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Pyshos et al.

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(54) **CONFIGURABLE LIGHTING SYSTEM**

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Feb. 16, 2017, now Pat. No. 9,820,350.
(Continued)

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F21K 9/62 (2016.01)
(Continued)

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CPC **H05B 33/0863** (2013.01); **F21K 9/62**
(2016.08); **F21S 8/026** (2013.01); **F21V 3/02**
(2013.01);
(Continued)

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CPC H05B 37/02; H05B 33/08; H05B 33/0845;
H05B 33/0863; F21K 9/62; F21S 8/026;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,127,783 A 10/2000 Pashley et al.
6,149,283 A 11/2000 Conway et al.
(Continued)

FOREIGN PATENT DOCUMENTS

CN 201844227 5/2011

OTHER PUBLICATIONS

Test Report of California Appliance Efficiency Compliance for
Permanently Installed High Efficacy LEDs under Title 24, issued
Nov. 18, 2015.

(Continued)

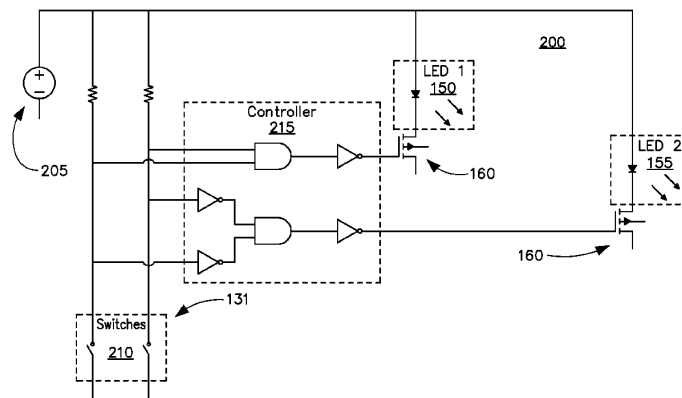
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(57) **ABSTRACT**

A system can configure a luminaire for providing illumina-
tion of a selected color temperature, a selected lumen output,
or a selected photometric distribution. The luminaire can
comprise at least two light sources that have different
illumination characteristics, for example different color tem-
peratures, different lumen outputs, or different photometric
distributions. The system can configure the luminaire to
operate a first of the two light sources, a second of the two
light sources, or both of the light sources based on an input.
When the luminaire is configured to operate both of the light
sources, the luminaire can produce illumination having a
color temperature, a lumen output, or a photometric distri-
bution that is different than either of the two light sources.

20 Claims, 10 Drawing Sheets



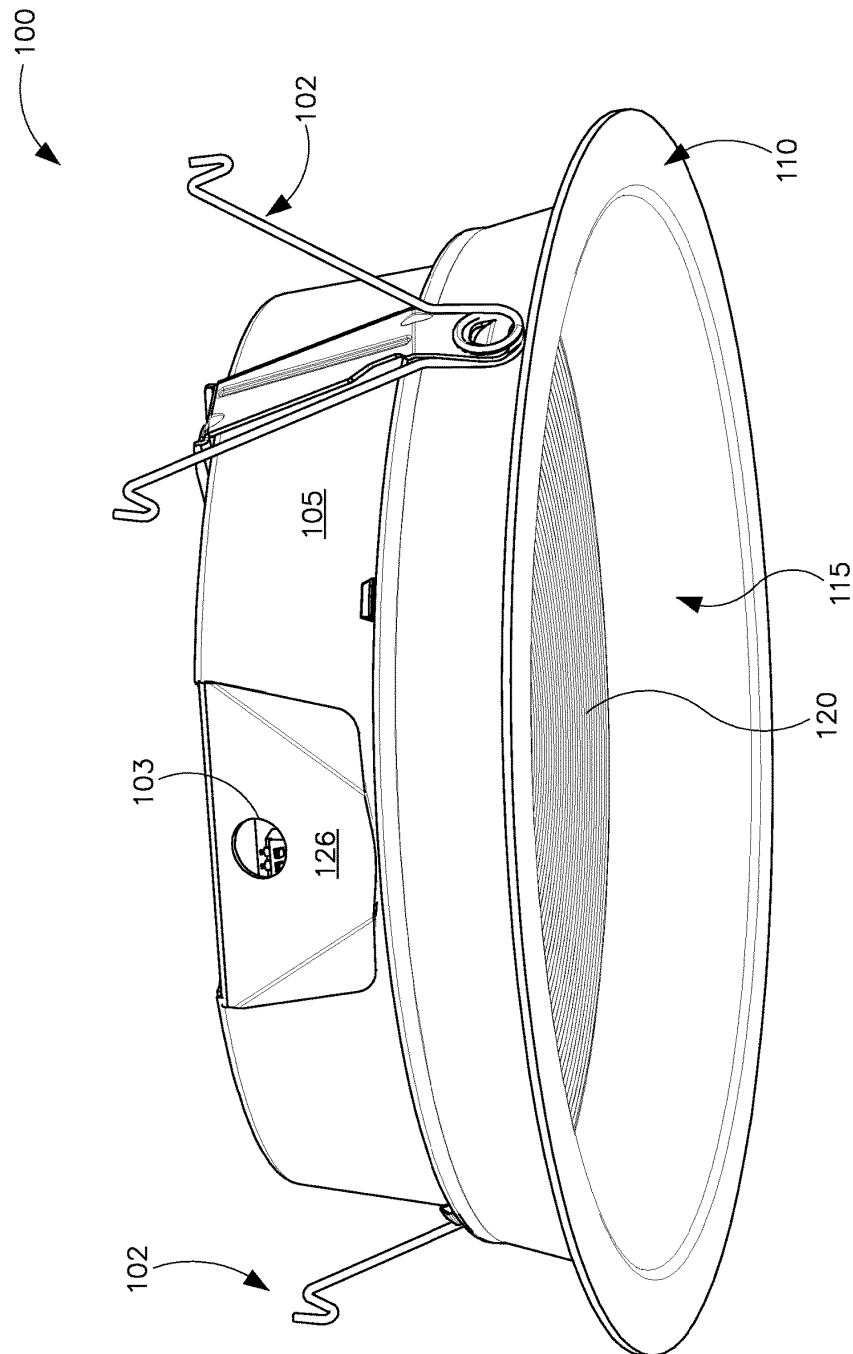


FIG. 1A

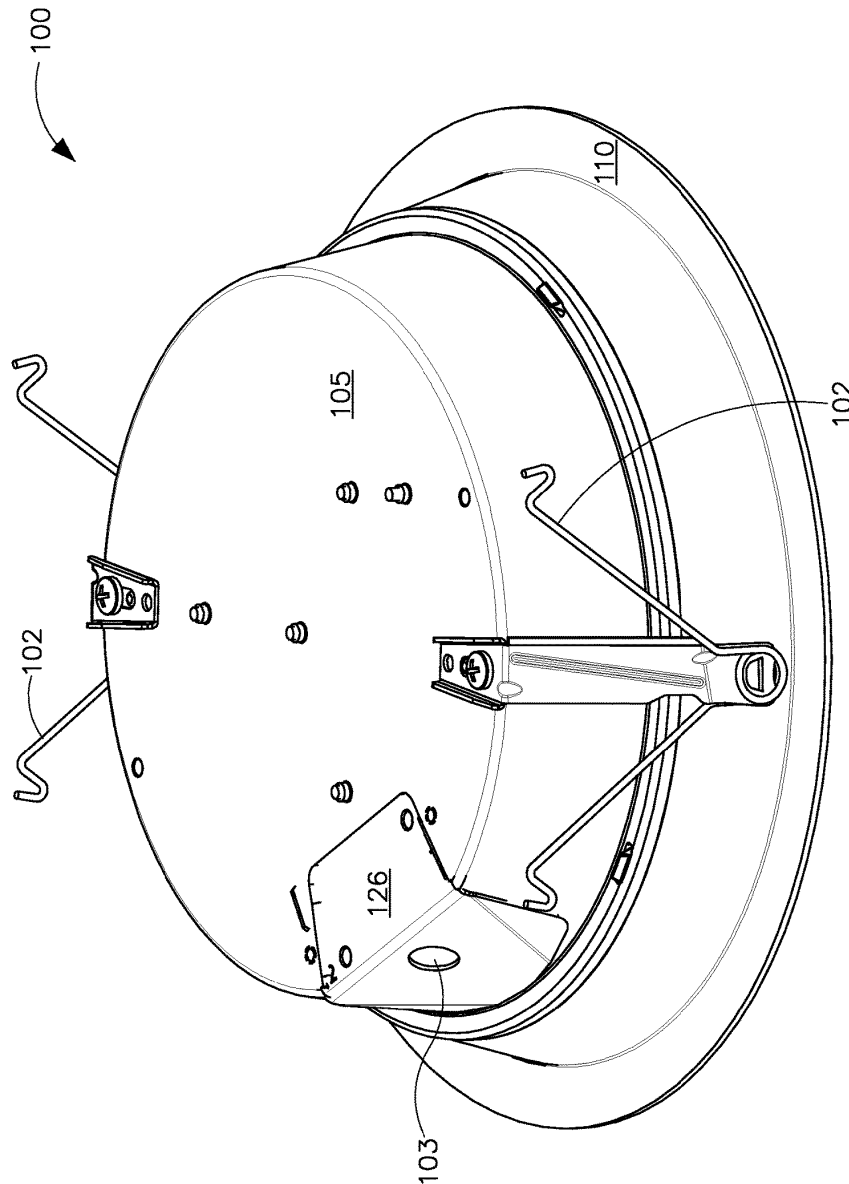


FIG. 1B

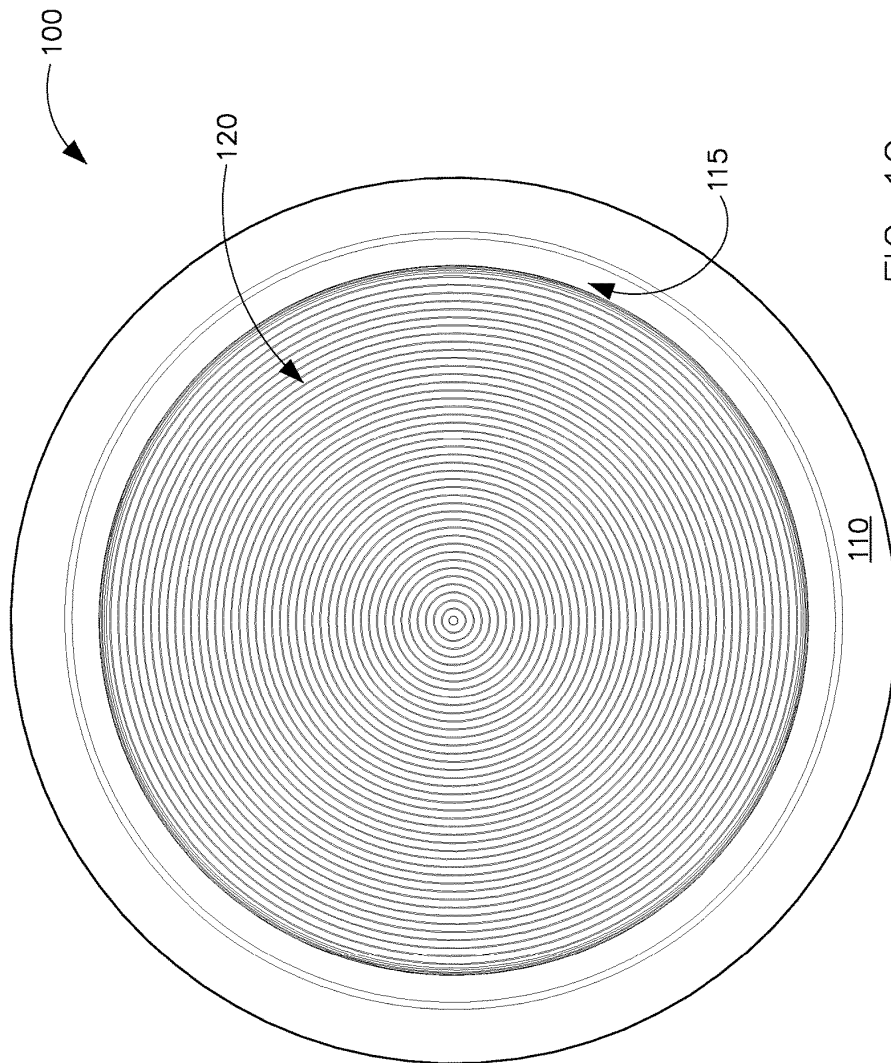


FIG. 1C

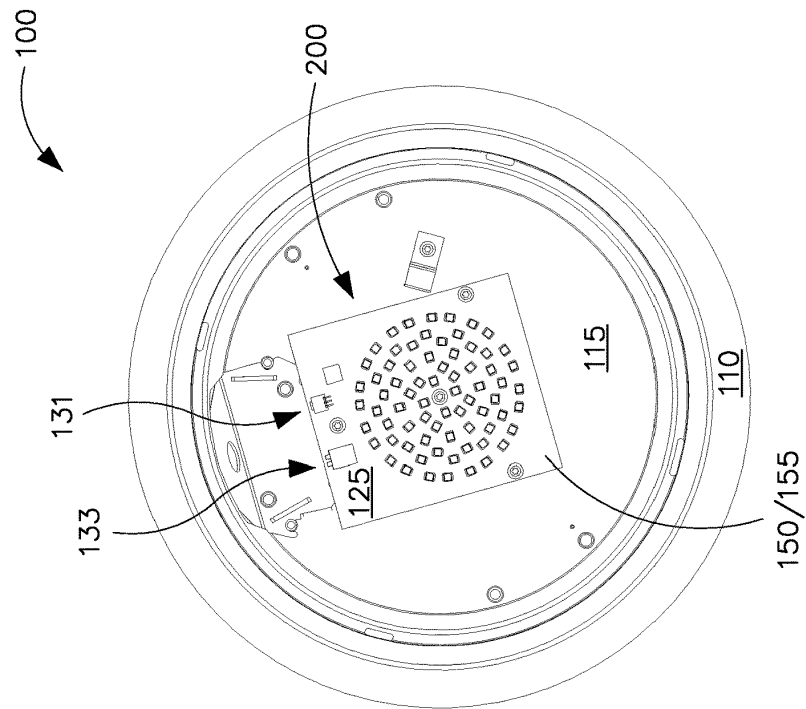


FIG. 1E

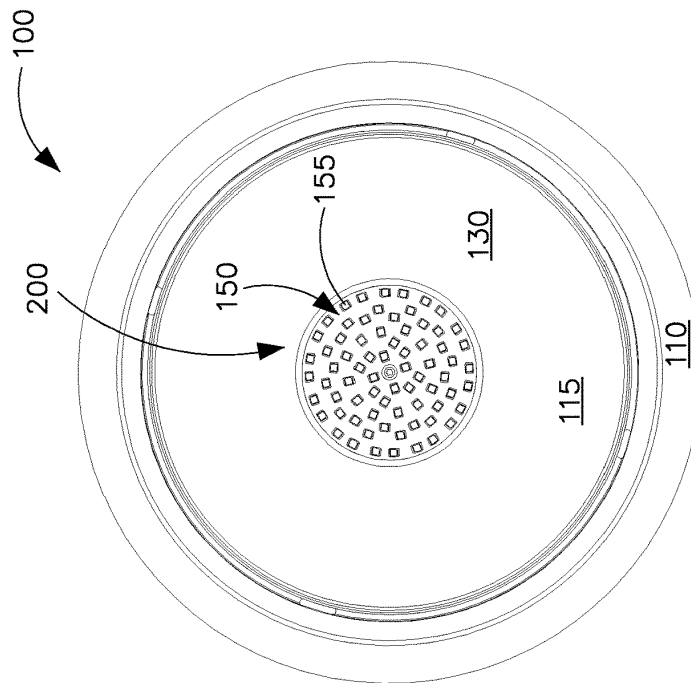
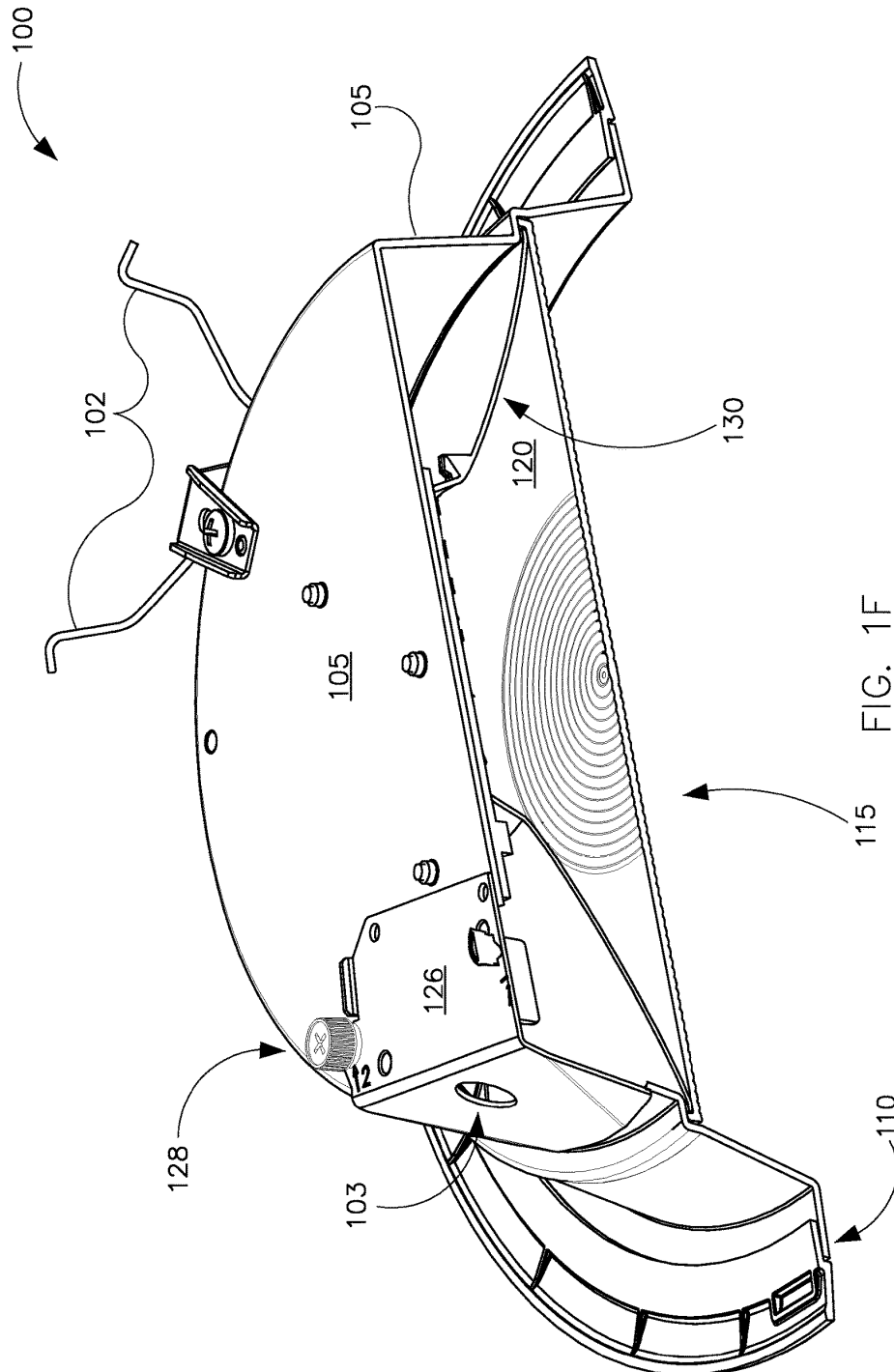


FIG. 1D



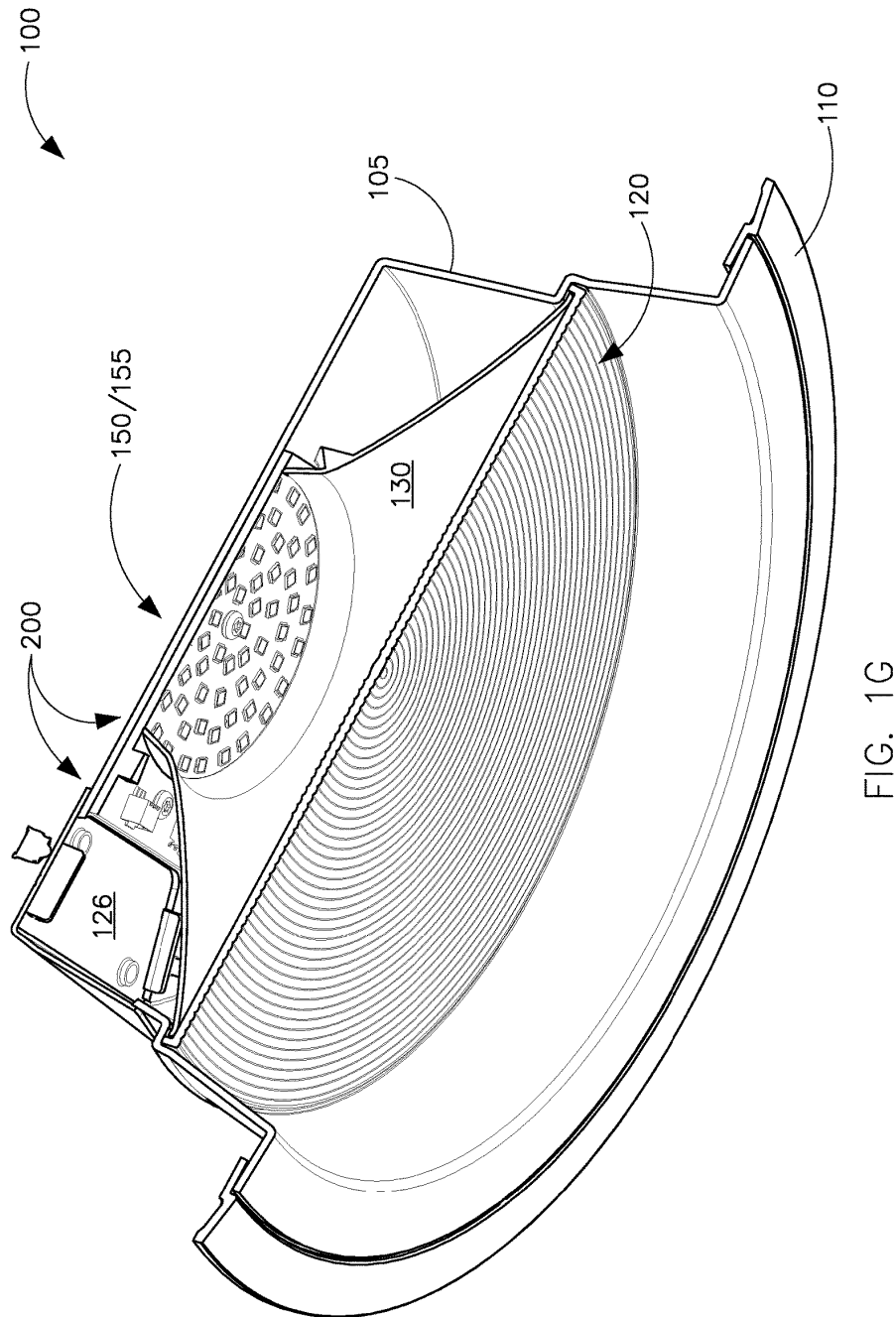


FIG. 1G

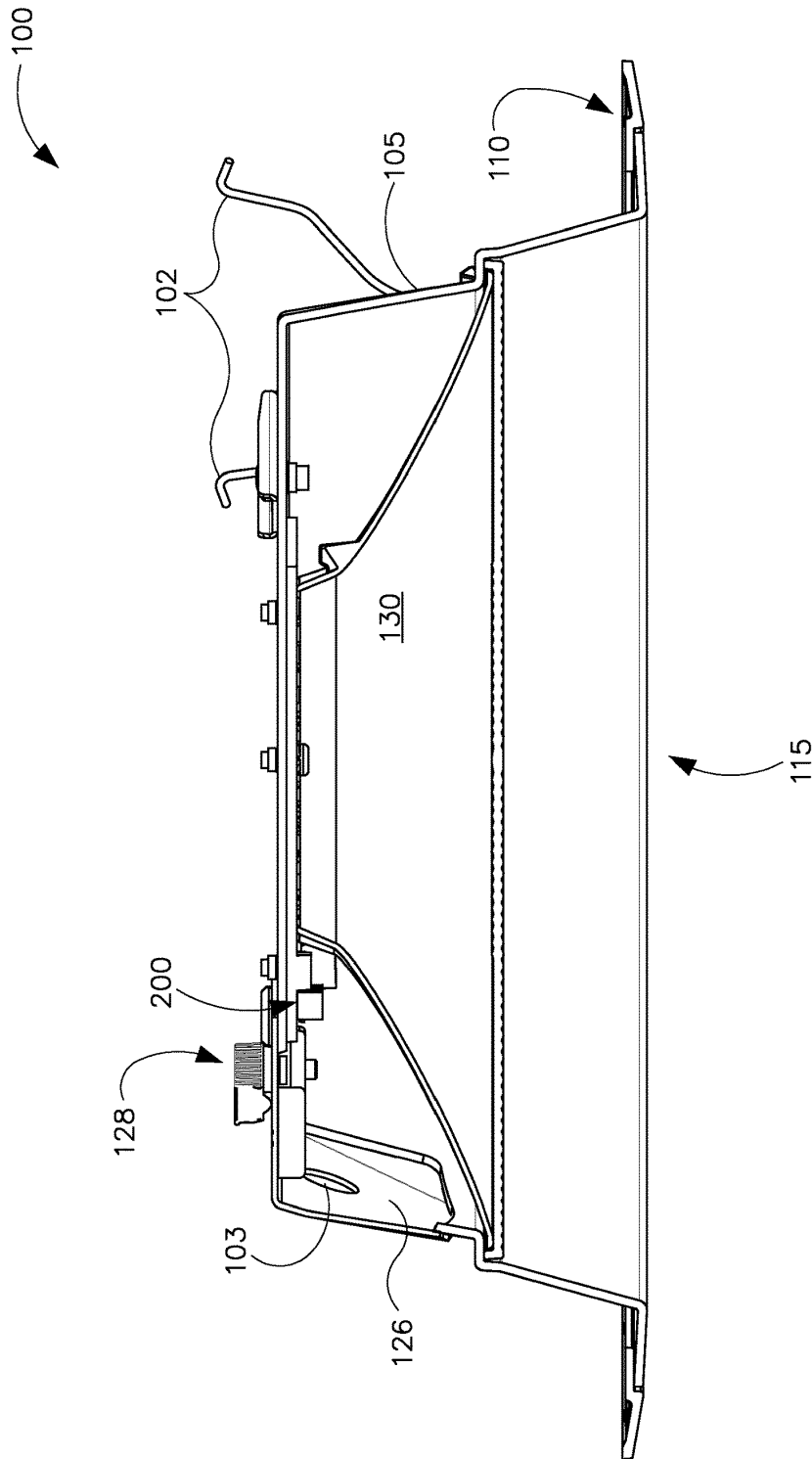


FIG. 1H

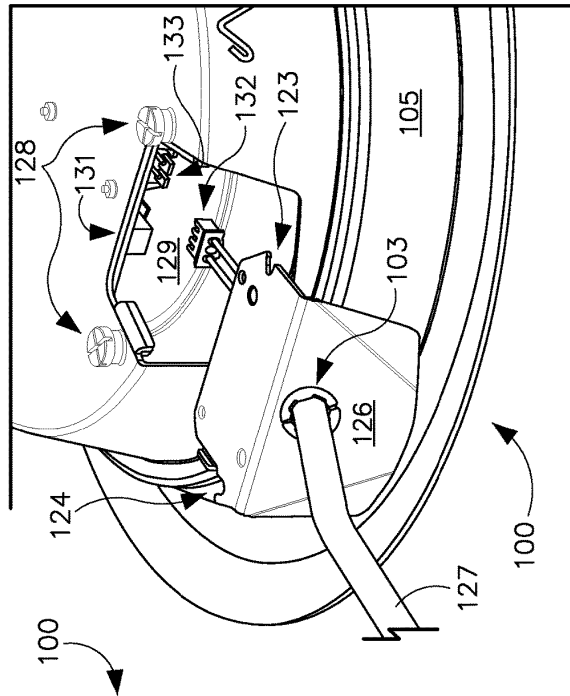


FIG. 1J

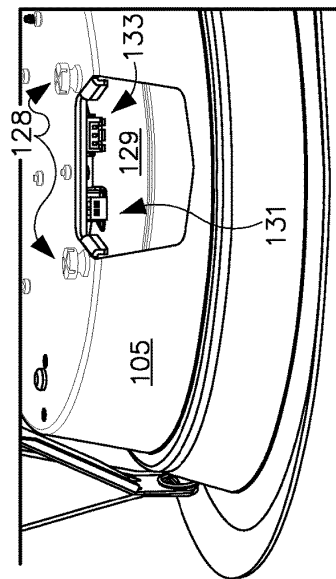


FIG. 11

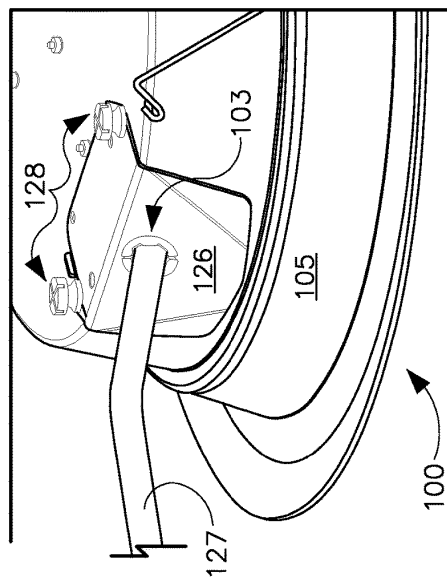
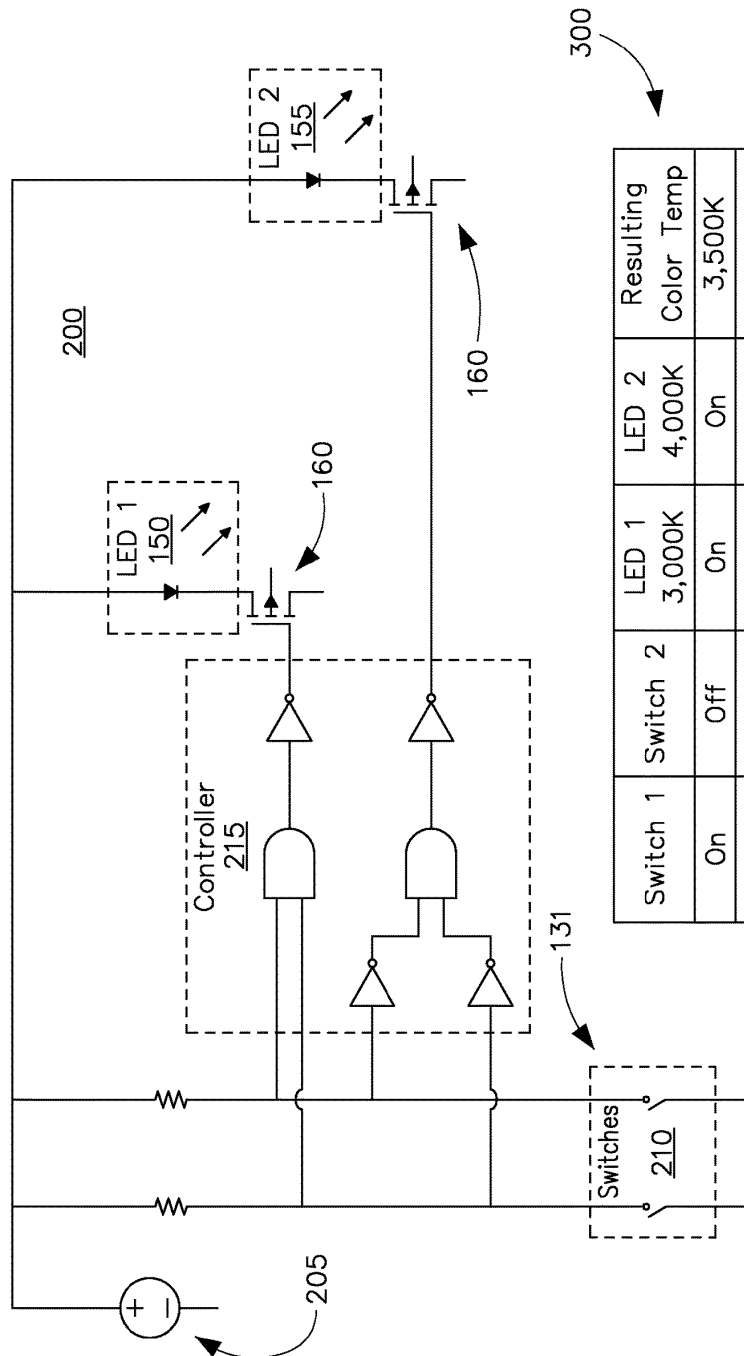


FIG. 1K

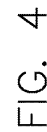
FIG. 2



300

Switch 1	Switch 2	LED 1 3,000K	LED 2 4,000K	Resulting Color Temp
On	Off	On	On	3,500K
Off	On	On	On	3,500K
On	On	On	Off	3,000K
Off	Off	Off	On	4,000K

FIG. 3



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CONFIGURABLE LIGHTING SYSTEM**CROSS REFERENCE TO RELATED APPLICATIONS**

The present application is a continuation application of and claims priority to U.S. patent application Ser. No. 15/435,141, filed Feb. 16, 2017, and titled "Configurable Lighting System," which claims priority to U.S. Provisional Patent Application No. 62/297,424 filed Feb. 19, 2016, and titled "Configurable Lighting System". The entire contents of the foregoing applications are hereby incorporated herein by reference.

TECHNICAL FIELD

Embodiments of the technology relate generally to lighting systems and more specifically to lighting systems that can be readily configured to produce illumination of different color temperatures.

BACKGROUND

For illumination applications, light emitting diodes (LEDs) offer substantial potential benefit associated with their energy efficiency, light quality, and compact size. However, to realize the full potential benefits offered by light emitting diodes, new technologies are needed.

With luminaires that incorporate incandescent or fluorescent technology, some flexibility can be obtained by swapping lamps to meet user preferences. In such luminaires, lamp selection can provide flexibility in terms of correlated color temperature (CCT or color temperature) and light output (lumen output). For example, a compact fluorescent downlight might accept 6-, 32-, and 42-watt lamps in 2700, 3000, and 3500 K CCT. Additionally, changing lamp position and focal point in a reflector of an incandescent or fluorescent fixture can change the fixture spacing criteria (SC) of a luminaire.

In contrast, conventional light-emitting-diode-based luminaires typically offer reduced flexibility when the luminaire's light-emitting-diode-based light source is permanently attached to the luminaire. Stocking conventional light-emitting-diode-based luminaires at distribution to accommodate multiple configurations that users may desire can entail maintaining a relatively large or cumbersome inventory.

Need is apparent for a technology to provide a light emitting diode system that can adapt to various applications, for example by delivering multiple color temperatures, multiple lumens, and/or multiple photometric distributions. Need further exists for a capability to enable a single luminaire to be stocked at distribution and then quickly configured according to application parameters and deployment dictates. Need further exists for luminaires that are both energy efficient and flexible. A capability addressing one or more such needs, or some other related deficiency in the art, would support improved illumination systems and more widespread utilization of light emitting diodes in lighting applications.

SUMMARY

In some aspects of the disclosure, a system can configure a luminaire for providing illumination of a selected color temperature, a selected lumen output, or a selected photometric distribution based on an input. The input may be field

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selectable or may be selectable at a distribution center or at a late stage of luminaire manufacture, for example.

In some aspects of the disclosure, the luminaire can comprise at least two light sources having different color temperatures. In a first configuration, the luminaire can produce illumination of a first color temperature using a first one of the light sources. In a second configuration, the luminaire can produce illumination of a second color temperature using a second one of the light sources. In a third configuration, the luminaire can produce illumination of a third color temperature using both of the first and second light sources. The third color temperature may be between the first and second color temperatures. The value of the third color temperature within a range between the first and second color temperatures can be controlled by manipulating the relative amounts of light output by the first and second light sources. That is, adjusting the lumen outputs of the first and second light sources can define the color temperature of the illumination produced by the luminaire in the third configuration.

In some aspects of the disclosure, the luminaire can comprise at least two light sources having different lumen outputs. In a first configuration, the luminaire can produce illumination of a first lumen output using a first one of the light sources. In a second configuration, the luminaire can produce illumination of a second lumen output using a second one of the light sources. In a third configuration, the luminaire can produce illumination of a third lumen output using both of the first and second light sources.

In some aspects of the disclosure, the luminaire can comprise at least two light sources having different photometric distributions. In a first configuration, the luminaire can produce illumination of a first photometric distribution using a first one of the light sources. In a second configuration, the luminaire can produce illumination of a second photometric distribution using a second one of the light sources. In a third configuration, the luminaire can produce illumination of a third photometric distribution using both of the first and second light sources.

In some aspects of the disclosure, a circuit and an associated input to the circuit can configure a luminaire for providing illumination having a selected property, for example a selected color temperature, a selected lumen output, or a selected photometric distribution. The input can be settable to a first number of states. The circuit can map the first number of states into a second number of states that is less than the first number of states. For example, the input can have four states and the circuit can map these four states into three states. The three states can correspond to three different values of the illumination property, for example three different color temperatures, three different lumen outputs, or three different photometric distributions.

The foregoing discussion of controlling illumination is for illustrative purposes only. Various aspects of the present disclosure may be more clearly understood and appreciated from a review of the following text and by reference to the associated drawings and the claims that follow. Other aspects, systems, methods, features, advantages, and objects of the present disclosure will become apparent to one with skill in the art upon examination of the following drawings and text. It is intended that all such aspects, systems, methods, features, advantages, and objects are to be included within this description and covered by this application and by the appended claims of the application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, and 1K (collectively FIG. 1) illustrate views of a luminaire in accordance with some example embodiments of the disclosure.

FIG. 2 illustrates a functional block diagram of a circuit that a luminaire can comprise in accordance with some example embodiments of the disclosure.

FIG. 3 illustrates a state table for a circuit that a luminaire can comprise in accordance with some example embodiments of the disclosure.

FIG. 4 illustrates a schematic of a circuit that a luminaire can comprise in accordance with some example embodiments of the disclosure.

Many aspects of the disclosure can be better understood with reference to the above drawings. The drawings illustrate only example embodiments and are therefore not to be considered limiting of the embodiments described, as other equally effective embodiments are within the scope and spirit of this disclosure. The elements and features shown in the drawings are not necessarily drawn to scale, emphasis instead being placed upon clearly illustrating principles of the embodiments. Additionally, certain dimensions or positionings may be exaggerated to help visually convey certain principles. In the drawings, similar reference numerals among different figures designate like or corresponding, but not necessarily identical, elements.

DESCRIPTION OF EXAMPLE EMBODIMENTS

In some example embodiments of the disclosure, a luminaire can comprise multiple groups of light emitting diodes of different color temperatures and a constant current power supply for powering the light emitting diodes. The power supply can utilize a switching scheme that can turn each group of light emitting diodes on and off to change the color temperature of the luminaire. In some example embodiments, the power supply can further vary the relative intensities of the light emitting diodes to manipulate the color temperature of the luminaire within a range.

For example, the luminaire can comprise a 3,000 K group of light emitting diodes and a 4,000 K group of light emitting diodes. When only the 3,000 K group is on, the luminaire can deliver 3,000 K illumination. When only the 4,000 K group is on, the luminaire can deliver 4,000 K illumination. When the 3,000 K group and the 4,000 K group are both on, the luminaire can deliver 3,500 K illumination. If the 4,000 K group of light emitting diodes is concurrently operated at a low lumen output and the 3,000 K group is operated at a high lumen output, the luminaire may deliver illumination of another selected color temperature, for example 3,100 K.

In some example embodiments, a controller can adjust lumen output automatically to maintain constant delivered lumens across multiple color temperatures or to suit application requirements. The controller implements the adjustment utilizing programmable driver current and/or via turning on and off various groups of light emitting diodes. Configurable color temperature or lumen output can function in combination with integral dimming, for example to facilitate interface with building automation, sensors, and dimmers.

In some example embodiments, luminaires can achieve an additional level of flexible configuration at a distribution center using interchangeable optics. For example, primary optics can provide medium distribution (e.g. spacing criteria equals 1.0), while a diffuser or concentrator lens can be used

to achieve wide distribution (e.g. spacing criteria equals 1.4), and narrow distribution (e.g. spacing criteria equals 0.4).

In some example embodiments, a luminaire's configuration of delivered lumens and color temperatures can be set at the factory, at distribution, or in the field. To meet current and emerging code compliance, performance markings on a luminaire can indicate and correspond to the desired setting. Economical, field-installed nameplates can identify the various electrical and optical performance ratings and, when installed, permanently program the delivered lumens and color temperature. Other settings, such as dimming protocols, can likewise be configured. The interface between the nameplate and internal logic can use mechanical, electrical or optical means, for example.

Accordingly, in some embodiments of the disclosure, the technology provides product markings and supports regulatory compliance. For example, nameplates can indicate energy codes and rebate opportunities, for compliance with product labeling and to facilitate compliance confirmation by local authorities who may have jurisdiction.

Some representative embodiments will be further described hereinafter with example reference to the accompanying drawings that describe representative embodiments of the present technology. In the drawings, FIG. 1 illustrates views of a representative luminaire 100; FIG. 2 illustrates a functional block diagram of a representative circuit 200 that the luminaire 100 can comprise; FIG. 3 illustrates a representative state table for the circuit 200; and FIG. 4 illustrates a representative schematic for the circuit 200. The technology may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the technology to those appropriately skilled in the art.

Referring now to FIG. 1, multiple views of the luminaire 100 are shown. FIG. 1A illustrates a side perspective view of the luminaire 100. FIG. 1B illustrates a top perspective view of the luminaire 100. FIG. 1C illustrates a view of the light-emitting bottom of the luminaire 100, showing a lens 120 in a light-emitting aperture 115 of the luminaire 100. FIG. 1D illustrates a view of the light-emitting bottom of the luminaire 100 with the lens 120 removed from the light-emitting aperture 115 of the luminaire. FIG. 1E illustrates a view of the light-emitting bottom of the luminaire 100 with the lens 120 and an associated reflector 130 removed from the light-emitting aperture 115 of the luminaire. FIG. 1F illustrates a cutaway perspective view of the luminaire 100. FIG. 1G illustrates another cutaway perspective view of the luminaire 100. FIG. 1H illustrates another cutaway view of the luminaire 100. FIGS. 1I, 1J, and 1K provide detailed views of a portion of the luminaire 100 comprising a cover 126 and an associated access aperture 129 for providing internal access to the luminaire 100. In FIG. 1I, the cover 126 is fully removed. In FIG. 1J, the cover 126 is positioned adjacent the access aperture 129, for example in connection with attachment or removal of the cover 126. In FIG. 1K, the cover 126 is attached to the luminaire 100.

As best seen in the views of FIGS. 1A and 1B, the illustrated example luminaire 100 is suited for inserting in an aperture in a ceiling to provide overhead lighting. In this example embodiment, the luminaire 100 can be characterized as an overhead light or a recessed ceiling light. Various other indoor and outdoor luminaires that may be mounted in a wide range of orientations can be substituted for the luminaire 100 illustrated in FIG. 1.

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The illustrated example luminaire 100 of FIG. 1 comprises a housing 105 that is circular with a protruding rim 110 that extends circumferentially about the housing 105. When the luminaire 100 is installed in a ceiling aperture, the rim 100 circumscribes and covers the edge of the ceiling aperture for aesthetics, for support, and for blocking of debris from above the ceiling. Hanger clips 102 hold the luminaire 100 in place in installation.

As best illustrated in FIGS. 1I, 1J, and 1K, the example luminaire 100 comprises an access aperture 129 and an associated cover 126. The access aperture 129 provides access to the interior of the luminaire housing 105, for example in the field and/or during luminaire installation. An installer can remove the cover 126 and manually set a dual inline pin (DIP) switch 131 to configure the luminaire 100 for long-term operation providing illumination with a selected color temperature, a selected lumen output, and/or a selected photometric distribution. As illustrated, the dual inline pin switch 131 is mounted on a circuit board adjacent the access aperture 129, thereby facilitating convenient and efficient access in the field or at a distribution center, for example.

An electrical cable 127 extends through a wiring aperture 103 in the cover 126. The electrical cable 127 terminates in a plug 132 that mates with a receptacle 133 that is mounted inside the housing 105 adjacent the access aperture 129 for convenient field access.

As illustrated, the example cover 126 comprises two notches 123, 124 that each receives a respective screw 128 for holding the cover 126 in place. The notch 123 is disposed on the right side of the cover 126 and is sized to receive one of the screws 128. Meanwhile, the notch 124 is disposed on a left side of the cover 126 and is sized to receive the other screw 128.

The left notch 124 and the right notch 123 are oriented so that the cover 126 is rotatable about the right screw 128 when the right screw 128 is loosely disposed in the right notch 123. In other words, cover rotation can occur when the right screw 128 is in the right notch 123 with threads engaged but prior to tightening. In this position, the cover 126 can rotate clockwise about the right screw 128. Thus, the right screw 128 provides an axis of rotation for the cover 126. This clockwise rotation facilitates convenient manipulation of the cover 126 by a person working the cover 126 to cover the access aperture 129, with the screws 128 engaged but not fully tightened. The clockwise rotation of the cover 126 about the right screw 128 provides the person with a capability to slide the left notch 124 of the cover 126 conveniently under the head of the left screw 128. Once the cover 126 is rotated so the left notch 124 is under the head of the left screw 128, the person (for example an installer) can tighten the two screws 128 to secure the cover 126.

To remove the cover 126, the person loosens the two screws 128 and then rotates the cover 126 counterclockwise about the right screw 128 so that the left notch 124 moves out from under the head of the left screw 128. Once the left notch 124 is free from the left screw 128, the installer can pull the right notch 123 out from under the right screw 128 to fully remove the cover 126.

As best seen in the views of FIGS. 1A, 1C, 1F, and 1G, the lens 120 of the luminaire 100 is positioned adjacent the lower, exit side of the light-emitting aperture 115. As illustrated, the lens 120 can mix and blend light emitted by two groups of light emitting diodes 150, 155, with each group having a different color temperature. In some embodiments, the two groups of light emitting diodes 150, 155 may have color temperatures that differ by at least 500 Kelvin, for

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example. The group of light emitting diodes 150 can be characterized as one light emitting diode light source, while the group of light emitting diodes 155 can be characterized as another light emitting diode light source. Other embodiments of a light emitting diode light source may have a single light emitting diode or more light emitting diodes than the embodiment illustrated in FIG. 1. A reflector 130 is disposed in and lines the aperture 115 to guide and manage the emitted light between the light emitting diodes 150, 155 and the lens 120. In some embodiments, an upper lens (not illustrated) replaces the reflector 130.

The light emitting diodes 150, 155 are mounted on a substrate 125, for example a circuit board, and form part of a circuit 200. In the illustrated embodiment, the light emitting diodes 150, 155 are interspersed. In other embodiments, the light emitting diodes 150, 155 may be separated from one another or spatially segregated according to color temperature or other appropriate parameter. As discussed in further detail below, the circuit 200 supplies electricity to the light emitting diodes 150, 155 with a level of flexibility that facilitates multiple configurations suited to different applications and installation parameters.

Turning to FIGS. 2, 3, and 4, some example embodiments of the circuit 200 will be discussed in further detail with example reference to the luminaire 100. The circuit 200 can be applied to other indoor and outdoor luminaires.

Referring now to FIG. 2, this figure illustrates an embodiment of the circuit 200 in an example block diagram form. The circuit 200 comprises a DC power supply 205 for supplying electrical energy that the circuit 200 delivers to the light emitting diodes 150, 155. In an example embodiment, the circuit 200 comprises a light emitting diode driver.

The dual inline pin switch 131 comprises individual switches 210 that provide an input for configuring the luminaire 100 to operate at a selected color temperature. In the illustrated embodiment, the circuit 200 comprises two manual switches 210. Other embodiments may have fewer or more switches 210. In various embodiments, the switches 210 can be mounted to the housing 105 of the luminaire 100, for example within the housing 105 (as illustrated in FIG. 1 and discussed above) or on an exterior surface of the housing 105. In some embodiments, the switches 210 are mounted on the substrate 125. In some embodiments, the switches 210 are implemented via firmware or may be solid state.

As an alternative to the illustrated dual inline pin switch 131, the input can comprise multiple DIP switches, one or more single in-line pin packages (SIP or SIPP), one or more rocker switches, one or more reed switches, one or more magnetic switches, one or more rotary switches, one or more rotary dials, one or more selectors or selector switches, one or more slide switches, one or more snap switches, one or more thumbwheels, one or more toggles or toggle switches, one or more keys or keypads, or one or more buttons or pushbuttons, to mention a few representative examples without limitation.

As further discussed below, a controller 215 operates the light emitting diodes 150, 155 according to state of the switches 210. In some example embodiments, the controller 215 comprises logic implemented in digital circuitry, for example discrete digital components or integrated circuitry. In some example embodiments, the controller 215 utilizes microprocessor-implemented logic with instructions stored in firmware or other static or non-transitory memory.

In the illustrated embodiment, the outputs of the controller 215 are connected to two MOSFET transistors 160 to control electrical flow through two light emitting diodes 150, 155. The illustrated MOSFET transistors 160 provide

one example and can be replaced with other appropriate current control devices or circuits in various embodiments. The switches **210** thus configure the luminaire **100** to operate with either or both of the light emitting diodes **150**, **155**. The light emitting diodes **150**, **155** illustrated in FIG. 2 may represent two single light emitting diodes or two groups of light emitting diodes, for example.

FIG. 3 illustrates a representative table **300** describing operation of the circuit **100** according to some example embodiments. In the example of FIG. 3, the light emitting diode **150** produces light having a color temperature of 3,000 Kelvin, and the light emitting diode **155** produces light having a color temperature of 4,000 Kelvin.

As shown in the example table **300**, when both of the switches **210** are in the on state, the controller **215** causes the light emitting diode **155** to be off and the light emitting diode **150** to be on. Accordingly, the luminaire **100** emits illumination having a color temperature of 3,000 Kelvin.

When both of the switches **210** are in the off state, the controller **215** causes the light emitting diode **155** to be on and the light emitting diode **150** to be off. Accordingly, the luminaire **100** emits illumination having a color temperature of 4,000 Kelvin.

When one of the switches **210** is in the off state and the other of the switches **210** is on the on state, the controller **215** causes the light emitting diode **155** to be on and the light emitting diode **150** to be on. The luminaire **100** thus emits illumination having a color temperature of 3,500 Kelvin. In some other example embodiments, the controller **215** can adjust the light output of one or both of the light emitting diodes **150**, **155** to set the color temperature to a specific value with the range of 3,000 to 4,000 Kelvin.

Accordingly, the controller **215** maps the four configurations of the two switches **210** to three states for configuring the two light emitting diodes **150**, **155** for permanent or long-term operation. Mapping two switch configurations to a single mode of long-term operation can simplify configuration instructions and reduce errors during field configuration. The resulting configurations support multiple color temperatures of illumination from a single luminaire **100**.

Some example embodiments support fewer or more than three states of illumination. For example, in one embodiment, the luminaire **100** comprises three strings of light emitting diodes **150** that have different color temperatures, such as 3,000 Kelvin, 2,700 Kelvin, and 4,000 Kelvin. In this example, in addition to the states illustrated in FIG. 3 and discussed above, the switching logic can support a fourth state in which only the 2,700 Kelvin string is on.

FIG. 4 illustrates a schematic of an example embodiment of the circuit **200**. The schematic of FIG. 4 provides one example implementation of the block diagram illustrated in FIG. 3.

As illustrated in FIG. 4 in schematic form, the circuit **200** conforms to the foregoing discussion of the block diagram format of FIG. 3. In FIG. 4, the light emitting diodes **150**, **155** of FIG. 3 are respectively represented with groups of light emitting diodes **150**, **155**. Additionally, the schematic details include a thermal protective switch **305** for guarding against overheating. FIG. 4 thus provides one example schematic for an embodiment of the electrical system of the luminaire **100** illustrated in FIG. 1 and discussed above.

As will be appreciated by those of ordinary skill, the textual and illustrated disclosure provided herein supports a wide range of embodiments and implementations. In some non-limiting example embodiments of the disclosure, a luminaire can comprise: a housing; a substrate disposed in the housing; a first plurality of light emitting diodes that are

mounted to the substrate and that have a first color temperature; a second plurality of light emitting diodes that are mounted to the substrate and that have a second color temperature; and a plurality of manual switches that are disposed at the housing for permanently configuring the luminaire to: provide illumination of the first color temperature by enabling the first plurality of light emitting diodes; provide illumination of the second color temperature by enabling the second plurality of light emitting diodes; and provide illumination of a third color temperature that is between the first color temperature and the second color temperature by enabling the first plurality of light emitting diodes and the second plurality of light emitting diodes.

In some example embodiments of the luminaire, the housing can comprise an aperture that is configured for emitting area illumination, and the substrate is oriented to emit light through the aperture. In some example embodiments of the luminaire, the plurality of manual switches are mounted to the substrate. In some example embodiments of the luminaire, the plurality of manual switches are mounted in the housing. In some example embodiments of the luminaire, the plurality of manual switches comprise a dual inline pin (DIP) switch. In some example embodiments of the luminaire, the plurality of manual switches provide two switch states, and each of the two switch states provides illumination of the third color temperature by enabling the first plurality of light emitting diodes and the second plurality of light emitting diodes. In some example embodiments of the luminaire, the housing is circular and comprises a lip configured for extending around an aperture in a ceiling. In some example embodiments of the luminaire, the housing comprises a wiring port disposed on a side of the housing. In some example embodiments of the luminaire, the housing comprises a light-emitting aperture in which the substrate is disposed. In some example embodiments, the luminaire further comprises: an aperture disposed at a lower side of the housing; a lens disposed at the aperture for refracting light emitted by the first and second light emitting diodes; and a reflector that is disposed between the lens and the light emitting diodes and that is operative to reflect light between the first and second light emitting diodes and the lens. In some example embodiments of the luminaire, the housing is circular and comprises a lip configured for extending around an aperture in a ceiling. In some example embodiments of the luminaire, the housing comprises a wiring port disposed on a side of the housing. In some example embodiments of the luminaire, the housing forms a cavity associated with the aperture. In some example embodiments of the luminaire, the first and second light source are mounted to a substrate that is disposed at an end of the cavity. In some example embodiments, the luminaire further comprises a reflector that is disposed in the cavity between the lens and the first and second light sources, the reflector operative to reflect light between the first and second light sources and the lens.

Technology for providing a configurable a luminaire has been described. Many modifications and other embodiments of the disclosures set forth herein will come to mind to one skilled in the art to which these disclosures pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the disclosures are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of this application. Although specific terms are

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employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. A luminaire comprising:
 - at least one input settable to one of at least two states, the at least two states comprising a first state and a second state;
 - a first light source having a first color temperature;
 - a second light source having a second color temperature; and
 - a controller connected to the at least one input, the first light source, and the second light source, the controller configured to:
 - power the first light source when the at least one input is in the first state; and
 - power the first light source and the second light source when the at least one input is in the second state.
2. The luminaire of claim 1, wherein the at least one input comprises a first switch and a second switch.
3. The luminaire of claim 2, wherein the first state comprises the first switch off and the second switch off, and wherein the second state comprises the first switch on and the second switch off.
4. The luminaire of claim 3, wherein when the at least one input is set to the first state, the luminaire emits light of the first color temperature, and
 - wherein when the input is set to the second state, the luminaire emits light of a third color temperature that results from the combination of the first color temperature and the second color temperature.
5. The luminaire of claim 1, wherein the first light source comprises a first light emitting diode,
 - wherein the second light source comprises a second light emitting diode, and
 - wherein the first color temperature is separated from the second color temperature by no less than 500 Kelvin.
6. The luminaire of claim 1, wherein the first light source comprises a first bank of light emitting diodes, and
 - wherein the second light source comprises a second bank of light emitting diodes.
7. The luminaire of claim 1, wherein the controller comprises digital logic,
 - wherein the at least one input comprises a dual inline pin (DIP) switch mounted on a circuit board, and
 - wherein a first configuration of the DIP switch defines the first state and a second configuration of the DIP switch defines the second state.
8. The luminaire of claim 1, further comprising a housing that encloses the first light source, the second light source, the at least one input, and the controller, the housing comprising:
 - a first aperture that provides access to the at least one input for setting the at least one input manually to the first state or the second state during luminaire installation; and
 - a cover covering the aperture and comprising a second aperture that is sized to receive an electrical cable for powering the luminaire.
9. The luminaire of claim 8, wherein the at least one input comprises a dual inline pin (DIP) switch mounted to the housing adjacent the first aperture, and
 - wherein the cover further comprises:
 - a first notch that is disposed on a first side of the cover and that is sized to receive a first fastener for fastening the cover to the housing; and

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- a second notch that is disposed on a second side of the cover and that is sized to receive a second fastener for fastening the cover to the housing,
 - wherein the first notch and the second notch are oriented so that the cover is rotatable about the first fastener when the first fastener is loosely disposed in the first notch, with the second fastener disposable in the second notch during said rotation of the cover.
10. The luminaire of claim 8, wherein the housing further comprises:
 - a third aperture for emitting light;
 - a lens disposed within the third aperture; and
 - a reflector disposed between the lens and the first and second light sources.
11. A luminaire comprising:
 - at least one input settable to one of a plurality of states;
 - a first light source having a first color temperature;
 - a second light source having a second color temperature;
 - a third light source having a third color temperature;
 - a controller coupled to the at least one input, the first light source, the second light source, and the third light source, the controller configured to:
 - power the first light source and the second light source when the at least one input is in a first state; and
 - power the first light source and a third light source when the at least one input is in a second state.
12. The luminaire of claim 11, wherein when the at least one input is in the first state, the luminaire emits light that is a combination of the first color temperature and the second color temperature, and
 - wherein when the at least one input is in the second state, the luminaire emits light that is a combination of the first color temperature and the third color temperature.
13. The luminaire of claim 11, wherein the first light source comprises at least one first light emitting diode,
 - wherein the second light source comprises at least one second light emitting diode,
 - wherein the third light source comprises at least one third light emitting diode, and wherein at least 300 Kelvin separates the first color temperature and the second color temperature and at least 300 Kelvin separates the second color temperature and the third color temperature.
14. The luminaire of claim 11, wherein the at least one input comprises a dual inline pin (DIP) switch mounted on a circuit board, and
 - wherein a first configuration of the DIP switch defines the first state and a second configuration of the DIP switch defines the second state.
15. The luminaire of claim 11, further comprising a housing that encloses the first light source, the second light source, the third light source, the at least one input, and the controller, the housing comprising:
 - a first aperture that provides access to the at least one input for setting the at least one input manually to the first state or the second state during luminaire installation; and
 - a cover covering the aperture and comprising a second aperture that is sized to receive an electrical cable for powering the luminaire.
16. A luminaire comprising:
 - a housing comprising an aperture;
 - a first light source and a second light source that are mounted in the housing and that are oriented to emit light for area illumination, wherein the first light source has a first color temperature and the second light source has a second color temperature; and

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one or more switches that are mounted at the housing and that are operable to configure the luminaire in a first operating configuration, a second operating configuration, and a third operating configuration,

wherein in the first operating configuration, the first light source is active, the second light source is inactive, and the luminaire is configured to emit light of the first color temperature,

wherein in the second operating configuration, the first light source is inactive, the second light source is active, and the luminaire is configured to emit light of the second color temperature, and

wherein in the third operating configuration, the first light source is active, the second light source is active, and the luminaire is configured to emit light of a third color temperature that is between the first color temperature and the second color temperature.

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17. The luminaire of claim **16**, wherein the one or more switches have two switch states that each produces the third operating configuration.

18. The luminaire of claim **16**, wherein the first light source comprises at least one light emitting diode, and wherein the second light source comprises at least one other light emitting diode.

19. The luminaire of claim **18**, wherein the luminaire is configured for mounting to a ceiling,

wherein the housing further comprises a cover sized to cover the aperture, and

wherein the one or more switches are disposed in the housing adjacent the aperture for access during luminaire installation.

20. The luminaire of claim **19**, wherein the one or more switches comprise a dual inline pin (DIP) switch.

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