

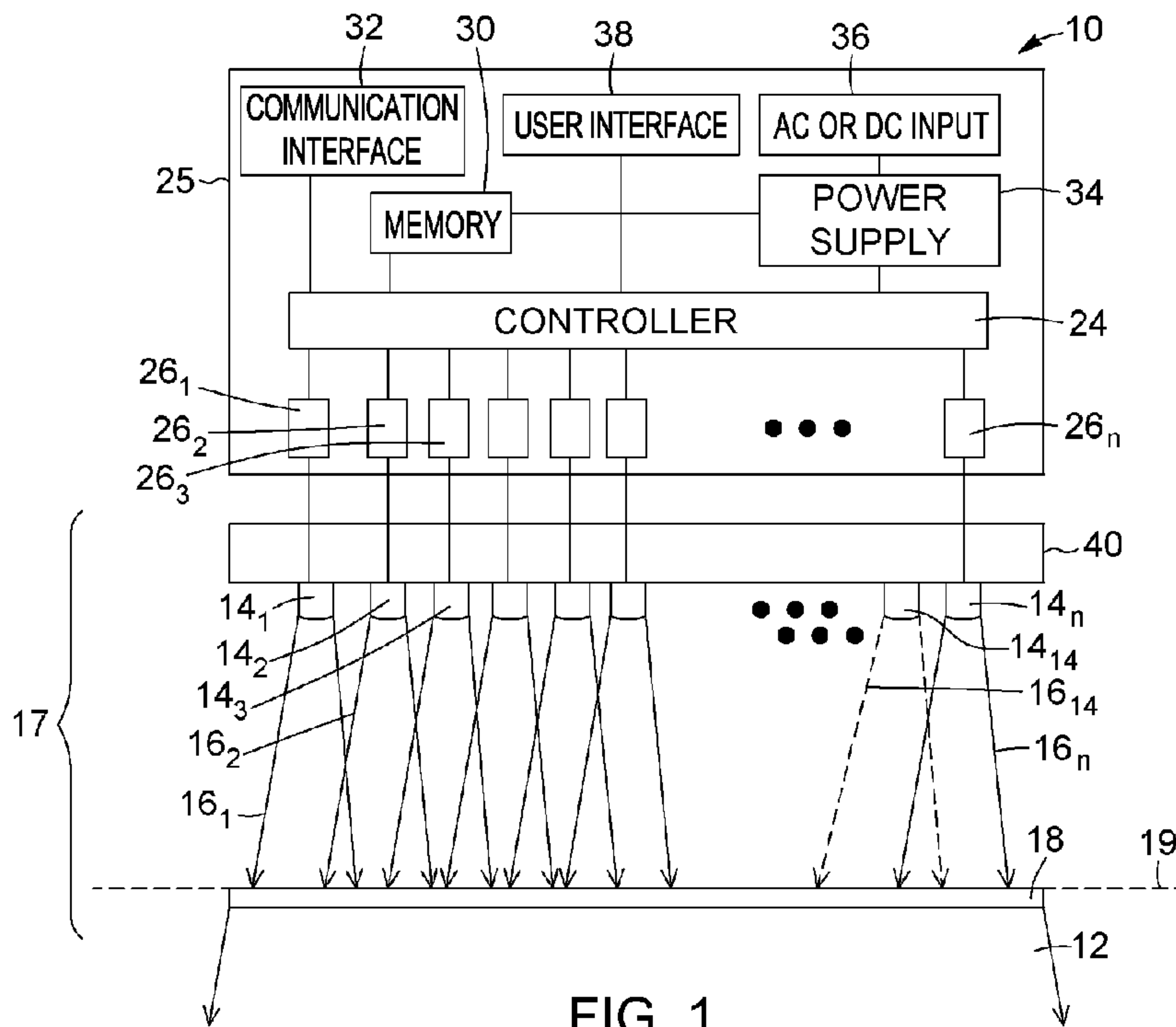


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(54) Titre : SYSTEME ET PROCEDE DE GENERATION DE LUMIERE REPRESENTATIVE D'UNE LUMIERE NATURELLE CIBLE

(54) Title: SYSTEM AND METHOD FOR GENERATING LIGHT REPRESENTATIVE OF A TARGET NATURAL LIGHT



(57) **Abrégé/Abstract:**

A lighting system and method for generating an output light beam representative of a target natural light are provided. The lighting system includes a plurality of solid-state light emitters each emitting a light sub-beam having an individual spectrum. The individual spectra of the solid-state light emitters collectively cover a visible portion of the natural light spectral profile and exclude infrared and ultraviolet components. The lighting system further includes a combining assembly combining the light sub-beams into the output light beam. A control module controls an intensity of the light sub-beam from each of the solid-state light emitters such that the resulting combined spectral profile of the output light beam is representative of a natural light spectral profile of the target natural light over its visible portion.

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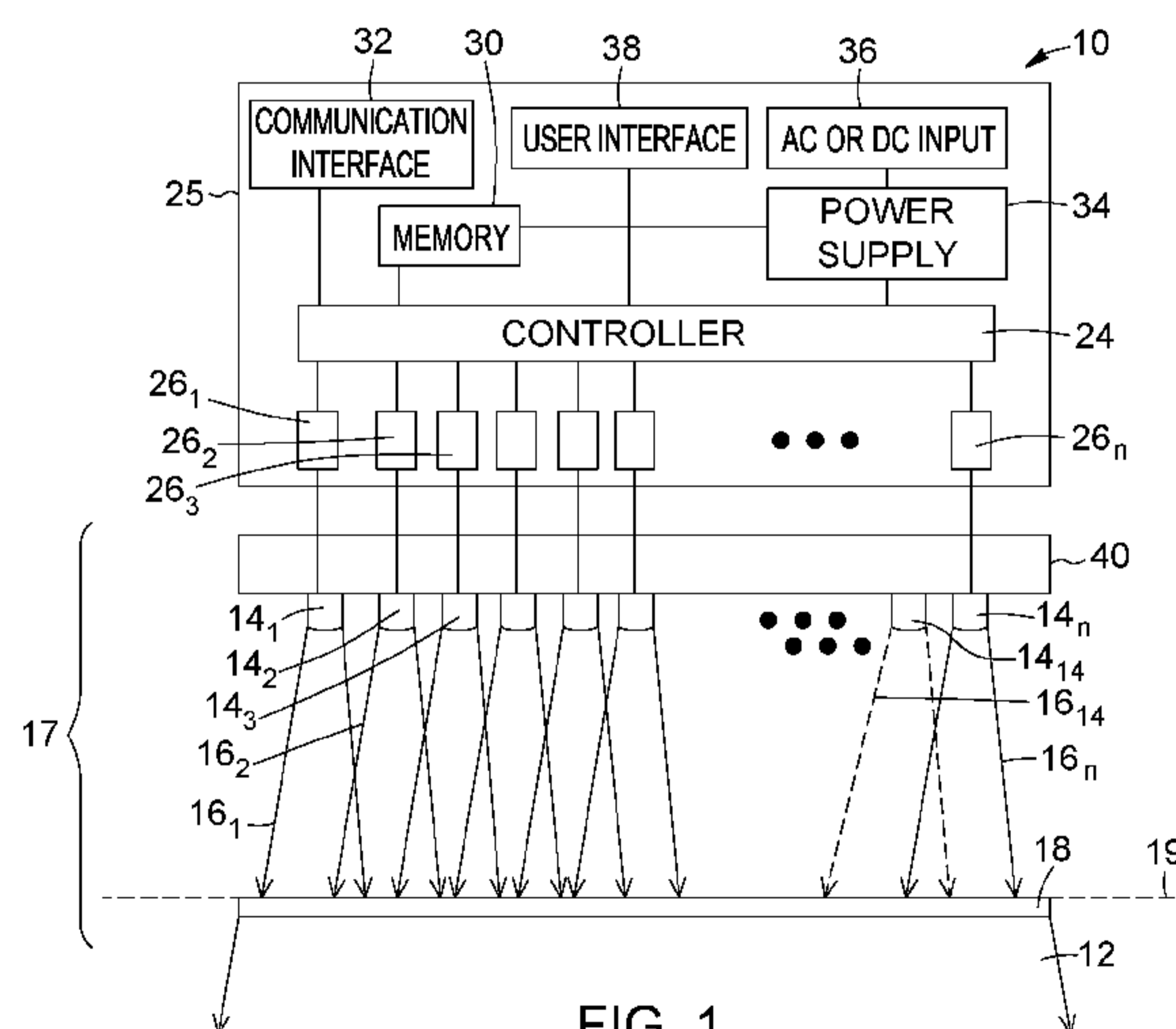


FIG. 1

(57) Abstract: A lighting system and method for generating an output light beam representative of a target natural light are provided. The lighting system includes a plurality of solid-state light emitters each emitting a light sub-beam having an individual spectrum. The individual spectra of the solid-state light emitters collectively cover a visible portion of the natural light spectral profile and exclude infrared and ultraviolet components. The lighting system further includes a combining assembly combining the light sub-beams into the output light beam. A control module controls an intensity of the light sub-beam from each of the solid-state light emitters such that the resulting combined spectral profile of the output light beam is representative of a natural light spectral profile of the target natural light over its visible portion.

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## SYSTEM AND METHOD FOR GENERATING LIGHT REPRESENTATIVE OF A TARGET NATURAL LIGHT

### TECHNICAL FIELD

5 The technical field generally relates to light sources and more particularly concerns a system and a method for generating an output light beam which has a spectral profile representative of a target natural light over the visible spectrum, which excluding undesirable wavelengths such as infrared and ultraviolet components.

10

### BACKGROUND

Lamp units developed to illuminate a space, surface or an object use different materials, designs and are applicable for multiple lighting purposes. The majority of such lamp units are now generally known to employ Light Emitting Diode  
15 (“LED”) technology as a replacement for conventional incandescent and/or fluorescent lighting to provide a lighting source that generates white light having a relatively high Colour Rendering Index (“CRI”), so that spaces, surfaces, and objects illuminated by the lighting appear as if illuminated by natural sunlight. The ability of a light source to render the color of an object is measured using the CRI  
20 which provides a measure of how a light source makes the color of an object appear to the human eye and how well subtle variations in color shade are revealed. In applications where accurate color rendition is required, such as for example retail lighting, museum lighting and lighting of artwork, a high CRI typically of at least 80 is highly desirable.

25

Lighting technologies that are currently available on the market (e.g. halogen or fluorescent) have unstable spectral outputs which shift over their lifetimes due to high operating temperatures tending to degenerate the chemicals employed to emit light, thus reducing the CRI for these light sources. As a consequence, white  
30 LEDs are increasingly being used to replace conventional fluorescent, compact fluorescent and incandescent light sources due to their long operating life

**CLAIMS**

1. A lighting system for generating an output light beam representative of a target natural light having a natural light spectral profile, the lighting system  
5 comprising:

a plurality of solid-state light emitters each emitting a light sub-beam having an individual spectrum, the individual spectra of the solid-state light emitters collectively covering a visible portion of the natural light spectral profile and excluding infrared and ultraviolet components;

10 a combining assembly combining the light sub-beams from said solid-state light emitters into the output light beam such that said output light beam has a combined spectral profile defined by a combination of the individual spectra of the plurality of solid-state emitters; and

15 a control module configured for controlling an intensity of the light sub-beam from each of the solid-state light emitters such that the combined spectral profile of the output light beam is representative of the natural light spectral profile of the target natural light over said visible portion.

20 2. The lighting system according to claim 1, wherein the solid-state emitters are Light Emitting Diodes.

25 3. The lighting system according to claim 1 or 2 wherein the control module comprises a controller configured to control driving parameters of the solid-state emitters.

4. The lighting system according to claim 3, wherein the control module further comprises a memory in communication with the controller and storing the driving parameters.

5. The lighting system according to any one of claims 1 to 4, wherein the control module comprises a plurality of emitter drivers, each emitter driver being associated with a corresponding one of the solid-state light emitters.
- 5 6. The lighting system according to any one of claims 1 to 5, wherein the control module controls the solid-state emitters according to a Pulse Width modulation scheme.
7. The lighting system according to any one of claims 1 to 6, wherein the  
10 combining assembly comprises a support structure on which the solid-state light emitters are mounted.
8. The lighting system according to claim 8, wherein:
- the light emitters are positioned on the support structure such that the  
15 sub-beams project towards a diffusing plane; and
  - the combining assembly further comprises a diffuser extending along the diffusing plane, the diffuser blending the sub-beams into said output beam.
- 20 9. The lighting system according to any one of claims 1 to 8, wherein the plurality of solid-state light emitters consists of between 12 and 20 of said light emitters.
10. The lighting system according to any one of claims 1 to 9, wherein the  
25 plurality of solid-state light emitters consists of colored light emitters.
11. The lighting system according to any one of claims 1 to 9, wherein the plurality of solid-state light emitters includes a plurality of colored light emitters and at least one white light emitter.

12. The lighting system according to any one of claims 1 to 11, wherein the combined spectral profiles span a wavelength range extending between about 350 and 750 nm.
- 5 13. The lighting system according to any one of claims 1 to 11, wherein the combined spectral profiles span a wavelength range extending between about 400 and 700 nm.
- 10 14. The lighting system according to any one of claims 1 to 13, wherein the control module is configured to control the intensity of the light sub-beams according to a plurality of sets of relative intensity values each providing a combined spectral profile representative of a different natural light.
- 15 15. A method for generating an output light beam representative of a target natural light having a natural light spectral profile, the method comprising:
- 15 a) providing a plurality of solid-state light emitters each emitting a light sub-beam having an individual spectrum, the individual spectra of the solid-state light emitters collectively covering a visible portion of the natural light spectral profile and excluding infrared and ultraviolet components;
- 20 b) combining the light sub-beams from said solid-state light emitters into the output light beam such that said output light beam has a combined spectral profile defined by a combination of the individual spectra of the plurality of solid-state emitters; and
- 25 c) controlling an intensity of the light sub-beam from each of the solid-state light emitters such that the combined spectral profile of the output light beam is representative of the natural light spectral profile over said visible portion.
- 30 16. The method according to claim 15, wherein the controlling of the solid-state emitters is performed according to a Pulse Width modulation scheme.

17. The method according to claim 15 or 16, wherein the combining of the light sub-beams comprises:

- projecting the light sub-beams towards a diffusing plane; and
- blending the sub-beams into said output beam using a diffuser extending along the diffusing plane.

5

18. The method according to any one of claims 15 to 17, wherein the plurality of solid-state light emitters consists of between 10 and 20 of said light emitters.

10 19. The method according to any one of claims 15 to 18, wherein the combined spectral profiles span a wavelength range extending between about 350 and 750 nm.

15 20. The method according to any one of claims 15 to 18, wherein the combined spectral profile span a wavelength range extending between about 400 and 700 nm.

20 21. The method according to any one of claims 15 to 20, wherein the intensity of the light sub-beams is controlled according to a plurality of sets of relative intensity values each providing a combined spectral profile representative of a different natural light.

22. The method according to any one of claims 15 to 21, wherein the plurality of solid-state light emitters consists of colored light emitters.

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23. The method according to any one of claims 15 to 21, wherein the plurality of solid-state light emitters includes a plurality of colored light emitters and at least one white light emitter.

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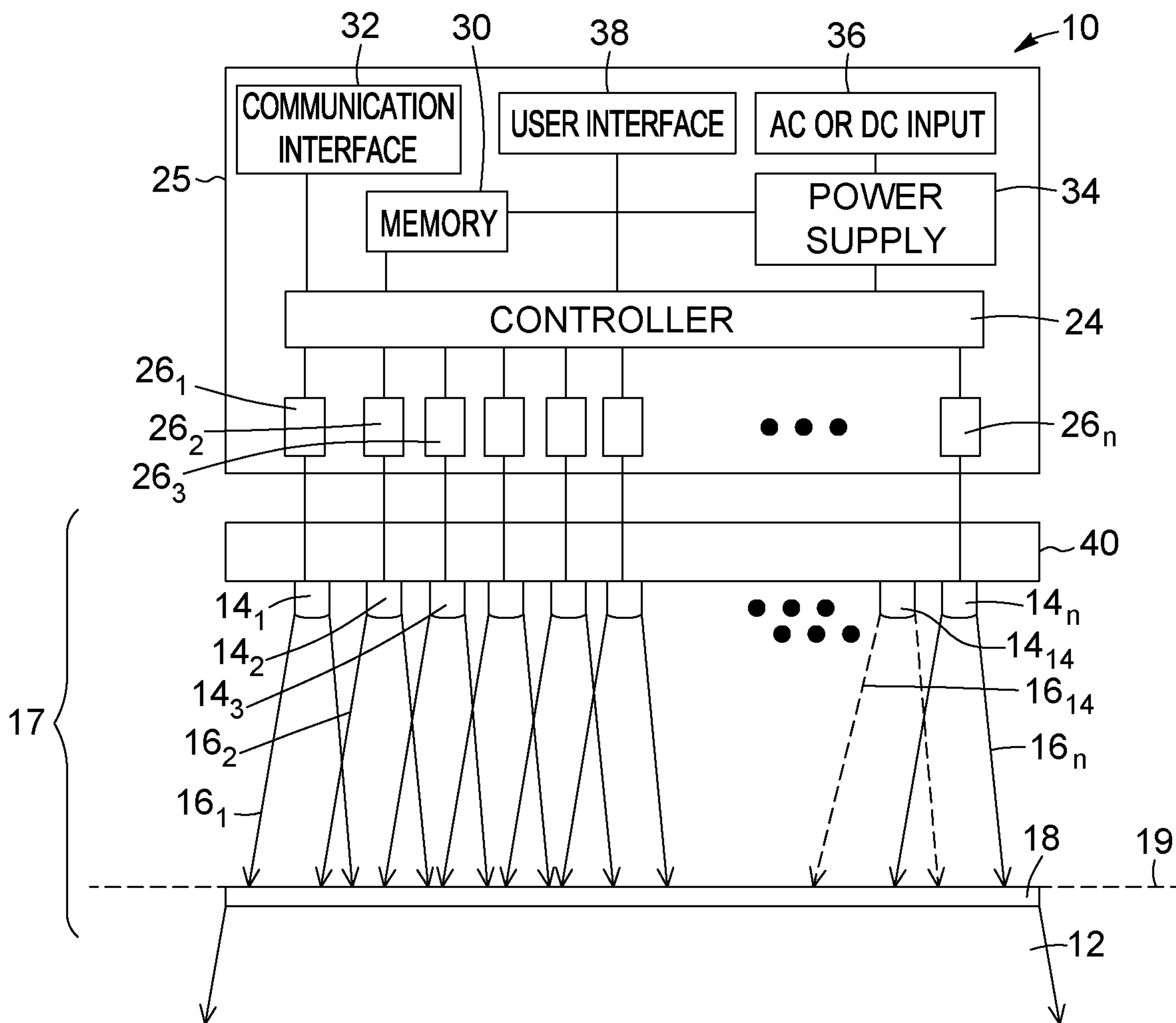


FIG. 1

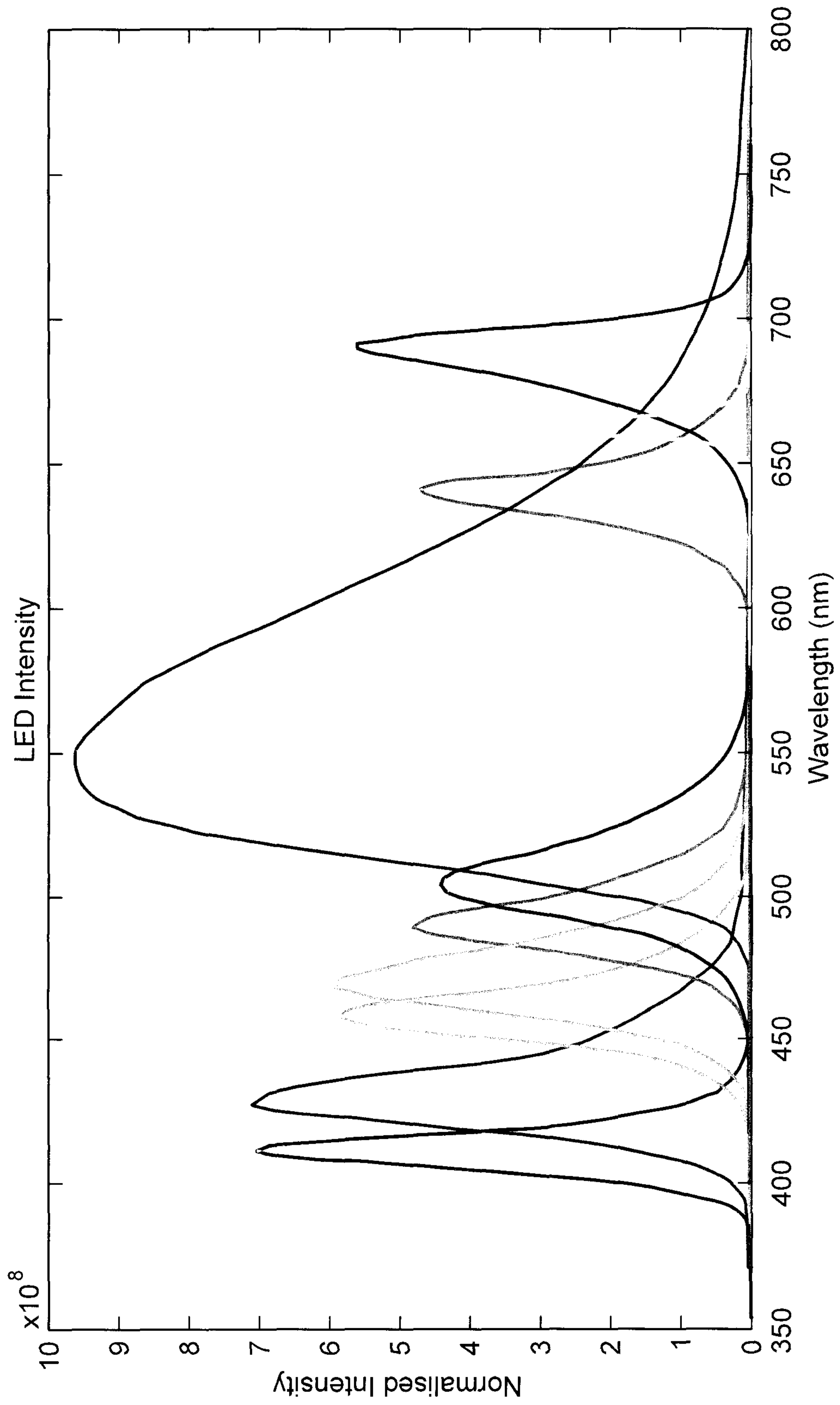


FIG. 2

Standard D65 (6501K)

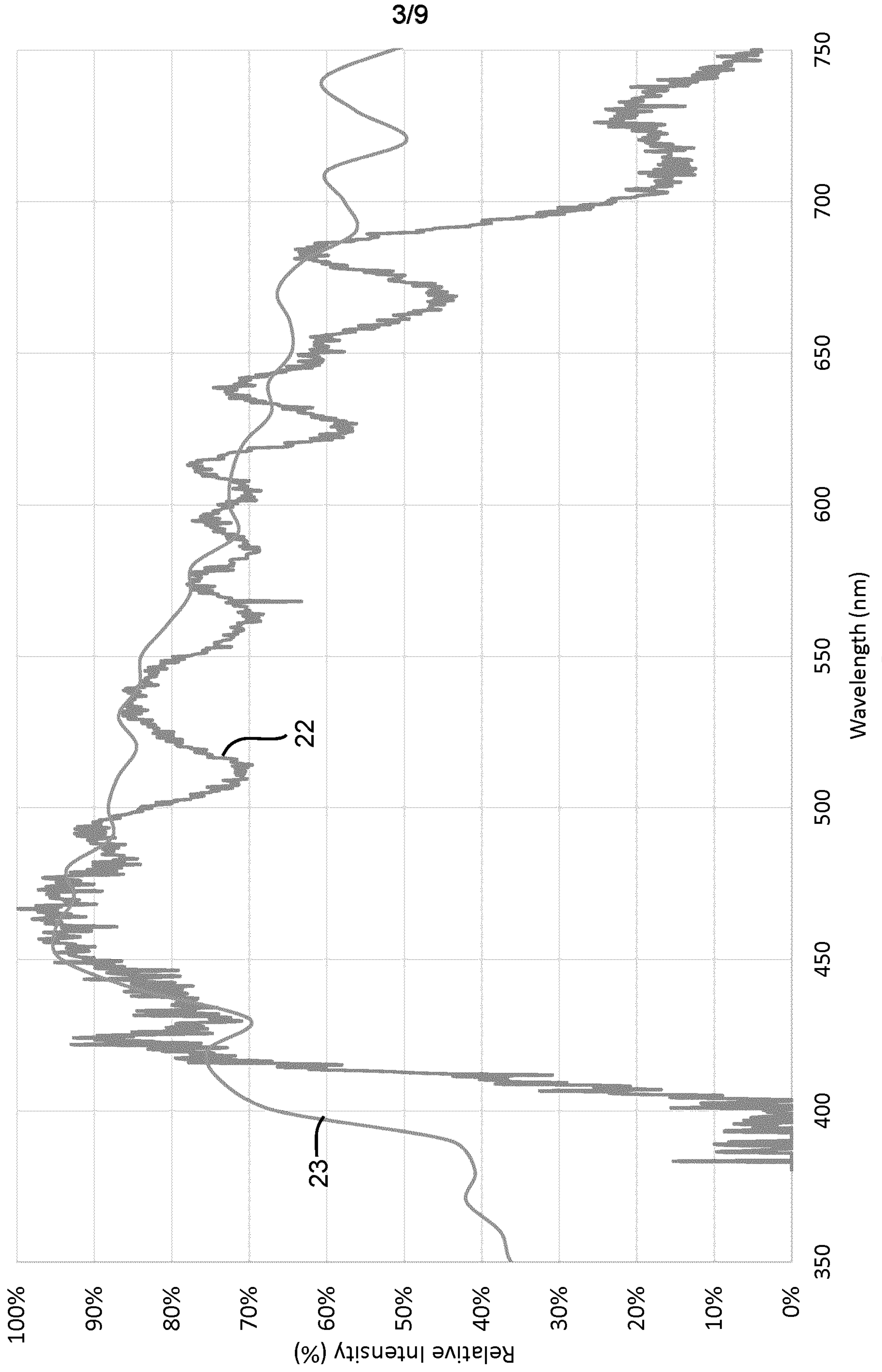


FIG. 3

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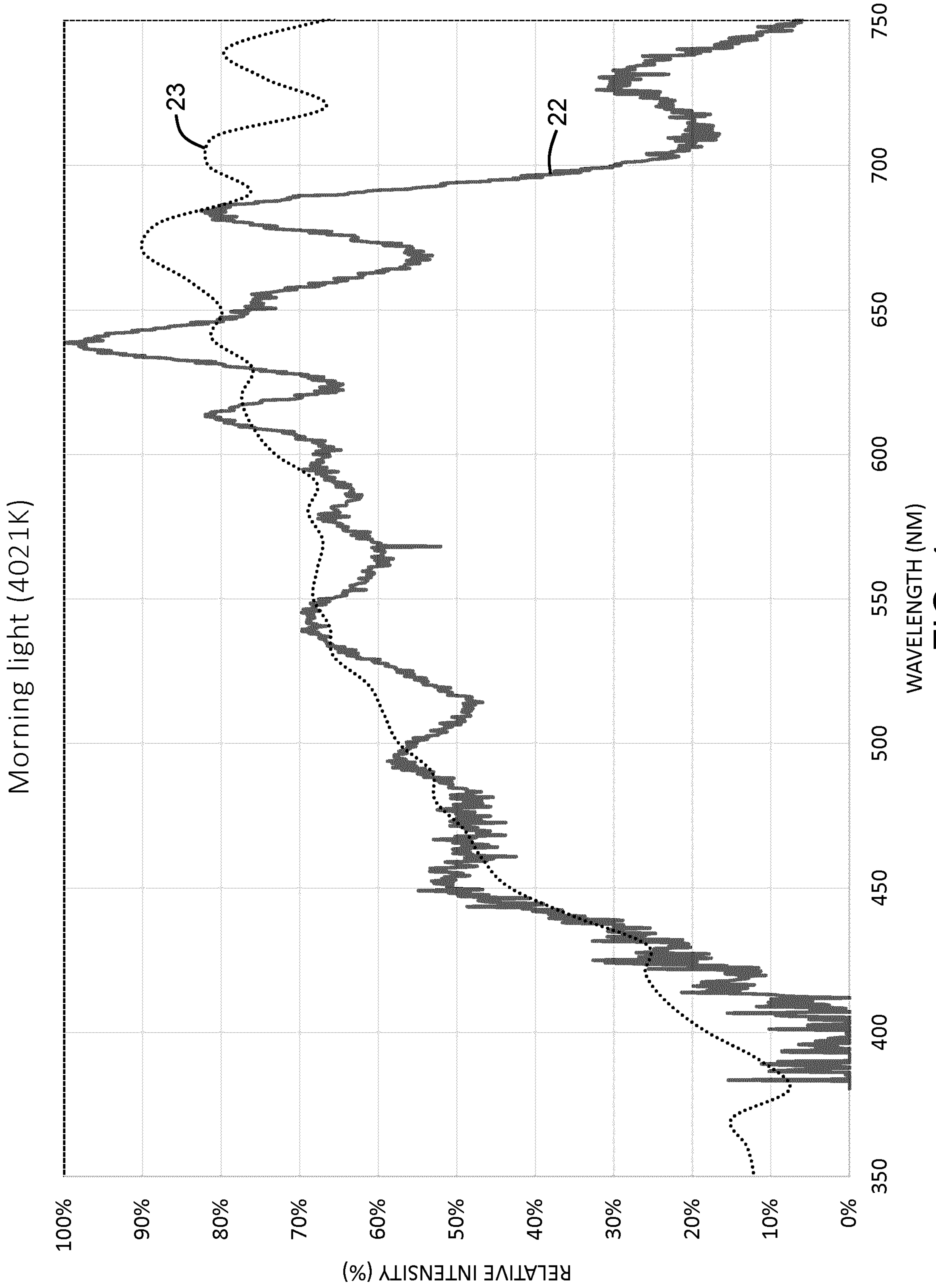


FIG. 4

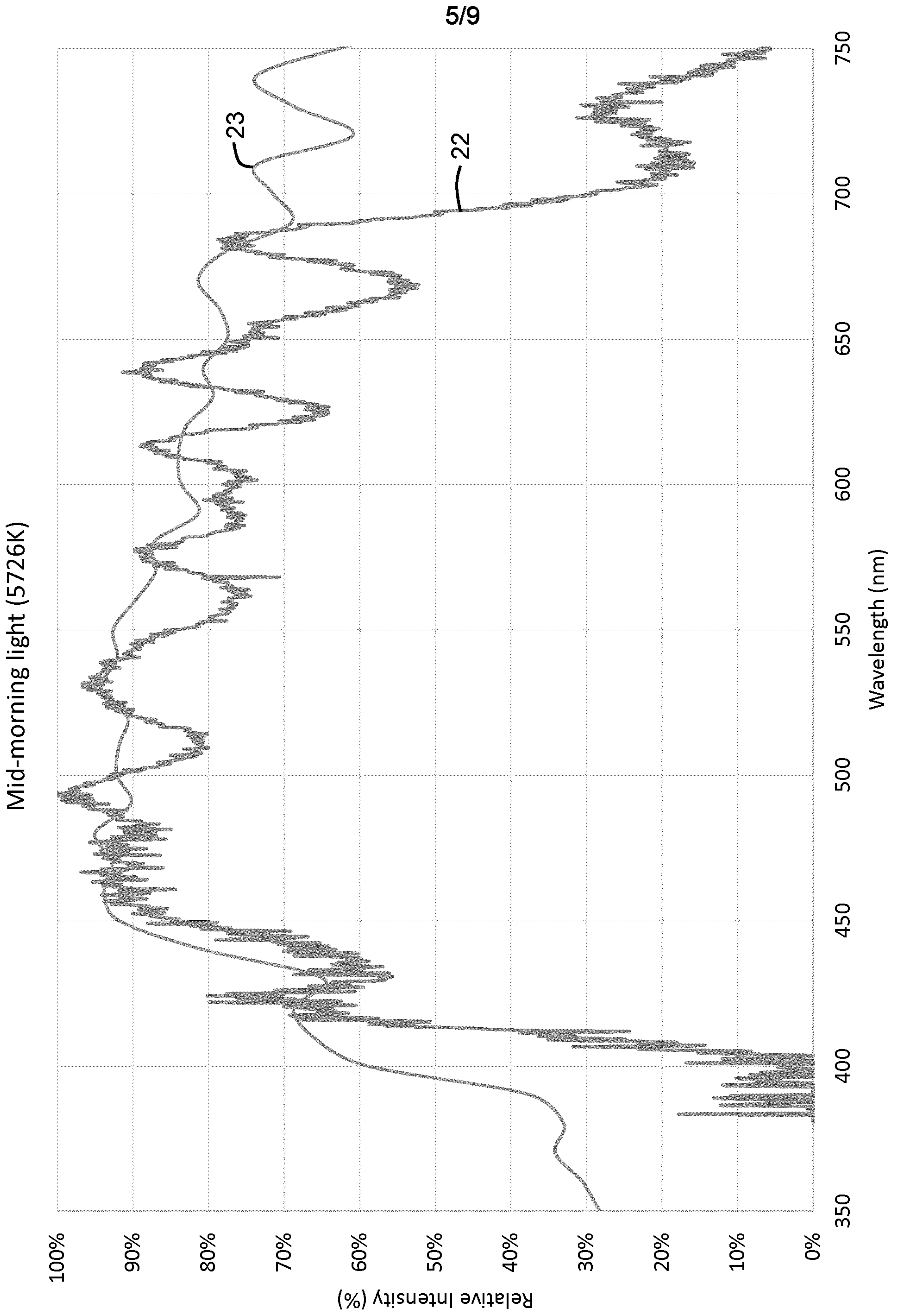


FIG. 5

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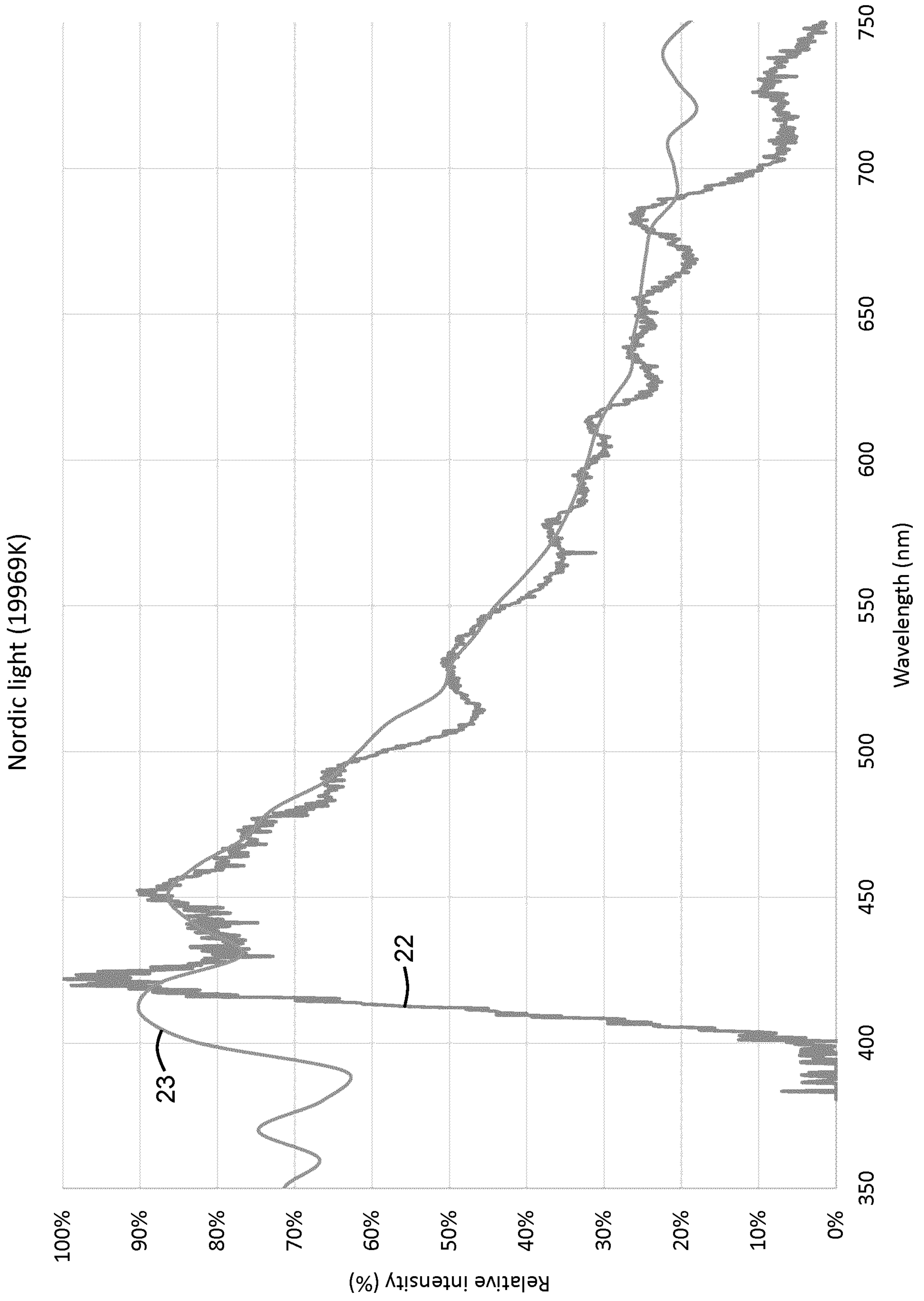


FIG. 6

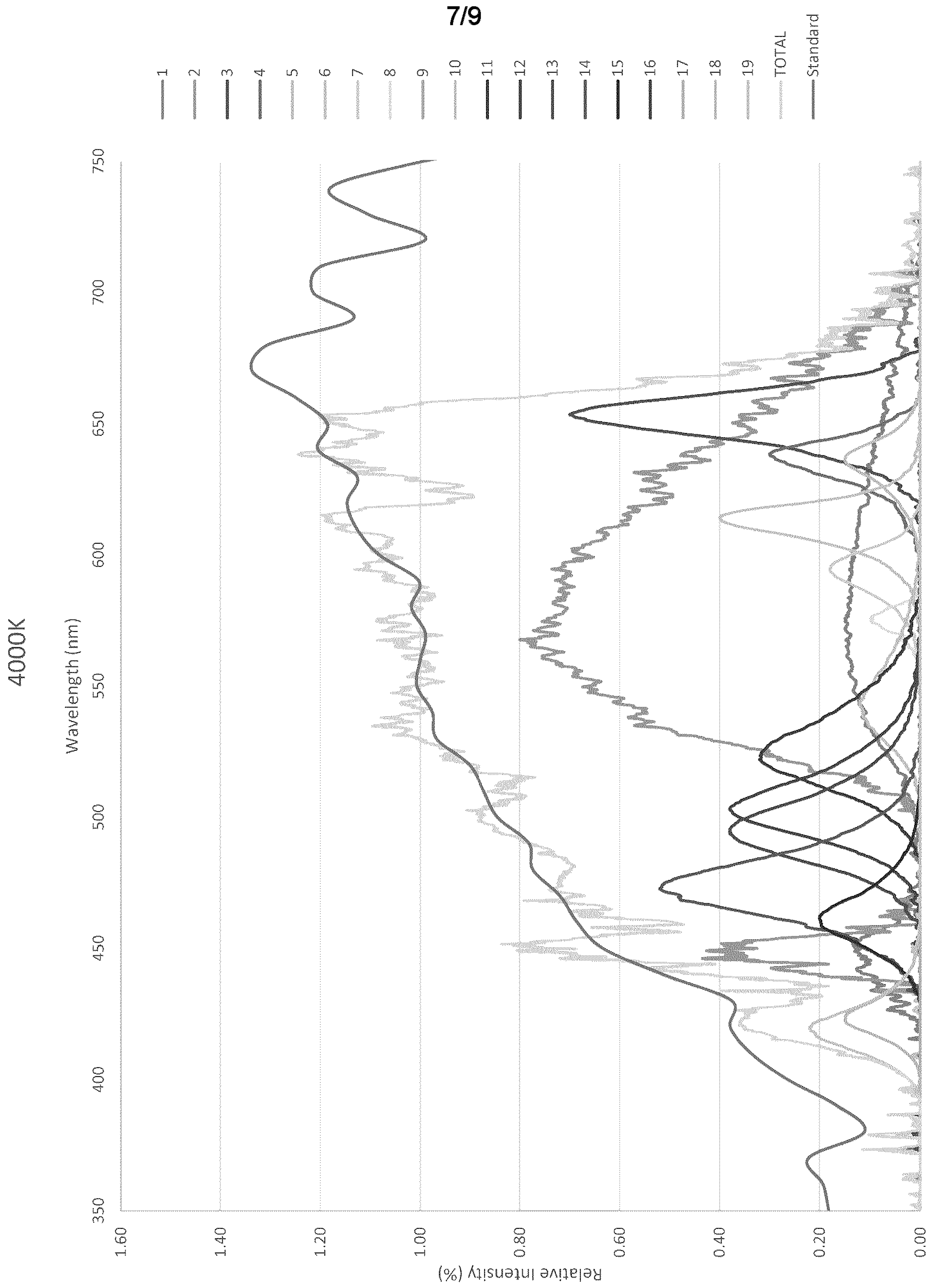


FIG. 7

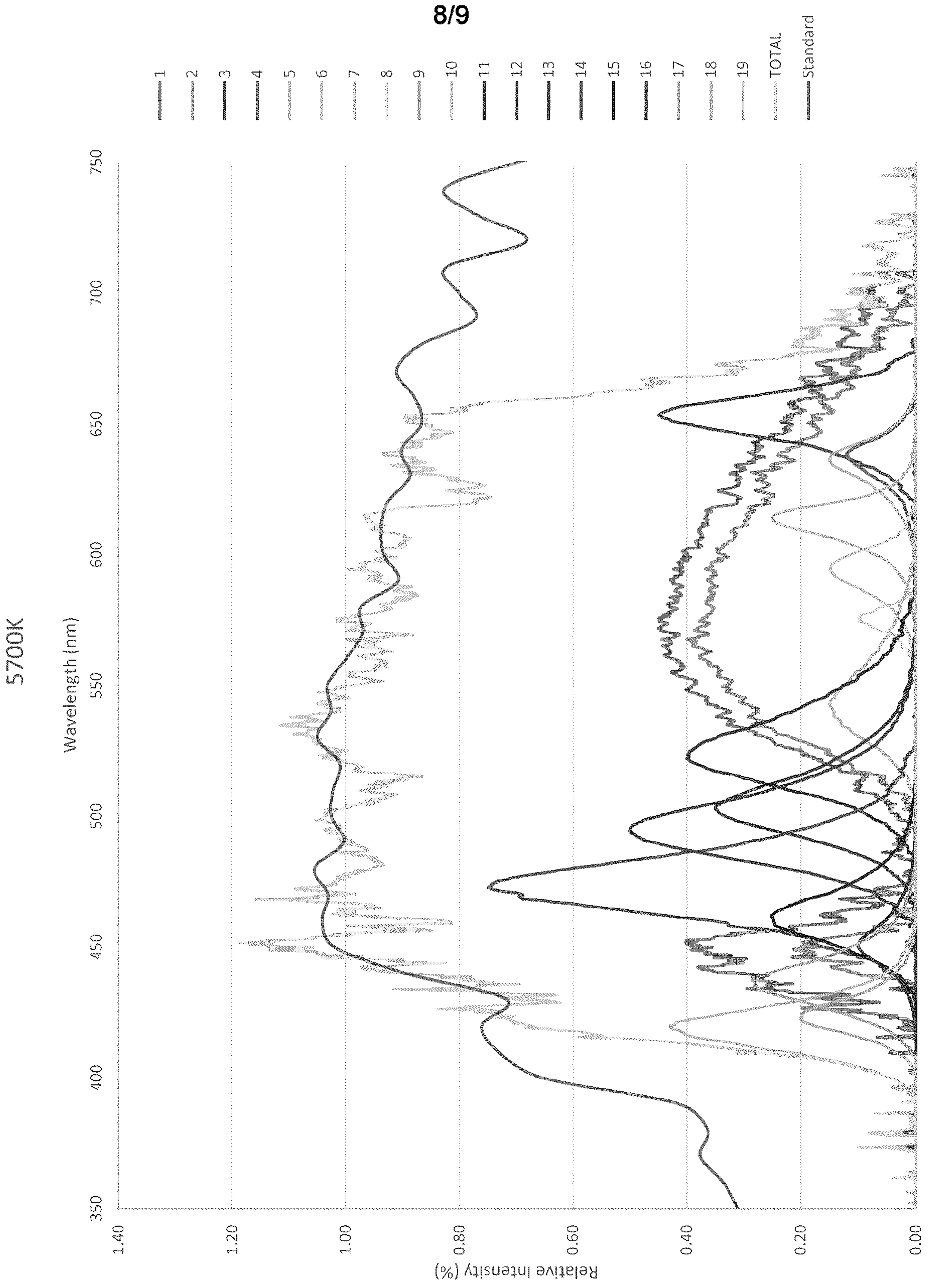


FIG. 8

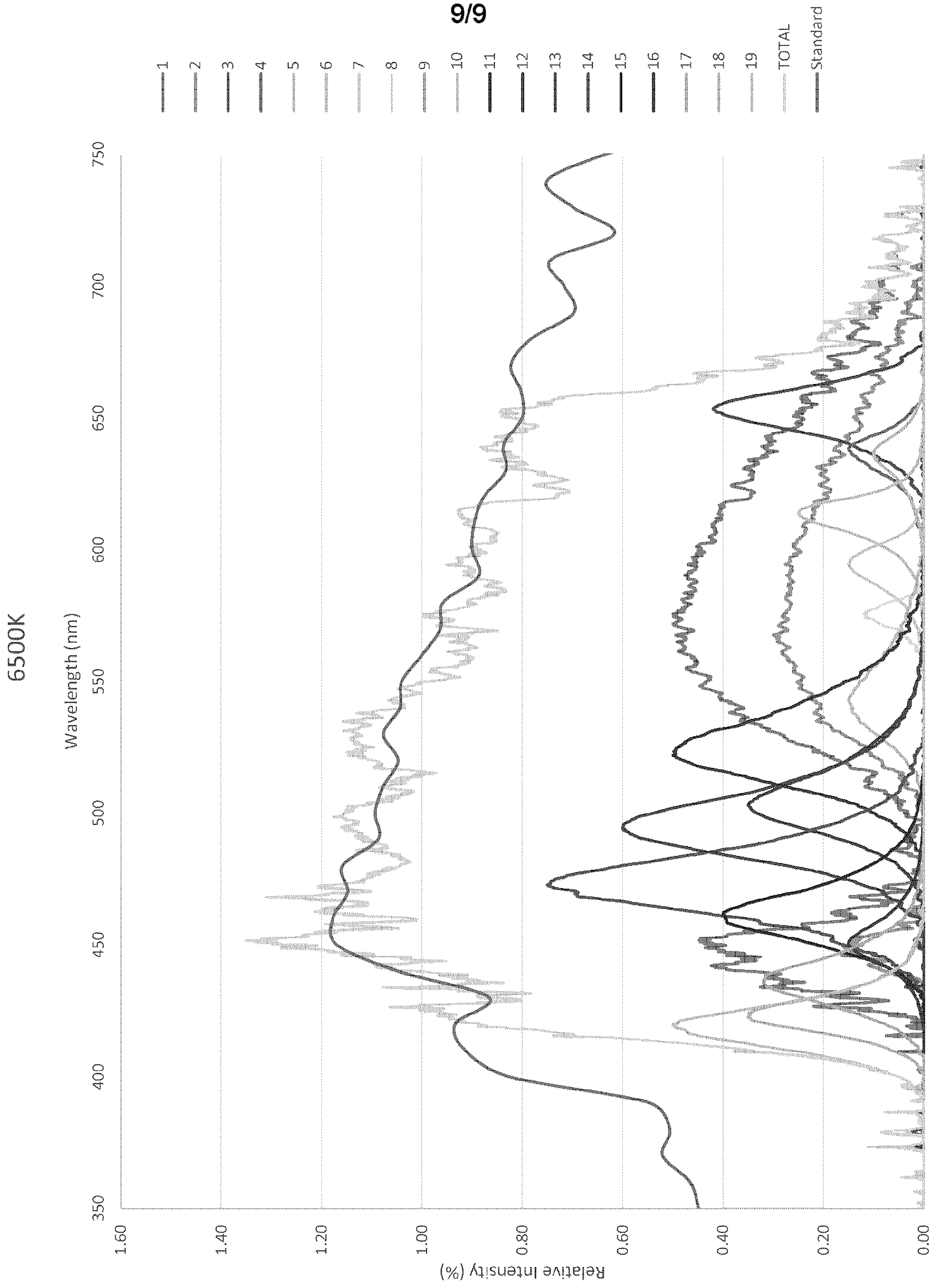


FIG. 9

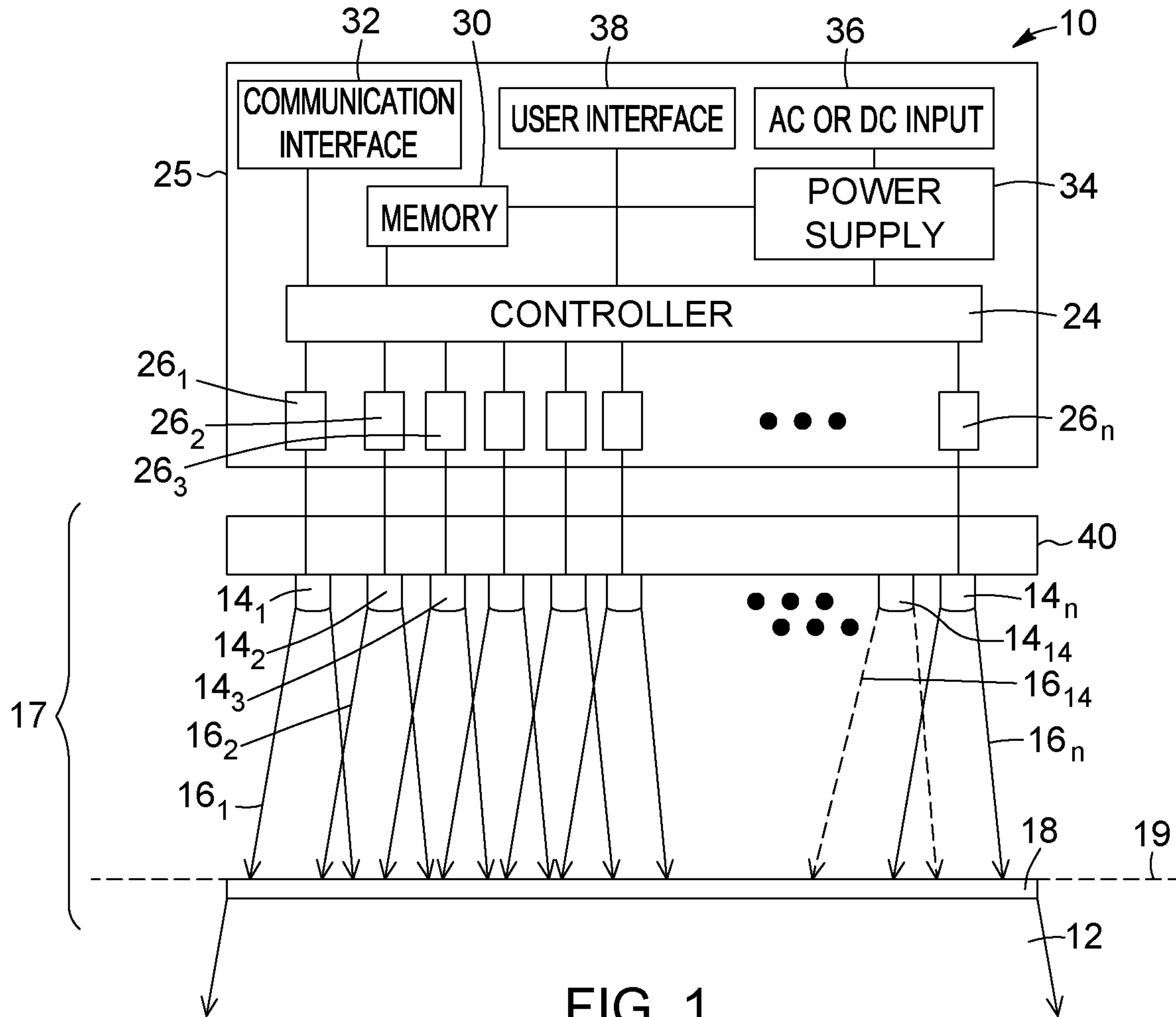


FIG. 1