



(51) International Patent Classification:

F21S 8/04 (2006.01) *F21S 10/04* (2006.01)
F21V 7/00 (2006.01) *F21Y 107/30* (2016.01)
F21V 7/04 (2006.01) *F21W 131/405* (2006.01)
F21V 14/02 (2006.01) *F21W 131/406* (2006.01)
F21V 14/04 (2006.01) *F21Y 115/10* (2016.01)
F21V 23/04 (2006.01) *F21Y 115/30* (2016.01)

(21) International Application Number:

PCT/EP2022/054069

(22) International Filing Date:

18 February 2022 (18.02.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

21158388.5 22 February 2021 (22.02.2021) EP

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(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: A LUMINAIRE FOR SPOTLIGHTING

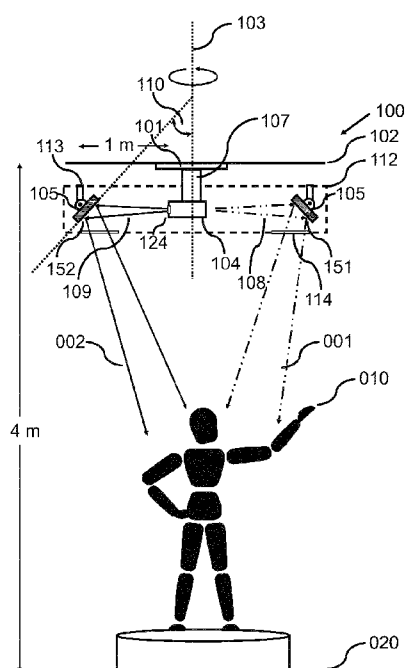


Figure 4

(57) **Abstract:** The invention concerns a luminaire (100) that is suitable but not limited to a spotlight luminaire for retail environment and entertainment. The luminaire (100) comprises, a mount (101) for mounting the luminaire (100) to a mounting surface (102) and the mount (101) has a center axis (103). The luminaire (100) further comprises a light source (104), a light source controller, and a light reflector (105). The light source (104) has a light emission window for emitting light, the light emission window comprising one or more light emitting surfaces (114, 124) for emitting light in one or more directions (108, 109, 118, 119) substantially parallel to the mounting surface (102). The light source controller is for controlling the light source (104). And the light reflector (105) has a light reflection window comprising one or more light reflective surfaces (151, 152), each light reflective surface having a tilt angle (110) with respect to the center axis (103) that is higher than 0 degrees and less than 90 degrees. The light emission window faces the light reflection window, and the light reflection window is located at a distance of at least 200 millimeters from the light emission window.

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

- *with international search report (Art. 21(3))*
- *in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE*

A LUMINAIRE FOR SPOTLIGHTING

FIELD OF THE INVENTION

The invention concerns a luminaire that is suitable but not limited to spotlighting for retail environment and entertainment. The luminaire may be configured to produce a dynamic lighting effect.

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BACKGROUND OF THE INVENTION

Spotlight luminaires create projected spots of light beams that can be used to brilliantly illuminate a person, object, or group on a stage. A good quality spotlighting used in retail stores can attract potential customers and is therefore of great importance. The design of the spotlighting system is expected to meet few criteria. These can be horizontal and vertical illumination, accent lighting, color quality, power consumption, ease of maintenance and installation, and the overall general appearance of the illumination space, *e.g.* a retail shop space. Spotlight luminaires are typically arranged on the ceiling of the retail shops. For example, the mannequins in shopping windows can be illuminated in an attractive way using several spotlight luminaires to create the desired degree of shadowing. These spotlight luminaires are often large in size, which may cause cluttering of the ceiling and may not be visually attractive for potential customers. Especially, in this case, the space requirements are strict, and there is a need for spotlight illumination that takes up less space on the ceiling.

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In EP 3553373 a lighting assembly is described that comprises a lighting tower, wherein the lighting tower comprises: a plurality of layers of lighting elements wherein each layer of lighting elements is configured to provide a different angle of emitted light onto a parabolic reflector with respect to light emitted from another layer of lighting elements onto the parabolic reflector when activated.

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SUMMARY OF THE INVENTION

It is an object of the present invention to provide a luminaire for spotlighting, which overcomes or at least alleviates the above-mentioned problem by having a reduced footprint.

According to a first aspect of the invention, this and other objects are achieved by a luminaire comprising, a mount, a light source, a light source controller, and a light reflector. The mount is for mounting the luminaire to a mounting surface and the mount has a center axis. The light source has a light emission window for emitting light, the light

5 emission window comprising one or more light emitting surfaces for emitting light in one or more directions substantially parallel to the mounting surface. The light source controller is for controlling the light source. And the light reflector has a light reflection window comprising one or more light reflective surfaces, each light reflective surface having a tilt angle with respect to the center axis that is higher than 0 degrees and less than 90 degrees.

10 The light emission window faces the light reflection window, and the light reflection window is located at a distance of at least 200 mm from the light emission window.

The center axis of the mount is perpendicular to the mounting surface.

The light source controller may be a switch to turn on and/or off the light source. The light source controller may include suitable electronic drivers and control

15 circuitry necessary for optimum operation of the light source. The light source controller may allow control of the light intensity emitted by the light source. The light source controller may also allow control of the spectral power distribution of the light emitted by the light source.

The light reflective surfaces may be optimally chosen to be highly reflective

20 towards the spectral power distribution of the emitted light from the light source. An example of the light reflector maybe but not limited to a mirror. Mirrors may be used to create multiple beams of light in multiple directions. This may help reduce the footprint of the spotlighting luminaires used for application areas like retail shop space by utilizing one light source. For example, beams of light emitted from a light source in the ceiling may be directed

25 by remote mirrors such that they all are directed to the same object. The reflected light beams from the light reflector may all converge on the object body or may illuminate different parts of the object body. If the emitted light from the light source has a narrow beam, then the light reflector may also have a small size yielding a luminaire for spotlighting that has a small footprint. Advantages of this technique may be the following: an object may be statically

30 illuminated from different angles without the need for many ceiling-cluttering spotlight luminaires, harsh shadows may be eliminated, and accent lighting may be realized.

The mounting surface may be parallel to a floor or a ceiling.

The light reflector may be configured to have the light reflective surface to form a tilt angle with respect to the center axis. If the luminaire is mounted on a ceiling, the

light reflective surfaces may be directed toward the ceiling to produce an accent lighting effect. The light reflective surfaces may be directed toward an object or multiple objects for producing desired spotlighting effect.

The distance between the light reflection window and the light emission window may be separated by a distance of at least 200 millimeters. This may be suitable for producing a spotlighting effect in applications like display cabinets (for example jewelry cabinets). In applications like the retail store and shop windows, the distance may be 500 millimeters, more preferably 1000mm or more to achieve useful spotlighting effects.

The light reflection window may be configured around the light emission window so that at least one light reflective surface is separated from the light emission window by at least 200 millimeters. Other light reflective surfaces may be present at different distances from the light emission window.

The light emission window may be configured for emitting light in two or more directions substantially parallel to the mounting surface.

Multiple emitted light reflected by multiple light reflective surfaces may be beneficial for producing a spotlighting effect. The directions of emitted light can have little or no overlap such that each direction can be substantially different from others.

The light reflection window is provided around the center axis and the light reflection window has a shape selected from the group consisting of a spherical segment and a truncated hollow cone.

The light reflection window may have a continuous light reflective surface that is concentrically configured around the light source and the center axis of the mount.

A light reflection window shaped in a spherical segment may have a curved light reflective surface when compared to a light reflection window shaped in a truncated hollow cone. Therefore, the choice of the shape of the light reflective surface may help produce various beam shapes according to the desired lighting effect. A truncated hollow cone shape may also include a faceted truncated hollow cone shape. In this case, the light reflection window may comprise an array of flat and linear light reflective surfaces. The spherical segment may also be faceted.

A light reflection window shaped in a spherical segment or a truncated hollow cone may have a light reflective surface that is extending within a half or a quarter section of the shape.

The light reflection window may also be shaped in a parabolic or elliptical cross-section around the light source.

The light reflection window may comprise two or more light reflective surfaces.

The light reflective surface may have various shapes for realizing different beam shapes for the reflected light. A deformable light reflective surface that is actively tunable by mechanical means, electrical means, or electro-magnetic means may be a suitable example.

The light reflective surfaces may be light reflector segments that are sparsely arranged within the light reflection window. The light reflective surfaces may be configured close to each other or equally spaced in distanced from each or a mix of both. The light reflective surfaces may be also configured as adjoining reflector segments such that these reflector segments are facets on a light reflection window shaped in a spherical segment, a truncated hollow cone, or a faceted truncated hollow cone shape. Also, these facets may be configured to have a combination of light reflective and non-reflective surfaces. The light reflective surfaces may be configured such that they appear concentrically configured around the center axis or the light source.

A user or a commissioner of the luminaire may flexibly arrange the light reflective surfaces within the light reflection window with respect to the light emission window to produce desired spotlighting effect.

In the case of a plurality of light reflective surfaces, the distance between the light source and one light reflective surface may vary from the distance between the light source and the other light reflective surfaces for producing various lighting effects.

At least one of the light reflective surfaces may comprise one or more of a diffusely reflective surface, a faceted mirror surface, and a color filter surface.

A faceted mirror surface may produce a 'start-effect'.

A color filter surface may be used for producing a specific color for spotlighting when the light source is configured to emit white light.

The luminaire may comprise a tilt angle adjuster for adjusting the tilt angle of each of the light reflective surfaces.

Depending on the application, it may be desired to produce light beams directed in different directions from the luminaire. The light reflection window may comprise a plurality of light reflective surfaces that have different tilt angles to illuminate different parts of an object or different areas in a space.

The luminaire may comprise a tilt angle controller for configuring the tilt angle adjuster.

The light reflection window may comprise n light reflective surfaces and the light emission window comprises m light emitting surfaces, where m is larger than n . The luminaire may comprise m light conduits, each light conduit may have a light exit window and a slot for accommodating a light reflective surface, and wherein each light conduit may be configured to channel light from a light emitting surface in the direction of a light reflective surface.

The luminaire may comprise, a housing for at least accommodating the light source, the light reflector, and the light conduits having a light exit window and a slot for accommodating a light reflective surface.

The light conduits may be channels so that light from a light emitting surface may transmit light towards a unique light reflective surface. The light conduit may also comprise a light valve for ensuring that only a light reflective surface receives light output from the light source.

The light exit windows may be configured parallel to the mounting surface.

The light exit windows may be configured with a tilt with respect to the mounting surface to avoid back-reflections.

The slots may be used as chambers for securing the removable light reflective surfaces. Therefore, the light reflective surfaces may be flexibly reorganized to have different positions and distances from the light source for producing desired spotlighting effect.

The number of slots may be higher than the number of light reflective surfaces.

The light reflector may be configured to rotate around the center axis of the mount.

If the light reflector has a plurality of light reflective surfaces with different tilt angles, then the rotating light reflector around a light source with a plurality of light emitting surfaces may create a dynamic spotlighting effect.

The light source may be configured to rotate around the center axis of the mount.

Different dynamic lighting effects may be produced when the light source is configured to rotate around the axis.

If the light reflective surfaces of the light reflector may different tilt angles, the above-mentioned rotatable light source and/or light reflector around the center axis of the mount may also produce a dynamic three-dimensional (3D) lighting effect for spotlighting.

The light emission window may comprise an array of individually controllable light emitting surfaces provided on a cylindrical surface.

The cylindrical surface may be a circular perimeter or a polygonal perimeter.

The light source may also comprise an array of light emitting surfaces

5 configured on a polygonal cylinder body and each of the light emitting surfaces is configured on a facet of the polygonal cylindrical body configured to have the emission direction substantially parallel to the mounting surface. The number of light emitting surfaces is the same or an integer multiple of the number of facets of the polygonal cylinder body.

10 If the light reflector has a plurality of light reflective surfaces, the number of light reflective surfaces may be the same or an integer multiple of the number of light emitting surfaces.

The light source controller may be configured to control the light source for producing a scanning light output at a scanning speed in a scanning direction.

15 The light source controller may be configured to control the rotation speed of the light speed. The light source controller may be configured to provide a scanning light output in a continuous manner or a pulsed manner with a certain waiting duration between scanning movement in a certain direction.

20 The light source controller may comprise a microcontroller, microprocessor, or application-specific integrated circuits that may be programmed by the manufacturer or the user for providing intelligent control over the light source for producing a scanning light output. A manufacturer, a user, or a commissioner of the luminaire may have access to upload a user-defined program for altering or enabling a new programmable function of the light source. Such a programmable function may include control of light source in terms of intensity, spectral power distribution, instance and duration of light emission, and period
25 nature of light emission. If the light source comprises a light emission window that is capable of rotating around the center axis of the mount, then the light source controller may offer control over the scanning speed, the scanning direction, and the spectrum and brightness of the light emitter. The light source may also comprise a plurality of light emitting surfaces configured to rotate around the axis. Then, the light source controller may also provide
30 individual control over each of the light emitting surfaces for producing a desired dynamic 3D lighting effect. Such lighting effects implemented in a retail environment may be effective for attracting the attention of the potential customer.

Similarly, the light source controller may also provide intelligent control over an array of light emitting surfaces for producing a desired dynamic 3D lighting effect. The light source controller may control each of the light emitting surface individually.

If the light reflector is configured to rotate around the light source and the axis, the controller may also provide control at least over the rotation speed and direction.

The luminaire may also comprise a user interface device for providing user-defined input on the scanning light parameters that at least comprises scanning speed, scanning direction, and scanning duration. The user interface device may also allow a user to produce a custom spotlighting effect.

The scanning direction may be clockwise or anti-clockwise or a mix of both.

The light source controller may be used to control the light valve.

The tilt angle controller and the light source controller may represent the same controller based on a microprocessor, a microcontroller, or an application-specific integrated circuit.

The luminaire may comprise a detector configured to detect a relative orientation of the light emission window with respect to the light reflective window. The detector may be configured to provide a detection signal to the light source controller. The detection signal may comprise information about the relative orientation of the light emission window with respect to the light reflection window and the light source controller is configured to control the light source based on the detection signal.

The luminaire may comprise a detector that is configured to determine the relative orientation of a light emitting surface with respect to a light reflective surface of the light reflector from a predetermined orientation. The detector may be communicatively connected to the controller and the controller is configured to synchronize and control the light output depending on the relative orientation of the light source.

The detector may be a rotational encoder or a rotational sensor. The light source controller may be configured to read the detection signal. Therefore, the light source may only emit light when the light emitting surface is aligned with a specific light reflective surface. With this technique, the light source controller may also configure the light emission towards individual reflector segments with constant and varying durations. This may allow efficient operation of the light source and also produce complex dynamic and 3D lighting effects.

The detector may be an optical rotational sensor.

The predetermined orientation may serve as a reference for determining the relative position of a light emitting surface orientation with respect to a light reflective surface.

The predetermined orientation may be stored in the controller during manufacturing or commissioning of the luminaire. The light source controller may use the predetermined orientation to produce complex control on the array of light emitting surfaces configured on a cylindrical surface for producing a complex dynamic and 3D spotlighting effect

In the case of the light reflector configured to rotate around the light source and the center axis, the detector may also be configured to determine the relative orientation of the light emission window and the light reflection window.

The light source may comprise at least one of a LED, a laser, and a laser pumped phosphor-light source.

The light source may emit mono- or multi-chromatic light. The light source may also be configured to change the spectral power distribution. The light source may be a combination of light emitters that emit lights having significantly different spectral power distribution, for example, RGB-LED or RGB(Y)-laser.

The light source may comprise at least one of a diffusing optic, a blurring optic, a magnifying optic, a collimating optic, and a beam shaping optic.

It may be desirable that the light emitted from the light emitting surfaces may completely reach the light reflective surface. This may improve the efficiency of the luminaire by redirecting light without any loss. Therefore, different types of collimating and/or magnifying optics may be used. If the light source is capable of producing narrow-beam and high-intensity light output, diffusing and blurring optics may be used to produce desired lighting effects. Depending on the type of spotlighting application, the illumination area may benefit from symmetric or asymmetric beam shapes of the light output, for example, circular or elliptical beam. The beam shaping optics may comprise liquid crystal lens, electro-wetting optical elements, or other forms of deformable lenses for producing various beam shapes for the light output. The optics described here may be actively tunable by mechanical means, electrical means, or electro-magnetic means.

One may consider a combination of beam shaping optics and various shapes of the light reflective surfaces for producing desired beam shapes.

The light source controller may also provide control over the active lens components and/or deformable reflector segments of the light reflector for actively controlling the beam shapes of the light output from the luminaire.

It is noted that the invention relates to all possible combinations of features recited in the claims. Other objectives, features, and advantages of the present inventive concept will appear from the following detailed disclosure, from the attached claims as well as from the drawings. A feature described in relation to one of the aspects may also be incorporated in the other aspect, and the advantage of the feature is applicable to all aspects in which it is incorporated.

BRIEF DESCRIPTION OF THE DRAWINGS

The above, as well as additional objects, features, and advantages of the disclosed devices, methods, and systems, will be better understood through the following illustrative and non-limiting detailed description of embodiments of devices, methods, and systems, with reference to the appended drawings, in which:

Fig. 1 shows a cross-sectional view from a side of a luminaire;

Fig. 2 shows a schematic of a perspective view of a possible configuration of the light reflector and the light source in a luminaire as shown in Fig. 1;

Fig. 3 shows a schematic of a perspective view of a luminaire with light reflective surfaces;

Fig. 4 shows a cross-sectional view from a side of an alternative configuration of a luminaire;

Fig. 5(a) and (b) show cross-sectional views from a bottom of a luminaire; and

Fig. 6 shows a cross-sectional view from a bottom of a luminaire.

As illustrated in the figures, the sizes of layers and regions are exaggerated for illustrative purposes and, thus, are provided to illustrate the general structures of embodiments of the present invention. Like reference numerals refer to like elements throughout.

DETAILED DESCRIPTION

The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which currently preferred embodiments of the invention are shown. This invention 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 for thoroughness and completeness, and fully convey the scope of the invention to the skilled person.

Referring initially to Figure 1, a cross-sectional view from a side of a luminaire 100 is shown. The luminaire 100 comprises a mount 101 for attaching the luminaire 100 to a mounting surface 102. The mounting surface 102 in this figure represent a ceiling that is 4 meters high from the floor 020. The mount 101 has a center axis 103 being perpendicular to the mounting surface 102. The luminaire 100 further comprises a light source 104 and a light reflector 105. The light source 104 is attached to the mount with a shaft 107. The light source 104 comprises a light emission window and the light emission window comprises light emitting surfaces 114 and 124. The light source may comprise an array of light emitting surfaces configured around a cylindrical surface. The light emitting surfaces 114, 124 are configured to emit light in the emission directions 108, 109 that are substantially parallel to the mounting surface 102 and perpendicular to the center axis 103. The emitted light in the emission directions 108, 109 may be white or lights having specific spectral power distributions. The light reflector 105 is configured to receive the light outputs from the emission directions 108, 109 on a reflection window comprising light reflective surfaces 151 and 152 for directing them in the illumination directions 001, 002 that are directed towards a mannequin 010. The light reflector 105 is configured to have the light reflective surfaces 151 and 152 form a tilt angle 110 with respect to the center axis 103 that is higher than 0 degrees and less than 90 degrees. Furthermore, the light reflection window is shown to be 1 meter apart from the light emission window. However, one may choose a different distance that is at least equal to or higher than 200 millimeters.

Figure 2 schematically shows a perspective view of a possible configuration of the light reflector 105 and the light source 104 with respect to the mounting surface 102 as shown in Figure 1. The light reflector 105 is configured concentrically around the center axis 103 and the light source 104. As shown in Figure 1, the light source 104 comprises an array of light emitting surfaces that are configured around the outer circumference of the cylindrical body and configured to emit light outputs in the emission directions 108, 109, 118, and 119. In this figure, the emission directions 108, 109, 118, and 119 are substantially different from each other and without any overlap in the emitted light beam.

The light reflector 105 has a light reflection window comprising a light reflective surface 151 on the inner circumferential surface to reflect the light originating from the light source 104. The light reflection window may have a spherical segment shape or a truncated hollow cone shape. The light reflection window may also have an elliptical cross-

section, a parabolic cross-section, or a free-form reflector. Because the light reflector 105 is configured concentrically around the light source 104, light originating from the light source 104 is reflected in the directions 001, 002, 003, and 004 to illuminate an object 030 on the floor 020. The light reflector 105 may be configured to have the reflected lights converge on an object. In Figure 2, the light reflective surface 151 of the light reflector 105 is configured to have a tilt angle 110 that is approximately 45 degrees with respect to the center axis 103 and 135 degrees with respect to the surface 102.

The array of light emitting surfaces in the lighting source 104 may be configured to produce constant illumination conditions such as constant intensity and spectral power distribution. The luminaire 100 may comprise a light source controller for controlling individual light emitting surfaces from the array. This may allow producing a scanning light output 111 in the clockwise direction from the light source 104 as shown in Figure 2. The light source controller may also be configured to produce the scanning light output in the anti-clockwise direction. The light source controller may also allow configuring the scanning speed, duration of the light pulse, and sequence of turning ON/OFF of individual light emitting surfaces for creating desired lighting effect.

Depending on the application, it may be desired to produce light beams directed at different directions from the luminaire 100. The light reflector 105 may comprise a plurality of light reflective surfaces 151, 152, 153, and 154 that have different tilt angles to illuminate different parts of an object as shown in Figure 3. The light reflective surfaces of the light reflector 105 are configured around the light source 104. The light source 104 is configured to emit light outputs in the emission directions 108, 109, 119, and 118 are parallel to the mounting surface 102. By having different tilt angles for the light reflective surfaces 151, 152, 153, and 154, the emitted lights received by the light reflective surfaces 151, 152, 153, and 154 are directed towards different desired directions 001, 002, 004, and 003, respectively on the floor surface 020. The light source 104 may comprise zoom lens optics, collimating optics, diffuser elements, or movable optical elements for manipulating the light outputs so that they are optimally received by light reflective surfaces 151, 152, 153, and 154.

The light reflective surfaces 151, 152, 153, and 154 as shown in Figure 3 may be configured close to each other or equally spaced in distanced from each or a mix of both. The light reflective surfaces may be also configured as adjoining light reflective surfaces such that these light reflective surfaces form facets on a unibody light reflector 105 as shown in Figure 2. Also, these facets may be configured to have a combination of reflective and

non-reflective surfaces. In this case, the light reflector 105 may be flexibly rotatable with respect to the light source 104 and may be configured to produce desired lighting effect.

Depending on the application, it may be desirable to have various beam shapes for the reflected light beams from the luminaire 100. In that case, the light source may
5 comprise adaptive optics or beam shaping optics for producing various beam shapes. Examples may include various actively movable lenses, liquid crystal lenses, or electro-wetting optical elements. On the other hand, the various shapes of the light reflective surfaces may also allow realizing different beam shapes for the reflected light. A deformable reflector may be a suitable example. One may consider a combination of beam shaping optics and
10 various shapes of the light reflector for producing desired beam shapes.

Figure 4 shows a cross-sectional side view of a luminaire 100 comprises a mount 101 and a shaft 107 for attaching a light source 104. The light source 104 is configured to rotate anti-clockwise around a center axis 103 that is perpendicular to the mounting surface 102 for mounting the luminaire 100. The rotation of the light source 104
15 may produce a scanning light output in a scanning direction that is the same as the rotation direction. The luminaire 100 may comprise a light source controller for controlling scanning light output properties, for example, scanning speed and intensity.

The light source 104 in Figure 4 may beneficially produce a narrow beam for keeping a small footprint of the luminaire 100. For example, a beam of light generated by a
20 laser with an angular beamwidth of 2.6 degrees full-width half maximum (FWHM) may be directed by a mirror as a light reflective surface with a dimension of 100 by 100 millimeters. The mirror may be placed 1 meter apart from the light emission window. The choice of the beamwidth of 2.6 degrees FWHM may be realistic for a laser source having a beam size of 1 square millimeter and an optics size of 50 millimeters diameter. If the laser source of that size
25 has a brightness of 1 giga candela per square meter (Gcd/m^2), the light source 104 may generate 3000 lumens (lm). After the optics, the maximum intensity is then about 1.3 mega candela per square meter (Mcd/m^2) which can potentially be the luminaire 100 output. Similarly, micro-spot products of SLD laser would result in a beam of 1.5 degrees FWHM with 35 millimeters diameter with optics may produce 400 lumens. Such a light source may
30 further reduce the footprint of the luminaire 100.

The luminaire 100 comprises a housing 112 for accommodating the light source 104 and the light reflector 105. The light reflector 105 may have one or more light reflective surfaces 151 and 152. The luminaire 100 further comprises tilt adjusters 113 for varying the tilt angle 110 of the light reflector 105 so that tilt angle 110 may be greater than 0

degrees, but less than 90 degrees. The light reflective surfaces 151 and 152 of the light reflector 105 may be equipped with individual tilt adjusters. A tilt angle controller may be programmed to set the desired tilt angles for the light reflective surfaces 151 and 152. The housing 112 comprises light exit windows 114 for allowing reflected light from the light reflective surfaces 151 and 152 to reach desired directions 001 and 002.

Bottom cross-sectional views of a luminaire 100 are shown in Figures 5(a) and (b). In Figure 5(a), the luminaire 100 comprises a light source 104 with an array of light emitting surfaces configured around a cylindrical surface. In Figure 5(b), the luminaire 100 comprises a light source 104 configured to rotate anti-clockwise and produce scanning light output, as shown in Figure 4. The housing of the luminaire 100 comprises channels as light conduits 115 so that each of the light emitting surfaces may emit light towards a unique light reflective surface 151 and 152. The luminaire 100 may also comprise a detector that is configured to determine the relative orientation of the light emission window of the light source 104 with respect to the light reflection window of the light reflector 105. The detector is communicatively connected to the light source controller. The information of the relative orientation may be utilized by the light source controller to synchronize and control the emission of the light for producing desired dynamic spotlighting effects.

For example, the light source 104 in Figure 5(a) may be controlled by the controller so that at least one of the light emitting surfaces may emit light having a different spectral power distribution than others. Also, specific light emitting surfaces may be configured to emit light in the desired emission directions 108, 109 and correspondingly towards specific light reflective surfaces 151 and 152. Besides, the light reflector 105 may be rotatable with respect to the light source 104 and vice versa. This may help utilize optimum position for the reflector segments for creating an optimum spotlighting effect and elimination of unwanted shadowing. Similarly, as shown in Figure 5(b), the light source controller may be configured so that the rotating light source 104 emits light when specific light reflector segments 151 and 152 are aligned with the desired emission directions 108, 109, respectively. In Figure 5(b), the luminaire 100 is shown to comprise a light valve 117 for ensuring that only a specific reflector segment receives light output from the light source 104. The light source controller may be used to control the light valve 117.

Figure 6 shows a cross-sectional view of a luminaire 100 from the bottom. The housing 112 of the luminaire 100 comprises slots 116. The slots 116 may be used as chambers for securing the light reflector 105 comprising removable the light reflective surface 151, 152, and 153. Therefore, the light reflective surface 151, 152, and 153 may be

reorganized to have different positions and distances from the light emission window of the light source 104. The slots 116 may be used to flexibly reconfigure the luminaire 100 for producing different lighting effects.

5 It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb “to comprise” and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article “a” or “an” preceding an element does not
10 exclude the presence of a plurality of such elements.

The mere fact that certain features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be used to advantage. The various aspects discussed above may be combined in order to provide additional advantages. Further, the person skilled in the art will understand that two or more
15 embodiments may be combined.

CLAIMS:

1. A luminaire (100) comprising:

- a mount (101) for mounting the luminaire (100) to a mounting surface (102), the mount (101) having a center axis (103),

- a light source (104) having a light emission window for emitting light, the

5 light emission window comprising one or more light emitting surfaces (114, 124) for emitting light in one or more directions (108, 109, 118, 119) substantially parallel to the mounting surface (102),

- a light source controller for controlling the light source (104), and

- a light reflector (105) having a light reflection window comprising two or
10 more light reflective surfaces (151, 152, 153, 154), each light reflective surface having a tilt angle (110) with respect to the center axis (103) that is higher than 0 degrees and less than 90 degrees,

wherein the light emission window faces the light reflection window, and

wherein the light reflection window is located at a distance of at least 200
15 millimeters from the light emission window, and

wherein the light reflection window comprises n light reflective surfaces (151, 152, 153, 154), and the light emission window comprises m light emitting surfaces (114, 124),

wherein the luminaire (100) comprises m light conduits (115), each light
20 conduit (115) having a light exit window (114) and a slot (116) for accomodating a light reflective surface (151, 152, 153, 154), and

wherein each light conduit (115) is configured to channel light from a light emitting surface (114, 124) in the direction of a light reflective surface (151, 152, 153, 154).

25 2. The luminaire (100) according to claim 1, wherein the light emission window is for emitting light in two or more directions (108, 109, 118, 119) substantially parallel to the mounting surface (102).

3. The luminaire (100) according to any one of the preceding claims, wherein the light reflection window is provided around the center axis (103), and wherein the light reflection window has a shape selected from the group consisting of a spherical segment and a truncated hollow cone.

5

4. The luminaire (100) according to any of the preceding claims, wherein at least one of the light reflective surfaces (151, 152, 153, 154) is one or more of a diffusely reflective surface, a faceted mirror surface, and a color filter surface.

10 5. The luminaire (100) according to any one of the preceding claims, wherein the luminaire (100) comprises a tilt angle adjuster (113) for adjusting the tilt angle (110) of each of the light reflective surfaces (151, 152, 153, 154).

15 6. The luminaire (100) according to claim 5, wherein the luminaire (100) comprises a tilt angle controller for controlling the tilt angle adjuster (113).

7. The luminaire (100) according to any one of the preceding claims, wherein the light reflector (105) is configured to rotate around the center axis (103) of the mount (101).

20 8. The luminaire (100) according to any one of the claims 1 to 7, wherein the light source (104) is configured to rotate around the center axis (103) of the mount (101).

9. The luminaire (100) according to any one of the claims 1 to 7, wherein the light emission window comprises an array of individually controllable light emitting surfaces (114, 124) provided on a cylindrical surface.

25 10. A luminaire (100) comprising:
- a mount (101) for mounting the luminaire (100) to a mounting surface (102), the mount (101) having a center axis (103),
30 - a light source (104) having a light emission window for emitting light, the light emission window comprising one or more light emitting surfaces (114, 124) for emitting light in one or more directions (108, 109, 118, 119) substantially parallel to the mounting surface (102),
- a light source controller for controlling the light source (104), and

- a light reflector (105) having a light reflection window comprising one or more light reflective surfaces (151, 152, 153, 154), each light reflective surface having a tilt angle (110) with respect to the center axis (103) that is higher than 0 degrees and less than 90 degrees,

5 wherein the light emission window faces the light reflection window, and wherein the light reflection window is located at a distance of at least 200 millimeters from the light emission window,

wherein the light source (104) is configured to rotate around the center axis (103) of the mount (101) or the light emission window comprises an array of individually
10 controllable light emitting surfaces (114, 124) provided on a cylindrical surface,

wherein the light source controller is configured to control the light source (104) to produce a scanning light output at a scanning speed in a scanning direction.

11. The luminaire (100) according to claim 2, wherein the luminaire (100)
15 comprises,

- a detector configured to detect a relative orientation of the light emission window with respect to the light reflective window,

wherein the detector is configured to provide a detection signal to the light source controller, the detection signal comprising information about the relative orientation
20 of the light emission window with respect to the light reflection window, and

wherein the light source controller is configured to control the light source (104) based on the detection signal.

12. The luminaire (100) according to any one of the preceding claims, wherein the
25 light source (104) comprises at least one of a LED, a laser, and a laser pumped phosphor-light source.

13. The luminaire (100) according to any one of the preceding claims, wherein the
30 light source (104) comprises at least one of a diffusing optic, a blurring optic, a magnifying optic, a collimating optic, and a beam shaping optic.

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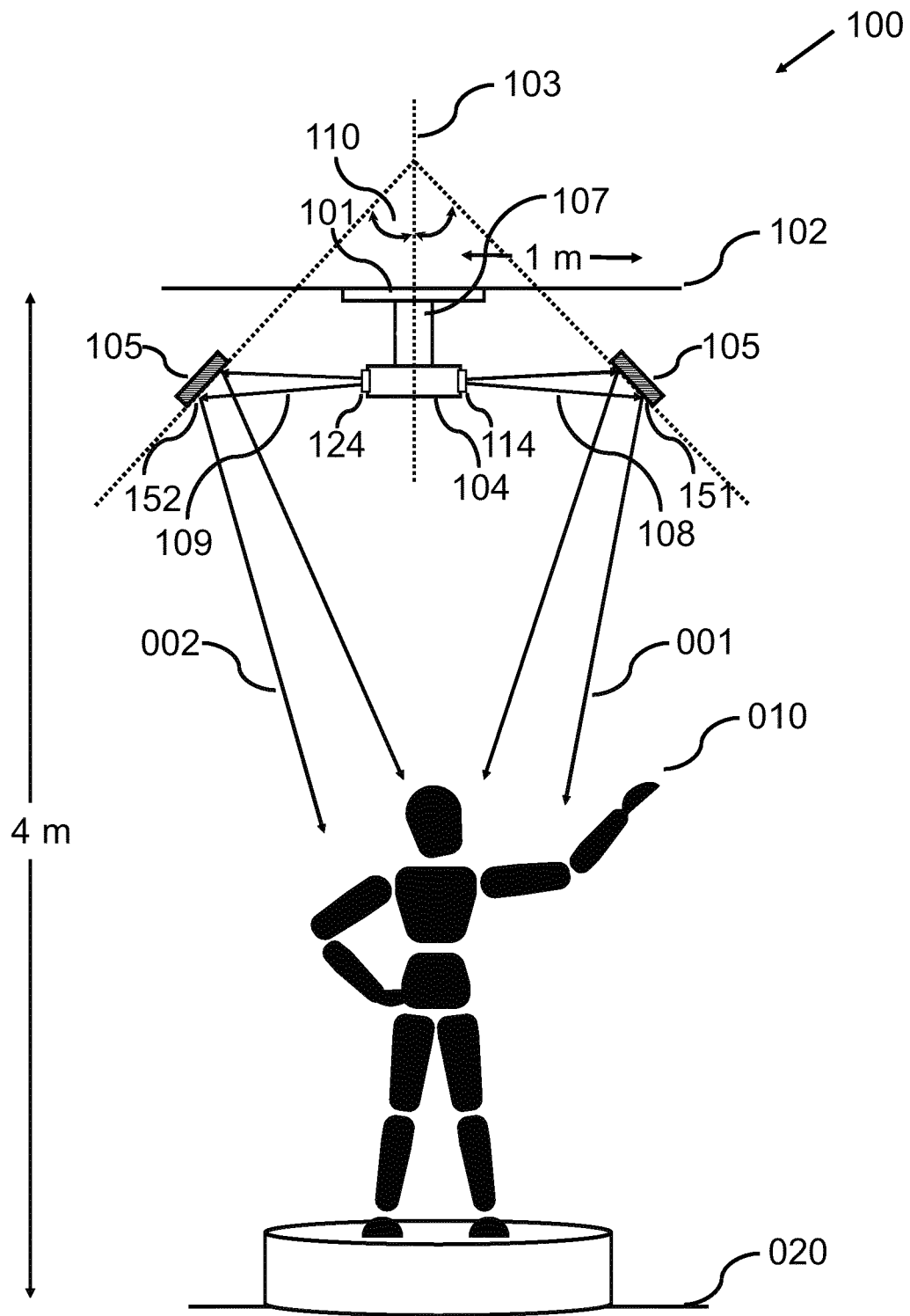


Figure 1

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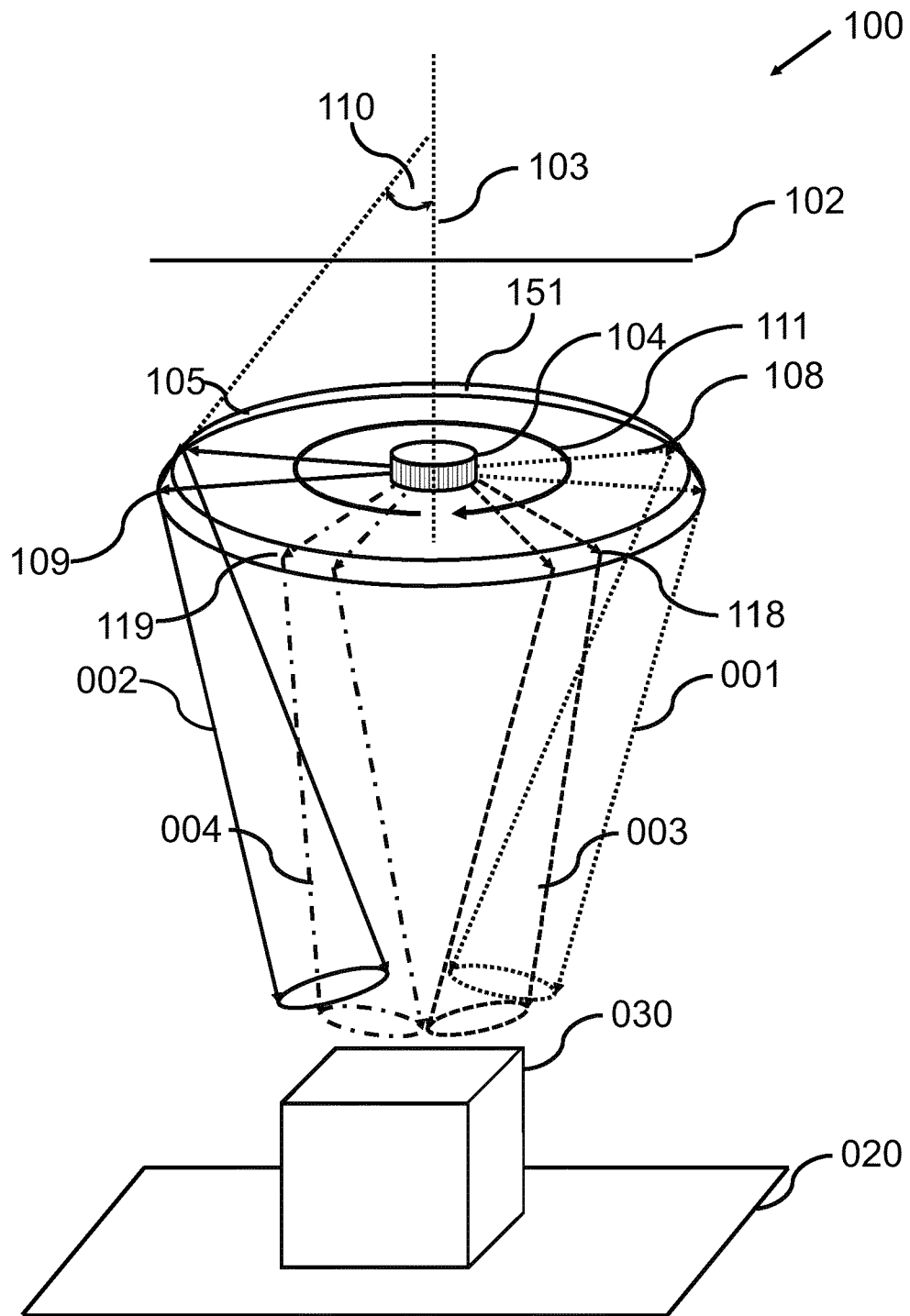


Figure 2

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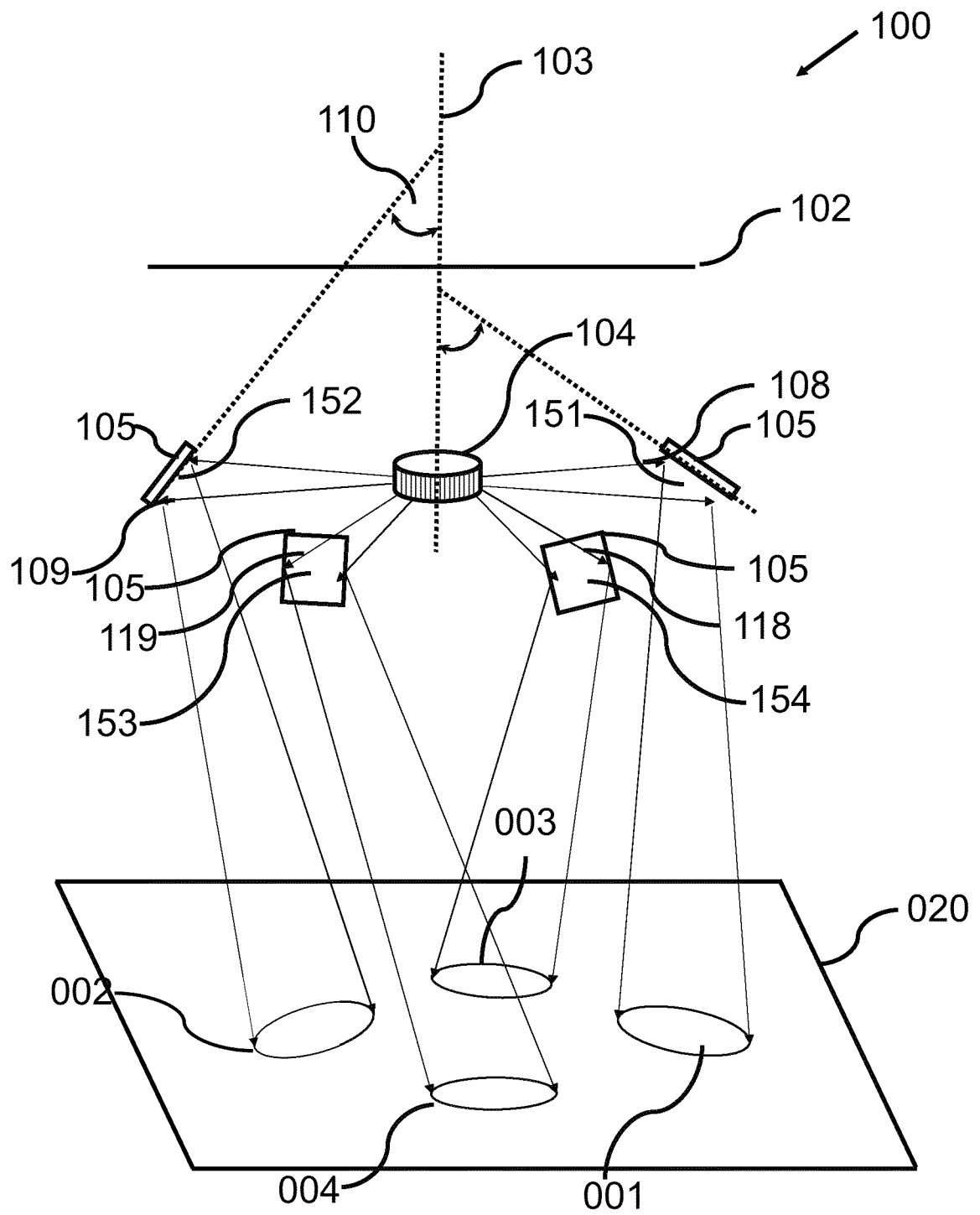


Figure 3

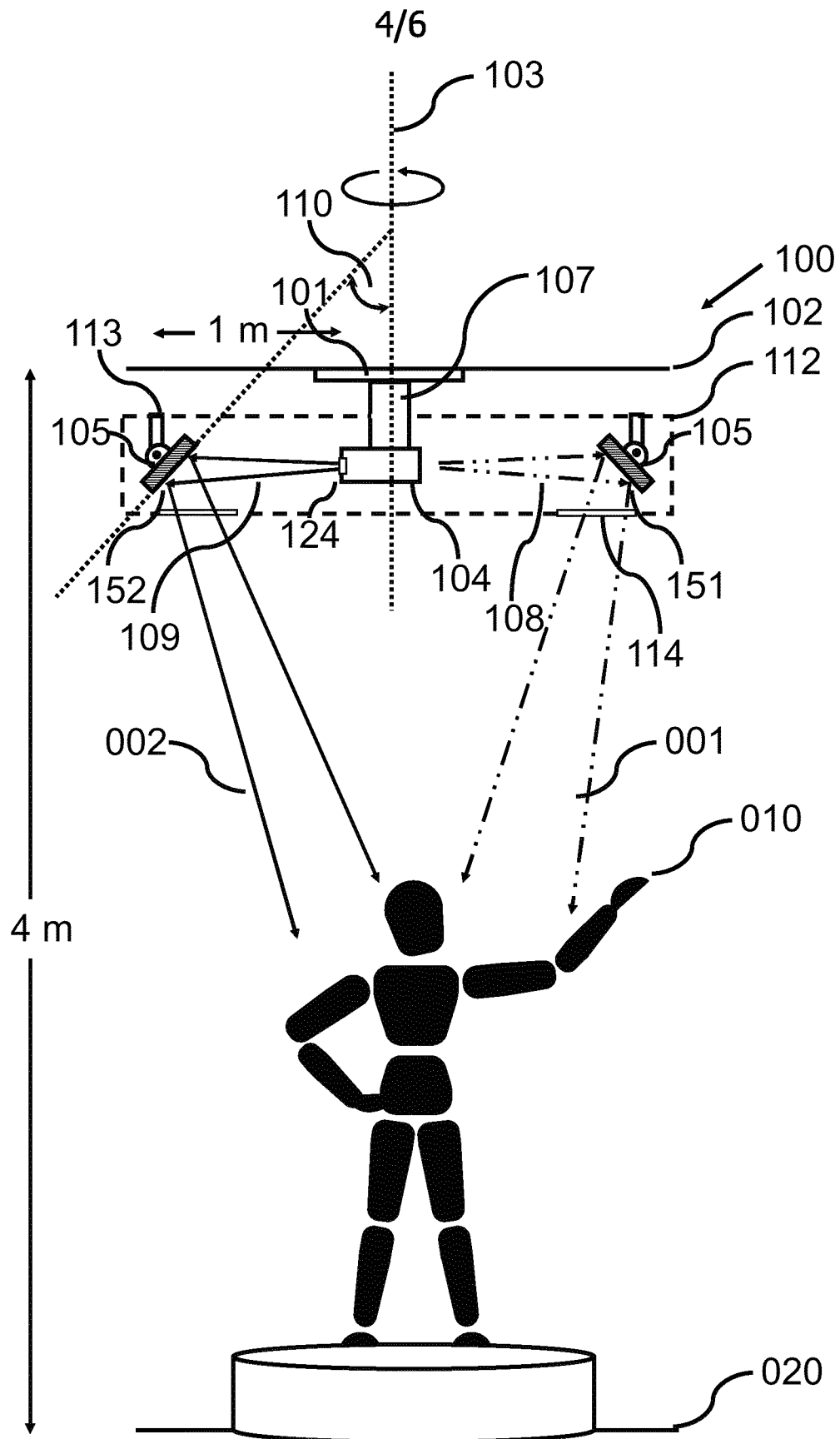


Figure 4

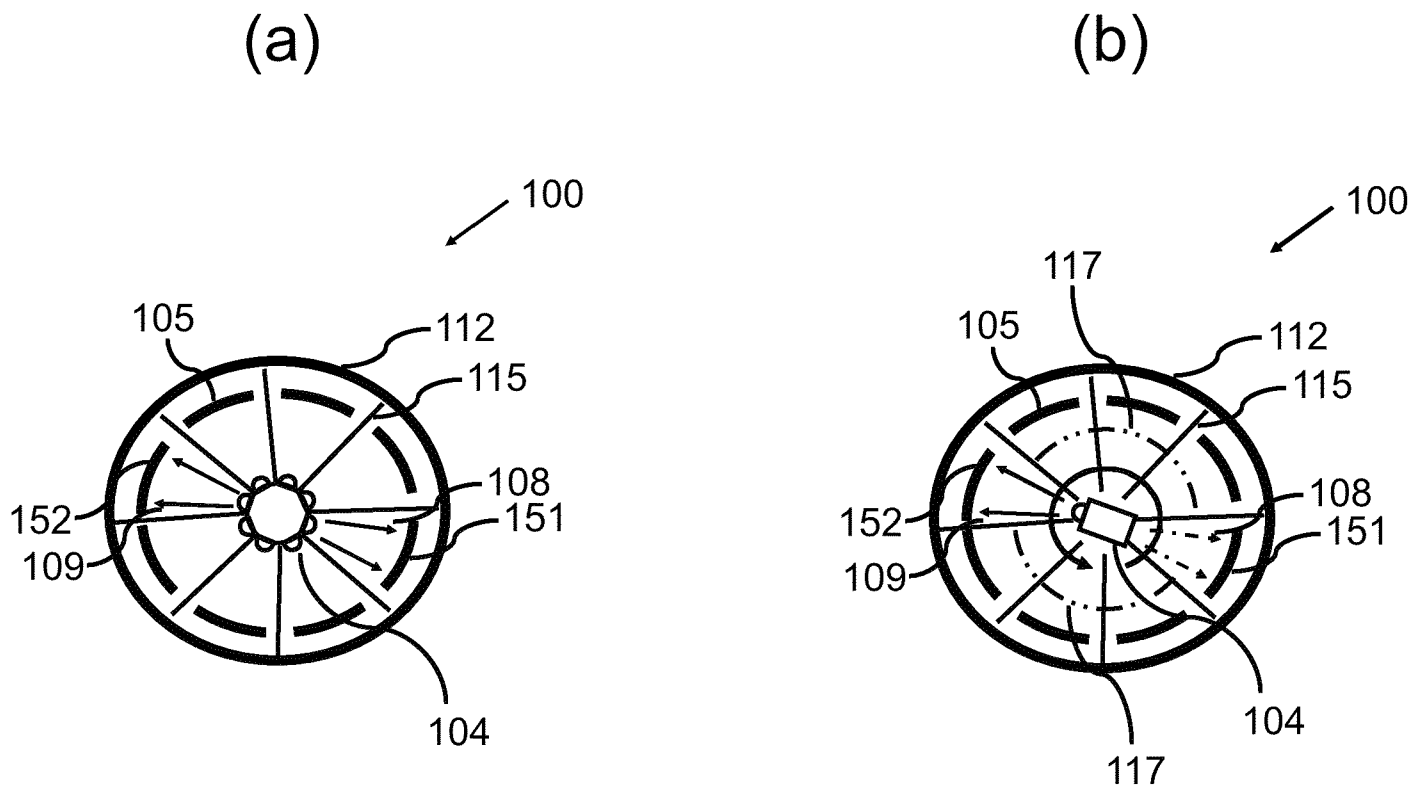


Figure 5

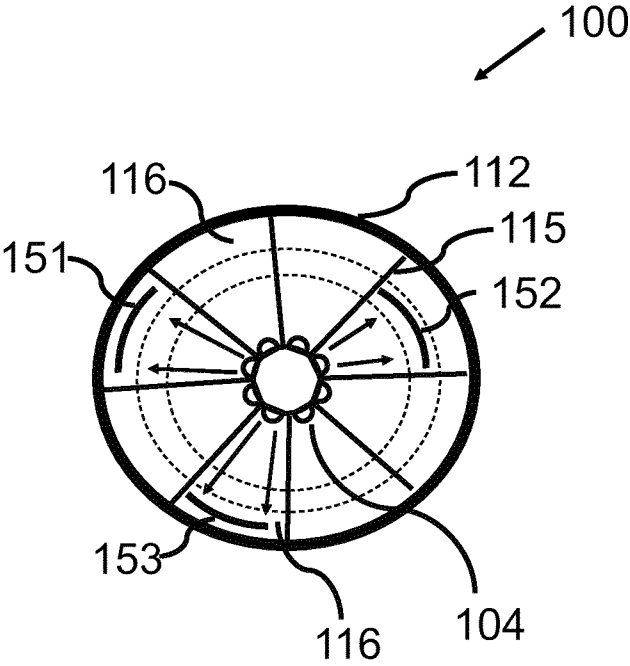


Figure 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2022/054069

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims;; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/054069

A. CLASSIFICATION OF SUBJECT MATTER INV. F21S8/04 F21V7/00 F21V7/04 F21V14/02 F21V14/04 F21V23/04 F21S10/04 ADD. F21Y107/30 F21W131/405 F21W131/406 F21Y115/10 F21Y115/30 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) F21S F21V F21Y F21W Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3 553 373 A1 (NBCUNIVERSAL MEDIA LLC [US]) 16 October 2019 (2019-10-16)	10, 12, 13
A	paragraphs [0031], [0038] figure 3A	1

A	WO 2017/141028 A1 (COLORDYNE LTD [GB]) 24 August 2017 (2017-08-24) figures 1A, 1B, 2, 3, 7	1, 10

A	US 2006/023452 A1 (LAI KUO-YEN [TW]) 2 February 2006 (2006-02-02) figures 8-10	10, 12, 13

A	US 2006/001384 A1 (TAIN RA-MIN [TW] ET AL) 5 January 2006 (2006-01-05) paragraphs [0015], [0035] figures 3A, 4	1, 10

-/-		
☒ 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 "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	Date of mailing of the international search report	
22 March 2022	05/04/2022	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Allen, Katie	

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2022/054069

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2019/022616 A1 (BRONO AS [NO]) 31 January 2019 (2019-01-31) figures 3, 6C, 8 -----	1, 10
A	EP 2 594 846 A1 (SHARP KK [JP]) 22 May 2013 (2013-05-22) paragraphs [0026], [0027] figure 3 -----	1, 10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2022/054069

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		US 10694600 B1	23-06-2020
		US 2019320514 A1	17-10-2019
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		WO 2012008262 A1	19-01-2012

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-13

Luminaire comprising a mount, a light source, a light source controller and a light reflector, characterised by light conduits between light emitting surfaces of a light source and a reflective surface, which include light exit windows and accommodation slots for reflective surfaces.

1.1. claims: 10, 12, 13

Luminaire comprising a mount, a light source, a light source controller and a light reflector, characterised by a light source controller that is configured to control the light source to produce a scanning light output at a scanning speed, in a scanning direction.
