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(54) **SPARKLE EFFECT LIGHTING DEVICE**

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H05B 37/02	(2006.01)
H05B 47/155	(2020.01)
F21Y 115/10	(2016.01)
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F21W 121/00	(2006.01)

(52) **U.S. Cl.**

CPC ***F21V 5/007*** (2013.01); ***H05B 47/155*** (2020.01); *F21W 2121/00* (2013.01); *F21W 2131/406* (2013.01); *F21Y 2115/10* (2016.08)

(58) **Field of Classification Search**

CPC F21V 5/007; H05B 37/029

See application file for complete search history.

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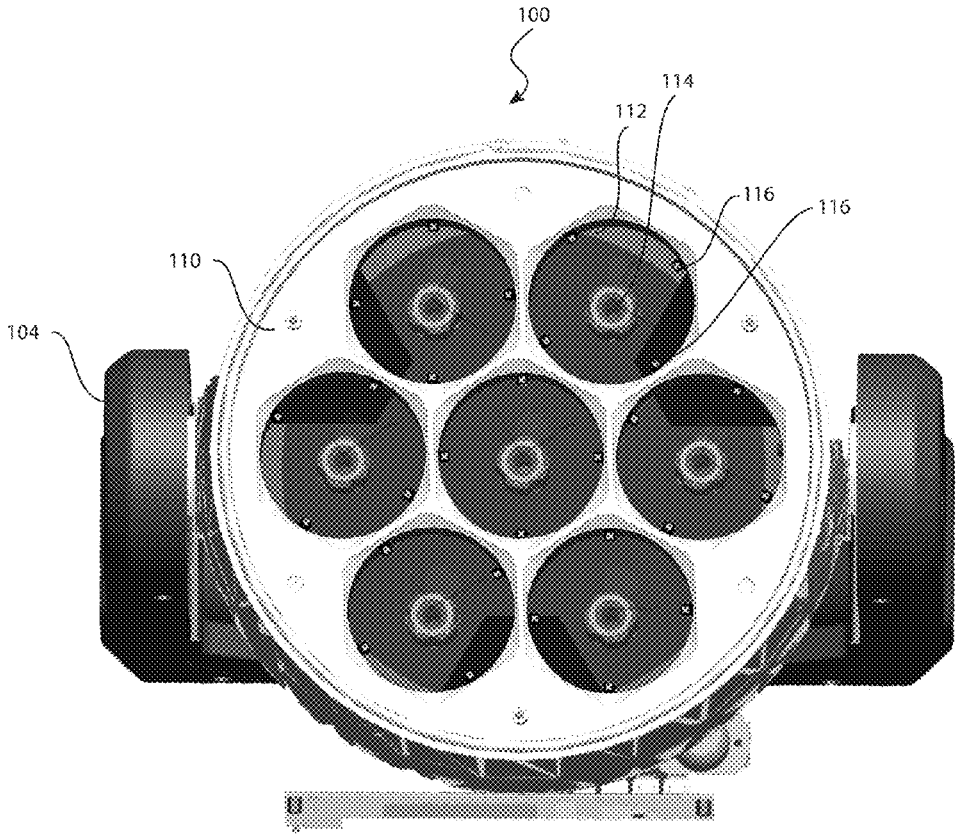
(57) **ABSTRACT**

A lighting device includes a lens, a primary light source and multiple secondary light sources positioned about a perimeter of the lens. Each of the secondary light sources is configured to produce a sparkling effect.

10 Claims, 4 Drawing Sheets



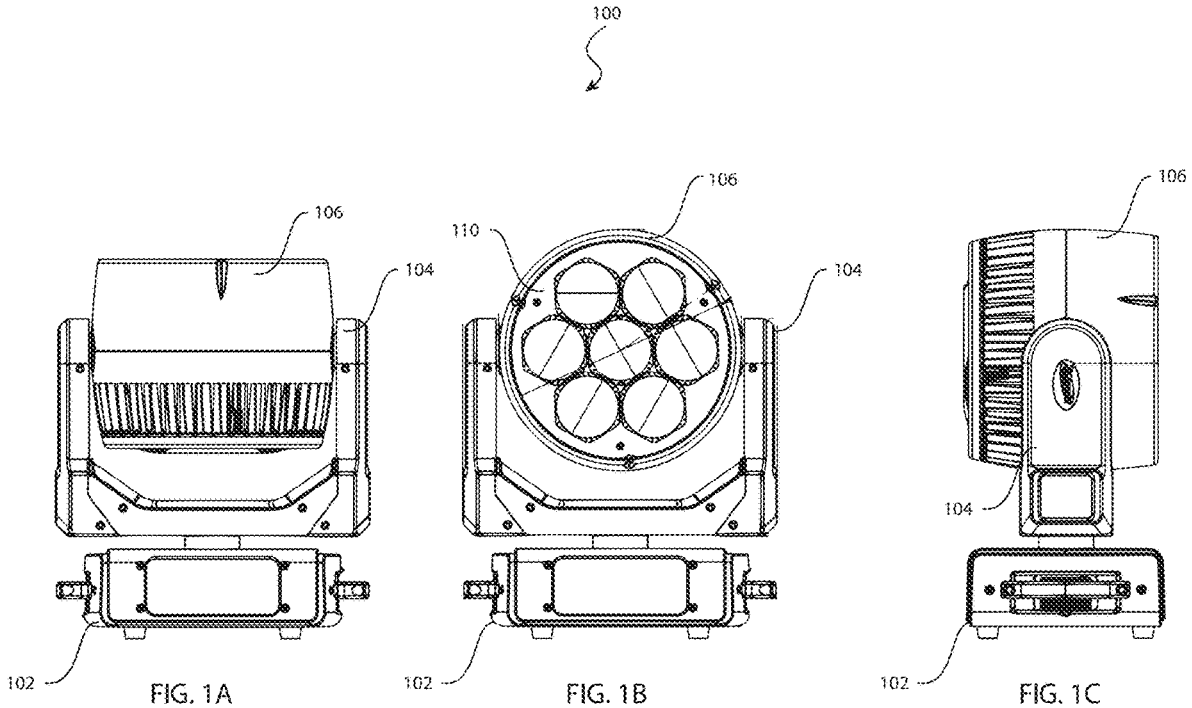


FIG. 1A FIG. 1B FIG. 1C

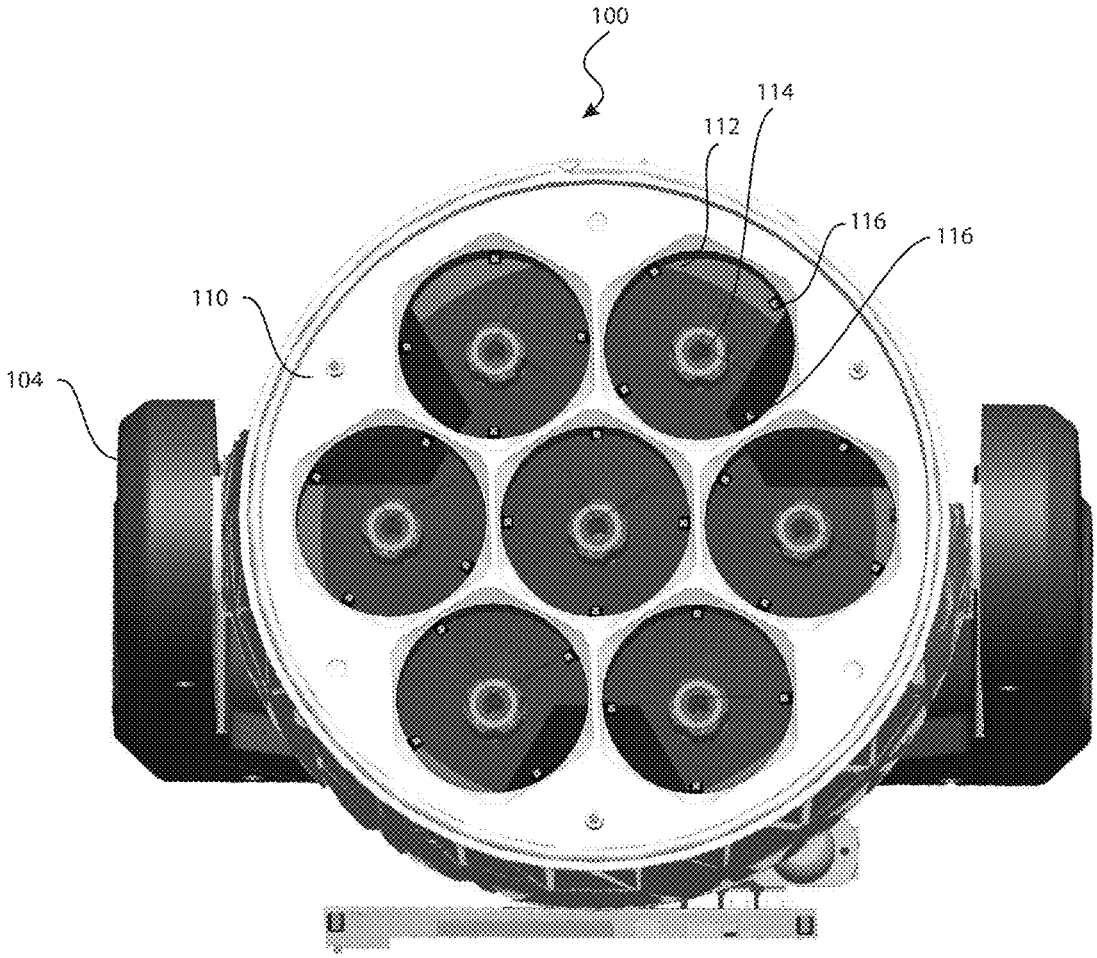


FIG. 2

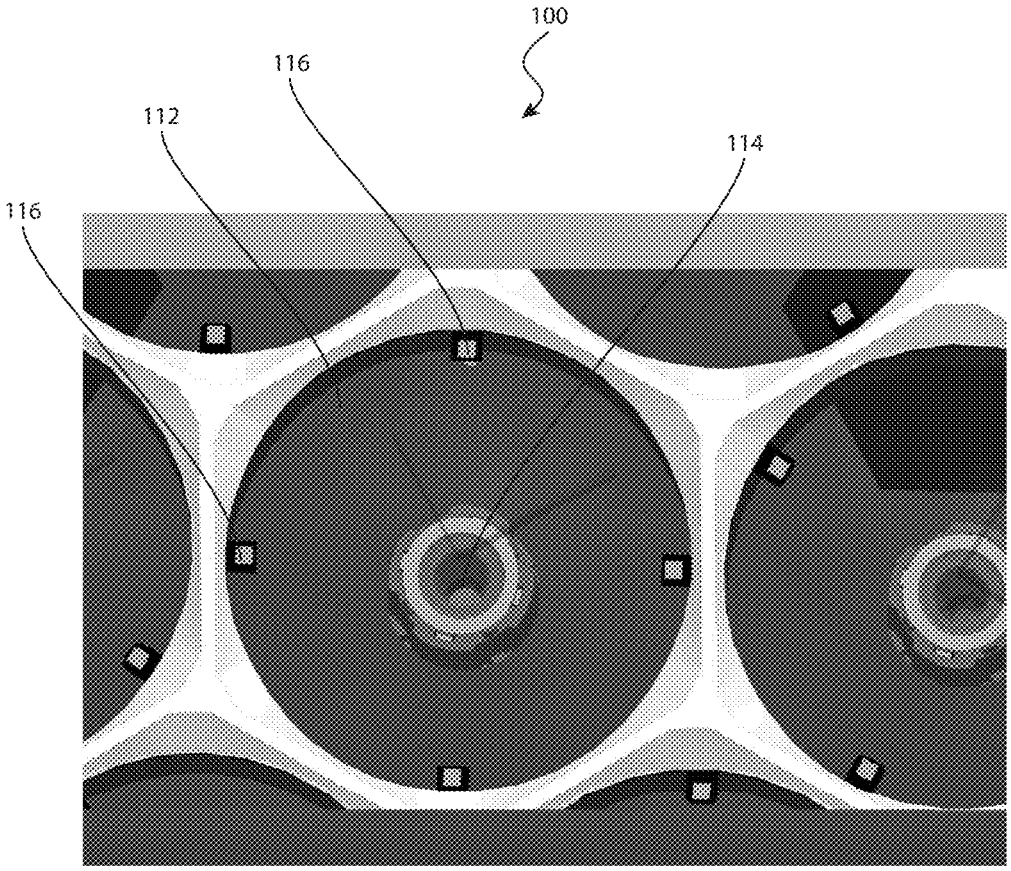


FIG. 3

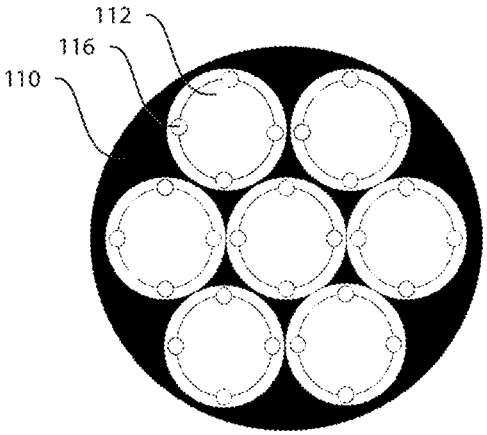


FIG. 4A

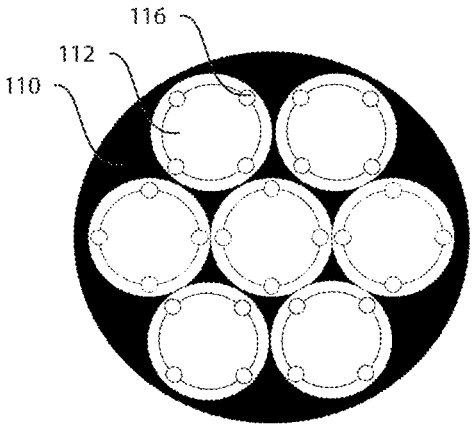


FIG. 4B

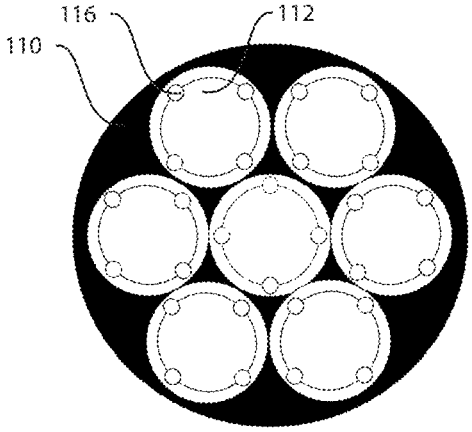


FIG. 4C

SPARKLE EFFECT LIGHTING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of U.S. Provisional Patent Application Ser. No. 62/730,724 filed on Sep. 13, 2018, which is incorporated herein by reference in its entirety.

BACKGROUND

Light emitting diode (LED) lighting systems provide illumination and direct view effects. Some conventional stage lighting use LEDs as a light source. LED lighting typically have high light output with low power consumption.

SUMMARY

Embodiments relate to lighting devices, in particular, lighting devices including a lens, a primary light source and multiple secondary light sources positioned about a perimeter of the lens. Each of the secondary light sources is configured to produce a sparkling effect.

These and other aspects and advantages of one or more embodiments will become apparent from the following detailed description, which, when taken in conjunction with the drawings, illustrate by way of example the principles of the one or more embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and advantages of the embodiments, as well as a preferred mode of use, reference should be made to the following detailed description read in conjunction with the accompanying drawings, in which:

FIG. **1**A is a profile view of a lighting device oriented so the face of the device is pointing in an upwards direction, according to some embodiments;

FIG. **1**B is a head-on view of a lighting device, according to some embodiments;

FIG. **1**C is a profile view of a lighting device oriented so the lens array of the device is pointing in a lateral direction, according to some embodiments;

FIG. **2** is a close-up view of the lens array of the lighting device, according to some embodiments;

FIG. **3** is an alternative close-up view of the lens array including the lens, primary light source and plurality of secondary light sources, according to some embodiments;

FIG. **4**A is an orientation of the secondary lighting sources, according to some embodiments;

FIG. **4**B is an alternative orientation of the secondary lighting sources, according to some embodiments; and

FIG. **4**C is an alternative orientation of the secondary lighting sources, according to some embodiments.

DETAILED DESCRIPTION

The descriptions of the various embodiments have been presented for purposes of illustration but are not intended to be exhaustive or limited to the embodiments disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art without departing from the scope and spirit of the described embodiments. The terminology used herein was chosen to best explain the principles of the embodiments, the practical application or technical improvement over technologies found in the marketplace, or to enable others of ordinary skill in the art to understand the embodiments disclosed herein. Further, particular features described herein can be used in combination with other described features in each of the various possible combinations and permutations. Unless otherwise specifically defined herein, all terms are to be given their broadest possible interpretation including meanings implied from the specification as well as meanings understood by those skilled in the art and/or as defined in dictionaries, treatises, etc.

FIG. **1**A is a profile view of a lighting device **100** oriented so the face of the device is pointing in an upwards direction, according to one embodiment. In some embodiments, the lighting device **100** comprises a base **102**, a yoke **104** and housing **106**. In this orientation, the lens array (**110**, FIG. **1**B) is pointed in an upwards position so a resulting output beam from the primary lighting sources and multiple secondary lighting sources would point upwards. In one or more embodiments, the lighting device **100** includes a controller, electronics, one or more motors, a power switch, one or more lighting switches, and an electrical plug or receptacle, etc. for connecting to provide power to operate the lighting device **100**, as known to those of ordinary skill in the art. Further, any conventional components required to operate the lighting device, such as wiring, circuitry, power sources (e.g., AC, DC, battery, USB, etc.) may be employed by one or more embodiments.

FIG. **1**B is a head-on view of a lighting device **100**, according to an embodiment. In this orientation, the lens array **110** is visible. FIG. **1**C is a profile view of a lighting device **100** oriented so the lens array is pointing in a lateral direction, according to an embodiment.

FIG. **2** is a close-up view of the lens array **110** of the lighting device **100**, according to an embodiment. Each respective lens in the lens array **110** comprises: a lens **112**, a primary light source **114** and multiple secondary light sources **116**. In some embodiments, the primary light source **114** is a multi-color light emitting diode (LED), but it is understood that any component capable of emitting light can be construed as a primary light source (e.g., incandescent lamp, high-intensity discharge lamp, video, neon, chip on board (COB), etc.). The primary light source **114** resides primarily in the center of and behind the lens **112**. About the perimeter of the lens **112** resides multiple secondary light sources **116**. In some embodiments, there are four secondary light sources **116** along the perimeter of the lens **112**. It is understood that any number of secondary light sources **116** may be used in connection with a lens **112** and primary light source **114**. In some embodiments, each of the secondary light sources **116** is a single color LED. However, it is understood that secondary light sources **116** can be of any variety of color, multi-color, etc., light emitting component. In one or more embodiments, the secondary light sources **116** are also equidistant from each other as they circumscribe the lens **112**. The secondary light sources **116** are each capable of producing a sparkle effect. The sparkle effect is understood to be a change in brightness (e.g., ramping up/down, dimming) or a switching on/off and changing the frequency of the switching or both including the separate control of red, green, blue, white and/or amber LEDs to create effects that include fading or flashing.

In some embodiments, the secondary light sources **116** reside behind the lens **112** such that the output of the secondary light sources **116** enter the lens **112** on an input surface and exit the lens on the output surface, same as with

the primary light source **114**. FIG. **3** is an alternative close-up view of the lens array including the lens **112**, primary light source **114** and multiple secondary light sources **116**, according to an embodiment.

In some embodiments, a light guide resides in front of a multicolor primary light source **114**. In some embodiments, the light guide is a light pipe type guide where the light exiting the primary light source enters the light pipe is refracted against the internal surfaces of the light pipe and then exits the light pipe towards an aperture. After the aperture, the light is focused using the lens **112**. In one or more embodiments, the lens **112** is capable of moving closer or farther from the aperture, the result of which is a wide angle or narrow angle output beam. In some embodiments, at least one secondary light source **116** is placed on input surface of the lens **112** along the edge thereof or any other desired place within the lens **112**. Placement of the secondary light source **116** creates a second layer of light output which can overlay, merge or appear separate from the primary light source **114** depending on relative position of the secondary light source inside the lens **112**, the lens **112** type and/or the relative intensities of primary and secondary light sources.

In some embodiments, the arrangement and patterns of the secondary light sources **116** can be of any variation, the desired effect is not dependent on the layout shown in FIGS. **2-4**. Variations in the secondary light source **116** orientation are possible depending on what visual appearance is desired. For example, placement of the secondary light sources **116** under the lens **112** leads to refractions and lighting emissions that help illuminate the lens **112** from the inside, providing visually interesting results.

In one or more embodiments, the secondary light sources **116** transverse to center of the lens **112** such that the light output of the secondary light sources **116** shines into the edge of the primary light source **114**. In some embodiments, the secondary light sources **116** are movable by mechanical means, and that their angle in relation to the lens **112** are variable for additional changes in resulting light output and refraction.

FIG. **3** more clearly demonstrates the position of the secondary light sources **116** in relation to the perimeter of the lens **112** and the primary light source **114**, according to some embodiments. The secondary light sources **116** are positioned such that each causes the least amount of interference with the light emitted from the primary light source **114**.

In one or more embodiments, the secondary light sources **116** reside on the input surface of the lens **112**. In some embodiments, the secondary light sources **116** reside on the output surface of the lens **112**. In one or more embodiments, the secondary light sources **116** reside within the lens **112**, between the input and output surfaces. In some embodiments, the secondary light sources **116** reside in a plane parallel with the output surface of the lens **112**.

FIG. **4**A is an orientation of the secondary lighting sources **116**, according to some embodiments. In this orientation, the lens array **110** comprises seven individual lenses **112**, each having four secondary light sources **116** each, located about the perimeter of the lens **112** (the primary light sources **114** are not shown for simplicity of the figure). In this orientation, the secondary light sources **116** are oriented in a north/south and east/west configuration along the lens array **110**. In some embodiments, each of the secondary light sources **116** are a single color LED (e.g., white, red, green, blue, amber LEDs), multi-colored (e.g., rgb, rgbw, rgbwa) LEDs, or a mix thereof. In one or more embodiments, the secondary light sources **116** are controllable independently from the primary light sources (**114**, FIG. **3**) and each secondary light source **116** is configured to be independently controllable from other secondary light sources. In one or more embodiments, the primary light source **114** and secondary light sources **116** are controllable via a variety of lighting and video control protocols (e.g., dmx512, RDM, wife, video, artnet, etc.) Thus, the sparkling effect produced by the secondary light sources **116** are uniform across the lens array **110** or can move about and/or meander across the face of the lens array **110** to give the appearance that the lens array comprises a series of facets.

FIG. **4**B is an alternative orientation of the secondary lighting sources **116**, according to some embodiments. In this orientation, a number of sets of the secondary light sources **116** are oriented in a north/south and east/west configuration while the remaining sets of secondary light sources **116** are rotated clockwise/counterclockwise to positions between the north/south and east/west configuration. This is evident in the two top most and bottom most clusters of secondary light sources **116**, which are rotated relative to the position of the north/south and east/west secondary light sources **116** towards the middle of the lens array **110**. While one or more embodiments demonstrate uniform disbursement of the secondary light sources **116** along the perimeter of a lens **112**, it can be appreciated that other embodiments include non-uniform spacing of the secondary light sources **116** as desired.

FIG. **4**C is an alternative orientation of the secondary lighting sources **116**, according to some embodiments. In one or more embodiments, the secondary light sources **116** circling the center lens **112** in the lens array **110** are oriented in a north/south and east/west configuration while the six other lenses **112** and multiple secondary light sources **116** are rotated relative to the orientation of the center most secondary light sources **116**.

References in the claims to an element in the singular is not intended to mean "one and only" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described exemplary embodiment that are currently known or later come to be known to those of ordinary skill in the art are intended to be encompassed by the present claims. No claim element herein is to be construed under the provisions of 35 U.S.C. section 112, sixth paragraph, unless the element is expressly recited using the phrase "means for" or "step for."

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, steps, operations, elements, materials, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, materials, components, and/or groups thereof.

The corresponding structures, materials, acts, and equivalents of all means or step plus function elements in the claims below are intended to include any structure, material, or act for performing the function in combination with other claimed elements as specifically claimed. The description of the present invention has been presented for purposes of illustration and description, but is not intended to be exhaustive or limited to the invention in the form disclosed. Many modifications and variations will be apparent to those of

ordinary skill in the art without departing from the scope and spirit of the invention. The embodiment was chosen and described in order to best explain the principles of the invention and the practical application, and to enable others of ordinary skill in the art to understand the invention for various embodiments with various modifications as are suited to the particular use contemplated.

What is claimed is:

1. A lighting device, comprising:

a plurality of lenses, each respective lens of the plurality of lenses comprising:

a primary light source centrally disposed behind its respective lens; and

a plurality of secondary light sources positioned about a perimeter of the respective lens, wherein each of the secondary lighting sources is disposed within the respective lens, and wherein each of the secondary light sources is configured to produce a sparkling effect based on one of a change in brightness of the secondary light sources, switching on and off of the secondary light sources and changing frequency of the switching on and off of the secondary light sources, or a combination thereof.

2. The lighting device of claim **1**, wherein each respective lens of the plurality of lenses further comprises:

an input surface configured to receive light from the primary light source; and

an output surface for the light.

3. The lighting device of claim **2**, wherein the input surface further receives light from the plurality of secondary light sources.

4. The lighting device of claim **2**, wherein for each respective lens of the plurality of lenses: each of the plurality of secondary lighting sources is disposed in a plane parallel with the output surface of the respective lens.

5. A lighting device, comprising:

a lens array including a plurality of lenses, each respective lens of the lens array comprising:

a respective primary light source;

an input surface for receiving light from the primary light source;

an output surface for the light and

a respective plurality of secondary light sources positioned about a perimeter of the respective lens, wherein the input surface further receives light from the secondary light sources, and wherein each of the secondary light sources is configured to produce a sparkling effect.

6. The lighting device of claim **5**, wherein each of the respective plurality of secondary light sources is disposed in front of the primary light source and behind the respective lens.

7. The lighting device of claim **5**, wherein each of the respective plurality of secondary lighting sources is disposed within the respective lens.

8. The lighting device of claim **5**, wherein each of the respective plurality of secondary lighting sources is disposed in a plane parallel with the output surface of the respective lens.

9. A lighting device, comprising:

a primary light source;

a fixed lens having an input surface for receiving light from the primary light source and an output surface for the light; and

a plurality of secondary light sources;

wherein:

each of the secondary light sources is positioned about a perimeter of the fixed lens;

the input surface further receives light from the secondary light sources; and

each of the secondary light sources is configured to produce a sparkling effect.

10. The lighting device of claim **9**, wherein the sparkling effect is based on one of a change in brightness of the secondary light sources, switching on and off of the secondary light sources and changing frequency of the switching on and off of the secondary light sources, or a combination thereof.

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