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(54) LOUVER FOR LED LIGHT ENGINES

(57) A louver (10) may be installed on or within a light fixture (20) containing a light emitting diode (LED) light engine (22) to distribute and diffuse light. The louver (10) includes a number of individual fins (14) that define apertures (16) within the louver (10). The louver (10) is positioned sufficiently close to LEDs (24) provided with the light fixture (20) so that high angle light emission from the LEDs (24) may be blocked, reflected, refracted, or otherwise managed.

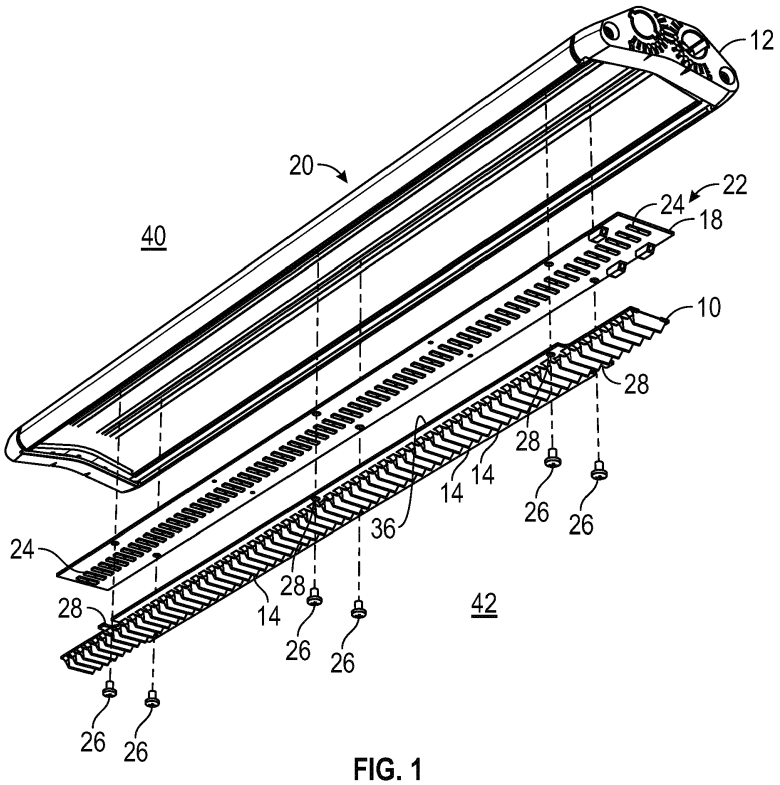

FIG. 1

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Description

REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application Serial No. 62/284,359, filed on September 28, 2015, and entitled LOUVER FOR LED LIGHT ENGINE, the content of which is hereby incorporated in its entirety by this reference.

FIELD OF THE INVENTION

[0002] Embodiments of the present invention relate to a louver that may be installed on or within a light fixture containing a light emitting diode (LED) light engine to better distribute and diffuse light.

BACKGROUND

[0003] LED light engines, which may be fitted as original equipment or installed as retrofit kits, are increasingly popular due to their long life and efficiency compared to other light sources. LED light engines also have a form factor that is different from traditional light sources. For example, some LED light engines may include a number of small LEDs mounted to a printed circuit board (PCB). Because of this form factor, with a flat surface and many point-like sources of light, traditional housings, reflectors, and lenses may not provide optimal scattering, diffusion, refraction, and/or reflection of light coming from an LED light engine. As a result, LED light fixtures or retrofit kits may distribute light unevenly, leading to bright spots, dark spots, or areas of high glare. In particular, high angle light emission from LED light engines may not be effectively reflected, refracted, or diffused and lead to glare or other undesirable lighting patterns that may be unpleasant or annoying to a viewer.

SUMMARY

[0004] The terms "invention," "the invention," "this invention" and "the present invention" used in this patent are intended to refer broadly to all of the subject matter of this patent and the patent claims below. Statements containing these terms should be understood not to limit the subject matter described herein or to limit the meaning or scope of the patent claims below. Embodiments of the invention covered by this patent are defined by the claims below, not this summary. This summary is a high-level overview of various embodiments of the invention and introduces some of the concepts that are further described in the Detailed Description section below. This summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used in isolation to determine the scope of the claimed subject matter. The subject matter should be understood by reference to appropriate portions of the entire specification of this patent, any or all drawings, and each claim.

[0005] According to certain embodiments of the present invention, a louver may be installed on or within a light fixture containing an LED light engine to better distribute and diffuse light. The louver includes a number of individual fins that define apertures within the louver. The louver is positioned sufficiently close to the LEDs so that high angle light emission from the LEDs may be blocked, reflected, refracted, or otherwise managed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The features and components of the following figures are illustrated to emphasize the general principles of the present disclosure. Corresponding features and components throughout the figures can be designated by matching reference characters for the sake of consistency and clarity.

Figure 1 is an exploded perspective view of one embodiment of a lighting fixture having a louver according to one embodiment of the invention.

Figure 2 is a cross-sectional view of the lighting fixture of Figure 1 provided with an outer lens.

Figure 3 is a perspective view of a louver according to another embodiment of the invention.

Figure 4 is an enlarged sectional view of a louver according to another embodiment of the invention.

Figure 5 is an enlarged view of a louver according to another embodiment of the invention.

Figures 6A-F are detail sectional views of fins of a louver according to another embodiment of the invention.

DETAILED DESCRIPTION

[0007] The subject matter of embodiments of the present invention is described here with specificity to meet statutory requirements, but this description is not necessarily intended to limit the scope of the claims. The claimed subject matter may be embodied in other ways, may include different elements or steps, and may be used in conjunction with other existing or future technologies. This description should not be interpreted as implying any particular order or arrangement among or between various steps or elements except when the order of individual steps or arrangement of elements is explicitly described.

[0008] The terms "invention," "the invention," "this invention" and "the present invention" used in this patent are intended to refer broadly to all of the subject matter of this patent and the patent claims below. Statements containing these terms should be understood not to limit the subject matter described herein or to limit the meaning or scope of the patent claims below. Embodiments of the invention covered by this patent are defined by the claims below, not this summary. This summary is a high-level overview of various aspects of the invention and introduces some of the concepts that are further de-

scribed in the Detailed Description section below. This summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used in isolation to determine the scope of the claimed subject matter. The subject matter should be understood by reference to appropriate portions of the entire specification of this patent, any or all drawings and each claim.

[0009] Embodiments of the present invention relate to a louver that may be installed on or within a light fixture containing an LED light engine to better distribute and diffuse light. Figures 1 and 2 illustrate one embodiment of a louver 10 for installation in a fixture housing 12 of a light fixture 20. The light fixture 20 further includes a light engine 22 provided in the fixture housing 12 to generate light. The light engine 22 includes a printed circuit board ("PCB") 18 onto which LEDs 24 are mounted. The area above the light engine 22 is the non-light emitting side 40 of the fixture 20 (because light is not directed toward that region of the light fixture 20) whereas the area below the light engine 22 is the light emitting side 42 of the fixture 20 from which light is emitted from the light fixture 20.

[0010] The louver 10 includes a number of individual fins 14 that define apertures 16 (see Figure 3) within the louver 10. In certain embodiments, the louver 10 is designed to be mounted onto the PCB 18 of the light engine 22 such that the apertures 16 of the louver 10 and the LEDs 24 on the PCB 18 align (i.e., light emitted from the LEDs 24 is able to pass through the apertures 16 of the louver 10). As can be seen in Figure 1, the width of the louver 10 can be narrowed or otherwise shaped or configured so as to accommodate other components (such as electrical components) on the PCB 18. Different constructions or arrangements of the louver 10 may also be used. For example, the louver 10 may be attached directly to the fixture housing 12, or other hardware associated with an assembled lighting fixture 20. Any arrangement or attachment of the components of the lighting fixture 20 may be used, so long as the louver 10 is positioned sufficiently close to the LEDs 24 so that high angle light emission from the LEDs 24 may be blocked, reflected, refracted, or otherwise managed.

[0011] The louver 10 may be constructed with one or more locating features, including locating pins, recesses, or other features that are designed to mate with other features of the PCB 18, fixture housing 12, or other components of the light engine 22 and/or lighting fixture 20. In one non-limiting example, the louver 10 may have holes 28 for fasteners 26, such as screws, rivets, bolts, or the like, that secure or affix the louver 10 to the PCB 18, fixture housing 12, or other components of the LED light engine 22 and/or lighting fixture 20. In some embodiments, alternative methods of securing the louver 10 into the lighting fixture 20 may be employed. For example, the louver 10 may be snapped, glued, or otherwise molded onto the PCB 18, fixture housing 12, or any other components of the lighting fixture 20 and/or LED light engine 22.

[0012] The louver 10 may be designed to work alone, or in conjunction with other light management components in the lighting fixture 20. For example, in some lighting fixtures 20, the louver 10 may be the only reflecting, refracting, or light directing device necessary in certain applications. However, in other fixtures 20, for example as illustrated in Figure 2, the louver 10 may be designed to work with other light management components such as a lens 30, reflector, or other light directing features of a light fixture 20.

[0013] Figure 3 shows an embodiment of a louver 10 in isolation The louver 10 comprises the plurality of apertures 16 separated by fins 14. The individual apertures 16 and corresponding fins 14 are configured such that, when installed on the PCB 18 or in the lighting fixture 20, the apertures 16 may align with individual or small groupings of LEDs 24. As shown in Figure 3, the louver 10 may be a long, rectangular component designed for a PCB 18 with one, two, or more rows of LEDs 24. However, in other embodiments, the louver 10 may take on any shape and/or the apertures 16 provided on the louver 10 in any number, location, and orientation as necessary for a particular PCB 18 or lighting fixture 20. For example, the louver 10 may be square, rectangular, circular, or any other shape as desired or required for a particular PCB 18 or lighting fixture 20. Multiple louvers 10 may also be used with a single fixture 20, light engine 22, or PCB 18.

[0014] The louver 10 may be manufactured from a variety of materials including polymeric materials, metals, composites, or any other material that may be shaped or formed into the necessary geometry. In certain embodiments, the louver 10 may be a stamped metal component or injection molded from a polymeric material. The louver 10 may also be constructed of multiple smaller components that are assembled together, as with fasteners or adhesives, to form the full-size part. Coatings may be used to enhance or tailor the reflective, refractive, or specular properties of the louver 10. In some cases, the louver 10 may be painted or otherwise colored for aesthetic purposes.

[0015] Figures 4 and 5 are enlarged sectional and perspective views, respectively, of embodiments of the louver 10. In some examples, the base of the louver 10 may be flush with the emitting surface of the LEDs 24. This configuration may provide an efficient use of the space between the LEDs 24 and provides clearance for any solder points. In other examples, the base of the louver 10 and the top emitting surface of the LEDs 24 are not flush. As one non-limiting example, the sides of the base defining the apertures 16 may extend below the LEDs 24.

[0016] Referring to Figures 4 and 5, the light control properties of the louver 10 may be at least partially dictated by fin height H, fin separation or pitch S, the shape/profile of the fins 14, and the size of louver apertures 16. Altering any of these variables permits tailoring the light control properties of the louver 10 to a particular application.

[0017] The louver apertures 16 may be of any size or

shape. The size of the louver apertures 16 may be determined by the fin pitch S and the fin thickness at the a base 41 of the fins 14. Closer fin spacing (i.e., smaller fin pitch S values) and narrower louver apertures 16 may restrict direct emission of light from the LEDs 24 to lower angles, and prevent more high angle emissions. In contrast, spacing the fins 14 farther apart (i.e., larger fin pitch S values) and wider louver apertures 16 may place the cutoff for high angle emissions at a greater angle such that more high angle light is emitted from the fixture 20. In some cases, smaller fin spacing may restrict the height that can be manufactured to the extent that the angle of light that can be influenced is restricted. A larger spacing may allow an increased influence over the light emission, but at the expense of compactness of the LED light engine.

[0018] Fin height H may also influence the angle of light emission. Greater fin heights H may restrict direct light emissions from the LEDs 24 to lower angles while lower fin heights H may increase the angle of emission. In certain embodiments, the effectiveness and extent of the light control properties of the louver 10 may also be characterized by the ratio of the fin height H to the fin pitch S (i.e. the ratio of H:S), and by the location of individual LEDs 24 within the louver apertures 16. For example and without limitation, if a particular LED 24 is offset with respect to the louver aperture 16, the light control properties of the louver 10 may be asymmetrical. Fin height H, fin pitch S, and the location of individual LEDs 24 within the fin aperture 16 may determine what percentage of light emitted from the LED 24 may be influenced by the louver 10. In various examples, the ratio of H:S, as well as other characteristics of the fins 14 and apertures 16, may be adjusted such that the cutoff angle from horizontal may be from about 0 degrees to about 90 degrees, such as from about 10 degrees to about 75 degrees, such as from about 15 degrees to about 70 degrees, such as from about 20 degrees to about 65 degrees, such as from about 25 degrees to about 60 degrees, such as from about 30 degrees to about 55 degrees, or various other suitable angles. The shape and optical properties of the fins 14 may further influence how the affected light emissions may be scattered, reflected, or otherwise directed.

[0019] Figure 4 illustrates one non-limiting example of a high angle ray of light 43 emanating from an LED 24 and through the louver aperture 16 that may strike a fin 14. This ray of light 43 may then be redirected, reflected, refracted, or diffused depending on the shape and any surface coatings or other optical characteristics of the louver fins 14. Some individual fins 14 may have two faces 32 and 62, and a crown 34 between the two faces 32 and 62. The faces 32 and 62 and crown 34 may have profiles or shapes selected to reflect or refract light in a particular direction, distribution, or illumination pattern. For example and without limitation, the fin faces 32 and 62 may be of any curved shape (including convex and concave) as well as planar. Moreover, the face 32 of one fin 14 may be different than the face 62 of the fin 14. For example, Figure 5 shows fins 14 where face 32 is concavely curved and face 62 is convexly curved. Similarly, the fin crown 34 may be curved, angled, or squared off. Surface coatings applied to the louver 10 or fins 14 may further tailor the optical properties of the louver 10. Reflective, refractive, specular, or diffusive coatings may be applied to the louver 10 or individual fins 14 to influence the direction and intensity of light in the illumination pattern.

[0020] The fins 14 illustrated in Figure 4 have a substantially parabolic shape and extend substantially perpendicular to a louver base 36 at regular intervals. However, in some embodiments, the fins 14 may have other shapes or profiles. Figures 6A-F illustrate various other non-limiting examples of shapes or profiles of the fins 14. A fin profile may be symmetrical or asymmetrical and not all fins 14 on a louver 10 need be identical. The fins 14 may also be spaced at regular or irregular intervals on the louver base 36. As one non-limiting example, the fins 14 may be shaped to extend at least partially over one or more LEDs 24 mounted on the PCB 18, light fixture 20, and/or light engine 22 so as to create, for example, an asymmetric distribution (see, e.g., Figures 6B, 6C).

[0021] In another embodiment, the fins 14 extending from the louver 10 may form a grid pattern on the PCB 18. Such a configuration may be suitable when multiple rows of LEDs 24 extend along the length of the PCB 18. For example, one or more longitudinal rib(s) may extend down the length of the louver 10 and divide the fins 14, thus creating more discrete apertures 16 to accommodate the rows of LEDs 24.

[0022] Any other geometric or curvilinear shape of the fins 14 is contemplated to achieve the desired light distribution from the fixture 20. Individual louver fins 14 may be molded or formed with, or mounted to, the louver base 36 at any angle to influence the directionality and light distribution light from the louver 10. Furthermore, the particular characteristics of any individual fin 14 and its associated louver aperture 16, including but not limited to, its height H, angle with respect to the louver base 36, separation (i.e., pitch S) from adjacent fins 14, fin shape, profile of the fin face 32, profile of the fin crown 34, applied coatings, or offset with respect to individual LEDs 24 may differ with respect to any other individual fin 14 on the louver 10.

[0023] A collection of exemplary embodiments, including at least some explicitly enumerated as "ECs" (Example Combinations), providing additional description of a variety of embodiment types in accordance with the concepts described herein are provided below. These examples are not meant to be mutually exclusive, exhaustive, or restrictive; and the invention is not limited to these example embodiments but rather encompasses all possible modifications and variations within the scope of the issued claims and their equivalents.

EC 1. A light fixture comprising: a housing; a light

engine mounted on the housing, the light engine comprising a plurality of light emitting diodes (LEDs) provided on a printed circuit board (PCB); a louver positioned over the PCB, the louver comprising a plurality of fins extending from a base of the louver, the louver further defining apertures between adjacent fins, wherein at least one aperture of the louver is aligned with and proximate to at least one LED of the plurality of LEDs such that light emitted from the at least one LED is directed through the at least one aperture.

EC 2. The light fixture of any of the preceding or subsequent example combinations, wherein the louver is mounted on the light engine through locating features, and wherein the locating features comprise screws, rivets, or bolts.

EC 3. The light fixture of any of the preceding or subsequent example combinations, wherein the louver is mounted on the PCB.

EC 4. The light fixture of any of the preceding or subsequent example combinations, wherein the louver is mounted on the housing through locating features, and wherein the locating features comprise screws, rivets, or bolts.

EC 5. The light fixture of any of the preceding or subsequent example combinations, wherein the at least one aperture is aligned with a grouping of LEDs of the plurality of LEDs.

EC 6. The light fixture of any of the preceding or subsequent example combinations, wherein the louver is rectangular.

EC 7. The light fixture of any of the preceding or subsequent example combinations, wherein each fin of the plurality of fins comprises at least one face and a crown, wherein the at least one face has a face profile, and wherein the crown has a crown profile.

EC 8. The light fixture of any of the preceding or subsequent example combinations, wherein the face profile is curved or planar.

EC 9. The light fixture of any of the preceding or subsequent example combinations, wherein the crown profile is curved, angled, or squared.

EC 10. The light fixture of any of the preceding or subsequent example combinations, wherein the face is a first face and the face profile is a first face profile, wherein each fin of the plurality of fins comprises a second face spaced apart from the first face through the crown, and wherein the second face has a second face profile.

EC 11. The light fixture of any of the preceding or subsequent example combinations, wherein the first face profile and the second face profile have a same shape.

EC 12. The light fixture of any of the preceding or subsequent example combinations, wherein a shape of the first face profile is different from a shape of the second face profile.

EC 13. The light fixture of any of the preceding or subsequent example combinations, wherein the second face profile is curved or planar.

EC 14. The light fixture of any of the preceding or subsequent example combinations, wherein the louver comprises a surface coating on at least one fin of the plurality of fins.

EC 15. The light fixture of any of the preceding or subsequent example combinations, wherein the surface coating is at least one of a reflective coating, a refractive coating, a specular coating, or a diffusive coating.

EC 16. The light fixture of any of the preceding or subsequent example combinations, wherein at least one of the plurality of fins is symmetrical about an axis extending through the crown.

EC 17. The light fixture of the preceding or subsequent example combinations, wherein at least one of the plurality of fins is asymmetrical about an axis extending through the crown.

EC 18. A method of assembling a light fixture comprising: providing a plurality of light emitting diodes (LEDs) within a housing of the light fixture; positioning a louver proximate to the plurality of LEDs, the louver comprising a plurality of fins extending from a base of the louver and apertures defined between adjacent fins; aligning at least one aperture with at least one LED of the plurality of LEDs; and securing the louver in such alignment with the LEDs.

EC 19. The method of any of the preceding or subsequent example combinations, wherein providing the plurality of LEDs within the housing comprises mounting a printed circuit board (PCB) with the plurality of LEDs to the housing.

EC 20. The method of any of the preceding or subsequent example combinations, wherein securing the louver comprises mounting the louver to the PCB through locating features.

EC 21. The method of any of the preceding or subsequent example combinations, wherein securing the louver comprises mounting the louver to the housing through locating features.

EC 22. The method of any of the preceding or subsequent example combinations, wherein aligning the at least one aperture with the at least one LED of the plurality of LEDs comprises aligning the at least aperture with a grouping of LEDs of the plurality of LEDs.

[0024] The foregoing is provided for purposes of illustrating, explaining, and describing embodiments of the present invention. Further modifications and adaptations to these embodiments will be apparent to those skilled in the art and may be made without departing from the scope or spirit of the invention. Different arrangements of the components depicted in the drawings or described above, as well as components and steps not shown or described are possible. Similarly, some features and sub-

combinations are useful and may be employed without reference to other features and subcombinations. Embodiments of the invention have been described for illustrative and not restrictive purposes, and alternative embodiments will become apparent to readers of this patent. Accordingly, the present invention is not limited to the embodiments described above or depicted in the drawings, and various embodiments and modifications can be made without departing from the scope of the invention.

Claims

1. A light fixture (20) comprising:

a housing;
a light engine (22) mounted on the housing, the light engine (22) comprising a plurality of light emitting diodes (LEDs (24)) provided on a printed circuit board (PCB) (18);
a louver (10) positioned over the PCB (18), the louver (10) comprising a plurality of fins (14) extending from a base (36) of the louver (10), the louver (10) further defining apertures (16) between adjacent fins (14), wherein at least one aperture of the louver (10) is aligned with and proximate to at least one LED (24) of the plurality of LEDs (24) such that light emitted from the at least one LED (24) is directed through the at least one aperture.

2. The light fixture (20) of claim 1, wherein the louver (10) is mounted on the light engine (22) through locating features, and wherein the locating features comprise screws, rivets, or bolts.

3. The light fixture (20) of claim 2, wherein the louver (10) is mounted on the PCB (18).

4. The light fixture (20) of any preceding claim, wherein the louver (10) is mounted on the housing through locating features, and wherein the locating features comprise screws, rivets, or bolts.

5. The light fixture (20) of any preceding claim, wherein the at least one aperture is aligned with a grouping of LEDs (24) of the plurality of LEDs (24).

6. The light fixture (20) of any preceding claim, wherein the louver (10) is rectangular.

7. The light fixture (20) of any preceding claim, wherein each fin (14) of the plurality of fins (14) comprises at least one face (32, 62) and a crown (34), wherein the at least one face (32, 62) has a face profile, and wherein the crown (34) has a crown profile.

8. The light fixture (20) of claim 7, wherein the face profile is curved or planar.

9. The light fixture (20) of claim 7 or 8, wherein the crown profile is curved, angled, or squared.

10. The light fixture (20) of claim 7-9, wherein at least one of the plurality of fins (14) is symmetrical about an axis extending through the crown (34).

11. The light fixture (20) of claim 7-10, wherein at least one of the plurality of fins is asymmetrical about an axis extending through the crown.

12. The light fixture (20) of any preceding claim, wherein the louver (10) comprises a surface coating on at least one fin (14) of the plurality of fins (14).

13. The light fixture (20) of claim 12, wherein the surface coating is at least one of a reflective coating, a refractive coating, a specular coating, or a diffusive coating.

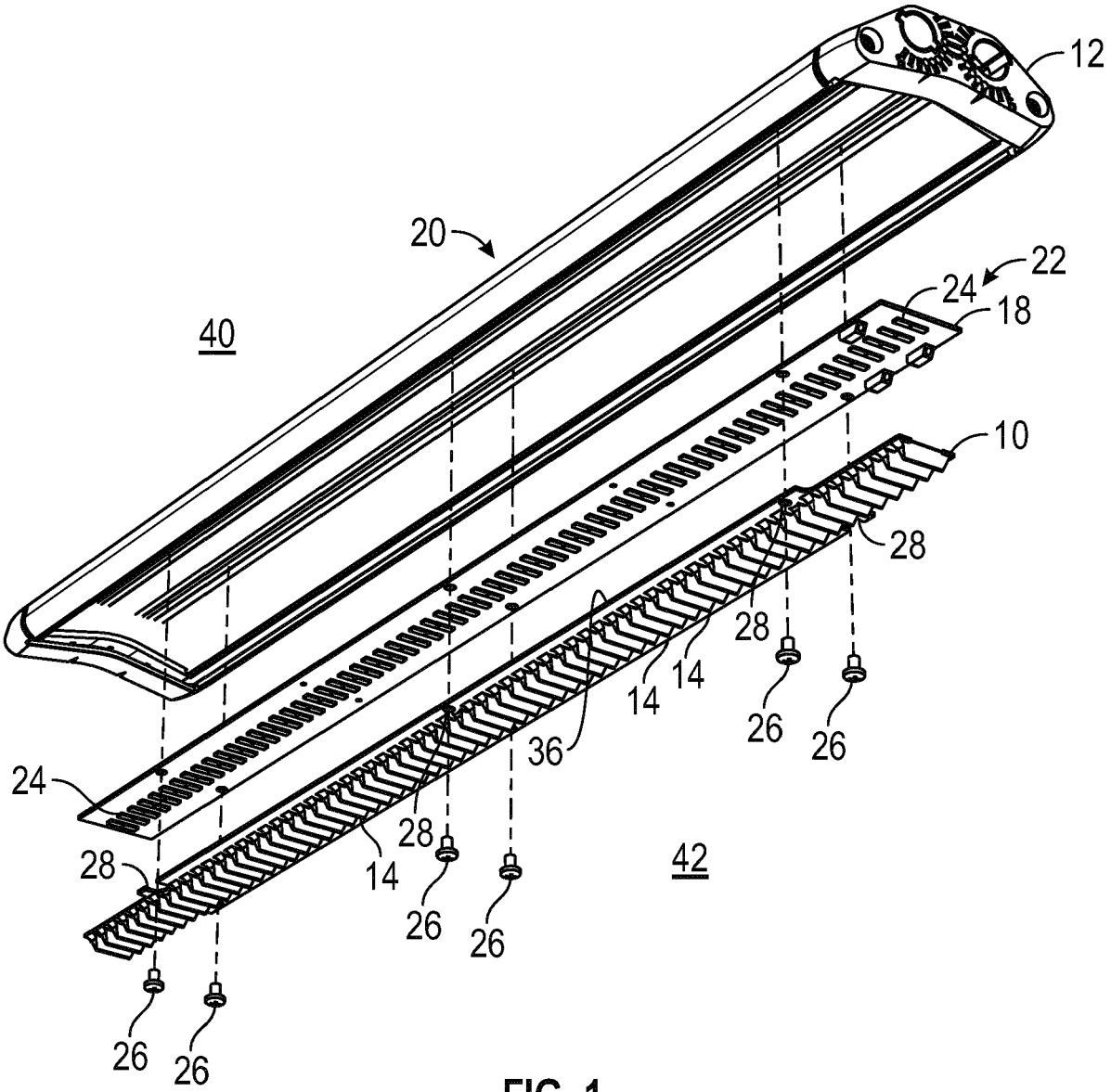

FIG. 1

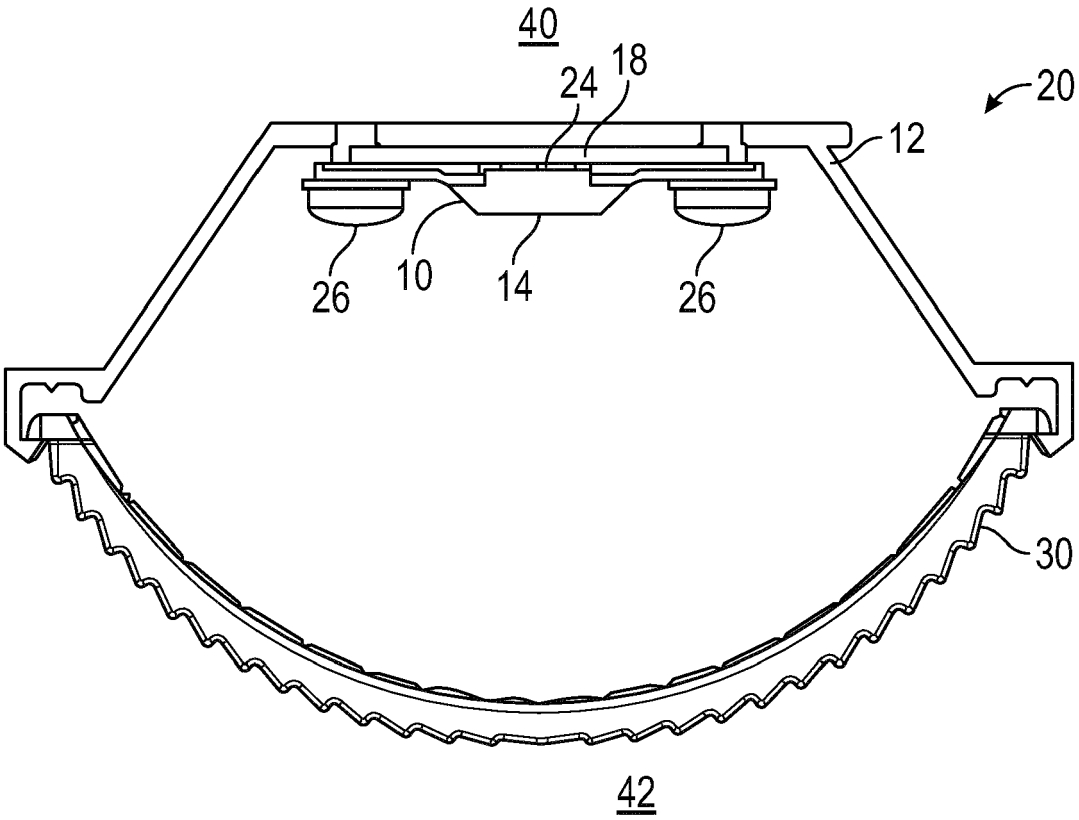

FIG. 2

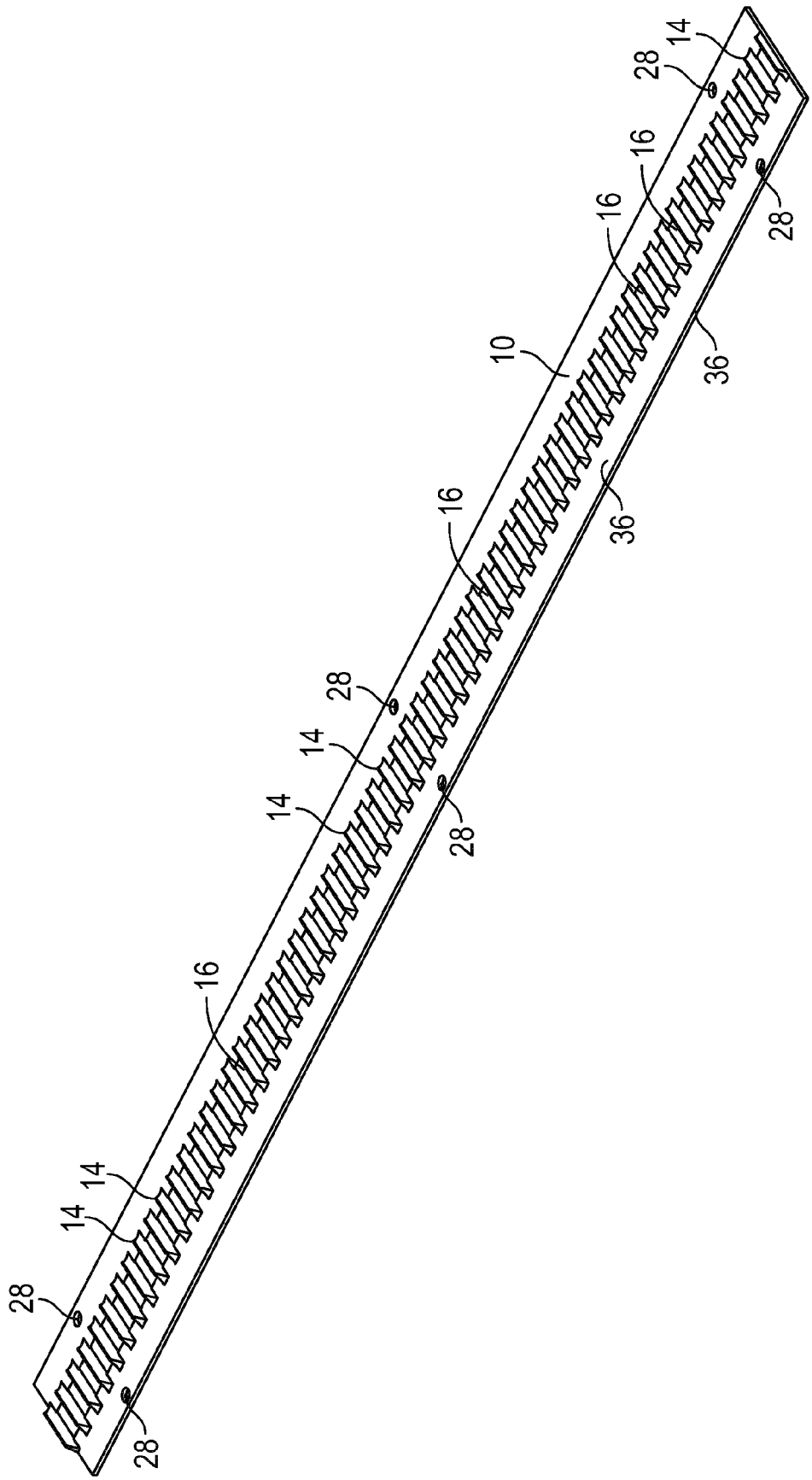

FIG. 3

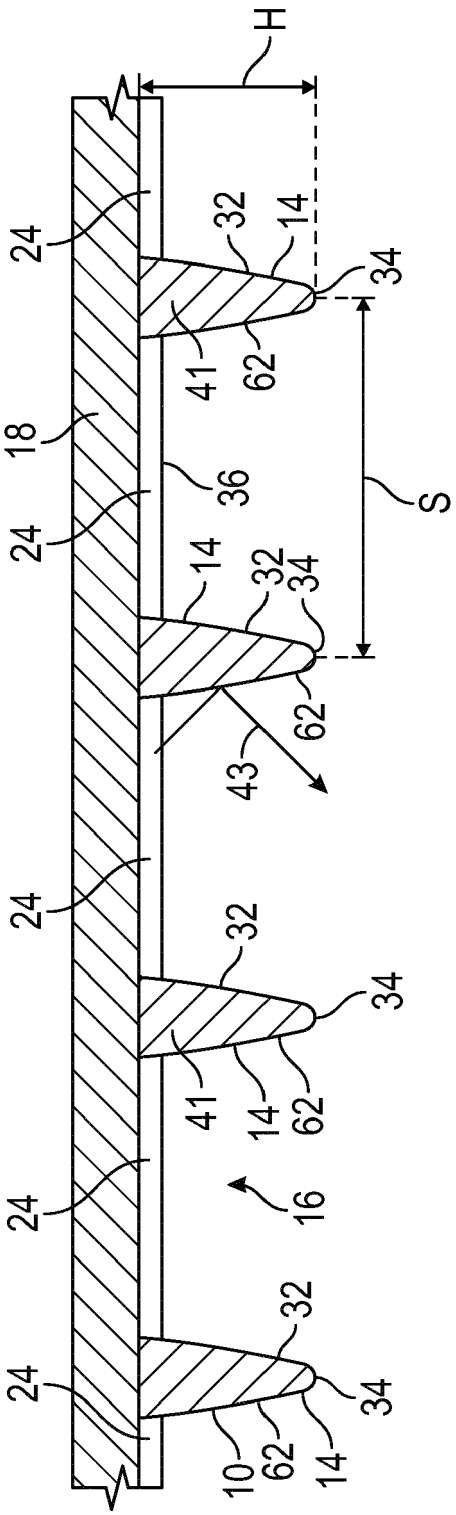
H
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FIG. 4

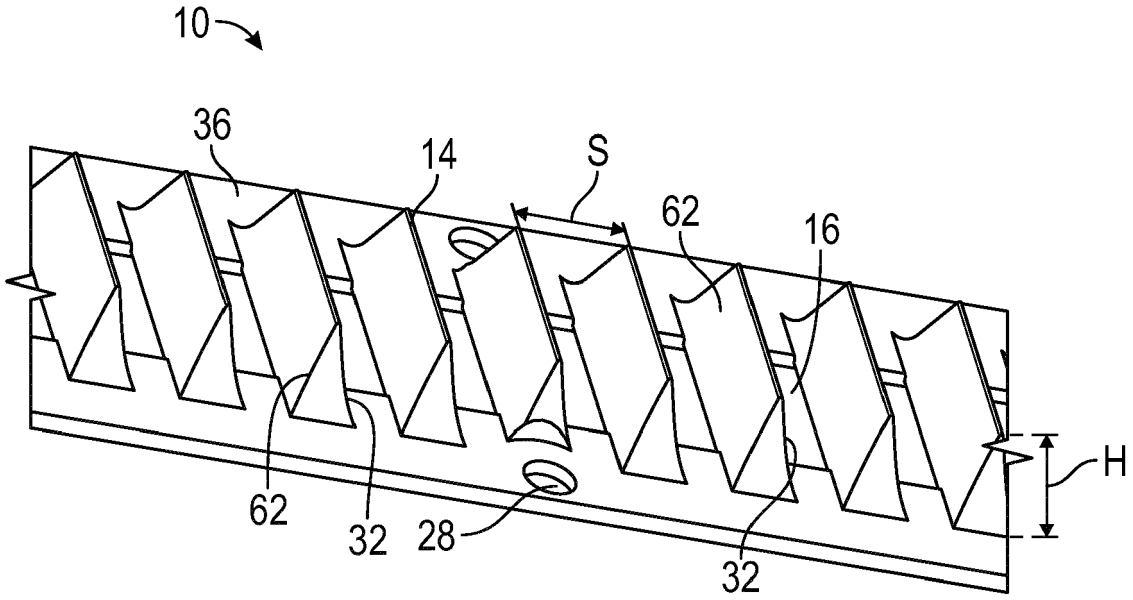

FIG. 5

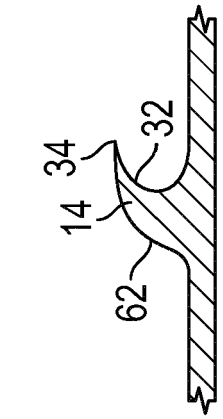

FIG. 6A

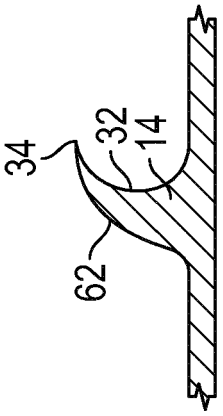

FIG. 6B

FIG. 6C

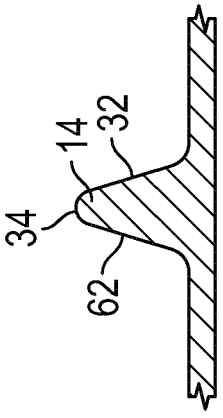

FIG. 6D

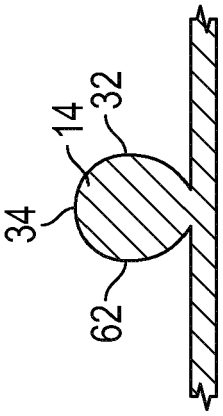

FIG. 6E

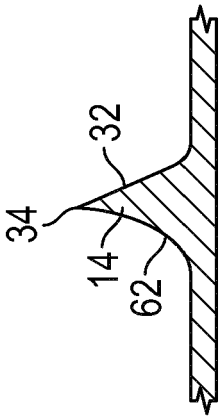

FIG. 6F

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 19 1180

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 051 001 A2 (LSI INDUSTRIES INC [US]) 22 April 2009 (2009-04-22) * paragraphs [0041], [0049], [0051] * * figures 5,8,9 *	1-13	INV. F21V7/00 F21V11/02 F21Y103/10
X	US 2013/107527 A1 (BOYER JOHN D [US] ET AL) 2 May 2013 (2013-05-02) * paragraphs [0064], [0064] * * figures 12A, 12B,12D *	1-13	ADD. F21V7/22 F21V17/04 F21V17/10 F21V17/12
X	US 7 934 851 B1 (BOISSEVAIN CHRIS [US] ET AL) 3 May 2011 (2011-05-03) * column 4, line 31 - column 5, line 7 * * figures 6,10 *	1-9, 11-13	F21Y115/10
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TECHNICAL FIELDS SEARCHED (IPC)

F21V
F21Y

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	22 December 2016	Dinkla, Remko

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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