;

상기 전력 모듈에 의해 출력되는 전력을 제 2 LED 세트에 선택적으로 공급하도록 구성되는 제 2 분기 스위치와;

제어 모듈을 포함하고,

상기 제어 모듈은:

제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 것 - 상기 제 1 상태 동안, 상기 제 1 LED 세트에 전력을 공급하도록 상기 제 1 분기 스위치가 활성화되고 상기 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 과;

상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여;

상기 제 2 분기 스위치를 활성화시키는 것;

상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 상기 전력 모듈을 구동하여 공급 전압을 증가시키는 것;

상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 공급하기 위해 상기 제 1 분기 스위치를 구동하여 상기 공급 전력의 일부를 소산하는 것; 및

상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다고 결정한 것에 응답하여 상기 제 1 분기 스위치를 비활성화하는 것을 수행하도록 구성되는

디바이스.

청구항 12

제 11 항에 있어서,

상기 공급 전력의 일부를 소산시키기 위해, 상기 제 1 분기 스위치는 상기 제 1 분기 스위치의 저항을 수정하도록 구성되는

디바이스.

청구항 13

제 11 항에 있어서,

상기 제어 모듈은:

상기 제 2 분기 스위치를 활성화하는 것과 상기 제 1 분기 스위치를 비활성화하는 것 사이의 차이에 대응하는 시간 지연을 결정하는 것과;

상기 제 2 상태에서부터 상기 제 1 상태로 변경하라는 명령에 응답하여;

상기 시간 지연 전에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 금지하는 것; 및

상기 시간 지연 후에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 수행하도록 더 구성되는 디바이스.

청구항 14

제 11 항에 있어서,

상기 시간 지연을 결정하기 위해, 상기 제어 모듈은,

상기 제 2 분기 스위치를 활성화한 후 및 상기 제 1 분기 스위치를 비활성화하기 전에 카운트 값을 증가시키도록 구성되는

디바이스.

청구항 15

제 11 항에 있어서,

상기 제 2 분기 스위치는 감지 엘리먼트와 직렬로 결합되며,

상기 제어 모듈은,

상기 감지 엘리먼트에서의 전압의 표시에 기초하여 상기 제 2 분기 스위치에서의 전류를 결정하도록 구성되는

디바이스.

청구항 16

제 15 항에 있어서,

상기 제어 모듈은,

상기 감지 엘리먼트에서의 전압에 의해 표시되는 전류 값이 상기 전류 임계치를 초과할 때 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과하는 것으로 결정하도록 더 구성되는

디바이스.

청구항 17

제 15 항에 있어서,

상기 감지 엘리먼트는 제 2 감지 엘리먼트이고, 상기 제 1 분기 스위치는 제 1 감지 엘리먼트와 직렬로 결합되는

디바이스.

청구항 18

제 17 항에 있어서,

상기 제 1 감지 엘리먼트는 저항성 엘리먼트를 포함하고, 상기 제 2 감지 엘리먼트는 저항성 엘리먼트를 포함하는

디바이스.

청구항 19

제 11 항에 있어서,

상기 제 1 분기 스위치는 스위칭 엘리먼트를 포함하는

디바이스.

청구항 20

전류 또는 전력을 조절하기 위한 시스템으로서,

전력을 출력하도록 구성된 전력 모듈과;

제 1 발광 다이오드(LED) 세트와;

제 2 LED 세트와;

상기 전력 모듈에 의해 출력되는 전력의 적어도 일부를 상기 제 1 LED 세트에 선택적으로 공급하도록 구성되는 제 1 분기 스위치와;

상기 전력 모듈에 의해 출력되는 전력의 적어도 일부를 상기 제 2 LED 세트에 선택적으로 공급하도록 구성되는 제 2 분기 스위치와;

제어 모듈을 포함하고,

상기 제어 모듈은:

제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 것 - 상기 제 1 상태 동안, 상기 제 1 LED 세트에 전력을 공급하도록 상기 제 1 분기 스위치가 활성화되고 상기 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 과;

상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여:

상기 제 2 분기 스위치를 활성화시키는 것;

상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 상기 전력 모듈을 구동하여 공급 전압을 증가시키는 것;

상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않을 때, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 공급하기 위해 상기 제 1 분기 스위치를 구동하여 상기 공급 전력의 일부를 소산하는 것; 및

상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과할 때 상기 제 1 분기 스위치를 비활성화하는 것을 수행하도록 구성되는

시스템.

발명의 설명

기술 분야

[0001]

본 개시는 발광 다이오드 스트링(a string of light emitting diodes)과 같은 부하에 공급되는 전압, 전류 또는

는 전력을 제어하도록 구성된 발광 다이오드 드라이버와 같은 드라이버에 관한 것이다.

배경 기술

- [0002] 드라이버는 부하에서 전압, 전류 또는 전력을 제어할 수 있다. 예를 들어, 발광 다이오드(LED) 드라이버는 발광 다이오드 스트림에 공급되는 전력을 제어할 수 있다. 일부 드라이버는 DC-DC 변환기, 가령, buck-부스트(buck-boost), buck(buck), 부스트(boost) 또는 다른 DC-DC 변환기를 포함할 수 있다. 그러한 DC-DC 변환기는 부하의 특성에 기초하여 부하에서의 전력을 변경하도록 요구될 수 있다. 예를 들어, 하이빔 설정(high beam setting)에서 자동차의 전방 조명(front lighting)을 작동시킬 때, 발광 다이오드의 스트림은로우 빔 설정(low beam setting)에서 작동할 때보다 더 높은 전력을 필요로 할 수 있다.

발명의 내용

해결하려는 과제

과제의 해결 수단

- [0003] 일반적으로, 본 개시는 발광 다이오드 세트(LEDs)에서 전류의 오버슈트(overshoot) 및 언더슈트(undershoot)를 감소시키는 기술에 관한 것이다. 예를 들어, 예시적인 자동차 애플리케이션에서, LED 드라이버는 주광 주행 조명(day light running lighting)을 위한 제 1 LED 스트림을 활성화시키는 것으로부터 제 1 LED 스트림보다 긴 하이빔 조명(high beam lighting)을 위한 제 2 LED 스트림을 활성화시키는 것으로 변경할 수 있다. LED의 변경을 고려하여, 전력 모듈은 하이빔 조명을 위한 제 2 LED 스트림에 전력을 공급하기 위해 전압 출력을 증가시킬 수 있다. 그러나, 하이빔 조명을 위한 제 2 LED 스트림은 전력 모듈이 전압을 충분히 증가시킬 때까지는 반드시 활성화되는 것은 아닐 수 있어서 출력 전류의 부족을 초래할 수 있다. 주광 주행 조명을 위한 제 1 LED 스트림을 즉시 비활성화하는 대신, 본원에 설명된 기술은 주광 하이빔 조명을 위한 제 2 LED 스트림을 활성화시킨 후에 주광 주행 조명을 위한 제 1 LED 스트림을 비활성화시킨다. 더욱이, 본원의 기술은 LED에 대한 손상을 방지하기 위해 전력 모듈 전압이 증가하는 동안 출력되는 전력을 소산시키면서 주광 주행 조명을 위한 LED 스트림 상에서 전력을 일정하게 유지할 수 있다. 이러한 방식으로, 본원에 설명된 기술은 출력 전류의 부족을 감소시키는 데 도움을 줄 수 있으며 목표 듀티 사이클을 정확하게 제공하는 데 도움을 줄 수 있다.
- [0004] 일 예에서, 시스템은 전류 또는 전력을 조절하는 방법을 포함한다. 상기 방법은 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 단계를 포함한다. 제 1 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하도록 활성화되고, 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화된다. 제 2 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화되고 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하도록 활성화된다. 상기 방법은 상기 제 1 상태로부터 상기 제 2 상태로 변경하라는 명령에 응답하여, 상기 제 2 분기 스위치를 활성화시키는 단계와, 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 제공하기 위해 전력 모듈을 구동하여 공급 전압을 증가시키는 단계와, 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화하기 위한 목표 전력을 제공하기 위해 상기 제 1 분기 스위치를 구동하여 상기 공급 전력의 일부를 소산하는 단계와, 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다는 결정에 응답하여 상기 제 1 분기 스위치를 비활성화시키는 단계를 더 포함한다.
- [0005] 다른 예에서, 전류 또는 전력을 조절하기 위한 디바이스는 제 1 분기 스위치, 제 2 분기 스위치 및 제어 모듈을 포함한다. 제 1 분기 스위치는 전력 모듈에 의해 출력되는 전력의 적어도 일부를 제 1 LED 세트에 선택적으로 제공하도록 구성된다. 제 2 분기 스위치는 전력 모듈에 의해 출력되는 전력의 적어도 일부를 제 2 LED 세트에 선택적으로 제공하도록 구성된다. 제어 모듈은 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하도록 구성된다. 제 1 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하도록 활성화되고 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화된다. 제 2 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화되고 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하도록 활성화된다. 상기 제 1 상태로부터 상기 제 2 상태로 변경하라는 명령에 응답하여, 상기 제어 모듈은, 상기 전력 모듈을 구동하여 상기 제 2 분기 스위치를 활성화시키고, 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 제공하기 위해 공급 전압을 증가시키고, 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화하기 위한 목표 전력을 제공하기 위해 상기 제 1

분기 스위치를 구동하여 상기 공급 전력의 일부를 소산시키고, 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다는 결정에 응답하여 상기 제 1 분기 스위치를 비활성화시키도록 구성된다.

[0006] 다른 예에서, 시스템은 전력 모듈, 제 1 LED 세트, 제 2 LED 세트, 제 1 분기 스위치, 제 2 분기 스위치, 및 제어 모듈을 포함한다. 전력 모듈은 전력을 출력하도록 구성된다. 제 1 분기 스위치는 전력 모듈에 의해 출력되는 전력의 적어도 일부를 제 1 LED 세트에 선택적으로 제공하도록 구성된다. 제 2 분기 스위치는 전력 모듈에 의해 출력되는 전력의 적어도 일부를 제 2 LED 세트에 선택적으로 제공하도록 구성된다. 제어 모듈은 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하도록 구성된다. 제 1 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하도록 활성화되고 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화된다. 제 2 상태 동안, 제 1 분기 스위치는 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 비활성화되고 제 2 분기 스위치는 제 2 LED 세트에 전력을 공급하도록 활성화된다. 상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여, 상기 제어 모듈은, 상기 전력 모듈을 구동하여 상기 제 2 분기 스위치를 활성화시키고, 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 제공하기 위해 공급 전압을 증가시키고, 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화하기 위한 목표 전력을 제공하기 위해 상기 제 1 분기 스위치를 구동하여 상기 공급 전력의 일부를 소산시키고, 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과할 때 상기 제 1 분기 스위치를 비활성화시키도록 구성된다.

[0007] 이들 예 및 다른 예에 대한 세부 사항은 첨부된 도면 및 이하의 상세한 설명에서 열거된다. 다른 특징, 목적 및 이점은 상세한 설명 및 도면과 청구범위로부터 명백해질 것이다.

도면의 간단한 설명

[0008] 도 1은 본 개시의 하나 이상의 기술에 따라 제 1 발광 다이오드(LED) 세트와 제 2 발광 다이오드(LED) 세트 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 예시적인 시스템을 도시한 블록도이다.

도 2는 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 제 1 예의 회로를 도시한 개념도이다.

도 3은 제 1 LED 세트와 제 2 LED 세트 간에 변경되는 시스템의 성능을 도시한다.

도 4는 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화시키는 시스템의 성능을 도시한다.

도 5는 본 개시에 따라, 도 1의 예시적인 시스템에 의해 수행될 수 있는 기술에 부합하는 흐름도이다.

도 6은 본 개시의 하나 이상의 기술에 따라, 도 5의 기술을 구현하는 시스템의 성능을 나타내는 도면이다.

도 7은 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 제 2 예의 회로를 도시한 개념도이다.

도 8은 제 1 LED 세트와 제 2 LED 세트 간에 변경되는 시스템의 성능도를 나타낸다.

도 9는 본 개시의 하나 이상의 기술에 따라, 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화시키는 시스템의 제 1 성능도를 나타낸다.

도 10은 본 개시의 하나 이상의 기술에 따라, 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화시키는 시스템의 제 2 성능도를 나타낸다.

도 11은 본 개시에 따라, 도 1의 예시적인 시스템에 의해 수행될 수 있는 기술에 부합하는 흐름도이다.

발명을 실시하기 위한 구체적인 내용

[0009] 적은 수의 발광 다이오드(LED)에서 더 많은 수의 LED로 점프하는 다기능 시스템의 경우, 더 많은 수의 LED를 활성화하기 위해서는 급속한 전압 증가가 필요할 수 있다. 그러나, 많은 시스템은 더 많은 수의 LED를 활성화하기 위해 출력 전압을 증가시키는 데 시간을 필요로 한다. 이와 같이, 일부 시스템은 출력 전압을 증가시키는 데 필요한 시간 때문에 출력 전류의 부족을 초래할 수 있다. 이러한 출력 전류의 부족은 논리적 펄스 폭 변조(pulse width modulation, PWM) 다밍 신호의 부과된 듀티 사이클과 출력 전류의 유효 듀티 사이클 사이의 갭을 유발할 수 있으며, 이는 각 기능의 평균 전류의 부정확성을 초래한다.

- [0010] 비용 최적화 시스템에서 펄스 폭 변조 디밍 전류 부정확성을 보상하기 위해, 일부 시스템은 (목표 평균 전류와 실현된 출력 전류 간의 갭을 측정하기 위해) 출력 전류의 지속적인 모니터링과, 목표 평균 전류와 실현된 출력 전류 사이의 갭을 보상하기 위해 LED 드라이버 제어기에 보다 높은 듀티 사이클 신호를 제공하는 마이크로컨트롤러를 사용할 수 있다. 이러한 시스템은 필연적으로 출력 전류 및 전압을 지속적으로 모니터링할 수 있고, 마이크로컨트롤러를 사용하여 LED 드라이버의 제어를 관리할 수 있고, 복잡한 소프트웨어를 사용하여 듀티 사이클을 적절히 설정하는 데 필요한 데이터의 수집 및 정교화를 관리할 수 있다. 또한, 이러한 시스템은 보다 작은 LED 세트(예를 들어, 더 작은 LED들, 더 작은 LED들 등)에서 보다 큰 LED 세트로 전환할 때 전류를 제공하지 못할 수 있으며, 이는 그 시스템에 의해 관리가능한 최대 듀티 사이클을 제한할 수 있다.
- [0011] 일부 시스템은, 펄스 폭 변조 디밍 전류 부정확성을 보상하기 위해 마이크로컨트롤러 또는 마이크로프로세서에 의존하기보다는, 각각의 LED 세트를 독립적으로 바이패스하고 각각의 LED 세트를 동작시키기 위한 목표 전력을 초과하는 전력을 독립적으로 소산하도록 구성된 분기 스위치를 포함할 수 있다. 예를 들어, 제 1 분기 스위치는 제 1 분기 스위치의 저항을 증가시키도록 동작할 수 있어서, 제 1 LED 세트를 동작시키기 위한 목표 전력을 초과하는 전력은 제 1 분기 스위치에서 소산될 수 있다. 이와 같이, 분기 스위치는, 예를 들어, LED 세트를 비활성화시킬 때 지면을 효과적으로 도입함으로써, 다른 시스템의 출력 전류 부족을 완화하는 데 도움을 줄 수 있다. 더욱이, 제어 모듈은 PWM 디밍 신호의 턴 오프를 지연시켜, 로직 PWM 디밍 신호의 부과된 듀티 사이클과 출력 전류의 유효 듀티 사이클 간의 갭을 감소 또는 제거하도록 구성될 수 있다.
- [0012] 도 1은 본 개시의 하나 이상의 기술에 따라, 제 1 LED 세트(104)와 제 2 LED 세트(106) 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 예시적인 시스템(100)을 나타내는 블록도이다. 도 1의 이 예에 도시된 바와 같이, 시스템(100)은 전력 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2 분기 스위치(110)(이들 스위치는 집합적으로, 시리즈 모듈(112)로 지칭됨), 및 제어 모듈(114)을 포함할 수 있다. 시스템(100)이 두 개의 LED 세트(예를 들어, 제 1 LED 세트(104) 및 제 2 LED 세트(106))를 도시하지만, 몇몇 예는 두 개 초과 LED 세트를 포함할 수 있다.
- [0013] 전력 모듈(102)은 시리즈 모듈(112)에 공급 전력을 출력하도록 구성될 수 있다. 일부 예에서, 전력 모듈(102)은 DC-DC 전력 변환기일 수 있거나 DC-DC 전력 변환기를 포함할 수 있다. 일부 예에서, 전력 모듈(102)은 목표 전력의 표시에 기초하여 공급 전력을 생성하도록 구성될 수 있다. 예를 들어, 전력 모듈(102)은 제어 모듈(114)에 의해 출력되는 목표 전력에 기초하여 공급 전력을 생성하도록 구성될 수 있다. 전력 모듈(102)은, 플라이백(flyback), 벡 부스트(buck-boost), 벡(buck), 쿡(Cuk) 등을 포함하지만 이에 한정되지 않는 하나 이상의 스위치 모드 전력 변환기를 포함할 수 있다. 전력 모듈(102)은 하나 이상의 에너지 저장 컴포넌트(예를 들어, 인덕터, 캐패시터 또는 또 다른 에너지 저장 컴포넌트)를 스위치 온 및 아웃하는 하나 이상의 스위칭 엘리먼트를 포함할 수 있다.
- [0014] 제 1 LED 세트(104)는 임의의 수의 LED를 포함할 수 있다. 일부 예에서, 제 1 LED 세트(104)의 두 개 이상의 LED는 직렬로 결합될 수 있다. 부가적으로, 또는 대안으로, 제 1 LED 세트(104)의 두 개 이상의 LED는 병렬로 결합될 수 있다. 유사하게, 제 2 LED 세트(106)는 임의의 수의 LED를 포함할 수 있다. 일부 예에서, 제 2 LED 세트(106)의 두 개 이상의 LED는 직렬로 결합될 수 있다. 부가적으로, 또는 대안으로, 제 2 LED 세트(106)의 두 개 이상의 LED는 병렬로 결합될 수 있다.
- [0015] 도 1의 예에서, 제 2 LED 세트(106)는 제 1 LED 세트(104)를 활성화시키는 전압보다 제 2 LED 세트(106)를 활성화시키는 더 높은 전압과 관련된다. 예를 들어, 제 2 LED 세트(106)는 제 1 LED 세트(104)보다 더 많은 양의 LED를 포함할 수 있다. 부가적으로, 또는 대안으로, 제 2 LED 세트(106)는 제 1 LED 세트(104)의 LED보다 높은 순방향 전압을 갖는 하나 이상의 LED를 포함할 수 있다. 일부 예에서, 제 2 LED 세트(106)는 제 1 LED 세트(104)보다는 높은 순방향 전압을 가질 수 있다. 도 1은 두 개의 분기를 도시하고 있지만, 'n'개의 분기가 사용될 수 있으며, 여기서 'n'은 1보다 큰 임의의 정수 값이다. 예를 들어, 일부 예는 제각기의 LED 세트에 각각 결합되는 세 개의 분기를 포함할 수 있다.
- [0016] 본원에 사용된 바와 같이, LED는 임의의 반도체 광원을 지칭할 수 있다. 일부 예에서, LED는 활성화될 때 광을 방출하도록 구성된 p-n 접합을 포함할 수 있다. 예시적인 애플리케이션에서, 제 1 LED 세트(104) 및/또는 제 2 LED 세트(106)는 자동차 애플리케이션 용 헤드라이트 어셈블리에 포함될 수 있다. 예를 들어, 제 1 LED 세트(104) 및/또는 제 2 LED (106)는 차량의 전방의 도로를 조명하는 LED 매트릭스일 수 있다. 일부 예에서, 제 1 LED 세트(104) 및/또는 제 2 LED 세트(106)는 하나 이상의 빔 설정과 관련될 수 있다. 예를 들어, 제 1 LED 세트(104)는 로우 빔 및/또는 하이 빔을 제공하도록 구성될 수 있다. 일부 예에서, 제 2 LED 세트(106)는 주간

주행 조명을 제공하도록 구성될 수 있다.

- [0017] 제 1 분기 스위치(108)는, 제 1 LED 세트(104)로의 전류를 차단하고 제 1 LED 세트(104)로의 출력을 위해 전력 모듈(102)에 의해 출력되는 출력을 소산시키는 데 적합한 임의의 디바이스를 포함할 수 있다. 일부 예에서, 제 1 분기 스위치(108)는 스위칭 엘리먼트를 포함할 수 있다. 스위칭 엘리먼트의 예는 실리콘 제어형 정류기(SCR), 전계 효과 트랜지스터(FET) 및 바이폴라 접합 트랜지스터(BJT)를 포함할 수 있지만, 이에 한정되는 것은 아니다. FET의 예는 JFET (Junction Field Effect Transistor), MOSFET, 듀얼 게이트 MOSFET, 절연 게이트 바이폴라 트랜지스터(IGBT), 임의의 다른 유형의 FET, 또는 이들의 임의의 조합을 포함할 수 있지만, 이에 한정되는 것은 아니다. MOSFET의 예는 PMOS, NMOS, DMOS, 또는 임의의 다른 유형의 MOSFET, 또는 이들의 임의의 조합을 포함할 수 있지만, 이에 한정되는 것은 아니다. BJT의 예는 PNP, NPN, 해태로결합, 또는 임의의 다른 유형의 BJT, 또는 이들의 임의의 조합을 포함할 수 있지만, 이에 한정되는 것은 아니다. 스위칭 엘리먼트는 하이측 스위치 또는 로우측 스위치일 수 있음을 이해해야 한다. 또한, 스위칭 엘리먼트는 전압 제어형 및/또는 전류 제어형일 수 있다. 전류 제어형 스위칭 엘리먼트의 예는 갈륨 질화물(GaN) MOSFET, BJT 또는 다른 전류 제어형 엘리먼트를 포함할 수 있지만, 이에 한정되는 것은 아니다.
- [0018] 제 1 분기 스위치(108)는 전력 모듈(102)로부터 출력되는 전력("Psupply")이 제 1 분기 스위치(108)를 통해 제 1 LED 세트(104)로 흐르도록 활성화될 수 있다. 일부 예에서, 제 1 분기 스위치(108)는 전력 모듈(102)로부터 출력되는 전력("Psupply")의 일부를 소산시키고 목표 전력("Ptarget1")을 제 1 LED 세트(104)에 출력하도록 활성화될 수 있다. 예를 들어, 제 1 분기 스위치(108)의 저항은, 전력 모듈(102)로부터 출력되는 전력("Psupply")의 일부를 소산시켜 제 1 LED 세트(104)에 출력되는 최종 전력이 목표 전력("Ptarget1")에 대응하도록 수정될 수 있다.
- [0019] 유사하게, 제 2 분기 스위치(110)는, 제 2 LED 세트(106)로의 전류를 차단하고 제 2 LED 세트(106)로의 출력을 위해 전력 모듈(102)에 의해 출력되는 출력을 소산시키는 데 적합한 임의의 디바이스를 포함할 수 있다. 일부 예에서, 제 2 분기 스위치(110)는 스위칭 엘리먼트를 포함할 수 있다.
- [0020] 제 2 분기 스위치(110)는 전력 모듈(102)로부터 출력되는 전력("Psupply")이 제 2 분기 스위치(110)를 통해 제 2 LED 세트(106)로 흐르도록 활성화될 수 있다. 일부 예에서, 제 2 분기 스위치(110)는 전력 모듈(102)로부터 출력되는 전력("Psupply")의 일부를 소산시키고 목표 전력("Ptarget2")을 제 2 LED 세트(106)에 출력하도록 활성화될 수 있다. 예를 들어, 제 2 분기 스위치(110)의 저항은, 전력 모듈(102)로부터 출력되는 전력("Psupply")의 일부를 소산시켜 제 2 LED 세트(106)에 출력되는 최종 전력이 목표 전력("Ptarget2")에 대응하도록 수정될 수 있다.
- [0021] 제어 모듈(114)은 전력 모듈(102)을 제어하도록 구성될 수 있다. 예를 들어, 제어 모듈(114)은, 제 1 LED 세트(104)를 활성화하고 제 2 LED 세트(106)를 비활성화하라는 명령을 수신하는 것에 응답하여, 제 1 LED 세트(104)에 대응하는 목표 전압, 목표 전류, 및/또는 목표 전력을 출력하도록 전력 모듈(102)을 구동할 수 있다. 유사하게, 제어 모듈(114)은, 제 1 LED 세트(104)를 비활성화하고 제 2 LED 세트(106)를 활성화하라는 명령을 수신하는 것에 응답하여, 제 2 LED 세트(106)에 대응하는 목표 전압, 목표 전류, 및/또는 목표 전력을 출력하도록 전력 모듈(102)을 구동할 수 있다.
- [0022] 제어 모듈(114)은 제 1 분기 스위치(108)를 제어하도록 구성될 수 있다. 예를 들어, 제어 모듈(114)은 전력이 전력 모듈(102)로부터 제 1 LED 세트(104)로 흐르도록 제 1 분기 스위치(108)를 활성화하기 위해, 제 1 분기 스위치(108)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다. 제어 모듈(114)은 전력 모듈(102)로부터 제 1 LED 세트(104)로 전력이 흐르지 못하도록 제 1 분기 스위치(108)를 비활성화시키기 위해, 제 1 분기 스위치(108)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다. 일부 예에서, 제어 모듈(114)은, 전력 모듈(102)에 의해 출력되는 전력의 일부를 소산시키고 전력 모듈(102)에 의해 출력되는 전력의 나머지 부분("Ptarget1")이 전력 모듈(102)에서 제 1 LED 세트(104)로 흐를 수 있도록 제 1 분기 스위치(108)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다.
- [0023] 제어 모듈(114)은 제 2 분기 스위치(110)를 제어하도록 구성될 수 있다. 예를 들어, 제어 모듈(114)은 전력이 전력 모듈(102)로부터 제 2 LED 세트(106)로 흐르도록 제 2 분기 스위치(110)를 활성화하기 위해, 제 2 분기 스위치(110)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다. 제어 모듈(114)은 전력 모듈(102)로부터 제 2 LED 세트(106)로 전력이 흐르지 못하도록 제 2 분기 스위치(110)를 비활성화시키기 위해, 제 2 분기 스위치(110)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다.

있다. 일부 예에서, 제어 모듈(114)은, 전력 모듈(102)에 의해 출력되는 전력의 일부를 소산시키고 전력 모듈(102)에 의해 출력되는 전력의 나머지 부분("Ptarget2")이 전력 모듈(102)에서 제 2 LED 세트(106)로 흐를 수 있도록 제 2 분기 스위치(110)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다.

[0024] 본원에 설명된 하나 이상의 기술에 따라, 전력 모듈(102)로부터 출력되는 전압이 제 2 LED 세트(106)를 활성화하기 위해 임계치 전압값(예를 들어, 순방향 전압)으로 증가하는 동안 전력 모듈(102)로부터 제 1 LED 세트(104) 및 제 2 LED 세트(106)로 전력 또는 전류를 출력하지 않는 대신, 제어 모듈(114)은 제 2 분기 스위치(110)에서의 전류가 전류 임계치를 초과할 때까지는 제 1 분기 스위치(108)의 비활성화를 지연시킬 수 있다.

[0025] 예를 들어, 제어 모듈(114)은 제 1 상태에서 제 2 상태로 변경하라는 명령을 수신할 수 있다. 제 1 상태 동안, 제 1 분기 스위치(108)는 제 1 LED 세트(104)에 전력을 공급하도록 활성화되고, 제 2 분기 스위치(110)는 제 2 LED 세트(106)에 전력을 공급하는 것을 금지하도록 비활성화된다. 제 2 상태 동안, 제 1 분기 스위치(108)는 제 1 LED 세트(104)에 전력을 공급하는 것을 금지하도록 비활성화되고 제 2 분기 스위치(110)는 제 2 LED 세트(106)에 전력을 공급하도록 활성화된다.

[0026] 제 1 상태에서 제 2 상태로 변경하라는 명령을 수신하는 것에 응답하여, 제어 모듈(114)은 제 2 분기 스위치(110)를 활성화할 수 있다. 예를 들어, 제어 모듈(114)은 제 2 분기 스위치(110)를 활성화하여 전력이 전력 모듈(102)로부터 제 2 LED 세트(106)로 흐르도록 한다.

[0027] 제 1 상태에서부터 제 2 상태로 변경하라는 명령을 수신하는 것에 응답하여, 제어 모듈(114)은 전력 모듈(102)을 구동하여 공급 전압을 증가시킴으로써 제 2 LED 세트(106)를 활성화시키기 위한 공급 전력을 제공하도록 구성될 수 있다. 예를 들어, 제어 모듈(114)은 제 1 LED 세트(104)에서 활성화된 LED의 양과 비교하여 제 2 LED 세트(106)에서 활성화된 LED의 양의 증가에 기초하여 전력 모듈(102)에 출력되는 기준 신호를 증가시킬 수 있다. 예를 들어, 제어 모듈(114)은 제 1 LED 세트(104)에서 활성화된 LED의 양과 비교하여 제 2 LED 세트(106)에서 활성화된 LED의 양의 증가에 기초하여 전력 모듈(102)에 출력되는 기준 신호를 감소시킬 수 있다(예를 들어, 단일 감지할 수 있다). 일부 예에서, 제어 모듈(114)은 제 1 LED 세트(104)에서 활성화된 LED의 양에 비교하여 제 2 LED 세트(106)에서 활성화된 LED의 양의 증가에 기초하여 전력 모듈(102)에 출력되는 기준 신호를 유지할 수 있다(예를 들어, 이중 감지할 수 있다).

[0028] 제 1 상태에서부터 제 2 상태로 변경하라는 명령을 수신하는 것에 응답하여, 제어 모듈(114)은 제 1 분기 스위치(108)를 구동하여 공급 전력의 일부를 소산함으로써, 제 2 분기 스위치(110)에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여 제 1 LED 세트(104)를 활성화하기 위한 목표 전력을 제공한다. 예를 들어, 제어 모듈(114)은, 전력 모듈(102)에 의해 출력되는 전력의 일부를 소산시키고 전력 모듈(102)에 의해 출력되는 전력의 나머지 부분("Ptarget1")이 전력 모듈(102)에서 제 1 LED 세트(104)로 흐를 수 있도록 제 1 분기 스위치(108)의 스위칭 엘리먼트의 제어 노드(예를 들어, 게이트)에서의 전압을 구동할 수 있다.

[0029] 제 1 상태에서부터 제 2 상태로 변경하라는 명령을 수신하는 것에 응답하여, 제어 모듈(114)은 제 2 분기 스위치(110)에서의 전류가 전류 임계치를 초과하는 것으로 결정한 것에 응답하여 제 1 분기 스위치(108)를 비활성화시킬 수 있다. 예를 들어, 제어 모듈(114)은 제 1 분기 스위치(108)를 비활성화하여 전력이 전력 모듈(102)로부터 제 1 LED 세트(104)로 흐르는 것을 금지하도록 한다. 이러한 방식으로, 분기 스위치(108 및 110)는, 예를 들어, 제 1 LED 세트(104)를 비활성화시키는데 있어 지연을 효과적으로 도입함으로써 출력 전류의 부족을 완화하는 데 도움을 줄 수 있다.

[0030] 도 2는 본 개시의 하나 이상의 기술에 따라, 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 제 1 예시적인 회로를 나타내는 개념도이다. 도시된 바와 같이, 회로(200)는 전력 모듈(202), 제 1 LED 세트(204), 제 2 LED 세트(206), 제 1 분기 스위치(208) 및 제 2 분기 스위치(210)(여들 스위치는 집합적으로 시리즈 모듈(212)로 지칭됨), 제어 모듈(214), 전력 소스(216), 바이패스 스위치(220), 감지 엘리먼트(222), 및 캐패시터(226 및 228)를 포함한다. 제어 모듈(214)은 도 1의 제어 모듈(114)의 예일 수 있다.

[0031] 일부 예에서, 감지 엘리먼트(222)는 저항성 엘리먼트를 포함할 수 있다. 도시된 바와 같이, 감지 엘리먼트(222)는 제 1 분기 스위치(208)와 직렬로 결합된다. 또한, 감지 엘리먼트(222)는 제 2 분기 스위치(210)와 직렬로 결합된다. 도 2의 예에서는, 상이한 수량의 LED 번호와 함께(예를 들어, 제 1 LED 세트(204)를 활성화시키고 제 2 LED 세트(206)를 활성화시키는) 두 개의 기능이 있다. 예를 들어, 제 1 LED 세트(204)와 비교하여

제 2 LED 세트(206)의 더 큰 크기의 LED에 의해 표시된 바와 같이, 제 2 LED 세트(206)는 제 1 LED 세트(204)보다 높은 전력을 사용한다. 일부 예에서, 제 2 LED 세트(206)는 제 1 LED 세트(204)보다 낮은 전압을 사용할 수 있다.

[0032] 제어 모듈(114)은 로직 모듈(236), 전류 모니터 모듈(230), PWM 엔진(232) 및 드라이버 모듈(234)을 포함한다. 전류 모니터 모듈(230)은 제 1 분기 스위치(208) 및/또는 제 2 분기 스위치(210)에서의 전류를 결정할 수 있다. 예를 들어, 전류 모니터 모듈(230)은 감지 엘리먼트(222)에서의 전압을 결정할 수 있다. 이 예에서, 전류 모니터 모듈(230)은 감지 엘리먼트(222)에서의 전압에 기초하여 전력 모듈(202)로부터 흐르는 전류를 결정할 수 있다. 제 1 분기 스위치(208)가 비활성화되고 제 2 분기 스위치(210)가 활성화되는 경우, 전류 모니터 모듈(230)은 감지 엘리먼트(222)에서의 전압에 비례하여 제 2 분기 스위치(210)에서의 전류를 추정할 수 있다. 유사하게, 제 1 분기 스위치(208)가 활성화되고 제 2 분기 스위치(210)가 비활성화되는 경우, 전류 모니터 모듈(230)은 감지 엘리먼트(222)에서의 전압에 비례하여 제 1 분기 스위치(208)에서의 전류를 추정할 수 있다. 유사하게, 제 1 분기 스위치(208)가 활성화되고 제 2 분기 스위치(210)가 활성화되는 경우, 전류 모니터 모듈(230)은 감지 엘리먼트(222)에서의 전압에 비례하여 제 1 분기 스위치(208) 및 제 2 분기 스위치(210)에서의 전류를 추정할 수 있다. 일부 예에서, 전류 모니터 모듈(230)은 제 1 분기 스위치(208)에서의 전류가 제 1 분기 스위치(208)에 대한 임계치 아래 또는 위에 있다는 표시를 출력할 수 있다. 일부 예에서, 전류 모니터 모듈(230)은 제 2 분기 스위치(210)에서의 전류가 제 2 분기 스위치(210)에 대한 임계치 아래 또는 그 위에 있다는 표시를 출력할 수 있다. 일부 예에서, 전류 모니터 모듈(230)은 제 1 분기 스위치(208) 및 제 2 분기 스위치(210)에서의 전류가 제 1 분기 스위치(208) 및 제 2 분기 스위치(210)에 대한 임계치 아래 또는 그 위에 있다는 표시를 출력할 수 있다.

[0033] 로직 모듈(236)은 활성화될 제 1 LED 세트(204) 및 제 2 LED 세트(206)의 LED의 목표 수량을 결정하도록 구성될 수 있다. 로직 모듈(236)은 회로(200)의 빔 설정을 하이 빔 설정으로부터 로우 빔 설정으로 변경하기 위한 표시를 (예를 들어, 회로(200)와의 사용자 상호 작용으로부터) 수신할 수 있다. 예를 들어, 로직 모듈(236)은 활성화될 LED의 수량의 표시를 수신하고 LED의 수량에 기초하여 목표 전력의 표시를 출력할 수 있다. 예를 들어, 하드웨어 사용자 인터페이스로부터, 로우 빔(LB) 입력에서의 저전압(예를 들어, 논리 0), 하이 빔(HB) 입력에서의 저전압(예를 들어, 논리 0), 및 주간 주행 조명(DRL) 입력에서의 고전압(예를 들어, 논리 1)을 수신하는 것에 응답하여, 로직 모듈(236)은 제 1 LED 세트(204)의 LED(204A-204D)를 활성화시키는 전력에 대응하는 목표 전력의 표시를 출력할 수 있다. 그러나, 하드웨어 사용자 인터페이스로부터, 로우 빔(LB) 입력에서의 고전압(예를 들어, 논리 1), 하이 빔(HB) 입력에서의 고전압(예를 들어, 논리 1), 및 주간 주행 조명(DRL) 입력에서의 저전압(예를 들어, 논리 0)을 수신하는 것에 응답하여, 로직 모듈(236)은 제 2 LED 세트(206)의 LED(206A-206B)를 활성화시키는 전력에 대응하는 목표 전력의 표시를 출력할 수 있다.

[0034] 부가적으로, 또는 대안으로, 로직 모듈(236)은 다가오는 자동차를 나타내는 센서 데이터에 응답하여 회로(200)의 빔 설정을 하이 빔 설정에서 로우 빔 설정으로 변경하도록 결정할 수 있다. 임의의 경우에, 회로(200)의 빔 설정을 결정하는 것에 응답하여, 로직 모듈(236)은 빔 설정에 대응하는 부하 유닛의 수량을 결정할 수 있다. 예를 들어, 로직 모듈(236)은 로우 빔 설정이 LED(206A)에만 관련되어 있을 때 LED의 목표 수량은 1이라고 결정할 수 있고, 로직 모듈(236)은 하이 빔 설정이 LED(206B)와 관련될 때 LED의 목표 수량은 2인 것으로 결정할 수 있다. 일부 예에서, 로직 모듈(236)은 아날로그 회로를 포함할 수 있다. 일부 예에서, 로직 모듈(236)은 하나 이상의 로직 엘리먼트 및/또는 타이밍 엘리먼트를 포함하는 디지털 회로일 수 있다.

[0035] 로직 모듈(236)은 LED의 목표 수량에 기초하여 목표 전력을 나타내는 기준 신호(예를 들어, 보상 전압)를 생성하도록 구성될 수 있다. 예를 들어, 로직 모듈(236)은 활성화될 LED의 목표 수량에 기초하여 기준 신호를 생성할 수 있다. 예를 들어, 로직 모듈(236)은 LED의 수량이 증가함에 따라 기준 신호를 증가시키고 LED의 수량이 감소함에 따라 기준 신호를 감소시킬 수 있다.

[0036] 부가적으로, 또는 대안으로, 로직 모듈(236)은 활성화될 LED의 전력 소비, 순방향 전압, 및/또는 평균 전류에 기초하여 기준 신호를 생성할 수 있다. 예를 들어, 로직 모듈(236)은 이전에 활성화된 LED와 비교하여 LED의 높은 전력 소비, 순방향 전압, 및/또는 평균 전류를 갖는 LED로 스위칭할 때 기준 신호를 증가시킬 수 있고, 이전에 활성화된 LED와 비교하여 LED의 낮은 전력 소비, 순방향 전압, 및/또는 평균 전류를 갖는 LED로 스위칭할 때 기준 신호를 감소시킬 수 있다.

[0037] 로직 모듈(236)은 제 1 LED 세트(204)를 활성화하기 위해 제 1 명령 PWM 신호를 생성할 수 있다. 예를 들어, 로직 모듈(236)은 목표 전력에 기초하여 제 1 명령 PWM 신호에 대한 듀티 사이클을 결정할 수 있다. 예를

들어, 로직 모듈(236)은 제 1 LED 세트(204)의 휘도를 감소시키기 위해 제 1 명령 PWM 신호의 듀티 사이클을 감소시킴으로써 다밍 기능을 수행할 수 있다. 유사하게, 로직 모듈(236)은 제 1 LED 세트(204)의 휘도를 증가시키기 위해 제 1 명령 PWM 신호의 듀티 사이클을 증가시킴으로써 브라이더닝 기능(brightening function)을 수행할 수 있다. 어느 경우여나, 로직 모듈(236)은 PWM 엔진(232)에 제 1 명령 PWM 신호를 출력할 수 있다.

[0038] 유사하게, 로직 모듈(236)은 제 2 LED 세트(206)를 활성화하기 위한 제 2 명령 PWM 신호를 생성할 수 있다. 예를 들어, 로직 모듈(236)은 목표 전력에 기초하여 제 2 명령 PWM 신호에 대한 듀티 사이클을 결정할 수 있다. 예를 들어, 로직 모듈(236)은 제 2 LED 세트(206)의 휘도를 감소시키기 위해 제 2 명령 PWM 신호의 듀티 사이클을 감소시킴으로써 다밍 기능을 수행할 수 있다. 유사하게, 로직 모듈(236)은 제 2 LED 세트(206)의 휘도를 증가시키기 위해 제 2 명령 PWM 신호의 듀티 사이클을 증가시킴으로써 브라이더닝 기능을 수행할 수 있다. 어느 경우여나, 로직 모듈(236)은 PWM 엔진(232)에 제 2 명령 PWM 신호를 출력할 수 있다.

[0039] 일부 예에서, 로직 모듈(236)은 제 1 LED 세트(204)의 LED(206B)를 활성화하기 위한 제 3 명령 PWM 신호를 선택적으로 생성할 수 있다. 예를 들어, 로직 모듈(236)은 목표 전력에 기초하여 제 3 명령 PWM 신호에 대한 듀티 사이클을 결정할 수 있다. 예를 들어, 로직 모듈(236)은 LED(206B)의 휘도를 감소시키기 위해 제 3 명령 PWM 신호의 듀티 사이클을 감소시킴으로써 다밍 기능을 수행할 수 있다. 유사하게, 로직 모듈(236)은 LED(206B)의 휘도를 증가시키기 위해 제 3 명령 PWM 신호의 듀티 사이클을 증가시킴으로써 브라이더닝 기능을 수행할 수 있다. 어느 경우여나, 로직 모듈(236)은 PWM 엔진(232)에 제 3 명령 PWM 신호를 출력할 수 있다.

[0040] PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 1 명령 PWM 신호에 기초하여 제 1 PWM 신호("PWM1")를 생성할 수 있다. 예를 들어, PWM 엔진(232)은 전력 모듈(202)에서의 저전압(undervoltage)을 보상하기 위해 제 1 PWM 신호를 생성할 수 있다. 아래에서 추가로 설명되는 바와 같이, PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 1 명령 PWM 신호의 듀티 사이클에 대응하는(예를 들어, 동일하고, 매칭하는 등) 유효 듀티 사이클을 갖도록 제 1 PWM 신호를 생성할 수 있다.

[0041] 유사하게, PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 2 명령 PWM 신호에 기초하여 제 2 PWM 신호("PWM2")를 생성할 수 있다. 예를 들어, PWM 엔진(232)은 전력 모듈(202)에서의 저전압을 보상하기 위해 제 2 PWM 신호를 생성할 수 있다. 아래에서 추가로 설명되는 바와 같이, PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 2 명령 PWM 신호의 듀티 사이클에 대응하는(예를 들어, 동일하고, 매칭하는 등) 유효 듀티 사이클을 갖도록 제 2 PWM 신호를 생성할 수 있다.

[0042] 일부 예에서, PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 3 명령 PWM 신호에 기초하여 제 3 PWM 신호("PWM3")를 선택적으로 생성할 수 있다. 예를 들어, PWM 엔진(232)은 전력 모듈(202)에서의 저전압을 보상하기 위해 제 3 PWM 신호를 생성할 수 있다. 아래에서 추가로 설명되는 바와 같이, PWM 엔진(232)은 로직 모듈(236)에 의해 출력된 제 3 명령 PWM 신호의 듀티 사이클에 대응하는(예를 들어, 동일하고, 매칭하는 등) 유효 듀티 사이클을 갖도록 제 3 PWM 신호를 생성할 수 있다.

[0043] 드라이버 모듈(234)은 제 1 PWM 신호에 기초하여 제 1 분기 스위치(208)를 활성화시키기 위한 구동 신호를 생성할 수 있다. 예를 들어, 드라이버 모듈(234)은 제 1 PWM 신호의 상승 에지 동안 제 1 분기 스위치(208)를 활성화하기 위해 제 1 분기 스위치(208)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다. 드라이버 모듈(234)은 제 1 PWM 신호의 하강 에지 동안 제 1 분기 스위치(208)를 비활성화시키기 위해 제 1 분기 스위치(208)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다.

[0044] 유사하게, 드라이버 모듈(234)은 제 2 PWM 신호에 기초하여 제 2 분기 스위치(210)를 활성화시키기 위한 구동 신호를 생성할 수 있다. 예를 들어, 드라이버 모듈(234)은 제 2 PWM 신호의 상승 에지 동안 제 2 분기 스위치(210)를 활성화하기 위해 제 2 분기 스위치(210)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다. 드라이버 모듈(234)은 제 2 PWM 신호의 하강 에지 동안 제 2 분기 스위치(210)를 비활성화시키기 위해 제 2 분기 스위치(210)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다.

[0045] 드라이버 모듈(234)은 제 3 PWM 신호에 기초하여 바이패스 스위치(220)를 활성화시키기 위한 구동 신호를 생성할 수 있다. 예를 들어, 드라이버 모듈(234)은 제 3 PWM 신호의 상승 에지 동안 바이패스 스위치(220)를 활성화하기 위해 바이패스 스위치(220)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다. 드라이버 모듈(234)은 제 3 PWM 신호의 하강 에지 동안 바이패스 스위치(220)를 비활성화시키기 위해 바이패스 스위치(220)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력할 수 있다.

[0046] 드라이버 모듈(234)은 제 1 분기 스위치(208)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력하여, 제 1

PWM 신호의 상승 에지 이후 및 제 1 PWM 신호의 후속하는 하강 에지 이전에 제 1 분기 스위치(208)에서 전력 모듈(202)에 의해 출력되는 전력의 일부를 소산시킬 수 있다. 일부 예에서, 드라이버 모듈(234)은 전류 임계치에 기초하여 제 1 LED 세트(204)를 활성화하기 위한 목표 전력을 제공하기 위해, 제 1 분기 스위치(208)를 구동하여 전력 모듈(202)로부터 공급 전력의 일부를 소산시킬 수 있다. 예를 들어, 드라이버 모듈(234)은 제 1 LED 세트(204)에서의 최대 전력을 제한하기 위해 제 1 분기 스위치(208)를 구동하도록 구성될 수 있다. 예를 들어, 드라이버 모듈(234)은 제 1 LED 세트(204)에서의 전류의 전력이 전류 임계치보다 클 때 제 1 분기 스위치(208)의 스위칭 엘리먼트를 구동하여 제 1 분기 스위치(208)에서의 저항을 증가시킬 수 있다. 일부 예에서, 드라이버 모듈(234)은 제 1 LED 세트(204)에서의 전력이 전력 임계치보다 작을 때 제 1 분기 스위치(208)의 스위칭 엘리먼트를 구동하여 제 1 분기 스위치(208)의 저항을 감소시킬 수 있다.

[0047] 드라이버 모듈(234)은 제 1 분기 스위치(210)의 제어 노드(예를 들어, 게이트)에 구동 신호를 출력하여, 제 2 PWM 신호의 상승 에지 이후 및 제 2 PWM 신호의 후속하는 하강 에지 이전에 제 2 분기 스위치(210)에서 전력 모듈(202)에 의해 출력되는 전력의 일부를 소산시킬 수 있다. 일부 예에서, 드라이버 모듈(234)은 전류 임계치에 기초하여 제 2 LED 세트(206)를 활성화하기 위한 목표 전력을 제공하기 위해, 제 2 분기 스위치(210)를 구동하여 전력 모듈(202)로부터의 공급 전력의 일부를 소산시킬 수 있다. 예를 들어, 드라이버 모듈(234)은 제 2 LED 세트(206)에서의 최대 전력을 제한하기 위해 제 2 분기 스위치(210)를 구동하도록 구성될 수 있다. 예를 들어, 드라이버 모듈(234)은 제 2 LED 세트(206)에서의 전류의 전력이 전류 임계치보다 클 때 제 2 분기 스위치(210)의 스위칭 엘리먼트를 구동하여 제 2 분기 스위치(210)에서의 저항을 증가시킬 수 있다. 일부 예에서, 드라이버 모듈(234)은 제 2 LED 세트(206)에서의 전력이 전력 임계치보다 작을 때 제 2 분기 스위치(210)의 스위칭 엘리먼트를 구동하여 제 2 분기 스위치(210)의 저항을 감소시킬 수 있다.

[0048] 도 3은 제 1 LED 세트와 제 2 LED 세트 간에 변경되는 시스템의 성능을 도시한다. 단지 예시의 목적으로, 도 3은 도 1의 시스템(100) 및 도 2의 회로(200)의 맥락에서 이하에 설명된다. 도 3의 횡축(예를 들어, 수평)은 시간을 나타내고, 도 3의 종축(예를 들어, 수직)은 전력 모듈(202)에서의 출력 전압(302), 전력 모듈(202)에 의해 출력된 출력 전류(304), LED(206A)에서의 출력 전류(306), LED(206B)에서의 출력 전류(308), 및 제 1 LED 세트(204)에서의 출력 전류(310)를 나타낸다.

[0049] 도 3의 예에서, 시간(340)에서, 로직 모듈(236)은 제 1 LED 세트(204)를 활성화하는 것("DRL"로 표시)으로부터 제 2 LED 세트(206)를 작동시키는 것("HB + LB")으로 변경한다. 그러나, 시간(340)에서, 전력 모듈(202)에 의해 출력되는 전압은 제 2 LED 세트(206)를 활성화하기 위한 순방향 전압보다 낮아서 출력 전류(330)의 부족을 초래한다. 유사하게, 시간(342)에서, 전력 모듈(202)에 의해 출력되는 전압은 제 1 LED 세트(204)를 활성화하기 위한 순방향 전압보다 작아서, 출력 전류(332)의 부족을 초래한다.

[0050] 도 4는 본 개시의 하나 이상의 기술에 따라, 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화시키는 시스템의 성능을 도시한다. 단지 예시의 목적으로, 도 4은 도 1의 시스템(100) 및 도 2의 회로(200)의 맥락에서 이하에 설명된다. 도 4의 횡축(예를 들어, 수평)은 시간을 나타내고, 도 4의 종축(예를 들어, 수직)은 전력 모듈(202)에서의 출력 전압(402), 전력 모듈(202)에 의해 출력된 출력 전류(404), LED(206A)에서의 출력 전류(406), LED(206B)에서의 출력 전류(408), 및 제 1 LED 세트(204)에서의 출력 전류(410)를 나타낸다.

[0051] 도 4의 예에서, 시간(440)에서, 로직 모듈(236)은 제 1 LED 세트(204)를 활성화하는 것("DRL"로 표시)로부터 제 2 LED 세트(206)를 작동시키는 것("HB + LB")으로 변경한다. 그러나, 제 1 LED 세트(204)를 즉시 비활성화시키는 대신에, PWM 엔진(232)은 PWM 신호를 생성하여 제 1 LED 세트(204) 및 제 2 LED 세트(206) 모두를 활성화시킨다. 도시된 바와 같이, 시간(440)에서, 전력 모듈(202)에 의해 출력되는 전압은 제 2 LED 세트(206)를 활성화하기 위한 순방향 전압보다 낮아서 제 2 LED 세트(206)에서 전류를 초래하지 않는다. 그러나, 도 4의 예에서, 시간(440)에서, 전류는 전력 모듈(202)이 전압을 증가시키는 동안 제 1 LED 세트(204)에 공급되며, 이는 도 3에 도시된 전류의 부족을 완화하는 것을 돕는다.

[0052] 또한, 앞서 논의된 바와 같이, 제 1 분기 스위치(208)는 전력 모듈(202)에 의해 공급되는 전력의 일부를 소산하여 제 1 LED 세트(204)에 공급되는 전류 및/또는 전력을 제한할 수 있다. 유사하게, 시간(442)에, 전류는 전력 모듈(202)이 전압을 증가시키는 동안 LED(206A)에 공급된다.

[0053] 도 5는 본 개시에 따라, 도 1의 예시적인 시스템에 의해 수행될 수 있는 기술에 부합하는 흐름도이다. 단지 예시의 목적으로, 도 5은 도 1의 시스템(100)과 도 2의 회로(200)의 맥락에서 이하에 설명된다. 그러나, 아래에 설명되는 기술은 전력 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2

분기 스위치(110)(이들 스위치는 집합적으로, 시리즈 모듈(112)로 지칭됨), 및 제어 모듈(114)과 함께 임의의 치환 및 임의의 조합으로 사용될 수 있다. 도 5는 도 6을 참조하여 설명된다.

- [0054] 도 6은 본 개시의 하나 이상의 기술에 따라, 도 5의 기술을 구현하는 시스템의 성능을 나타내는 도면이다. 도 6의 횡축(예를 들어, 수평)은 시간을 나타내고 도 6의 종축(예를 들어, 수직)은 제 2 분기 스위치(210)를 활성화하기 위해 로직 모듈(236)에 의해 출력되는 제 2 명령 PWM 신호(602), 제 2 분기 스위치(210)를 활성화하기 위해 PWM 엔진(232)에 의해 출력되는 제 2 PWM 신호(604), 제 1 분기 스위치(208)를 활성화하기 위해 로직 모듈(236)에 의해 출력되는 제 1 명령 PWM 신호(606), 제 1 분기 스위치(208)를 활성화하기 위해 PWM 엔진(232)에 의해 출력되는 제 1 PWM 신호(608), 제 2 분기 스위치(210)에서의 전류(610), 제 1 분기 스위치(208)에서의 전류(612), 및 전력 모듈(202)에서의 출력 전압(614)을 도시한다.
- [0055] PWM 엔진(232)은, 시간(640)에, 제 1 LED 세트(204)를 비활성화시키고 제 2 LED 세트(206)를 활성화시키는 제 1 상태에서부터, 제 1 LED 세트(204)를 활성화시키고 제 2 LED 세트(206)를 비활성화시키는 제 2 상태로 변경하라는 명령을 수신한다(502). 예를 들어, PWM 엔진(232)은 로직 모듈(236)로부터 제 1 명령 PWM 신호(606) 및 제 2 명령 PWM 신호(602)를 수신한다. 시간(640)에, PWM 엔진(232)은 제 1 분기 스위치(208)를 활성화시키고 카운트 값을 '0'으로 리셋한다(504). 예를 들어, PWM 엔진(232)은 시간(640)에 상승 에지를 갖는 제 1 PWM 신호(608)를 생성한다. PWM 엔진(232)은 카운트 값을 증가시킨다(506).
- [0056] 전류 모니터 모듈(230)은 제 1 분기 스위치(208)에서의 전류가 전류 임계치를 초과하는지의 여부를 결정한다(508). 제 1 분기 스위치(208)에서의 전류가 전류 임계치를 초과하지 않는다고 결정하는 것(508의 "no")에 응답하여, PWM 엔진(232)은 제 1 분기 스위치(208)를 활성화한 후에 발생하는 각각의 사이클마다 카운트 값을 증가시킨다(506).
- [0057] 그러나, 제 1 분기 스위치(208)에서의 전류가 전류 임계치를 초과한다고 결정하는 것(508의 "yes")에 응답하여, PWM 엔진(232)은 시간(642)에 제 2 LED 세트(206)를 비활성화시킨다(510). 예를 들어, PWM 엔진(232)은 시간(642)에 하강 에지를 갖는 제 2 PWM 신호(604)를 생성한다. 이 예에서, PWM 엔진(232)은, PWM 엔진(232)이 제 1 분기 스위치(208)를 비활성화할 때 발생하는 카운트 값에 기초하여, 제 1 분기 스위치(208)를 활성화하는 것과 제 2 분기 스위치(210)를 비활성화하는 것 사이의 대응하는 시간 지연을 결정할 수 있다.
- [0058] 시간(644)에, PWM 엔진(232)은 제 1 LED 세트(204)를 활성화시키고 제 2 LED 세트(206)를 비활성화시키는 제 2 상태에서부터, 제 1 LED 세트(204)를 비활성화시키고 제 2 LED 세트(206)를 활성화시키는 제 1 상태로 변경하라는 명령을 수신한다(512). 제 2 상태에서 제 1 상태로 변경하라는 명령에 응답하여, PWM 엔진(232)은 시간 지연까지는 제 2 상태에서 제 1 상태로 변경하는 것을 금지한다(514). 예를 들어, PWM 엔진(232)은 카운트 값까지는 제 2 상태에서 제 1 상태로 변경하는 것을 금지한다. 시간(646)에, PWM 엔진(232)은 제 1 LED 세트(204)를 활성화하고 제 2 LED 세트(206)를 비활성화하는 제 2 상태에서부터 제 1 LED 세트(204)를 비활성화하고 제 2 LED 세트(206)를 활성화하는 제 1 상태로 변경하며(516), 이 처리는 시간(648)에 502로 반복된다.
- [0059] 도 7은 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트(704)와 제 2 LED 세트(706) 간의 변경시에 출력 전류의 부족을 완화하도록 구성된 제 2 예의 회로(700)를 도시한 개념도이다. 도시된 바와 같이, 회로(700)는 전력 모듈(702), 제 1 LED 세트(704), 제 2 LED 세트(706), 제 1 분기 스위치(708) 및 제 2 분기 스위치(710)(이들 스위치는 집합적으로 시리즈 모듈(712)로 지칭됨), 제어 모듈(714), 전력 소스(716), 바이패스 스위치(720), 감지 엘리먼트(722), 및 캐패시터(726 및 200)를 포함하며, 이는 회로(200)의 컴포넌트와 유사할 수 있다. 그러나, 회로(700)는 감지 엘리먼트(724)를 더 포함한다.
- [0060] 일부 예에서, 감지 엘리먼트(722)는 저항성 엘리먼트를 포함할 수 있다. 도시된 바와 같이, 감지 엘리먼트(722)는 제 1 분기 스위치(708)와 직렬로 연결되고 감지 엘리먼트(724)는 제 2 분기 스위치(710)와 직렬로 결합된다. 도 7의 예에서는, 상이한 수량의 LED 턴오프와 함께(예를 들어, 제 1 LED 세트(704)를 활성화시키고 제 2 LED 세트(706)를 활성화시키는) 두 개의 기능이 있다. 예를 들어, 제 1 LED 세트(704)와 비교하여 제 2 LED 세트(706)의 더 큰 크기의 LED에 의해 표시된 바와 같이, 제 2 LED 세트(706)는 제 1 LED 세트(704)보다 높은 전력을 사용한다. 일부 예에서, 제 2 LED 세트(706)는 제 1 LED 세트(704)보다 낮은 전압을 사용할 수 있다.
- [0061] 도 2의 회로(200)와 대조적으로, 도 7의 예에서, 감지 엘리먼트(722 및 724)는 독립적인 감지 경로를 제공한다. 즉, 전류 모니터 모듈(730)은 감지 엘리먼트(722)에서의 전압의 표시(예를 들어, 비례 또는 스텝 다운 값)를 사용하여 제 1 분기 스위치(708)에서의 전류를 결정할 수 있다. 유사하게, 전류 모니터 모듈(730)은 감지 엘리먼트(724)에서의 전압의 표시(예를 들어, 비례 또는 스텝 다운 값)를 사용하여 제 2 분기 스위치(710)에서의 전류

를 결정할 수 있다. 이와 같이, 전류 모니터 모듈(730)은 감지 앰퍼먼트(722)에서의 전압에 의해 표시되는 전류 값이 전류 임계치를 초과할 때 제 1 분기 스위치(708)에서의 전류가 전류 임계치를 초과한다고 결정할 수 있다. 유사하게, 전류 모니터 모듈(730)은 감지 앰퍼먼트(724)에서의 전압에 의해 표시되는 전류 값이 전류 임계치를 초과할 때 제 2 분기 스위치(710)에서의 전류가 전류 임계치를 초과한다고 결정할 수 있다. 이러한 방식으로, 전류 모니터 모듈(730)은 제 1 LED 세트(704) 및 제 2 LED 세트(706)를 동작시키기 위한 제어 부트를 단기 위한 피드백을 제공할 수 있다.

이와 같이, 제어 모듈(714)은 각자의 모니터링 경로를 공유함으로써, 운영되는 전압의 점프 업(jump up)을 유도할 수 있고, 동시에 다른 분기가 전류를 도통하기 시작할 때까지 하나의 분기를 도통 상태로 유지할 수 있다. 도 5 및 도 6에서 이미 설명된 파와 같이, PWM 연산(732)은 제 1 LED 스트림(704) 상의 추가 전류를 보상하기 위해 부하된 제 1 PWM 신호 및 제 2 PWM 신호부터 사이클을 조합할 수 있다.

도 8은 제 1 LED 세트와 제 2 LED 세트 간에 변경되는 시스템의 상을 나타낸다. 단지 예시의 목적으로, 도 8은 도 1의 시스템(100)과 도 2의 회로(200)의 맥락에서 이하에 설명된다. 그러나, 아래에 설명되는 기술은 전 력 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2 분기 스위치(110)에 를 스위치로 결합적으로, 시리즈 모듈(112)로 지정됨), 및 제어 모듈(114)과 함께 임의의 치환 및 임의의 조합 으로 사용될 수 있다. 도 8의 회로(예를 들어, 수평)은 시간을 나타내고, 도 8의 중축(예를 들어, 수직)은 전 력 모듈(202)에서의 출력(802), 제어 모듈(214)의 보상 캐패시터에서의 보상된 전압(804), 제 1 LED 세트 (204)에서의 출력(806), 제 2 LED 세트(206)에서의 출력(808), 및 전력 모듈(202)의 입력에서의 입력터 전류(810)를 나타낸다.

도 3의 예에서, 시간(840)에, 로컬 모듈(236)은 보강된 전압(304)을 공급시키며, 이는 출력 전압(802) 및 입력 전압(810)을 구성시킨다. 그러나, 출력 전압(802)은 제 1 LED 칩(204)을 활성화하기 위한 순방향 전압보다 작아서, 출력 전류(820)의 부하를 초래한다.

도 9는 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트와 제 2 LED 세트 간의 변경시에 출력 전류의 부족을 완화시키는 시스템의 제 1 성도를 나타낸다. 단지 예시의 목적으로, 도 9은 도 1의 시스템(100), 도 2의 회로(200) 및 도 7의 회로(700)의 맥락에서 이하에 설명된다. 그러나, 아래에 설명되는 기술은 전류 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2 분기 스위치(110)(이를 스위치는 집합적으로, 시리얼 모듈(112)로 지칭됨), 및 제어 모듈(114)과 함께 임의의 치환 및 임의의 조합으로 사용될 수 있다. 도 9의 횡축(예를 들어, 수평)은 시간을 나타내고, 도 9의 종축(예를 들어, 수직)은 전류 모듈(702)에서의 출력 전압(902), 제어 모듈(714)의 보상 캐패시터에서의 보상된 전압(904), 제 1 LED 세트(704)에서의 출력 전류(906), 제 2 LED 세트(706)에서의 출력 전류(908), 및 전류 모듈(702)와 인덕터의 인덕터 전류(910)를 나타낸다.

도 9의 예에서, 시간(940)에, 로직 모듈(736)은 보정된 전압(904)을 상승시키며, 이는 출력 전압(902) 및 입력 전압(910)을 구성시킨다. PWM 엘리먼트(732)는 각기 엘리먼트(722)에서의 전압이 제 1 LED 세트(704)에서의 출력 전압(906)에 대해, 0.7 암페어를 초과할 때까지 제 2 분기 스위치(710)를 비활성화하는 것을 금지하며, 이는 도 8에 도시된 전류의 부족을 원하지도록 돕는다. 도 9의 예에서, PWM 엘리먼트(732)는 카운트 값에 기초하여 제 1 분기 스위치(708)를 활성화하는 것과 제 2 분기 스위치(710)를 비활성화하는 것 사이의 때을 하는 시간 지연(950)을 결정할 수 있다.

도 10은 본 개시의 하나 이상의 기술에 따라 제 1 LED 세트와 제 2 LED 세트 간의 변경자에 출력 전류의 부족을 완화시키는 시스탬의 제 2 상응도를 나타낸다. 단지 예시의 목적으로, 도 10은 도 1의 시스템(100), 도 2의 회로(200) 및 도 7의 회로(700)의 맥락에서 이하에 설명된다. 그러나, 아래에 설명되는 기술은 전류 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2 분기 스위치(110)의 다른 스위치는 전 함적으로, 시리드 모듈(112)로 지칭함), 및 제어 모듈(114)과 함께 임의의 전환 및 임의의 조합으로 사용될 수 있다. 도 10의 확률(예를 들어, 수평)은 시간을 나타내고, 도 10의 종축(예를 들어, 수직)은 전류 모듈(702)에 서의 출력 전압(1002), 제어 모듈(714)의 보상 캐패시터에서의 보상된 전압(1004), 제 1 LED 세트(704)에서의 출력 전류(1006), 제 2 LED 세트(706)에서의 출력 전류(1008), 및 전류 모듈(702)의 입력에서의 입력 전류 (1010)를 나타낸다.

(1010)를 나타낸다.

도 10의 예에서, PWM 열진(732)은 제 1 분기 스위치(768)를 활성화하는 것과 제 2 분기 스위치(710)를 비활성화하는 것 사이의 대응하는 추정된 시간 지연(1050)을 설명하기 위해, 진류 턴-온 PWM 에지로서 다음 턴-온 PWM 에지에 동일한 지연을 적용할 수 있다. 예를 들어, PWM 열진(232)은 도 9의 시간 지연(950)에 상응하도록 추정

된 시간 지연을 결정할 수 있다. 이러한 방식으로, PWM 엔진(732)은 목표 듀티 사이클을 정확하게 재공하면서 전력 모듈이 전압을 증가시키기 위한 시간을 충분히 허용할 수 있게 한다.

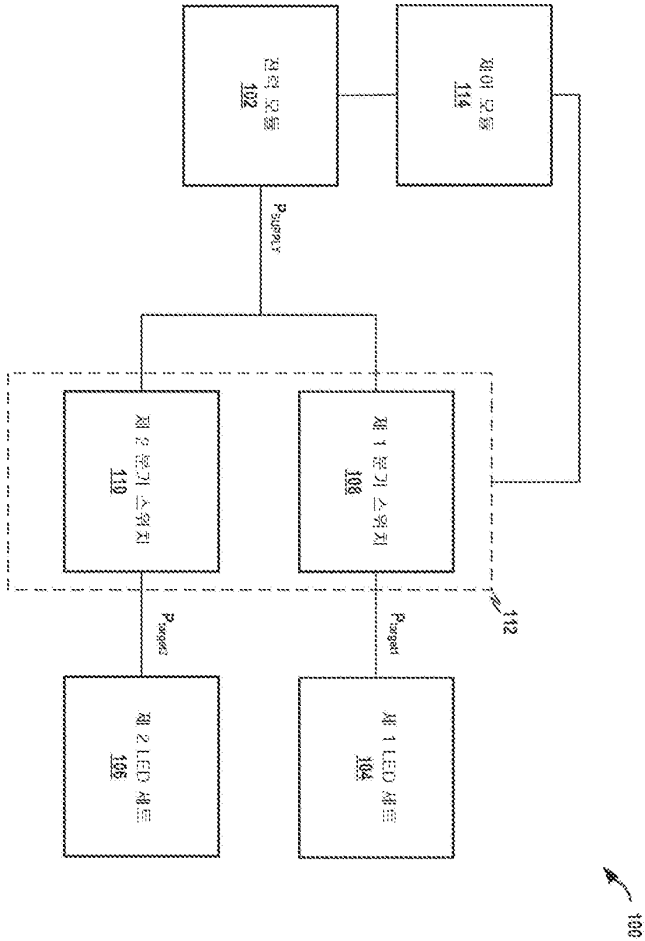
- [0069] 도 11은 본 개시에 따라, 도 1의 예시적인 시스템에 의해 수행될 수 있는 기술에 부합하는 흐름도이다. 단지 예시의 목적으로, 도 11은 도 1의 시스템(100), 도 2의 회로(200) 및 도 3의 회로(300)의 맥락에서 이하에 설명된다. 그러나, 아래에 설명되는 기술은 전력 모듈(102), 제 1 LED 세트(104), 제 2 LED 세트(106), 제 1 분기 스위치(108) 및 제 2 분기 스위치(110)(아들 스위치는 집합적으로, 시리즈 모듈(112)로 지칭됨), 및 제어 모듈(114)과 함께 임의의 치환 및 임의의 조합으로 사용될 수 있다.
- [0070] 본 개시의 하나 이상의 기술에 따르면, PWM 엔진(232)은 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정한다(1102). 예를 들어, PWM 엔진(232)은 제 1 상태에서 제 2 상태로 변경하라는 명령을 수신한다. 일부 예에서, PWM 엔진(232)은 제 1 상태에서 제 2 상태로 변경하라는 명령을 생성한다. PWM 엔진(232)은 제 2 분기 스위치(210)를 활성화시킨다(1104). 예를 들어, PWM 엔진(232)은 제 2 LED 세트(206)를 활성화하기 위한 제 2 PWM 신호를 생성할 수 있다. 로직 모듈(236)은 제 2 LED 세트(206)를 활성화시키기 위한 공급 전력을 제공하도록, 전력 모듈(202)을 구동하여 공급 전압을 증가시킬 수 있다(1106). 예를 들어, 로직 모듈(236)은 전력 모듈(202)에 대한 보상 캐패시터에서의 보상 전압을 증가시킬 수 있다.
- [0071] 드라이버 모듈(234)은 제 1 LED 세트(204)를 활성화하기 위한 목표 전력을 제공하기 위해, 제 1 분기 스위치(208)를 구동하여 공급 전력의 일부를 소산시킬 수 있다(1108). 예를 들어, 드라이버 모듈(234)은 제 1 LED 세트(204)를 활성화하기 위한 목표 전력을 제공하기 위해 제 1 분기 스위치(208)의 저항을 수정한다. 드라이버 모듈(234)은 제 2 분기 스위치(210)에서의 전류가 전류 임계치를 초과한다고 결정하는 것에 응답하여 제 1 분기 스위치(208)를 비활성화시킨다(1110).
- [0072] PWM 엔진(232)은 제 2 분기 스위치(210)를 활성화하는 것과 제 1 분기 스위치(208)를 비활성화하는 것 간의 차이에 대응하는 시간 지연을 결정한다(1112). 예를 들어, PWM 엔진(232)은 제 2 분기 스위치(210)를 활성화하는 것과 제 1 분기 스위치(208)를 비활성화하는 것 간의 각 사이클마다 증가되는 카운트 값을 결정한다. PWM 엔진(232)은 제 2 상태에서 제 1 상태로 변경하라는 명령을 수신한다(1114). PWM 엔진(232)은 시간 지연 후에 제 2 상태에서부터 제 1 상태로 변경한다(1116).
- [0073] 다음의 예는 본 개시의 하나 이상의 양태를 나타낼 수 있다.
- [0074] 예 1. 전류 또는 전력을 조절하기 위한 방법으로, 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 단계 - 상기 제 1 상태 동안, 제 1 발광 다이오드(LED) 세트에 전력을 공급하도록 제 1 분기 스위치가 활성화되고 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 와; 상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여: 상기 제 2 분기 스위치를 활성화하기 위해 전력 모듈을 구동하는 단계; 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 공급 전압을 증가시키는 단계; 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 제공하기 위해 상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 단계; 및 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다고 결정한 것에 응답하여 상기 제 1 분기 스위치를 비활성화하는 단계를 포함한다.
- [0075] 예 2. 예 1의 방법에서, 상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 단계는 목표 전력과 공급 전력 간의 차이에 기초하여 제 1 분기 스위치의 저항을 수정하는 단계를 포함한다.
- [0076] 예 3. 예 1 또는 예 2의 임의의 조합의 방법에서, 상기 제 1 상태에서부터 상기 제 2 상태로 변경하기 위한 시간 지연을 결정하는 단계와; 상기 제 2 상태에서부터 상기 제 1 상태로 변경하라는 명령에 응답하여: 상기 시간 지연 이전에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 금지하는 단계; 및 상기 시간 지연 후에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 단계를 더 포함한다.
- [0077] 예 4. 예 1 내지 예 3 중 임의의 조합의 방법에서, 상기 시간 지연을 결정하는 단계는, 상기 제 2 분기 스위치를 활성화한 후 및 상기 제 1 분기 스위치를 비활성화하기 전에 카운트 값을 증가시키는 단계를 포함한다.
- [0078] 예 5. 예 1 내지 예 4 중 임의의 조합의 방법에서, 상기 제 2 분기 스위치는 감지 엘리먼트와 직렬로 결합되며, 상기 방법은 감지 엘리먼트에서의 전압의 표시에 기초하여 상기 제 2 분기 스위치에서의 전류를 결정하는 단계

를 포함한다.

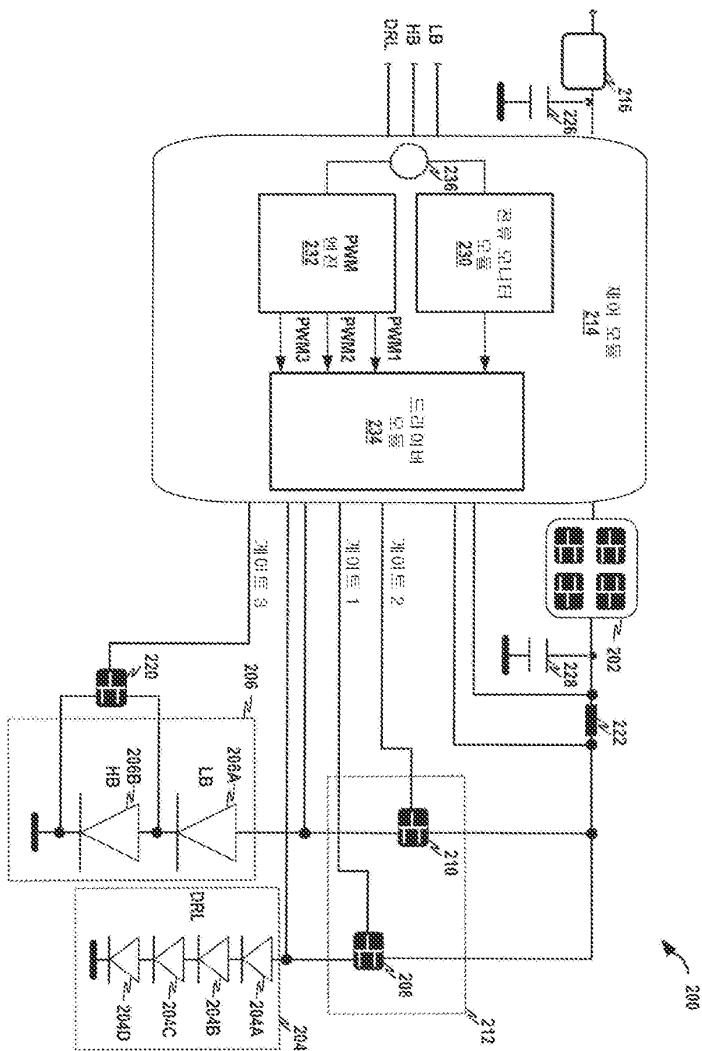
- [0079] 예 6. 예 1 내지 예 5 중 임의의 조합의 방법에서, 상기 감지 엘리먼트에서의 전압에 의해 표시되는 전류 값이 상기 전류 임계치를 초과할 때 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과하는 것으로 결정하는 단계를 더 포함한다.
- [0080] 예 7. 예 1 내지 예 6 중 임의의 조합의 방법에서, 상기 감지 엘리먼트는 제 2 감지 엘리먼트이고, 상기 제 1 분기 스위치는 제 1 감지 엘리먼트와 직렬로 결합된다.
- [0081] 예 8. 예 1 내지 예 7 중 임의의 조합의 방법에서, 상기 제 1 감지 엘리먼트는 저항성 엘리먼트를 포함하고, 상기 제 2 감지 엘리먼트는 저항성 엘리먼트를 포함한다.
- [0082] 예 9. 예 1 내지 예 8 중 임의의 조합의 방법에서, 제 1 LED 세트를 비활성화시키기 위한 제 1 명령 펄스 폭 변조(PWM) 신호를 수신하는 단계와; 상기 제 2 LED 세트를 활성화시키기 위한 제 2 명령 PWM 신호를 수신하는 단계 - 상기 제 1 명령 신호 및 상기 제 2 명령 신호는 제 1 상태에서 제 2 상태로 변경하라는 명령을 나타냄 - 을 더 포함한다.
- [0083] 예 10. 예 1 내지 예 9 중 임의의 조합의 방법에서, 상기 제 1 분기 스위치는 스위칭 엘리먼트를 포함한다.
- [0084] 예 11. 전류 또는 전력을 조절하기 위한 디바이스로서, 전력 모듈에 의해 출력되는 전력을 제 1 발광 다이오드(LED) 세트에 선택적으로 공급하도록 구성되는 제 1 분기 스위치와; 상기 전력 모듈에 의해 출력되는 전력을 제 2 LED 세트에 선택적으로 공급하도록 구성되는 제 2 분기 스위치와; 제어 모듈을 포함하며, 상기 제어 모듈은: 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 것 - 상기 제 1 상태 동안, 상기 제 1 발광 다이오드(LED) 세트에 전력을 공급하도록 상기 제 1 분기 스위치가 활성화되고 상기 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 과; 상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여: 상기 제 2 분기 스위치를 활성화하기 위해 상기 전력 모듈을 구동하는 것; 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 공급 전압을 증가시키는 것; 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않는다는 결정에 응답하여, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 공급하기 위해 상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 것; 및 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과한다고 결정한 것에 응답하여 상기 제 1 분기 스위치를 비활성화하는 것을 수행하도록 구성된다.
- [0085] 예 12. 예 11의 디바이스에서, 공급 전력의 일부를 소산시키기 위해, 상기 제 1 분기 스위치는 상기 제 1 분기 스위치의 저항을 수정하도록 구성된다.
- [0086] 예 13. 예 11 또는 예 12의 임의의 조합의 디바이스로서, 상기 제어 모듈은 상기 제 2 분기 스위치를 활성화하는 것과 상기 제 1 분기 스위치를 비활성화하는 것 간의 차이에 대응하는 지연 시간을 결정하는 것과; 상기 제 2 상태에서부터 상기 제 1 상태로 변경하라는 명령에 응답하여: 상기 시간 지연 이전에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 금지하는 것; 및 상기 시간 지연 후에 상기 제 2 상태에서부터 상기 제 1 상태로 변경하는 것을 수행하도록 더 구성된다.
- [0087] 예 14. 예 11 내지 예 13 중 임의의 조합의 디바이스에서, 상기 시간 지연을 결정하기 위해, 상기 제어 모듈은: 상기 제 2 분기 스위치를 활성화한 후 및 상기 제 1 분기 스위치를 비활성화하기 전에 카운트 값을 증가시키도록 구성된다.
- [0088] 예 15. 예 11 내지 예 14 중 임의의 조합의 디바이스에서, 상기 제 2 분기 스위치는 감지 엘리먼트와 직렬로 결합되며, 상기 제어 모듈은 상기 감지 엘리먼트에서의 전압의 표시에 기초하여 상기 제 2 분기 스위치에서의 전류를 결정하도록 구성된다.
- [0089] 예 16. 예 11 내지 예 15 중 임의의 조합의 디바이스에서, 상기 제어 모듈은 상기 감지 엘리먼트에서의 전압에 의해 표시되는 전류 값이 상기 전류 임계치를 초과할 때 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과하는 것으로 결정하도록 더 구성된다.
- [0090] 예 17. 예 11 내지 예 16 중 임의의 조합의 디바이스에서, 상기 감지 엘리먼트는 제 2 감지 엘리먼트이고, 상기 제 1 분기 스위치는 제 1 감지 엘리먼트와 직렬로 결합된다.

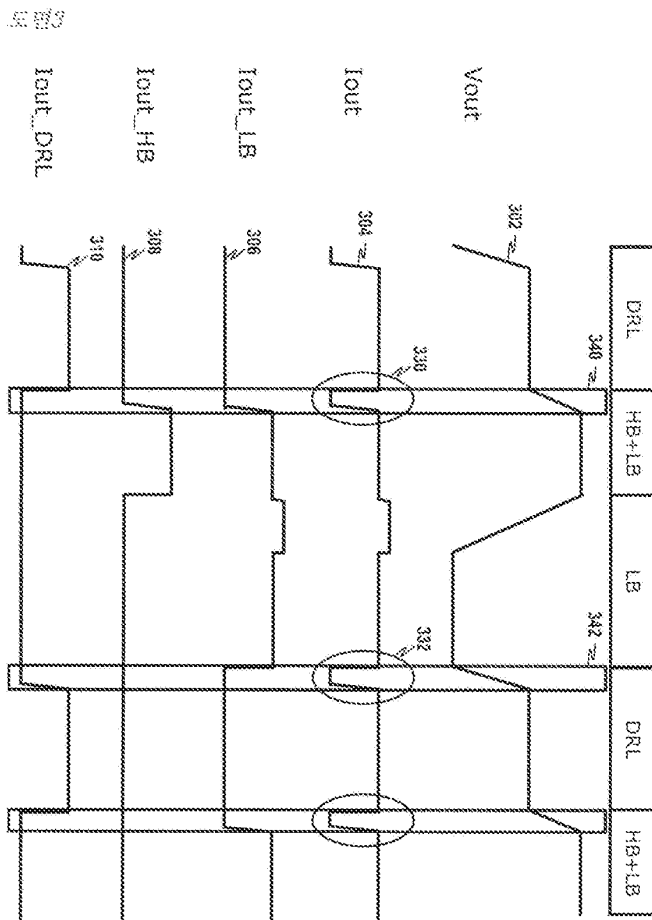
- [0091] 예 18. 예 11 내지 예 17 중 임의의 조합의 다바이스에서, 상기 제 1 감지 엘리먼트는 저항성 엘리먼트를 포함하고, 상기 제 2 감지 엘리먼트는 저항성 엘리먼트를 포함한다.
- [0092] 예 19. 예 11 내지 예 18 중 임의의 조합의 다바이스에서, 상기 제 1 분기 스위치는 스위칭 엘리먼트를 포함한다.
- [0093] 예 20. 전류 또는 전력을 조절하기 위한 시스템으로서, 전력을 출력하도록 구성되는 전력 모듈과; 제 1 발광 다이오드(LED) 세트와; 제 2 LED 세트와; 상기 전력 모듈에 의해 출력되는 전력의 적어도 일부를 상기 제 1 LED 세트에 선택적으로 공급하도록 구성되는 제 1 분기 스위치와; 상기 전력 모듈에 의해 출력되는 전력의 적어도 일부를 상기 제 2 LED 세트에 선택적으로 공급하도록 구성되는 제 2 분기 스위치와; 제어 모듈을 포함하며, 상기 제어 모듈은: 제 1 상태에서 제 2 상태로 변경하라는 명령을 결정하는 것 - 상기 제 1 상태 동안, 상기 제 1 LED 세트에 전력을 공급하도록 상기 제 1 분기 스위치가 활성화되고 상기 제 2 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 2 분기 스위치가 비활성화되고, 상기 제 2 상태 동안, 상기 제 1 LED 세트에 전력을 공급하는 것을 금지하도록 상기 제 1 분기 스위치가 비활성화되고 상기 제 2 LED 세트에 전력을 공급하도록 상기 제 2 분기 스위치가 활성화됨 - 과; 상기 제 1 상태에서부터 상기 제 2 상태로 변경하라는 명령에 응답하여: 상기 제 2 분기 스위치를 활성화하는 것; 상기 제 2 LED 세트를 활성화시키기 위한 공급 전력을 공급하기 위해 상기 전력 모듈을 구동하여 공급 전압을 증가시키는 것; 상기 제 2 분기 스위치에서의 전류가 전류 임계치를 초과하지 않을 때, 상기 제 1 LED 세트를 활성화시키기 위한 목표 전력을 공급하기 위해 상기 제 1 분기 스위치를 구동하여 공급 전력의 일부를 소산하는 것; 및 상기 제 2 분기 스위치에서의 전류가 상기 전류 임계치를 초과할 때 상기 제 1 분기 스위치를 비활성화하는 것을 수행하도록 구성된다.
- [0094] 다양한 양태가 본 개시에서 설명되었다. 이들 양태 및 다른 양태는 아래의 청구범위의 범주 내에 있다.

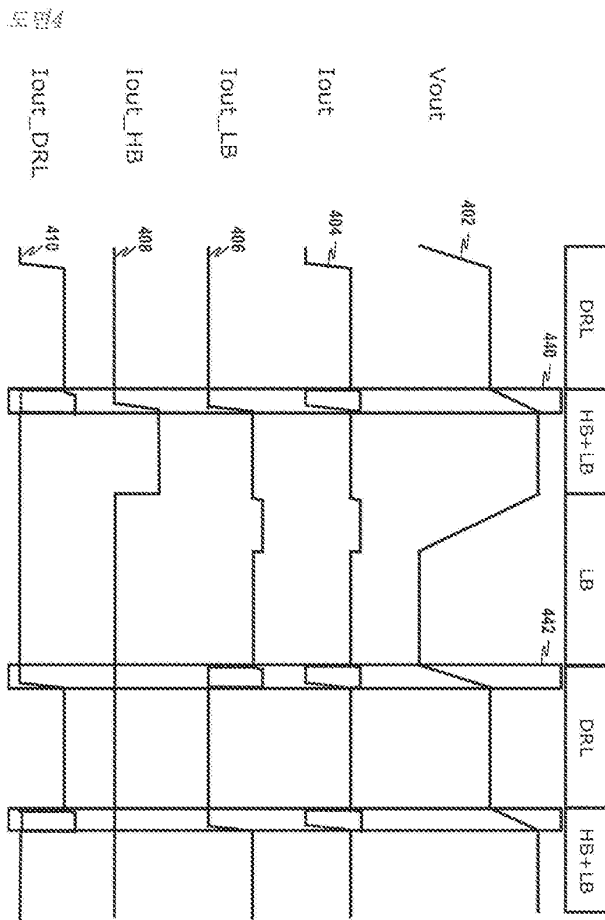
59
59



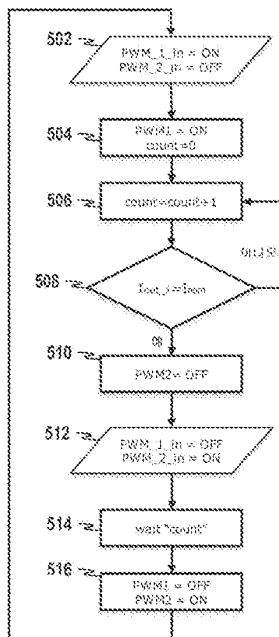
도면2



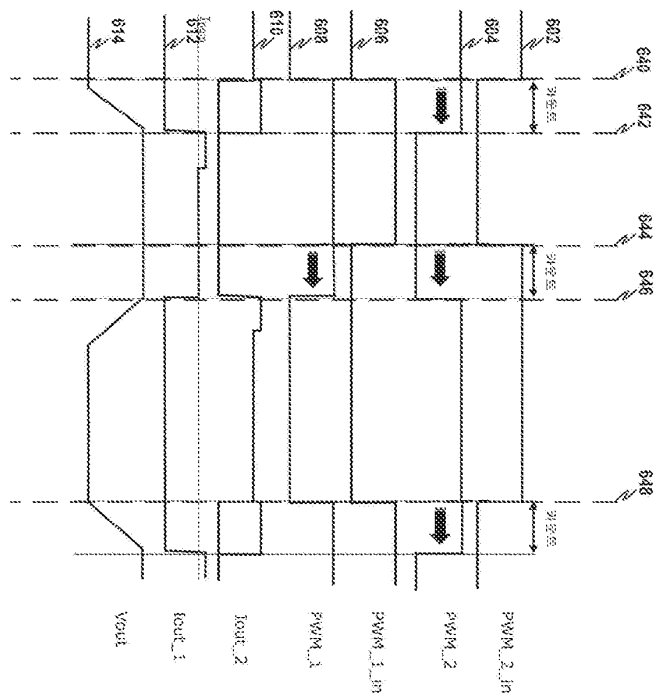




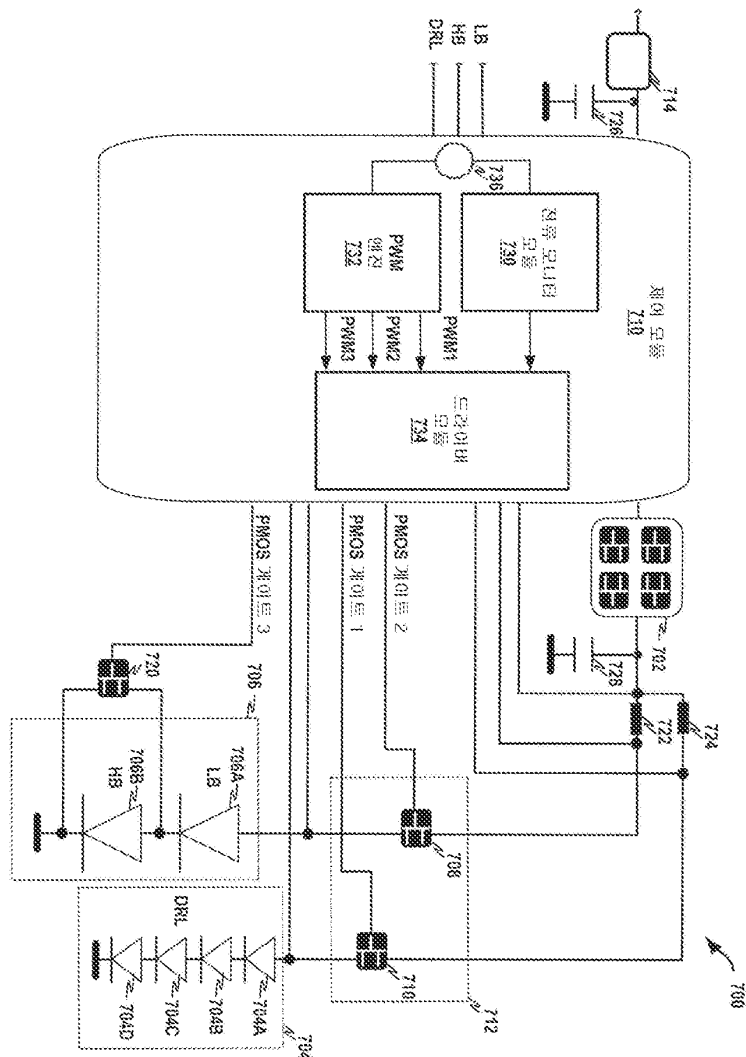
도면5



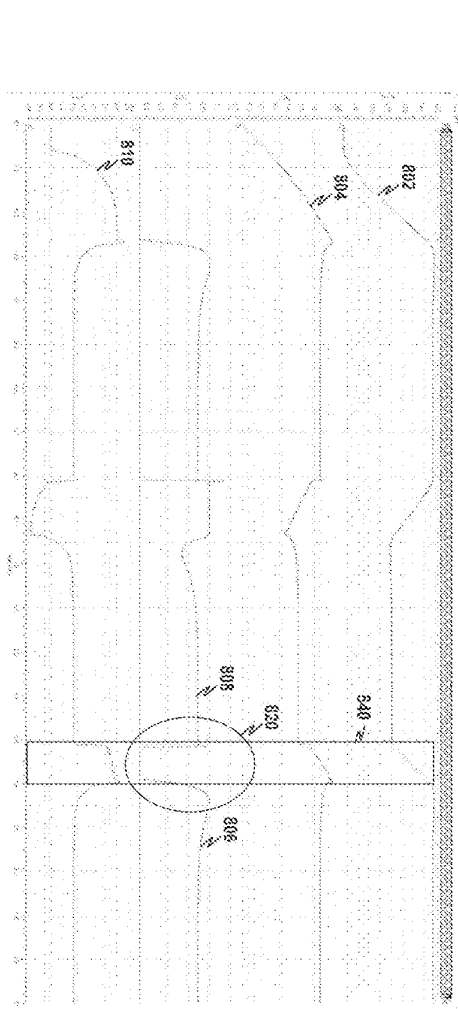
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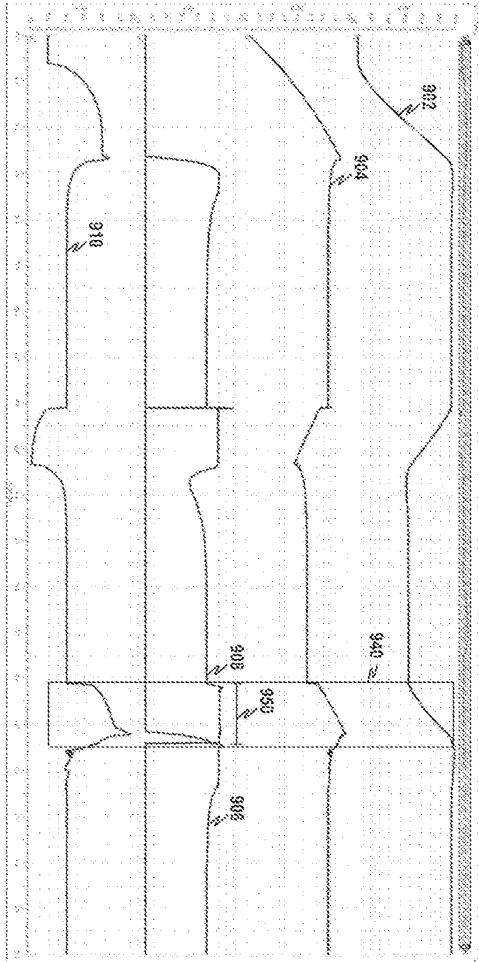
597



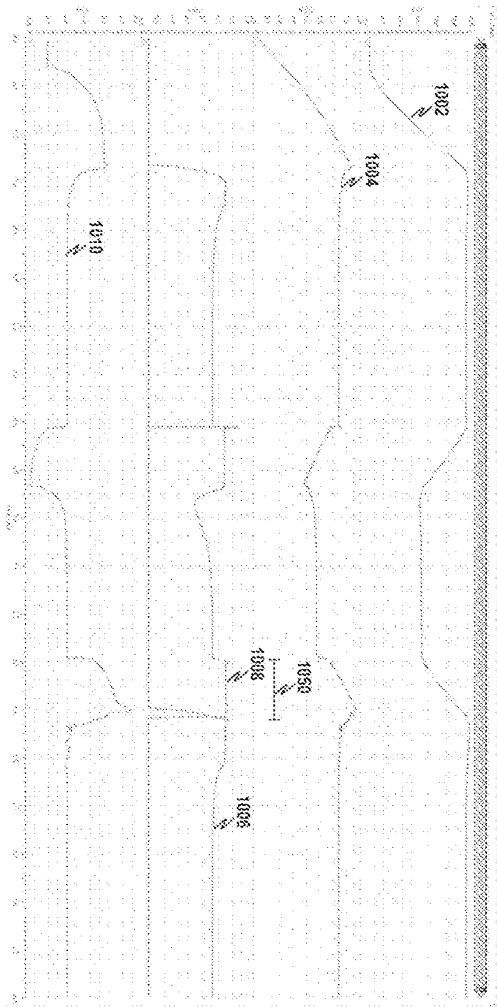
도면8



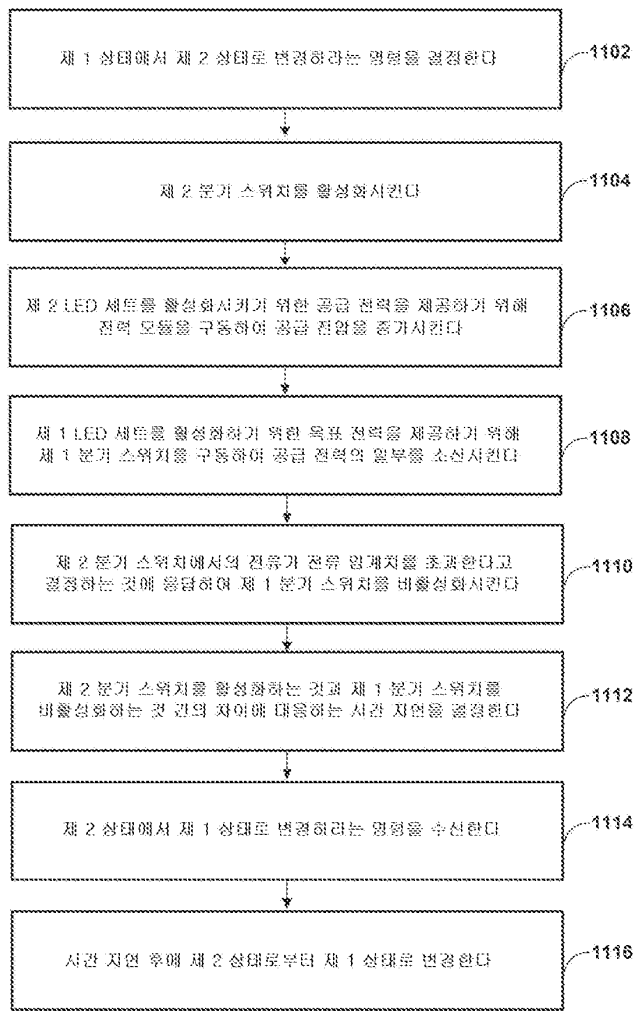
도면9



도면10



도면11



PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: THOMAS, Jim P.O. Box 692289 Houston, Texas 77269 USA
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PCT

**NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION**

(PCT Rule 44.1)

Date of mailing (day/month/year) 24 March 2022 (24.03.2022)
--

Applicant's or agent's file reference AGSL0002PCT
--

FOR FURTHER ACTION See paragraphs 1 and 4 below
--

International application No. PCT/US2021/061419

International filing date (day/month/year) 01 December 2021 (01.12.2021)
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Applicant AGS LIGHTING MANAGEMENT, LLC
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1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70

For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ With regard to any protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90bis.1 and 90bis.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Within **22 months** from the priority date, the applicant may request that a supplementary international search be carried out by a different International Searching Authority, that offers this service (Rule 45bis.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/KR International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. 82-42-481-8578

Authorized officer COMMISSIONER Telephone No. 82-42-481-5571
--



Form PCT/ISA/220 (July 2017)

* Attention

Copies of the documents cited in the international search report can be searched in the following Korean Intellectual Property Office English website for six months(expire date : **2022.09.24**) from the date of mailing of the international search report.

<http://www.kipo.go.kr/en/> => PCT ISA Portal => PCT Status

ID : PCT international application number

PW : **F276XR8X)**

Inquiries related to PCT International Search Report or Written Opinion prepared by KIPO as an International Searching Authority can be answered not only by KIPO but also through IPKC (Intellectual Property Korea Center), located in Vienna, VA, which functions as a PCT Help Desk for PCT applicants.

Homepage: <http://www.ipkcenter.com>

Email: ipkc@ipkcenter.com

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference AGSL0002PCT		FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US2021/061419	International filing date (<i>day/month/year</i>) 01 December 2021	(Earliest) Priority Date (<i>day/month/year</i>) 21 December 2020
Applicant AGS LIGHTING MANAGEMENT, LLC		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 3
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2021/061419

A. CLASSIFICATION OF SUBJECT MATTER		
H05B 45/20(2020.01)i; F21V 23/00(2006.01)i; F21V 23/06(2006.01)i; F21V 23/04(2006.01)i; F21Y 115/10(2016.01)i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) H05B 45/20(2020.01); F21V 23/04(2006.01); G09G 3/32(2006.01); G09G 3/34(2006.01); H05B 33/08(2006.01); H05B 37/02(2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Korean utility models and applications for utility models Japanese utility models and applications for utility models		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS(KIPO internal) & Keywords: a plurality of LEDs, driver circuit, current, switch, color temperature		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2018-0231226 A1 (SAMSUNG ELECTRONICS CO., LTD.) 16 August 2018 (2018-08-16) paragraphs [0037]-[0054], claims 1, 2 and figures 2, 3	1-9
A		10-20
Y	US 2019-0239298 A1 (ABL IP HOLDING LLC) 01 August 2019 (2019-08-01) paragraphs [0020]-[0024] and figure 1	1-9
Y	US 2018-0209626 A1 (HUBBELL INCORPORATED) 26 July 2018 (2018-07-26) paragraphs [0037]-[0046] and figures 1, 2	6-8
A	US 2020-0118482 A1 (SAMSUNG ELECTRONICS CO., LTD.) 16 April 2020 (2020-04-16) paragraphs [0066]-[0088] and figures 2, 3	1-20
A	KR 10-2019-0108511 A (INFINEON TECHNOLOGIES AG) 24 September 2019 (2019-09-24) paragraphs [0012]-[0029] and figure 1	1-20
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 23 March 2022		Date of mailing of the international search report 24 March 2022
Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon 35208, Republic of Korea		Authorized officer KIM, Sung Hee
Facsimile No. +82-42-481-8578		Telephone No. +82-42-481-3516

Form PCT/ISA/210 (second sheet) (July 2019)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/US2021/061419

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
US	2018-0231226	A1	16 August 2018	CN	108419332	A	17 August 2018
				KR	10-2018-0092629	A	20 August 2018
				US	10527271	B2	07 January 2020
US	2019-0239298	A1	01 August 2019	CA	3031800	A1	26 July 2019
				CA	3031800	C	27 April 2021
				CA	3077059	A1	26 July 2019
				MX	2019001197	A	01 August 2019
				US	10674579	B2	02 June 2020
				US	10681784	B2	09 June 2020
				US	11026307	B2	01 June 2021
				US	2020-0045789	A1	06 February 2020
				US	2020-0260547	A1	13 August 2020
				US	2021-0251063	A1	12 August 2021
US	2018-0209626	A1	26 July 2018	CA	2969862	A1	23 June 2016
				US	10190759	B2	29 January 2019
				US	2016-0178173	A1	23 June 2016
				US	9970639	B2	15 May 2018
				WO	2016-100423	A1	23 June 2016
US	2020-0118482	A1	16 April 2020	EP	3824459	A1	26 May 2021
				KR	10-2020-0042809	A	24 April 2020
				US	10971057	B2	06 April 2021
				WO	2020-080778	A1	23 April 2020
KR	10-2019-0108511	A	24 September 2019	CN	110278626	A	24 September 2019
				DE	102019106389	A1	19 September 2019
				US	10085314	B1	25 September 2018

Form PCT/ISA/210 (patent family annex) (July 2019)

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: THOMAS, Jim P.O. Box 692289 Houston, Texas 77269 USA

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43(*dt* 1))

Date of mailing <i>y/ not her) nmbs</i> 24 March 2022	
Applicant's or agent's file reference AGSL0002PCT	FOR FURTHER ACTION See paragraph 2 below
International application No. PCT/US2021/061419	International filing date <i>y/ not her) nmbs</i> 01 December 2021
Priority date <i>y/ not her) nmbs</i> 21 December 2020	
International Patent Classification (IPC) or both national classification and IPC H05B 45/20(2020.01)i; F21V 23/00(2006.01)i; F21V 23/06(2006.01)i; F21V 23/04(2006.01)i; F21Y 115/10(2016.01)i	
Applicant AGS LIGHTING MANAGEMENT, LLC	

1. This opinion contains indications relating to the following items:	
☒ Box No. I ☐ Box No. II ☐ Box No. III ☐ Box No. IV ☒ Box No. V ☐ Box No. VI ☒ Box No. VII ☐ Box No. VIII	Basis of the opinion Priority Non-establishment of opinion with regard to novelty, inventive step and industrial applicability Lack of unity of invention Reasoned statement under Rule 43(<i>dt</i> 1(a)(i)) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement Certain documents cited Certain defects in the international application Certain observations on the international application
2. FURTHER ACTION If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1(<i>dt</i> b) that written opinions of this International Searching Authority will not be so considered. If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later. For further options, see Form PCT/ISA/220.	

Name and mailing address of the ISA/KR Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208 Facsimile No. +82-42-481-8578	Date of completion of this opinion 23 March 2022	Authorized officer KIM, Sung Hee Telephone No. +82-42-481-3516
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Form PCT/ISA/237 (Cover sheet) (revised January 2019)

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2021/061419

Box No. I

Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43(*de* 1(b))).
3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13*bis*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13*bis*.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13*bis*.1(b) and Administrative Instructions, Section 713).
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2021/061419

Box No. V	Reasoned statement under Rule 43b/s.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	1-20	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	10-20	YES
	Claims	1-9	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO
2. Citations and explanations :			
Reference is made to the following documents:			
D1: US 2018-0231226 A1 (SAMSUNG ELECTRONICS CO., LTD.) 16 August 2018			
D2: US 2019-0239298 A1 (ABL IP HOLDING LLC) 01 August 2019			
D3: US 2018-0209626 A1 (HUBBELL INCORPORATED) 26 July 2018			
D4: US 2020-0118482 A1 (SAMSUNG ELECTRONICS CO., LTD.) 16 April 2020			
D5: KR 10-2019-0108511 A (INFINEON TECHNOLOGIES AG) 24 September 2019			
I. Novelty and Inventive Step (PCT Article 33(2) and (3))			
1. Claims 1-9			
1.1. Claim 1			
D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a lighting fixture comprising: an array of light emitting diodes (LEDs) comprising: one or more first LEDs (315) of a first light source module (310) connected in series, and one or more second LEDs (325) of a second light source module (320) connected in series, wherein the first light source module (310) is configured to emit light of a first color temperature, and the second light source module (320) is configured to emit light of a second color temperature that is different from the first color temperature; and a switch unit (S) connected to a power supply (100) to supply power to the first light source module (310) and/or the second light source module (320), wherein because the power supply (100) provides a constant current value, the switch unit (S) may be used as a path of transmitting corresponding current (see paragraphs [0045], [0053], [0054], claim 1 and figures 2, 3). Claim 1 differs from D1 in a first switch configured to cause a driver circuit to output one of a plurality of currents. However, the different feature would be easily derived from the disclosure of D2 (see paragraph [0020]: a switching device controls driver channels or current sources to control the current provided to LED groups). Therefore, claim 1 is considered to lack an inventive step over D1, D2.			
1.2. Claims 2-9			
The additional features of claims 2, 3 would be easily derived from the disclosure of D1 (see claim 1: an operation mode of the switch module comprises: a first mode of operation in which the first light source module is turned on and the second light source module is turned off; a second mode of operation in which the second light source module is turned on and the first light source module is turned off; and a third mode of operation in which the first and second light source modules are simultaneously turned on). The additional feature of claim 4 would be easily derived from the disclosure of D2 (see paragraph [0024] and figure 1: a first LED group (112) produces light with a color temperature of 2700K and a second LED group (114) produces light with a color temperature of 5000K). The additional feature of claim 5 is merely a variation of the feature of D2 (see paragraph [0020]: the switching device controls driver channels or current sources to control the current provided to LED groups). The additional feature of claim 6 would be easily derived from the disclosure of D1 (see claims 1, 2: the LED lighting device comprising a power supply, the first light source module (310) and the second light source			

Form PCT/ISA/237 (Box No. V) (revised January 2019)

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2021/061419

Box No. V

**Reasoned statement under Rule 43b/s.1(a)(i) with regard to novelty, inventive step and industrial applicability;
citations and explanations supporting such statement**

module (320)) and the disclosure of D3 (see paragraph [0037] and figure 2: a light fixture has a frame (100) covered by a cover (120) mounted to the frame (100)).

The additional feature of claim 7 is virtually suggested by the feature of D3 (see paragraph [0045] and figures 1, 2: LED boards are obscured by the cover (120), and a rectangular 8-inch LED board (the first type) and a rectangular 11-inch LED board (the second type) are used in various combinations for light fixtures having nominal lengths of 9 inches, 12 inches, 18 inches, 21 inches, 24 inches, 27 inches and 36 inches).

The additional feature of claim 8 would be easily derived from the disclosure of D3 (see paragraphs [0037], [0039] and figures 1, 2: the light fixture has the frame (100) and receives power through a power cord (105), and the light fixture is controlled by the switch (110) connected to a master circuit board ("master board") that is covered by the cover (120) mounted to the frame (100) using screws (130), wherein the one of the second plurality of currents is greater than one of the first plurality of currents by the scale factor; and a second extender port configured to couple with the first extender port to combine a first modular lighting apparatus and the second modular lighting apparatus to traverse a first linear distance and a second linear distance. And it is not obvious to a person skilled in the art from the cited documents, when taken individually or in any combination.

The additional feature of claim 9 is merely one of several straightforward possibilities that a person skilled in the art would add or select, in accordance with circumstances, without the exercise of inventive skill.

Therefore, claims 2-5, 9 are considered to lack an inventive step over D1, D2, and claims 6-8 are considered to lack an inventive step over D1, D2, D3.

2. Claims 10-17

None of the cited documents discloses the features of claim 10: a linear light-emitting diode (LED) lighting system, comprising: a first modular lighting apparatus which comprises a first extender port; and a second modular lighting apparatus which comprises: a second plurality of light-emitting diodes (LEDs) having a second number of LEDs, each LED of the second plurality of LEDs associated with a first color temperature, wherein the second number is greater than a first number by a scale factor; a second switch assembly configured to: couple one of the second plurality of currents to the second plurality of LEDs, wherein the one of the second plurality of currents is greater than one of the first plurality of currents by the scale factor; and a second extender port configured to couple with the first extender port to combine a first modular lighting apparatus and the second modular lighting apparatus to traverse a first linear distance and a second linear distance. And it is not obvious to a person skilled in the art from the cited documents, when taken individually or in any combination.

Claims 11-17 are dependent on claim 10.

Therefore, claims 10-17 are novel and involve an inventive step.

3. Claims 18-20

None of the cited documents discloses the features of claim 18: a linear light-emitting diode (LED) system, comprising: a first modular lighting apparatus comprising a first switch assembly comprising a second switch configured to: cause a first portion of one of a first plurality of currents to couple to each LED of a first plurality of LEDs, cause the first portion of the one of the first plurality of currents to couple to each LED of a second plurality of LEDs or cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs; and a second modular lighting apparatus comprising: a second array of light emitting diodes (LEDs) comprising a third plurality of LEDs associated with a third color temperature, wherein the third color temperature matches a first color temperature, and a fourth plurality of LEDs associated with a fourth color temperature matching a second color temperature; and a second switch assembly configured to couple to a second driver circuit, wherein the second switch assembly comprises a fourth switch configured to cause a second portion of the one of the second plurality of currents to couple to each LED of a third plurality of LEDs, or cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs. And it is not obvious to a person skilled in the art from the cited documents, when taken individually or in any combination.

Claims 19, 20 are dependent on claim 18.

Therefore, claims 18-20 are novel and involve an inventive step.

II. Industrial Applicability (PCT Article 33(4))

Claims 1-20 are industrially applicable.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/US2021/061419

Box No. VII **Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:

The unit of measure employed in claim 7 is not additionally expressed in terms of the units stipulated by PCT Rule 10.1(a).

Electronic Acknowledgement Receipt	
EFS ID:	46027530
Application Number:	17129228
International Application Number:	
Confirmation Number:	1012
Title of Invention:	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
First Named Inventor/Applicant Name:	Peter Angelo DallePezze
Customer Number:	37106
Filer:	Jim Thomas
Filer Authorized By:	
Attorney Docket Number:	AGSL:0002
Receipt Date:	23-JUN-2022
Filing Date:	21-DEC-2020
Time Stamp:	17:14:27
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	AGSL0002_SUPP_IDS.pdf	1263554	no	4
			9176d9210f74fe4a7b7899cf60a4195cb365eb9f		

Warnings:

Information:					
2	Foreign Reference	AGSL0002_SUPP_IDS_Foreign_KR.pdf	2684140 5835e762f725cec10383db824dda67cc8fd1418	no	40
Warnings:					
Information:					
3	Non Patent Literature	AGSL0002_SUPP_IDS_NPL1_PCT_Search_Report.pdf	301548 3bd873df229e44eb374418894ec02002340c37cf	no	10
Warnings:					
Information:					
Total Files Size (in bytes):			4249242		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012
37106	7590	12/07/2022		
FLETCHER YODER P.C. P.O. Box 692289 HOUSTON, TX 77269-2289			EXAMINER HAMMOND, CRYSTAL L.	
			ART UNIT 2844	PAPER NUMBER
			NOTIFICATION DATE 12/07/2022	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket@fyiplaw.com

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Claim Rejections - 35 USC § 103

2. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

3. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries for establishing a background for determining obviousness under 35 U.S.C. 103 are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claim(s) 1-3 and 5-9 is/are rejected under 35 U.S.C. 103 as being unpatentable over Koo et al (US 2018/0231226) in view of Yadav (US 2018/0209626).

(1) regarding Claim 1:

Koo discloses a linear light-emitting diode (LED) lighting apparatus (Fig 6), comprising:

an array of light emitting diodes (LEDs) comprising (310, 320):

a first plurality of LEDs (310) configured to produce a first light having a first color temperature ([0010]), wherein the first plurality of LEDs aligns within a first linear shape (See 310);

a second plurality of LEDs (320) configured to produce a second light having a second color temperature different from the first color temperature ([0010]), wherein the second plurality of LEDs align within a second linear shape (See 320);

a driver circuit (Combination of S, 311, 312, 321 and 322) configured to output a plurality of currents;

a switch (S) assembly configured to couple to the driver circuit, wherein the switch assembly comprises:

~~a first switch configured to cause the driver circuit to output one of the plurality of currents;~~

a second switch (200) configured to cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both (See Figs 6, 7 and 8).

However Koo does not disclose the first switch.

Yadav, in the same field of endeavor discloses:

a first switch configured to cause the driver circuit to output one of the plurality of currents (930 in Fig 15).

It would have been obvious to one of ordinary skill in the art, before the effective filing date of the claimed invention, to incorporate the first switch Yadav into the device of Koo as Yadav {0091} in order to add a power saving feature of a sensor or other device that may switch the device on and off in order to save power.

(2) regarding Claim 2:

The combination of Koo and Yadav further discloses:

wherein the second switch comprises a plurality of selectable positions (See Fig 6, 7 and 8 of Koo, [0079]).

(3) regarding Claim 3:

The combination of Koo and Yadav further discloses:

wherein the plurality of selectable positions comprises:

a first position configured to cause the switch assembly to couple the one of the plurality of currents to the first plurality of LEDs (Fig 6 of Koo);

a second position configured to cause the switch assembly to couple the one of the plurality of currents to the second plurality of LEDs (Fig 7 of Koo); and

a third position configured to cause the switch assembly to couple a first portion of the one of the plurality of currents to the first plurality of LEDs and a second portion of the one of the plurality of currents to the second plurality of LEDs (Fig 8 of Koo).

(4) regarding Claim 5:

The combination of Koo and Yadav further discloses:

wherein the second switch comprises a plurality of selectable positions, wherein each of the plurality of selectable positions is configured to cause the switch assembly to send a respective signal to the driver circuit, wherein the respective signal is configured to cause the driver circuit to output the one of the plurality of currents that corresponds to a current position of the plurality of selectable positions (See Fig 6, 7 and 8 of Koo, [0079] and [0050]).

(5) regarding Claim 6:

The combination of Koo and Yadav further discloses:

comprising a housing comprising an interior volume configured to hold the driver circuit, the first plurality of LEDs, and the second plurality of LEDs (See Fig 1 and 2 of Yadav).

(6) regarding Claim 7:

The combination of Koo and Yadav further discloses:

wherein the housing comprises a length greater than or equal to 24 inches (See Fig 1 and 2 of Yadav).

(7) regarding Claim 8:

The combination of Koo and Yadav further discloses:

wherein the switch assembly is configured to be positioned in a receptacle of the housing, and wherein the switch assembly is configured to be flush with a surface of the housing when positioned in the receptacle (See Fig 1 and 2 of Yadav).

(8) regarding Claim 9:

The combination of Koo and Yadav further discloses:

comprising at least one electrical connection configured to transmit electricity from the lighting apparatus to at least one other lighting apparatus. ([0040] of Koo).

6. Claim(s) 8 is/are rejected under 35 U.S.C. 103 as being unpatentable over Koo et al (US 2018/0231226) in view of Yadav (US 2018/0209626).

(1) regarding Claim 4:

The combination of Koo and Yadav discloses all of the subject matter above ([0056], [0057]).

However the combination does not disclose the first color temperature corresponds to 3000 Kelvin and the second color temperature corresponds to 4000 Kelvin.

It would have been an obvious matter of design choice to choose 3000 and 4000 Kelvin for the two color temperatures, since the applicant has not disclosed that changing the colors solves any problem or is for a particular reason. It appears that the claimed invention would perform equally well with warm versus cool or cool versus warm colors designated as the first and second color temperatures.

Allowable Subject Matter

7. Claims 10-20 are allowed.

8. The following is an examiner's statement of reasons for allowance: Claim 10 requires A linear light-emitting diode (LED) lighting system, comprising: a first modular

lighting apparatus traversing a first linear distance, wherein the first modular lighting apparatus comprises: a first plurality of light-emitting diodes (LEDs) arranged within a first linear form factor and having a first number of LEDs, each LED of the first plurality of LEDs associated with a first color temperature; a first driver circuit configured to output a first plurality of currents; a first switch assembly configured to: cause the first driver circuit to output one of the first plurality of currents; and couple the one of the first plurality of currents to the first plurality of LEDs; and a first extender port; and a second modular lighting apparatus traversing a second linear distance that is longer than the first linear distance, wherein the second modular lighting apparatus comprises: a second plurality of light-emitting diodes (LEDs) arranged within a second linear form factor and having a second number of LEDs, each LED of the second plurality of LEDs associated with the first color temperature, wherein the second number is greater than the first number by a scale factor; a second driver circuit configured to output a second plurality of currents; a second switch assembly configured to: cause the second driver circuit to output one of the second plurality of currents; couple the one of the second plurality of currents to the second plurality of LEDs, wherein the one of the second plurality of currents is greater than the one of the first plurality of currents by the scale factor; and a second extender port configured to couple with the first extender port to combine the first modular lighting apparatus and the second modular lighting apparatus to traverse the first linear distance and the second linear distance. Claim 18 requires A linear light-emitting diode (LED) system, comprising: a first modular lighting apparatus comprising: a first array of light emitting diodes (LEDs) comprising: a first plurality of LEDs associated with a first color temperature, wherein the first plurality of LEDs aligns

within a first linear shape; a second plurality of LEDs associated with a second color temperature different from the first color temperature, wherein the second plurality of LEDs aligns within a second linear shape; a first driver circuit configured to output a first plurality of currents; a first switch assembly configured to couple to the first driver circuit, wherein the first switch assembly comprises: a first switch configured to cause the first driver circuit to output one of the first plurality of currents; a second switch configured to: cause a first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs; cause the first portion of the one of the first plurality of currents to couple to each LED of the second plurality of LEDs; or cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs; and a second modular lighting apparatus configured to electrically couple to the first lighting apparatus, wherein the second lighting apparatus comprises: a second array of light emitting diodes (LEDs) comprising: a third plurality of LEDs associated with a third color temperature, wherein the third plurality of LEDs aligns within a third linear shape, wherein the third color temperature matches the first color temperature, and wherein the third plurality of LEDs is longer than the first plurality of LEDs; a fourth plurality of LEDs associated with a fourth color temperature matching the second color temperature, wherein the fourth plurality of LEDs aligns within a fourth linear shape, and wherein the fourth plurality of LEDs is longer than the second plurality of LEDs; a second driver circuit configured to output a second plurality of currents; a second switch assembly configured to couple to the second driver circuit, wherein the second switch assembly comprises: a third switch configured to cause the second driver circuit to output one of

the second plurality of currents; and a fourth switch configured to: cause a second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs; cause the second portion of the one of the second plurality of currents to couple to each LED of the fourth plurality of LEDs; or cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to CRYSTAL L HAMMOND whose telephone number is (571)270-1682. The examiner can normally be reached M-F 12pm-4pm Alt Fridays.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Taningco can be reached on 571-272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CRYSTAL L HAMMOND/
Primary Examiner, Art Unit 2844

Notice of References Cited	Application/Control No. 17/129,228		Applicant(s)/Patent Under Reexamination DallePezze et al.	
	Examiner CRYSTAL L HAMMOND		Art Unit 2844	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20180231226-A1	08-2018	KOO; Won Hoe	F21V23/04	1/1
*	B	US-20180209626-A1	07-2018	Yadav; Pritam	H05B45/20	1/1
*	C	US-20170223800-A1	08-2017	WU; Ben	H05B45/14	1/1
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20221201

<i>Search Notes</i> 	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.
	Examiner CRYSTAL L HAMMOND	Art Unit 2844

CPC - Searched*		
Symbol	Date	Examiner
text search in combination with (H05B45/20 OR F21V23/009 OR F21V23/04 OR F21V23/06 OR F21Y2103/10 OR F21Y2113/10 OR F21Y2115/10 OR F21Y2113/13).cpc.	11/30/2022	clh

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
inventive entity search	11/30/2022	clh
search history attached	11/30/2022	clh

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844	
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PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	0	((("AGS") near3 ("LIGHTING") near3 ("MANAGEMENT") near3 ("LLC"))).AS,AANM.	(USPAT)	OR	ON	ON	2022/11/30 07:51 PM
L2	2	((("AGS") near3 ("LIGHTING") near3 ("MANAGEMENT") near3 ("LLC"))).AS,AANM.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/11/30 07:51 PM
L3	5	((("DALLEPEZZE") near3 ("Peter")) OR ((("SVENDSEN") near3 ("Andrew"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2022/11/30 07:51 PM
L4	47	(Artificial Intelligence) Similar to: 17/129,228 with 0 CPC Selections and 0 Text Selections Text: (CN-114207346-A OR EP-4012256-A1 OR WO-2021025120-A1 OR US-20220268423-A1 OR EP-3123824-B1 OR US-20220205618-A1 OR US-11371679-B1 OR WO-2022140069-A1 OR US-10371363-B2 OR US-20200363047-A1 OR US-10495272-B2 OR US-20180259142-A1 OR US-10180220-B2 OR US-10006615-B2 OR US-20190331327-A1 OR US-20180292074-A1 OR US-20140071673-A1 OR US-9927079-B2 OR US-20160341377-A1 OR WO-2015138262-A1 OR CA-2883639-C OR US-20190264881-A1 OR US-20190145591-A1	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO))	OR	ON	ON	2022/11/30 07:58 PM

		OR US-9989206-B2 OR WO-2015144493-A1 OR EP-3123824-A1 OR US-20140070724-A1 OR US-10746386-B2 OR EP-2990718-A1 OR US-20150226392-A1 OR CA-2883639-A1 OR WO-2014043268-A1 OR US-20170108181-A1 OR CN-106133433-B OR DE-202014103047-U1 OR US-20150345765-A1 OR US-20200041079-A1 OR DE-202014103052-U1 OR US-10012353-B2 OR EP-3363269-A1 OR WO-2017064090-A1 OR US-20140268748-A1 OR US-20120002417-A1 OR CN-108353484-A OR US-9874333-B2 OR US-20170261189-A1 OR US-8641229-B2 OR DE-202012007143-U1 OR US-9951914-B1 OR US-20160356467-A1).did.					
L5	379761	(H05B45/20 OR F21V23/009 OR F21V23/04 OR F21V23/06 OR F21Y2103/10 OR F21Y2113/10 OR F21Y2115/10 OR F21Y2113/13).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/11/30 08:14 PM
L6	4	("20180209626" OR "20180231226" OR "20190239298" OR "20200118482").pn.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/30 08:16 PM
L7	61524	(H05B45/20 OR F21V23/04 OR H05B45/46 OR F21Y2113/13 OR F21Y2115/10).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/30 08:28 PM
L8	61524	L4 OR L7	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/30 08:28 PM
L9	63741	L5 OR L7	(US-PGPUB; USPAT)	OR	ON	ON	2022/11/30 08:28 PM
L10	370302	L7	(US-PGPUB; USPAT;	OR	ON	ON	2022/11/30

L11	390628	L5 OR L10	USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	08:29 PM
L12	16502	L11 AND "color temperature" AND switch\$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/11/30 08:29 PM
L13	16502	L9 AND "color temperature" AND switch\$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/11/30 08:31 PM
L14	7131	L9 AND "color temperature" AND switch\$3	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:31 PM
L15	14274	L12 AND second AND different	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO;	OR	ON	ON	2022/11/30 08:32 PM

L16	1773	L9 AND ("color temperature" SAME second SAME different) AND switch\$3	DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:32 PM
L17	1755	L9 AND ("color temperature" SAME second SAME different) AND switch\$3 AND (LED.U/C. "light emitting diode")	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:33 PM
L18	6	("20080252197" "20100066258" "20110089864" "20140197751" "20140210357" "20170223800").PN.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:34 PM
L19	973	L17 AND fixture	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:36 PM
L20	2	("10337912" "9874478").PN.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2022/11/30 08:39 PM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-22)

Approved for use through 05/31/2024. OMB 0651-0031

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	17129228
	Filing Date	2020-12-21
	First Named Inventor	Peter Angelo DallePezze
	Art Unit	2844
	Examiner Name	HAMMOND, CRYSTAL L
	Attorney Docket Number	AGSL:0002

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	1	20180231226	A1	2018-08-16	Koo et al.			
	2	20190239298	A1	2019-08-01	Bruckner et al.			
	3	20180209626	A1	2018-07-26	Yadav et al.			
	4	20200118482	A1	2020-04-16	Jung et al.			
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**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	17129228
Filing Date	2020-12-21
First Named Inventor	Peter Angelo DallePezze
Art Unit	2844
Examiner Name	HAMMOND, CRYSTAL L
Attorney Docket Number	AGSL:0002

1	20190108511	KR	A	2019-09-24	Infineon Technologies AG	×
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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T ⁵
	1	International Search Report and Written Opinion for PCT/US2021/061419, dated March 24, 2022, 10 pages	

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EXAMINER SIGNATURE

Examiner Signature	/CRYSTAL L HAMMOND/	Date Considered	11/30/2022
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ Applicant is to place a check mark here if English language translation is attached.

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Application Number	17129228
Filing Date	2020-12-21
First Named Inventor	Peter Angelo DallePezze
Art Unit	2844
Examiner Name	HAMMOND, CRYSTAL L
Attorney Docket Number	AGSL:0002

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

- ☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

- ☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jim Thomas/	Date (YYYY-MM-DD)	2022-06-23
Name/Print	Jim Thomas	Registration Number	71,611

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Bibliographic Data

Application No: 17/129,228

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /CRYSTAL L HAMMOND/

Examiner's Signature

Initials

Title:

CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN
LINEAR LED FIXTURES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/21/2020	315	2844	AGSL:0002
RULE			

APPLICANTS

AGS Lighting Management, LLC, Houston, TX, UNITED STATES

INVENTORS

Peter Angelo DallePezze, Houston, TX, UNITED STATES

Andrew Michael Svendsen, Lakewood, CO, UNITED STATES

CONTINUING DATA

This application has PRO of 63040585 06/18/2020

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/04/2021

** SMALL ENTITY **

STATE OR COUNTRY

UNITED STATES

ADDRESS

FLETCHER YODER P.C.

P.O. Box 692289

HOUSTON, TX 77269-2289

UNITED STATES

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012
37106	7590	01/10/2023	EXAMINER	
FLETCHER YODER P.C.			HAMMOND, CRYSTAL L.	
P.O. Box 692289				
HOUSTON, TX 77269-2289				
			ART UNIT	PAPER NUMBER
			2844	
			NOTIFICATION DATE	DELIVERY MODE
			01/10/2023	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket@fyiplaw.com

<i>Applicant-Initiated Interview Summary</i>	Application No. 17/129,228	Applicant(s) DallePezze et al.		
	Examiner CRYSTAL L HAMMOND	Art Unit 2844	AIA (First Inventor to File) Status Yes	Page 1 of 1

All Participants (applicant, applicants representative, PTO personnel)	Title	Type
CRYSTAL L HAMMOND	Primary Examiner	Telephonic
Jim Thomas	Attorney	

Date of Interview: 05 January 2023

Issues Discussed:

Proposed Amendment(s)

Examiner agrees that the proposed amendments would overcome the current rejection of record.
Applicant also clarified the invention as claimed.

☒ Attachment

/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844	
Applicant is reminded that a complete written statement as to the substance of the interview must be made of record in the application file. It is the applicants responsibility to provide the written statement, unless the interview was initiated by the Examiner and the Examiner has indicated that a written summary will be provided. See MPEP 713.04 Please further see: MPEP 713.04 Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews, paragraph (b) 37 CFR § 1.2 Business to be transacted in writing	

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§	
Peter Angelo DallePezze et al.	§	Group Art Unit: 2844
	§	
Application No.: 17/129,228	§	Examiner: Hammond, Crystal
	§	
Filed: December 21, 2020	§	Confirmation No.: 1012
	§	
For: CONTROLLING COLOR	§	Atty. Docket: AGSL:0002
TEMPERATURE AND	§	
LUMINANCE IN LINEAR LED	§	
FIXTURES	§	

PROPOSED EXAMINER INTERVIEW AGENDA

Dear Examiner Hammond:

Thank you for agreeing to an interview to discuss this case with me at 10:00 AM EST on January 5, 2023. I would like to propose briefly discussing the proposed amendment to claim 1. I will plan to call you at (571)270-1682 at the scheduled time. Please feel free to call me at the number below if you need anything else.

Best regards,

Jim Thomas
FLETCHER YODER
281-970-4545

PROPOSED AMENDMENTS

(for discussion purposes only)

1. A linear light-emitting diode (LED) lighting apparatus, comprising:
 - an array of light emitting diodes (LEDs) having a first length, wherein the array of LEDs comprises ~~comprising~~:
 - a first plurality of LEDs configured to produce a first light having a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
 - a second plurality of LEDs configured to produce a second light having a second color temperature different from the first color temperature, wherein the second plurality of LEDs align within a second linear shape;
 - a driver circuit configured to output a plurality of currents;
 - a switch assembly configured to couple to the driver circuit, wherein the switch assembly comprises:
 - a first switch configured to cause the driver circuit to output one of the plurality of currents;
 - a second switch configured to cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both, and
 - wherein the linear LED lighting apparatus is configured to electrically couple to an additional linear LED lighting apparatus having a second length different than the first length by a scale factor, wherein the additional linear LED lighting apparatus is configured to produce a third light having the first color temperature via a third plurality of LEDs or a fourth light having the second color temperature via a fourth plurality of LEDs.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 17/129,228		Filing Date 12/21/2020		☐ To be Mailed				
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO												
APPLICATION AS FILED - PART I												
		(Column 1)	(Column 2)									
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)					
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A							
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A		N/A							
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A							
TOTAL CLAIMS (37 CFR 1.16(j))		minus 20 =	*		x \$50 =							
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*		x \$240 =							
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).										
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))												
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL						
APPLICATION AS AMENDED - PART II												
		(Column 1)	(Column 2)		(Column 3)							
AMENDMENT	01/25/2023	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)					
	Total (37 CFR 1.16(j))	* 20	Minus	** 20	= 0	x \$40 =	0					
	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0	x \$192 =	0					
	☐ Application Size Fee (37 CFR 1.16(s))											
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))											
						TOTAL ADD'L FEE		0				
AMENDMENT		(Column 1)	(Column 2)		(Column 3)							
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)					
	Total (37 CFR 1.16(j))	*	Minus	**	=	x \$0 =						
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =						
	☐ Application Size Fee (37 CFR 1.16(s))											
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
						TOTAL ADD'L FEE						
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.						LIE						
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".						/MARCUS M WASHINGTON/						
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".												
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.												

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If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§	
Peter Angelo DallePezze et al.	§	Group Art Unit: 2844
	§	
Application No.: 17/129,228	§	Examiner: Hammond, Crystal
	§	
Filed: December 21, 2020	§	Confirmation No.: 1012
	§	
For: CONTROLLING COLOR	§	Atty. Docket: AGSL:0002
TEMPERATURE AND	§	
LUMINANCE IN LINEAR LED	§	
FIXTURES	§	

Commissioner for Patents
P.O. Box 1450
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CERTIFICATE OF TRANSMISSION OR MAILING 37 C.F.R. 1.8	
I hereby certify that this correspondence is being transmitted by facsimile to the United States Patent and Trademark Office in accordance with 37 C.F.R. § 1.6(d), or is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4), or is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:	
January 25, 2023	/Jim Thomas/
Date	Jim Thomas Reg. No. 71,611

**INTERVIEW AGENDA, AMENDMENT AND
RESPONSE TO NON-FINAL OFFICE ACTION MAILED DECEMBER 7, 2022**

In response to the Office Action mailed December 7, 2022, Applicant respectfully requests reconsideration of the above-identified application in view of the amendments and remarks set forth below.

Authorization for Extensions of Time and Payment of Fees

In accordance with 37 C.F.R. § 1.136, Applicant hereby provides a general authorization to treat this and any future reply requiring an extension of time as incorporating a request thereof. Applicant submits that no fees are currently due in association with the present response. However, if any additional fees are required at this or any other time, then Applicant authorizes the Commissioner to charge such fees to Deposit Account No. 06-1315; Order No. AGSL:0002.

IN THE CLAIMS

A listing of all claims and their current status in accordance with 37 C.F.R.
§1.121(c) is provided below.

1. (Currently Amended) A linear light-emitting diode (LED) lighting apparatus,
comprising:

an array of light emitting diodes (LEDs) having a first length, wherein the array
of LEDs comprises ~~comprising~~:

a first plurality of LEDs configured to produce a first light having a first
color temperature, wherein the first plurality of LEDs aligns within
a first linear shape;

a second plurality of LEDs configured to produce a second light having a
second color temperature different from the first color temperature,
wherein the second plurality of LEDs align within a second linear
shape;

a driver circuit configured to output a plurality of currents;

a switch assembly configured to couple to the driver circuit, wherein the switch
assembly comprises:

a first switch configured to cause the driver circuit to output one of the
plurality of currents;

a second switch configured to cause the one of the plurality of currents to
couple to the first plurality of LEDs, the second plurality of LEDs,
or both; and

wherein the linear LED lighting apparatus is configured to electrically couple to
an additional linear LED lighting apparatus having a second length different than the first
length by a scale factor, wherein the additional linear LED lighting apparatus is
configured to produce a third light having the first color temperature via a third plurality
of LEDs or a fourth light having the second color temperature via a fourth plurality of
LEDs.

2. (Original) The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions.
3. (Original) The linear LED lighting apparatus of claim 2, wherein the plurality of selectable positions comprises:
 - a first position configured to cause the switch assembly to couple the one of the plurality of currents to the first plurality of LEDs;
 - a second position configured to cause the switch assembly to couple the one of the plurality of currents to the second plurality of LEDs; and
 - a third position configured to cause the switch assembly to couple a first portion of the one of the plurality of currents to the first plurality of LEDs and a second portion of the one of the plurality of currents to the second plurality of LEDs.
4. (Original) The linear LED lighting apparatus of claim 1, wherein the first color temperature corresponds to 3000 Kelvin and the second color temperature corresponds to 4000 Kelvin.
5. (Original) The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions, wherein each of the plurality of selectable positions is configured to cause the switch assembly to send a respective signal to the driver circuit, wherein the respective signal is configured to cause the driver circuit to output the one of the plurality of currents that corresponds to a current position of the plurality of selectable positions.
6. (Original) The linear LED lighting apparatus of claim 1, comprising a housing comprising an interior volume configured to hold the driver circuit, the first plurality of LEDs, and the second plurality of LEDs.

7. (Original) The linear LED lighting apparatus of claim 6, wherein the housing comprises a length greater than or equal to 24 inches.
8. (Original) The linear LED lighting apparatus of claim 6, wherein the switch assembly is configured to be positioned in a receptacle of the housing, and wherein the switch assembly is configured to be flush with a surface of the housing when positioned in the receptacle.
9. (Original) The linear LED lighting apparatus of claim 1, comprising at least one electrical connection configured to transmit electricity from the lighting apparatus to at least one other lighting apparatus.
10. (Original) A linear light-emitting diode (LED) lighting system, comprising:
 - a first modular lighting apparatus traversing a first linear distance, wherein the first modular lighting apparatus comprises:
 - a first plurality of light-emitting diodes (LEDs) arranged within a first linear form factor and having a first number of LEDs, each LED of the first plurality of LEDs associated with a first color temperature;
 - a first driver circuit configured to output a first plurality of currents;
 - a first switch assembly configured to:
 - cause the first driver circuit to output one of the first plurality of currents; and
 - couple the one of the first plurality of currents to the first plurality of LEDs; and
 - a first extender port; and
 - a second modular lighting apparatus traversing a second linear distance that is longer than the first linear distance, wherein the second modular lighting apparatus comprises:

a second plurality of light-emitting diodes (LEDs) arranged within a second linear form factor and having a second number of LEDs, each LED of the second plurality of LEDs associated with the first color temperature, wherein the second number is greater than the first number by a scale factor;

a second driver circuit configured to output a second plurality of currents;

a second switch assembly configured to:

cause the second driver circuit to output one of the second plurality of currents; and

couple the one of the second plurality of currents to the second plurality of LEDs, wherein the one of the second plurality of currents is greater than the one of the first plurality of currents by the scale factor; and

a second extender port configured to couple with the first extender port to combine the first modular lighting apparatus and the second modular lighting apparatus to traverse the first linear distance and the second linear distance.

11. (Original) The linear LED lighting system of claim 10, wherein the first switch assembly is configured to receive a signal to cause the first driver circuit to output the one of the first plurality of currents.

12. (Original) The linear LED lighting system of claim 11, wherein the signal is received via a wired connection.

13. (Original) The linear LED lighting system of claim 11, wherein the signal is received via a mechanical switch.

14. (Original) The linear LED lighting system of claim 11, wherein the signal comprises a wireless signal.

15. (Original) The linear LED lighting system of claim 10, wherein the first driver circuit comprise a current regulator.
16. (Original) The linear LED lighting system of claim 10, wherein the first extender is configured to electrically couple the first lighting apparatus to the second lighting apparatus.
17. (Original) The linear LED lighting system of claim 10, wherein each LED of the first plurality of LEDs receives a same amount of current via the one of the first plurality of currents that each LED of the second plurality of LEDs receives via the one of the second plurality of currents.
18. (Original) A linear light-emitting diode (LED) system, comprising:
a first modular lighting apparatus comprising:
a first array of light emitting diodes (LEDs) comprising:
a first plurality of LEDs associated with a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
a second plurality of LEDs associated with a second color temperature different from the first color temperature, wherein the second plurality of LEDs aligns within a second linear shape;
a first driver circuit configured to output a first plurality of currents;
a first switch assembly configured to couple to the first driver circuit, wherein the first switch assembly comprises:
a first switch configured to cause the first driver circuit to output one of the first plurality of currents;
a second switch configured to:
cause a first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs;

cause the first portion of the one of the first plurality of currents to couple to each LED of the second plurality of LEDs; or
cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs; and
a second modular lighting apparatus configured to electrically couple to the first lighting apparatus, wherein the second lighting apparatus comprises:
a second array of light emitting diodes (LEDs) comprising:
a third plurality of LEDs associated with a third color temperature, wherein the third plurality of LEDs aligns within a third linear shape, wherein the third color temperature matches the first color temperature, and wherein the third plurality of LEDs is longer than the first plurality of LEDs;
a fourth plurality of LEDs associated with a fourth color temperature matching the second color temperature, wherein the fourth plurality of LEDs aligns within a fourth linear shape, and wherein the fourth plurality of LEDs is longer than the second plurality of LEDs;
a second driver circuit configured to output a second plurality of currents;
a second switch assembly configured to couple to the second driver circuit, wherein the second switch assembly comprises:
a third switch configured to cause the second driver circuit to output one of the second plurality of currents; and
a fourth switch configured to:
cause a second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs;
cause the second portion of the one of the second plurality of currents to couple to each LED of the fourth plurality of LEDs;
or

cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs.

19. (Original) The linear LED system of claim 18, wherein the first modular lighting apparatus comprises a first connector configured to couple to a second connector part of the second modular lighting apparatus, wherein the first connector and second connector are configured to transmit data between the first modular light apparatus and the second modular lighting apparatus.

20. (Original) The linear LED system of claim 18, wherein a first ratio of the one of the second plurality of currents to the one of the first plurality of currents matches a second ratio of a first number of LEDs in the first plurality of LEDs to a second number of LEDs in the third plurality of LEDs.

REMARKS

In the Office Action, the Examiner rejected claims 1-9 and allowed claims 10-20. By the present response, claim 1 is amended. The amendments do not add any new matter, and support may be found in at least paragraphs [0030]-[0038] of the originally filed application. Upon entry of these amendments, claims 1-20 will be pending in the present application and are believed to be in condition for allowance. In view of the foregoing amendments and the following remarks, Applicant respectfully requests reconsideration and allowance of all pending claims.

Interview Summary

Applicant thanks Examiner Hammond for participating in an applicant-initiated telephonic interview with Applicant's representative, Jim Thomas, on January 5, 2025. During the course of the interview, Applicant's representative proposed to amend independent claim 1 to include various aspects of the specification. After discussing the amendment with the Examiner, the Examiner indicated that amended claim 1 will overcome the current rejections based on the currently cited references and that an updated search would be required. Again, Applicant appreciates the Examiner's courtesy for scheduling and conducting the interview.

Rejections under 35 U.S.C. § 103

The Examiner rejected claims 1-3 and 5-9 under 35 U.S.C. § 103(a) as being unpatentable over Koo (U.S. Patent Application Publication No. 2018/0231226) in view of Yadav (U.S. Patent Application Publication No. 2018/0209626). The Examiner rejected claim 4 as being unpatentable over Koo and Yadav and design choice. As mentioned above, Applicant presently amends claim 1 to clarify certain aspects of the invention. During the Examiner interview, the Examiner indicated that the amendments would overcome the present rejection to claim 1 in view of Koo and Yadav. As such, Applicant respectfully submits that independent claim 1 is patentable over Koo and

Yadav. Moreover, based at least on their dependencies from allowable claim 1, as well as the recitations therein, Applicant respectfully submits that claims 2-9 are also patentable over Koo and Yadav. Accordingly, Applicant respectfully requests that the Examiner withdraw the rejection to claims 1-9 under 35 U.S.C. § 103(a) and allow the same.

Allowable Subject Matter

In the Office Action, the Examiner indicated that claims 10-20 are allowable as written. *See* Office Action, page 6. Applicant thanks the Examiner for this indication of allowable subject matter. In view of the amendment to claim 1, Applicant respectfully submits that the present application is in condition for allowance.

Conclusion

In view of the amendments, interview summary, and remarks set forth above, Applicant respectfully requests withdrawal of the rejection and allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: January 25, 2023

/Jim Thomas/
Jim Thomas
Registration No. 71,611
FLETCHER YODER
P.O. Box 692289
Houston, TX 77269-2289
(281) 970-4545

Electronic Acknowledgement Receipt	
EFS ID:	47423248
Application Number:	17129228
International Application Number:	
Confirmation Number:	1012
Title of Invention:	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
First Named Inventor/Applicant Name:	Peter Angelo DallePezze
Customer Number:	37106
Filer:	Jim Thomas
Filer Authorized By:	
Attorney Docket Number:	AGSL:0002
Receipt Date:	25-JAN-2023
Filing Date:	21-DEC-2020
Time Stamp:	17:41:42
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AGSL0002_Response_to_NFOA.pdf	121025	yes	10
			6f7bb99b3c7fe7c51047fb696983ffd5a0d7e986		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Amendment/Request for Reconsideration-After Non-Final Rejection	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	10
Warnings:			
Information:			
Total Files Size (in bytes):		121025	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			

Notice of References Cited	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.	
	Examiner CRYSTAL L HAMMOND	Art Unit 2844	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20110116260-A1	05-2011	KRETSCHMANN; Hanno	H05B45/20	362/249.02
*	B	US-9719642-B1	08-2017	Macias; Guillermo	F21K9/278	1/1
	C					
	D					
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	G					
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	I					
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	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
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	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20230408

Issue Classification 	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.
	Examiner CRYSTAL L HAMMOND	Art Unit 2844

CPC						
Symbol					Type	Version
H05B	/	45	/	20	F	2020-01-01
F21V	/	23	/	009	I	2013-01-01
F21V	/	23	/	04	I	2013-01-01
F21V	/	23	/	06	I	2013-01-01
F21Y	/	2103	/	10	A	2016-08-01
F21Y	/	2115	/	10	A	2016-08-01
F21Y	/	2113	/	10	A	2016-08-01

CPC Combination Sets					
Symbol				Type	Set
	/		/		

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/CRYSTAL L HAMMOND/	08 April 2023	O.G. Print Claim(s)	O.G. Print Figure
Primary Examiner, Art Unit 2844	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20230408

Issue Classification 	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.	
	Examiner CRYSTAL L HAMMOND	Art Unit 2844	

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H05B45/20	/	45	/ 20
F21V23/04	/	23	/ 04
F21V23/06	/	23	/ 06
F21Y103/10	/	103	/ 10
F21Y115/10	/	115	/ 10
F21Y113/10	/	113	/ 10
NON-CLAIMED			
	/		/

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/CRYSTAL L HAMMOND/	08 April 2023	O.G. Print Claim(s)	O.G. Print Figure
Primary Examiner, Art Unit 2844	(Date)	1	1

U.S. Patent and Trademark Office

Part of Paper No.: 20230408

Issue Classification 	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.
	Examiner CRYSTAL L HAMMOND	Art Unit 2844

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19										
	2		11		20										
	3		12												
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NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 20	
/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844 (Primary Examiner) _____ (Date) 08 April 2023		O.G. Print Claim(s) 1	O.G. Print Figure 1

U.S. Patent and Trademark Office

Part of Paper No.: 20230408

<i>Search Notes</i> 	Application/Control No. 17/129,228	Applicant(s)/Patent Under Reexamination DallePezze et al.
	Examiner CRYSTAL L HAMMOND	Art Unit 2844

CPC - Searched*		
Symbol	Date	Examiner
text search in combination with (H05B45/20 OR F21V23/009 OR F21V23/04 OR F21V23/06 OR F21Y2103/10 OR F21Y2113/10 OR F21Y2115/10 OR F21Y2113/13).cpc.	11/30/2022	clh

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
inventive entity search	11/30/2022	clh
search history attached	11/30/2022	clh
updated search	02/20/2023	clh
updated search	04/08/2023	clh

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	text search in combination with all classes/subclasses	04/08/2023	clh

/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844	
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PE2E SEARCH - Search History (Prior Art)

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L3	5	((("DALLEPEZZE") near3 ("Peter")) OR ((("SVENDSEN") near3 ("Andrew"))).INV.	(US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT)	OR	ON	ON	2022/11/30 07:51 PM
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L24	41	"8917026" "8736186" "10136485" "10716183" "11408583").pn. (Artificial Intelligence) Similar to: 17/129,228 with 0 CPC Selections and 0 Text Selections Text: (US-20210400780-A1 OR WO-2022140030- A1 OR US-10907786- B2 OR EP-3660388-A1 OR GB-2579840-A OR CN-106102205-A OR CN-107455015-B OR CN-107455015-A OR RU-2691638-C2 OR TW-I507641-B OR EP- 3089553-A1 OR EP- 3089553-B1 OR RU- 2017112321-A OR CN- 106102205-B OR EP- 3192329-A1 OR WO- 2016037994-A1 OR TW-201344110-A OR JP-6679574-B2 OR US- 20220003365-A1 OR CN-105378375-A OR JP-2017528878-A OR CN-109838762-A OR CN-109315050-A OR WO-2023287886-A1 OR US-20220086979- A1 OR US- 20210018151-A1 OR US-11191140-B2 OR US-20210018150-A1 OR US-20220264716- A1 OR US-11212889- B2 OR EP-2981759-A1 OR WO-2014161665- A1 OR EP-2981759-B1 OR TW-I582337-B OR US-20180363859-A1 OR WO-2017131703- A1 OR US-10697595- B2 OR TW-201447170- A OR WO-2017131706- A1 OR US- 20160040859-A1 OR JP-2017016936-A OR DE-102013005934-A1 OR CN-111511066-A OR DE-202020107200- U1 OR US- 20110116260-A1 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO))	OR	ON	ON	2023/02/20 07:46 PM
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L25	1	CN-108419332-A OR US-10197224-B1 OR EP-3123824-B1 OR WO-2022128988-A1 OR US-10495272- B2).did. L23 AND L24	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO))	OR	ON	ON	2023/02/20 07:47 PM
L26	41	(Artificial Intelligence) Similar to: 17/129,228 with 0 CPC Selections and 0 Text Selections Text: (US-20210400780-A1 OR WO-2022140030- A1 OR WO- 2019148523-A1 OR US-10907786-B2 OR US-20200200343-A1 OR GB-2579840-A OR CN-106102205-A OR CN-107455015-B OR CN-107455015-A OR RU-2691638-C2 OR DE-212021000145-U1 OR TW-I507641-B OR EP-3089553-A1 OR EP-3089553-B1 OR RU-2017112321-A OR CN-106102205-B OR WO-2016037994-A1 OR EP-3192329-A1 OR TW-201344110-A OR JP-6679574-B2 OR US- 20220003365-A1 OR CN-105378375-A OR CN-109838762-A OR JP-2017528878-A OR EP-4012256-A1 OR US-20220268423-A1 OR US-20220086979- A1 OR US- 20210018151-A1 OR WO-2023287886-A1 OR WO-2014161665- A1 OR EP-2981759-A1 OR US-20220264716- A1 OR US-11589436- B2 OR US-11212889-	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO))	OR	ON	ON	2023/04/08 10:51 AM

		B2 OR CN-109315050-B OR EP-2981759-B1 OR CN-109315050-A OR TW-I582337-B OR US-20180363859-A1 OR WO-2017131703-A1 OR US-10697595-B2 OR TW-201447170-A OR US-20160040859-A1 OR DE-102013005934-A1 OR WO-2017131706-A1 OR US-20190024853-A1 OR CN-111511066-A OR DE-202020107200-U1 OR CN-108419332-A OR US-20110116260-A1).did.					
L27	555	((light ADJ emitting ADJ diode) LED) AND (color ADJ temperature) AND (second another additional) near5 (switch) AND (second another additional) near5 (color temperature) AND (second another additional) near5 length	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2023/04/08 12:02 PM
L28	12	((light ADJ emitting ADJ diode) LED) AND (color ADJ temperature) AND (second another additional) near5 (switch) AND (second another additional) near5 (color temperature) AND (second another additional) near5 length).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/04/08 12:12 PM
L29	62344	(H05B45/20 OR F21V23/009 OR F21V23/04 OR F21V23/06 OR F21Y2103/10 OR F21Y2113/10 OR F21Y2115/10 OR F21Y2113/13).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2023/04/08 12:40 PM
L30	104	L29 AND L27	(US-PGPUB; USPAT)	OR	ON	ON	2023/04/08 12:40 PM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
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04/08/2023 12:58:26 PM
Workspace: 17129228

Page 10 of 11
CH

N1	273	((light ADJ emitting ADJ diode) LED) AND (color ADJ temperature) AND (second another additional) near5 (switch) AND (second another additional) near5 (color temperature) AND (second another additional) near5 length	(US-PGPUB; USPAT)	OR	ON	ON	2023/04/08 12:10 PM
N2	12	((light ADJ emitting ADJ diode) LED) AND (color ADJ temperature) AND (second another additional) near5 (switch) AND (second another additional) near5 (color temperature) AND (second another additional) near5 length).clm.	(US-PGPUB; USPAT)	OR	ON	ON	2023/04/08 12:11 PM

Bibliographic Data

Application No: 17/129,228

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /CRYSTAL L HAMMOND/

Examiner's Signature

Initials

Title:

CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN
LINEAR LED FIXTURES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
12/21/2020	315	2844	AGSL:0002
RULE			

APPLICANTS

AGS Lighting Management, LLC, Houston, TX, UNITED STATES

INVENTORS

Peter Angelo DallePezze, Houston, TX, UNITED STATES

Andrew Michael Svendsen, Lakewood, CO, UNITED STATES

CONTINUING DATA

This application has PRO of 63040585 06/18/2020

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

01/04/2021

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

FLETCHER YODER P.C.

P.O. Box 692289

HOUSTON, TX 77269-2289

UNITED STATES

FILING FEE RECEIVED

\$830



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

37106 7590 04/14/2023
FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289

EXAMINER	
HAMMOND, CRYSTAL L	
ART UNIT	PAPER NUMBER
2844	

DATE MAILED: 04/14/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012

TITLE OF INVENTION: CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0.00	\$0.00	\$480	07/14/2023

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

37106 7590 04/14/2023
FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012

TITLE OF INVENTION: CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0.00	\$0.00	\$480	07/14/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
HAMMOND, CRYSTAL L	2844	315-294000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via Patent Center or EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012
37106 7590 04/14/2023 FLETCHER YODER P.C. P.O. Box 692289 HOUSTON, TX 77269-2289			EXAMINER HAMMOND, CRYSTAL L	
			ART UNIT 2844	PAPER NUMBER
DATE MAILED: 04/14/2023				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.** Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 17/129,228	Applicant(s) DallePezze et al.	
	Examiner CRYSTAL L HAMMOND	Art Unit 2844	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to amendmnets filed 01/25/2023.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-20 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☐ All b) ☐ Some* c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.	7. ☐ Other _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.	

/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844	
--	--

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Allowable Subject Matter

2. Claims 1-20 are allowed.
3. The following is an examiner's statement of reasons for allowance: Claim 1 requires a second plurality of LEDs configured to produce a second light having a second color temperature different from the first color temperature, wherein the second plurality of LEDs align within a second linear shape; a second switch configured to cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both; and wherein the linear LED lighting apparatus is configured to electrically couple to an additional linear LED lighting apparatus having a second length different than the first length by a scale factor, wherein the additional linear LED lighting apparatus is configured to produce a third light having the first color temperature via a third plurality of LEDs or a fourth light having the second color temperature via a fourth plurality of LEDs.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to CRYSTAL L HAMMOND whose telephone number is (571)270-1682. The examiner can normally be reached M-F 12pm-4pm Alt Fridays.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Taningco can be reached on 571-272-8048. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/CRYSTAL L HAMMOND/
Primary Examiner, Art Unit 2844

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	§	
Peter Angelo DallePezze et al.	§	Group Art Unit: 2844
	§	
Application No.: 17/129,228	§	Confirmation No.: 1012
	§	
Filed: December 21, 2020	§	Examiner: Hammond, Crystal L.
	§	
For: CONTROLLING COLOR	§	Atty. Docket: AGSL:0002
TEMPERATURE AND LUMINANCE IN	§	
LINEAR LED FIXTURES	§	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF TRANSMISSION OR MAILING 37 C.F.R. 1.8	
I hereby certify that this correspondence is being transmitted by facsimile to the United States Patent and Trademark Office in accordance with 37 C.F.R. § 1.6(d), or is being transmitted via the Office electronic filing system in accordance with 37 C.F.R. § 1.6(a)(4), or is being deposited with the U.S. Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date below:	
July 10, 2023	/Jim Thomas/
Date	Jim Thomas Reg. No. 71,611

AMENDMENT UNDER 37 C.F.R. §1.312

Pursuant to 37 C.F.R. §1.312, Applicant respectfully request entry of the following amendments in the above-identified patent application.

IN THE CLAIMS

The following listing of the claims is provided in accordance with 37 C.F.R. §1.121.

1. (Previously Presented) A linear light-emitting diode (LED) lighting apparatus, comprising:
 - an array of light emitting diodes (LEDs) having a first length, wherein the array of LEDs comprises:
 - a first plurality of LEDs configured to produce a first light having a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
 - a second plurality of LEDs configured to produce a second light having a second color temperature different from the first color temperature, wherein the second plurality of LEDs align within a second linear shape;
 - a driver circuit configured to output a plurality of currents;
 - a switch assembly configured to couple to the driver circuit, wherein the switch assembly comprises:
 - a first switch configured to cause the driver circuit to output one of the plurality of currents;
 - a second switch configured to cause the one of the plurality of currents to couple to the first plurality of LEDs, the second plurality of LEDs, or both; and
 - wherein the linear LED lighting apparatus is configured to electrically couple to an additional linear LED lighting apparatus having a second length different than the first length by a scale factor, wherein the additional linear LED lighting apparatus is configured to produce a third light having the first color temperature via a third plurality of LEDs or a fourth light having the second color temperature via a fourth plurality of LEDs.
2. (Original) The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions.

3. (Original) The linear LED lighting apparatus of claim 2, wherein the plurality of selectable positions comprises:
 - a first position configured to cause the switch assembly to couple the one of the plurality of currents to the first plurality of LEDs;
 - a second position configured to cause the switch assembly to couple the one of the plurality of currents to the second plurality of LEDs; and
 - a third position configured to cause the switch assembly to couple a first portion of the one of the plurality of currents to the first plurality of LEDs and a second portion of the one of the plurality of currents to the second plurality of LEDs.
4. (Original) The linear LED lighting apparatus of claim 1, wherein the first color temperature corresponds to 3000 Kelvin and the second color temperature corresponds to 4000 Kelvin.
5. (Original) The linear LED lighting apparatus of claim 1, wherein the second switch comprises a plurality of selectable positions, wherein each of the plurality of selectable positions is configured to cause the switch assembly to send a respective signal to the driver circuit, wherein the respective signal is configured to cause the driver circuit to output the one of the plurality of currents that corresponds to a current position of the plurality of selectable positions.
6. (Original) The linear LED lighting apparatus of claim 1, comprising a housing comprising an interior volume configured to hold the driver circuit, the first plurality of LEDs, and the second plurality of LEDs.
7. (Original) The linear LED lighting apparatus of claim 6, wherein the housing comprises a length greater than or equal to 24 inches.
8. (Original) The linear LED lighting apparatus of claim 6, wherein the switch assembly is configured to be positioned in a receptacle of the housing, and wherein the switch assembly is configured to be flush with a surface of the housing when positioned in the receptacle.

9. (Original) The linear LED lighting apparatus of claim 1, comprising at least one electrical connection configured to transmit electricity from the lighting apparatus to at least one other lighting apparatus.
10. (Original) A linear light-emitting diode (LED) lighting system, comprising:
a first modular lighting apparatus traversing a first linear distance, wherein the first modular lighting apparatus comprises:
a first plurality of light-emitting diodes (LEDs) arranged within a first linear form factor and having a first number of LEDs, each LED of the first plurality of LEDs associated with a first color temperature;
a first driver circuit configured to output a first plurality of currents;
a first switch assembly configured to:
cause the first driver circuit to output one of the first plurality of currents;
and
couple the one of the first plurality of currents to the first plurality of LEDs; and
a first extender port; and
a second modular lighting apparatus traversing a second linear distance that is longer than the first linear distance, wherein the second modular lighting apparatus comprises:
a second plurality of light-emitting diodes (LEDs) arranged within a second linear form factor and having a second number of LEDs, each LED of the second plurality of LEDs associated with the first color temperature, wherein the second number is greater than the first number by a scale factor;
a second driver circuit configured to output a second plurality of currents;
a second switch assembly configured to:
cause the second driver circuit to output one of the second plurality of currents; and
couple the one of the second plurality of currents to the second plurality of LEDs, wherein the one of the second plurality of currents is greater

than the one of the first plurality of currents by the scale factor;
and

a second extender port configured to couple with the first extender port to
combine the first modular lighting apparatus and the second modular lighting apparatus
to traverse the first linear distance and the second linear distance.

11. (Original) The linear LED lighting system of claim 10, wherein the first switch assembly
is configured to receive a signal to cause the first driver circuit to output the one of the first
plurality of currents.

12. (Original) The linear LED lighting system of claim 11, wherein the signal is received via
a wired connection.

13. (Original) The linear LED lighting system of claim 11, wherein the signal is received via
a mechanical switch.

14. (Original) The linear LED lighting system of claim 11, wherein the signal comprises a
wireless signal.

15. (Original) The linear LED lighting system of claim 10, wherein the first driver circuit
comprise a current regulator.

16. (Currently Amended) The linear LED lighting system of claim 10, wherein the first
extender port is configured to electrically couple the first modular lighting apparatus to the
second modular lighting apparatus.

17. (Original) The linear LED lighting system of claim 10, wherein each LED of the first
plurality of LEDs receives a same amount of current via the one of the first plurality of currents
that each LED of the second plurality of LEDs receives via the one of the second plurality of
currents.

18. (Currently Amended) A linear light-emitting diode (LED) system, comprising:
- a first modular lighting apparatus comprising:
 - a first array of light emitting diodes (LEDs) comprising:
 - a first plurality of LEDs associated with a first color temperature, wherein the first plurality of LEDs aligns within a first linear shape;
 - a second plurality of LEDs associated with a second color temperature different from the first color temperature, wherein the second plurality of LEDs aligns within a second linear shape;
 - a first driver circuit configured to output a first plurality of currents;
 - a first switch assembly configured to couple to the first driver circuit, wherein the first switch assembly comprises:
 - a first switch configured to cause the first driver circuit to output one of the first plurality of currents;
 - a second switch configured to:
 - cause a first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs;
 - cause the first portion of the one of the first plurality of currents to couple to each LED of the second plurality of LEDs; or
 - cause half of the first portion of the one of the first plurality of currents to couple to each LED of the first plurality of LEDs and each LED of the second plurality of LEDs; and
 - a second modular lighting apparatus configured to electrically couple to the first modular lighting apparatus, wherein the second modular lighting apparatus comprises:
 - a second array of light emitting diodes (LEDs) comprising:
 - a third plurality of LEDs associated with a third color temperature, wherein the third plurality of LEDs aligns within a third linear shape, wherein the third color temperature matches the first color temperature, and wherein the third plurality of LEDs is longer than the first plurality of LEDs;
 - a fourth plurality of LEDs associated with a fourth color temperature matching the second color temperature, wherein the fourth plurality of LEDs

aligns within a fourth linear shape, and wherein the fourth plurality of LEDs is longer than the second plurality of LEDs;
a second driver circuit configured to output a second plurality of currents;
a second switch assembly configured to couple to the second driver circuit,
wherein the second switch assembly comprises:

a third switch configured to cause the second driver circuit to output one of the second plurality of currents; and

a fourth switch configured to:

cause a second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs;

cause the second portion of the one of the second plurality of currents to couple to each LED of the fourth plurality of LEDs; or

cause half of the second portion of the one of the second plurality of currents to couple to each LED of the third plurality of LEDs and each LED of the fourth plurality of LEDs.

19. (Original) The linear LED system of claim 18, wherein the first modular lighting apparatus comprises a first connector configured to couple to a second connector part of the second modular lighting apparatus, wherein the first connector and second connector are configured to transmit data between the first modular light apparatus and the second modular lighting apparatus.

20. (Original) The linear LED system of claim 18, wherein a first ratio of the one of the second plurality of currents to the one of the first plurality of currents matches a second ratio of a first number of LEDs in the first plurality of LEDs to a second number of LEDs in the third plurality of LEDs.

REMARKS

By the present paper, Applicant respectfully requests entry of the above amendments to claims 16 and 18. Applicant notes that the amendment merely corrects formal matters and do not change the scope of the respective claims. As such, Applicant has elected to file the amendment under 37 C.F.R. §1.312 and respectfully request that the Examiner enter the present amendments prior to issuance.

General Authorization

In accordance with 37 C.F.R. § 1.136, Applicant hereby provides a general authorization to treat this and any future reply requiring an extension of time as incorporating a request therefore. Furthermore, Applicant authorizes the Commissioner to charge the appropriate fee for any extension of time, or any other fees that the Commissioner believes are due, now or in the future, to Deposit Account No. 06-1315; Order No. AGSL:0002/THO.

Conclusion

In view of the amendments and remarks set forth above, Applicant respectfully request entry of the amendment prior to issuance. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: July 10, 2023

/Jim Thomas/
Jim Thomas
Reg. No. 71,611
FLETCHER YODER
P.O. Box 692289
Houston, Texas 77269-2289
(281) 970-4545

Electronic Patent Application Fee Transmittal				
Application Number:		17129228		
Filing Date:		21-Dec-2020		
Title of Invention:		CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES		
First Named Inventor/Applicant Name:		Peter Angelo DallePezze		
Filer:		Jim Thomas/Amanda Hennessey		
Attorney Docket Number:		AGSL:0002		
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				480

Electronic Acknowledgement Receipt	
EFS ID:	48269701
Application Number:	17129228
International Application Number:	
Confirmation Number:	1012
Title of Invention:	CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES
First Named Inventor/Applicant Name:	Peter Angelo DallePezze
Customer Number:	37106
Filer:	Jim Thomas
Filer Authorized By:	
Attorney Docket Number:	AGSL:0002
Receipt Date:	10-JUL-2023
Filing Date:	21-DEC-2020
Time Stamp:	18:04:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$480
RAM confirmation Number	E202370I05026715
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	AGSL0002_PartB_FeeTransmittal.pdf	1670824	no	1
			1da167febd597c9833d46ff46cc3ae0265d8de15		
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	AGSL0002_Comments_on_Statement_of_Reasons_for_Allowance.pdf	75147	no	1
			e7167970456e8161aba4b45bf328674456cbe6a9		
Warnings:					
Information:					
3		AGSL0002_Rule_312_Amendment.pdf	95936	yes	8
			dd185698995389bbae08fcad25f0fc778d153de		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment after Notice of Allowance (Rule 312)		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	8	
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	37950	no	2
			19aceae12ac9d9c0cee16f03eea745820f888f37		
Warnings:					
Information:					
Total Files Size (in bytes):			1879857		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

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Commissioner for Patents
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Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

37106 7590 04/14/2023

FLETCHER YODER P.C.
P.O. Box 692289
HOUSTON, TX 77269-2289

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(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL0002	1012

TITLE OF INVENTION: CONTROLLING COLOR TEMPERATURE AND LUMINANCE IN LINEAR LED FIXTURES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0.00	\$0.00	\$480	07/14/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
HAMMOND, CRYSTAL L	2844	315-294000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Fletcher Yoder, P.C.

2

3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

AGS Lighting Management, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Houston, Texas

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☒ Electronic Payment via Patent Center or EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 06-1315

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Jim Thomas/

Date July 10, 2023

Typed or printed name Jim Thomas

Registration No. 71,611

First Named Inventor	§		
Peter Angelo DallePezze et al.	§	Group Art Unit:	2844
	§		
Application No.: 17/129,228	§	Examiner:	Hammond, Crystal L.
	§		
Filed: December 21, 2020	§	Confirmation No.:	1012
	§		
For: CONTROLLING COLOR	§	Atty. Docket:	AGSL:0002
TEMPERATURE AND LUMINANCE IN	§		
LINEAR LED FIXTURES	§		

CERTIFICATE OF TRANSMISSION OR MAILING 37 C.F.R. 1.8	
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July 10, 2023	/Jim Thomas/
Date	Jim Thomas Reg. No. 71.611

On April 14, 2023, a Notice of Allowance and Fee(s) Due was mailed for the above-referenced application. In this paper, the Examiner provided a Statement of Reasons for Allowance. Although Applicant gratefully acknowledge the Examiner's Allowance of the present claims, Applicant does not necessarily agree with the Examiner's Reasons for Allowance. First, Applicant believes that the record in this case is sufficiently clear that the Examiner's Statement of Reasons of Allowance is not needed. Further, Applicant notes that the claims include recitations in addition or alternative to those noted by the Examiner that are not taught or suggested by the prior art of record. Accordingly, Applicant respectfully declines to accept any of the Examiner's comments as admissions of Applicant.

/Jim Thomas/
Jim Thomas
Reg. No. 71,611
FLETCHER YODER, P.C.
(281) 970-4545



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	12/21/2020	Peter Angelo DallePezze	AGSL:0002	1012
37106	7590	08/07/2023		
FLETCHER YODER P.C. P.O. Box 692289 HOUSTON, TX 77269-2289			EXAMINER HAMMOND, CRYSTAL L.	
			ART UNIT 2844	PAPER NUMBER
			NOTIFICATION DATE 08/07/2023	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

docket@fyiplaw.com

Response to Rule 312 Communication	Application No. 17/129,228	Applicant(s) DallePezze et al.	
	Examiner CRYSTAL L HAMMOND	Art Unit 2844	AIA (FITF) Status Yes
-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --			
1. ☒ The amendment filed on <u>10 July 2023</u> under 37 CFR 1.312 has been considered, and has been: a) ☒ entered. b) ☐ entered as directed to matters of form not affecting the scope of the invention. c) ☐ disapproved because the amendment was filed after the payment of the issue fee. Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue. d) ☐ disapproved. See explanation below. e) ☐ entered in part. See explanation below. f) ☐ not entered because the supplemental or corrected Application Data sheet (ADS) ☐ was not accompanied by a petition to accept an unintentionally delayed claim under 37 CFR 1.55 or 27 CFR 1.78; ☐ did not identify the information being changed in accordance with 37 CFR 1.76(c)(2); ☐ was not properly signed in accordance with 37 CFR 1.76(e) (or 37 CFR 1.33(b) for applications filed prior to September 16, 2012). _____			
/CRYSTAL L HAMMOND/ Primary Examiner, Art Unit 2844			

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

First Named Inventor:	§	
Peter Angelo DallePezze et al.	§	Group Art Unit: 2844
	§	
Application No.: 17/129,228	§	Confirmation No.: 1012
	§	
Filed: December 21, 2020	§	Examiner: Hammond, Crystal L.
	§	
For: CONTROLLING COLOR	§	Atty. Docket: AGSL:0002
TEMPERATURE AND LUMINANCE IN	§	
LINEAR LED FIXTURES	§	

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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July 10, 2023	/Jim Thomas/
Date	Jim Thomas Reg. No. 71,611

AMENDMENT UNDER 37 C.F.R. §1.312

Pursuant to 37 C.F.R. §1.312, Applicant respectfully request entry of the following amendments in the above-identified patent application.

OK TO ENTER: /C.L.H/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/129,228	09/05/2023	11751302	AGSL:0002	1012
37106	7590	08/16/2023		
FLETCHER YODER P.C. P.O. Box 692289 HOUSTON, TX 77269-2289				

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at <https://patentcenter.uspto.gov/>. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at <https://certifiedcopycenter.uspto.gov/index.html>. The Certified Copy Center may be reached at (800)972-6382.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment is 202 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (<https://patentcenter.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

INVENTOR(s) (Please see PATENT CENTER site <https://patentcenter.uspto.gov> for additional inventors):

Peter Angelo DallePezze, Houston, TX;
Andrew Michael Svendsen, Lakewood, CO;

APPLICANT(s) (Please see PATENT CENTER site <https://patentcenter.uspto.gov> for additional applicants):

AGS Lighting Management, LLC, Houston, TX;

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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17/129,228	05-Sep-2023	11751302

FLETCHER YODER P.C.
P.O. Box 692289
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