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SURFACE MOUNTED LIGHT FIXTURE AND HEAT DISSIPATING STRUCTURE FOR SAME

Abstract

A light emitting apparatus includes a light source, a unitary formed heat sink with a plurality of heat dissipating fins, a lensed enclosure that retains a light source and at least one power consuming device other than the light source. The lensed enclosure includes a recessed opening having at least a first wall that terminates at a substantially perpendicular second wall. The plurality of heat dissipating fins are disposed on at least one adjacent exterior side of the walled enclosure, the fins extending outwardly. At least one fin coupled to the heat sink extends beyond the light source, and the heat generated by the light source travels by conduction laterally through the heat sink to the at least one coupled fin.

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. patent application Ser. No. 18/668,304, filed May 20, 2024, which is a continuation of U.S. patent application Ser. No. 18/143,616, filed May 5, 2023 (now U.S. Pat. No. 12,018,822), which is a continuation of U.S. patent application Ser. No. 18/102,995, filed Jan. 30, 2023 (now U.S. Pat. No. 11,739,918), which is a continuation of U.S. patent application Ser. No. 17/954,386, filed Sep. 28, 2022 (now U.S. Pat. No. 11,629,850), which is a continuation of U.S. patent application Ser. No. 17/407,831, filed Aug. 20, 2021 (now U.S. Pat. No. 11,493,190), which is a continuation-in-part of U.S. patent application Ser. No. 17/158,923, filed Jan. 26, 2021 (now U.S. Pat. No. 11,118,764), which is a continuation of U.S. patent application Ser. No. 16/863,962, filed Apr. 30, 2020 (now U.S. Pat. No. 11,009,218), which is a continuation of U.S. patent application Ser. No. 16/667,682, filed Oct. 29, 2019 (now U.S. Pat. No. 10,907,805), which is a continuation of U.S. patent application Ser. No. 16/283,813, filed Feb. 24, 2019 (now U.S. Pat. No. 10,495,289), which is a continuation of U.S. patent application Ser. No. 15/782,665, filed Oct. 12, 2017 (now U.S. Pat. No. 10,415,803), which is a continuation of U.S. patent application Ser. No. 14/486,531, filed Sep. 15, 2014 (now U.S. Pat. No. 9,816,693), which is a continuation of U.S. patent application Ser. No. 13/161,283, filed Jun. 15, 2011 (now U.S. Pat. No. 8,944,637), which is a continuation-in-part of U.S. patent application Ser. No. 29/390,547, filed Apr. 26, 2011 (now U.S. Pat. No. D653792), the disclosures of each of which are hereby incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present invention relates generally to light fixtures. More specifically, the present invention relates to a light fixture for a light-emitting diode (LED) light source having effective heat dissipation capability.

BACKGROUND

[0003] Solid state lighting, such as LEDs, offers a viable alternative to traditional light sources such as fluorescent, high-intensity discharge (HID), and incandescent lamps. Indeed, light fixtures (technically referred to as luminaires in accordance with International Electrotechnical Commission terminology) employing LEDs are fast emerging as a superior alternative to conventional light fixtures because of their high energy conversion and optical efficiency, robustness, lower operating costs, and so forth.

[0004] However, a significant concern in the design and operation of LED-based light fixtures is that of thermal management. Implementation of LEDs for many light fixture applications has been hindered by the amount of heat build-up within the electronic circuits of the LEDs. This, heat build-up reduces LED light output, shortens lifespan, and can eventually cause the LEDs to fail. Consequently, effective heat dissipation is an important design consideration for maintaining light output and/or increasing lifespan for the light source.

SUMMARY

[0005] A light emitting apparatus includes a light source, a unitary formed heat sink with a plurality of heat dissipating fins, a lensed enclosure that retains a light source and at least one power consuming device other than the light source. The lensed enclosure comprises a recessed opening having at least a first wall that terminates at a substantially perpendicular second wall. At least one light source couples to the second wall surface. The second wall surface is the room facing side of a heat sink, wherein the side opposite to the heat sink side retaining the light source is the heat sink side that is mechanically and/or electromechanically coupled to a support structure. At least one power consuming device other than the light source is coupled to at least one of: the apparatus interior and an exterior surface facing the illuminated room. At least one adjacent exterior side of the walled enclosure has a plurality of heat dissipating fins, unitarily formed with the heat sink, that extend outwardly. At least one fin coupled to the heat sink extends beyond the light source toward the illuminated room, and the heat generated by the light source travels by conduction latterly laterally through the heat sink to the at least one coupled fin.

[0006] A light emitting apparatus includes a light source, an lensed enclosure that retains a light source, a unitary formed heat sink with a plurality of heat dissipating fins, an aperture opening disposed between two fins, and at least one power consuming device other than the light source. The lensed enclosure includes a recessed opening having at a least first wall that terminates at a substantially perpendicular second wall. At least one light source couples to the second wall surface. The second wall surface is the room facing side of a heat sink and the side opposite to the heat sink side retaining the light source is the heat sink side that is mechanically and/or

electromechanically facing a support structure. At least one power consuming device other than the light source is disposed above the side of the heat sink facing the structure and coupled to the heat sink by at least one elongated mechanical fastener. At least one adjacent exterior side of the walled enclosure has a plurality of heat dissipating fins, unitarily formed with the heat sink, that extend outwardly. At least two adjacent fins coupled to the heat sink extend beyond the light source toward the illuminated room. At least one aperture opening is disposed between the two adjacent fins. Heat generated by the light source travels by conduction laterally through the heat sink to the at least two fins extending beyond the light source toward the illuminated room, and air flowing between the two fins remove by convection heat conducted through the fins.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0007] A more complete understanding of the present invention may be derived by referring to the detailed description and claims when considered in connection with the Figures, wherein like reference numbers refer to similar items throughout the Figures, and:
[0008] FIG. **1** shows a top view of a surface mounted light fixture in accordance with an embodiment;
[0009] FIG. **2** shows a side view of the surface mounted light fixture;
[0010] FIG. **3** shows a front perspective view of a heat dissipating structure for the surface mounted light fixture of FIG. **1**;
[0011] FIG. **4** shows a front view of the heat dissipating structure;
[0012] FIG. **5** shows a back perspective view of the heat dissipating structure for the surface mounted light fixture;
[0013] FIG. **6** shows a back view of the heat dissipating structure;
[0014] FIG. **7** shows a side sectional view of the heat dissipating structure along sections lines **7-7** of FIG. **6**;
[0015] FIG. **8** shows a back perspective view of the heat dissipating structure emphasizing an X-brace configuration of the heat dissipating structure;
[0016] FIG. **9** shows an exploded perspective view of a mounting detail for the surface mounted light fixture of FIG. **1**;
[0017] FIG. **10** shows a partial sectional side view of the mounting detail for the surface mounted light fixture;
[0018] FIG. **11** shows a partial side view of a lens assembly for the surface mounted light fixture;
[0019] FIG. **12** shows a block diagram of a wiring configuration for multiple surface mounted light fixtures;
[0020] FIG. **13** shows a block diagram of another wiring configuration for multiple surface mounted light fixtures;
[0021] FIG. **14**A shows a partial top view of a light source module of the light emitting heat dissipating apparatus; and
[0022] FIG. **14**B shows a transverse section through the lighting module.
[0023] FIG. **15** is a side sectional view of a light emitting apparatus according to an embodiment.
DETAILED DESCRIPTION
[0024] Embodiments of the invention entail a surface mounted light fixture and a heat dissipating structure for the light fixture. The light fixture and heat dissipating structure are configured to accommodate multiple LED light sources. LED lamps, i.e., LED light sources, are particularly suitable for applications calling for low-profile light fixtures due to their compact size. Additionally, the low energy consumption, long operating life, and durability of LED light sources make them advantageous in commercial applications in which a significant number of light fixtures

are required to appropriately illuminate a relatively large area.

[0025] The surface mounted configuration of the light fixture is especially suitable in, for example, commercial environments, where its low profile decreases the possibility of damage by operational traffic within the commercial space. The heat dissipating structure includes sockets each of which is configured to receive one of the multiple LED light sources. The heat dissipating structure maintains low temperature at the sockets, i.e., the junction between the LED light source and the structure, by effectively conducting heat generated by the LED light source away from the LED light source. Maintaining a low temperature at this junction yields improvements in lamp energy efficiency and enhanced lifespan for the LED light sources. Additionally, the configuration of the heat dissipating structure provides a rigid and moisture resistant design suitable in adverse environments.

[0026] Referring to FIGS. **1** and **2**, FIG. **1** shows a top view of a surface mounted light fixture **20** in accordance with an embodiment, and FIG. **2** shows a side view of surface mounted light fixture **20**. Surface mounted light fixture **20** generally includes a heat dissipating structure **22**, an electronics assembly **24** (shown in ghost form in FIG. **1**), and lens assemblies **26**. Light fixture **20** further includes a bolt **28** (visible in FIG. **9**) configured for attachment of heat dissipating structure **22** to an external panel (not shown), which will be discussed in further detail in connection with FIGS. **9** and **10**.

[0027] Heat dissipating structure **22** includes a first side **30** and a second side **32** opposing first side **30**. In an mounting configuration of light fixture **20**, light fixture **20** is hung such that second side **32** resides against an external panel, ceiling surface, or the like. Thus, first side **30** faces outwardly toward the underlying volume in which light fixture **20** is installed.

[0028] First side **30** includes at least one projection region **34** extending outwardly from first side **30**. A socket **36** is formed in an apex **38** of each projection region **34**. Each socket **36** is configured to receive a light source **40**. Light source **40** may be any suitable lamp or light array, such as an LED lamp. One each of lens assemblies **26** is coupled to first side **30** of heat dissipating structure **22** over each socket **36** containing light source **40**. Lens assemblies **26** protect light sources **40** from environmental hazards, such as water damage. Additionally lens assemblies **26** function to appropriately distribute the light from each light source **40** (discussed below).

[0029] A junction box **42** is coupled to first side **28** of heat dissipating structure **22** at a central section **44** of structure **22**. Thus, junction box **42** is centrally located between adjacent projection regions **34**. In an embodiment, heat dissipating structure **22** and junction box **42** may be formed as a monolithic casting (i.e., formed from a single piece of material) of a heat conducting metallic or non-metallic material. In alternative embodiments, heat dissipating structure **22** and junction box **42** may be two separately manufactured components that are bolted, welded, or otherwise coupled together during manufacturing.

[0030] In its centralized location between adjacent projection regions **32**, junction box **42** functions to centralize power distribution and serves as a data receiving and transmitting hub for light fixture **20**. More particularly, electronics assembly **24** is housed in junction box **42**, and electronics assembly **24** is configured for electrically interconnecting light sources **40** to an external power source (not shown). Junction box **42** can additionally contain sensory and communications devices such as an occupancy sensor **46**, motion sensor, photocell, and the like. In some embodiments, junction box **42** can additionally include one or more openings **47** extending through its side walls. These openings **47** will be discussed in greater detail in connection with FIG. **13**. A cover **48** is attached to junction box **42** to protect electronics assembly **24** and any other components from environmental hazards, such as water damage.

[0031] The configuration of heat dissipating structure **22** and the use of light sources **40** in the form of LED-based light sources yields a low profile configuration of light fixture **20** having a height **50** of, for example, less than two inches.

[0032] Referring now to FIGS. **3** and **4**, FIG. **3** shows a front perspective view of heat dissipating structure **22** for surface mounted light fixture **20** (FIG. **1**), and FIG. **4** shows a front view of heat dissipating structure **22**. In the front views of FIGS. **3** and **4**, first side **30** of heat dissipating structure **22** is visible. As mentioned previously, first side **30** faces outwardly toward the underlying volume in which light fixture **20** is installed.

[0033] In an embodiment, heat dissipating structure **22** is defined, or delineated, by four quadrants **52**. Each of quadrants **52** meets at central section **44**, and each of quadrants **52** includes one of projection regions **34**. Thus, heat dissipating structure **22** includes four projection regions **34** in the illustrated embodiment. The base of each projection region **34** is surrounded by a generally rectangular, and more particularly, square, frame section **54** (most clearly distinguishable in FIG. **4**. A flanged outer frame **56** delineates an outer perimeter of heat dissipating structure **22**.

[0034] As shown, each of projection regions **34** is a pyramid shaped region having four generally triangular sides **58**, each of sides **58** being truncated at apex **38** to accommodate one of sockets **36**. In particular, apex **38** of each projection region **34** includes a substantially planar surface **60** surrounding one of sockets **36**. Planar surface **60** is oriented substantially perpendicular to an outwardly extending direction of projection region **34**. This outwardly extending direction corresponds to height **50** (FIG. **2**) of light fixture **20** (FIG. **2**). Planar surface **60** includes apertures **62** extending through heat dissipating structure **22** from second side **32** (FIG. **2**) to first side **30**. Apertures **62** serve as weep holes designed to allow moisture to drain from heat dissipating structure **22**, as will be discussed in greater detail below.

[0035] As mentioned above, junction box **42** is coupled to first side **30** of heat dissipating structure **22** and is located at central section **44**. Accordingly, each of projection regions **34** is immediately adjacent to junction box **42**. Junction box **42** may be integrally formed with heat dissipating structure **22** to form as a monolithic casting, or junction box **42** may be bolted, welded, or otherwise coupled to heat dissipating structure **22**. As such, junction box **42** is illustrated in FIGS. **3** and **4** using dashed lines to represent these at least two means for forming the “coupling” between junction box **42** and heat dissipating structure **22**.

[0036] Junction box **42** includes a threaded opening **64** extending through a back wall **66** of junction box **42**. Threaded opening **64** is adapted to receive bolt **28** (FIG. **9**) for fastening heat dissipating structure **22** to an external panel and thus fasten light fixture **20** (FIG. **1**) to the external panel, as will be discussed in connection with FIGS. **9** and **10**.

[0037] Referring now to FIGS. **5-7**, FIG. **5** shows a back perspective view of heat dissipating structure **22** for surface mounted light fixture **20** (FIG. **1**). FIG. **6** shows a back view of heat dissipating structure **22**, and FIG. **7** shows a side sectional view of the heat dissipating structure along sections lines **7-7** of FIG. **6**. In the back views of FIGS. **5** and **6**, second side **32** of heat dissipating structure **22** is visible. As mentioned previously, second side **32** resides against an external panel, ceiling surface, or the like.

[0038] Second side **32** includes a heat sink **66** formed in an internal cavity **68** of each of projection regions **34**. Heat sink **66** includes a plurality of fins **70** residing in internal cavity **68**. Each of fins **70** is in contact with and radially arranged about an outer surface **72** of socket **36**. That is, fins **70** are oriented in a starburst pattern surrounding outer surface **72** of socket **36**.

[0039] As best represented in the side sectional view of FIG. **7**, heat dissipating structure **22** exhibits height **50** between apex **38** and frame section **54**. Due to the pyramid structure of each of projection regions **34**, a height **74** immediately proximate frame section **54** is significantly less than height **50**. The decreasing height from apex **38** to frame section **54** results in a correspondingly decreasing height of internal cavity **68** from apex **38** to outer frame **56**.

[0040] A top edge **76** (see FIG. **5**) of each of fins **70** is coupled with an inner surface **78** of projection region **34** and with outer frame **56**. Consequently, each of fins **70** exhibits a variable fin height **80** corresponding to height **50** at apex **38** and decreasing to height **74** at the outer perimeter of projection region **34** delineated by frame section **54**. Additionally, a bottom edge **82** (see FIG. **5**) of each of fins **70** residing in internal cavity **68** is approximately flush with outer frame **56** of heat dissipating structure **22** so that fins **70** do not project outside of outer frame **56**.

[0041] Heat dissipating structure **22** further includes laterally oriented channels **84** visible from second side **32**. Each channel **84** has a first end **86** opening into junction box **72** and a second end **88** opening into one of sockets **36**. In particular, each projection region **34** has one of channels **84** extending between junction box **42** and its corresponding socket **36**. In an embodiment, each channel **84** is adapted to receive a wire (not shown) extending between electronics assembly **24** (FIG. **1**) and socket **36** for electrically interconnecting light source **40** (FIG. **1**) to electronics assembly **24**. In an embodiment, during assembly of light fixture **20** (FIG. **1**), wires (not shown) may be routed from junction box **42** to each of sockets **36** via channels **84**. After the wires are residing in channels **84**, channels **84** may be sealed using an industrial sealant or encapsulating compound, so that moisture cannot enter channels **84**.

[0042] FIG. **8** shows a back perspective view of the heat dissipating structure **22** emphasizing an X-brace configuration of heat dissipating structure **22**. In particular, a number of fins **70** are not illustrated so that primary fins **70** that provide enhanced rigidity to heat dissipating structure **22** can be clearly visualized.

[0043] It will be recalled that a generally rectangular frame section **54** surrounds a base of each projection region **34**, such that frame section **54** delineates an outer perimeter of internal cavity **68**. For each of projection regions **34**, a first pair **90** of fins **70** extends from outer surface **72** of socket **36** to a first pair of diagonally opposed corners **92** of frame section **54**. Additionally, a second pair **94** of fins **70** extends from outer surface **72** of socket **36** to a second pair of diagonally opposed corners **96** of frame section **54**. Thus, each of first and second pairs **90** and **94**, respectively, of fins **70** yields an X-brace configuration within each of projection regions **34** to impart structural rigidity in each quadrant **52** of heat dissipating structure **22**.

[0044] For purposes of explanation, each of quadrants **52** are successively labeled **52**A, **52**B, **52**C, and **52**D in FIG. **8**. Thus, quadrant **52**A is referred to herein as a first quadrant **52**A, quadrant **52**B is referred to herein as a second quadrant **52**B, quadrant **52**C is referred to herein as a third quadrant **52**C, and quadrant **52**D is referred to herein as a fourth quadrant **52**B. First and third quadrants **52**A and **52**C are arranged in diagonally opposing relation relative to central section **44**. In addition, second and fourth quadrants **52**B and **52**D are arranged in diagonally opposing relation relative to central section **44**. Each of projection regions **34** are successively labeled **34**A, **34**B, **34**C, and **34**D in FIG. **8**. Hence, projection region **34**A is referred to herein as a first projection region **34**A, projection region **34**B is referred to herein as a second projection region **34**B, projection region **34**C is referred to herein as a third projection region **34**C, and projection region **34**D is referred to herein as a fourth projection region **34**D.

[0045] In an embodiment, first pair **90** of fins **70** residing in internal cavity **68** of first projection region **34**A located in first quadrant **52**A is serially aligned with first pair **90** of fins **70** residing in internal cavity **68** of third projection region **34**C located in third quadrant **52**C. Similarly, second pair **94** of fins **70** residing in internal cavity **68** of second projection region **34**B located in second quadrant **52**B is serially aligned with second pair **94** of fins **70** residing in internal cavity **68** of fourth projection region **34**D located in fourth quadrant **52**D. The term “serially aligned” refers to an arrangement of fins **70** in a straight line or row. Accordingly, first pair **90** of fins **70** in each of first and third projection regions **34**A and **34**C are in a straight line or row, and second pair **94** of fins **70** in each of second and fourth projection regions **34**B and **34**D are in a straight line or row. This configuration of fins **850** extends the X-brace configuration diagonally across the entirety of heat dissipating structure **22** in order to further enhance the structural rigidity of heat dissipating structure **22**. Fins **70** are illustrated as being relatively thin at the junction between central section **44** and fins **70** for simplicity of illustration. However, in practice, fins **70** may be thickened at the junction between central section **44** and fins **70** in order to withstand the stress applied by bolt **28** (FIG. **9**) following installation.

[0046] Referring to FIGS. **9** and **10**, FIG. **9** shows an exploded perspective view of a mounting detail for the surface mounted light fixture **20**, and FIG. **10** shows a partial sectional side view of the mounting detail for surface mounted light fixture **20**. In an embodiment, surface mounted light fixture **20** is suitable for installation in a refrigerated environment where the ambient temperature may not exceed 45° F. (7.2° C.). The refrigerated environment may be a refrigerated cooler, a walk-in refrigerated room, or the like configured to hold perishable food products. This installation environment is not a requirement however. In alternative embodiments, light fixture **20** may be installed in an environment in which the ambient temperature is greater than or less than 45° F. (7.2° C.).

[0047] A refrigerated cooler or walk-in refrigerated room may occasionally be subjected to cleaning by, for example, pressure washing. Thus, such an environment light fixture **20** can be subjected to significant moisture from cleaning operations. Accordingly, light fixture **20** employs several moisture protection strategies that will be discussed in connection with its installation.

[0048] Light fixture **20** is installed on a ceiling panel **98**, such as the ceiling of an insulated cooler box or a dropped ceiling of a refrigerated room. The term “dropped ceiling” refers to a secondary ceiling hung below the main (structural) ceiling, and the area above the dropped ceiling, i.e., ceiling panel **98**, is referred to as a plenum space **100**.

[0049] Installation entails drilling a hole through ceiling panel **98** that is compatible with the diameter of bolt **28**. A gasketed plate **102** is placed directly over the hole. In an embodiment, plate **102** may have a gasket **104** laminated to an underside of plate **102**. Thus, once installed, gasket **104** would reside between plate **102** and a top surface **106** of ceiling panel **98**. Gasketed plate **102** may further include another gasket **108** placed on and/or adhered to a top side of plate **102**. Next, a conventional junction box **110** is placed on top of gasket **108**. A neoprene washer **112** can be inserted onto bolt **28**. Bolt **28** is inserted through junction box **110**, through plate **102**, and through ceiling panel **98**.

[0050] Light fixture **20** is placed against a bottom surface **114** of ceiling panel **98** with a gasket **116** (visible in FIG. **10**) interposed between ceiling panel and second side **32** of light fixture **20**. Bolt **28** is rotated until some resistance is felt. That is, bolt **28** is rotated into threaded engagement with threaded opening **64** extending through junction box **42** of light fixture **20**.

[0051] Referring briefly to FIG. **3**, heat dissipating structure **22** may include four holes **118** extending through structure **22**. Now with reference back to FIGS. **9** and **10**, installation continues by fastening four sheet metal alignment screws **120** (two visible in FIG. **10**) into ceiling panel **98** via holes **118** after aligning light fixture **20** in its final position. Bolt **28** and alignment screws **120** are fully tightened. After bolt **28** is fully tightened, a cover **122** may be coupled to junction box **110** to seal junction box **110** from moisture.

[0052] It should be noted that alignment screws **120** are relatively short so that they do not extend fully through ceiling panel **98**. Accordingly, only a single hole is made through ceiling panel **98**, thereby creating only one breach in ceiling panel **98** per light fixture **20**. As bolt **28** is tightened, compression stress is applied to the X-brace configuration of fins **70** (FIG. **8**). This compression stress transfers to fins **70** which act as tributaries for the compression stress. In this manner, the applied pressure is uniformly distributed around flanged outer frame **56** of heat dissipating structure **22**, i.e., the perimeter of light fixture **20** (FIG. **1**), resulting in a tight seal.

[0053] In an embodiment, bolt **28** may be fabricated from a thermally non-conductive material, such as a composite of plastic or graphite, or bolt **28** may be fabricated from a non-corrosive metal that is coated with a thermally non-conductive material. Bolt **28** includes a longitudinally aligned interior passage **124** for directing wiring **126** from an external power source (not shown) to electronics assembly **24** housed in junction box **42**. Wiring **126** may include power and control wires for light sources **40** (FIG. **1**) and any other electronics, such as occupancy sensor **46** (FIG. **1**). Wiring **126** is sealed in passage **124** and is thus sealed from air and moisture travel. In the absence of moist air (or liquid) penetrating from above ceiling panel **98**, and by utilizing a thermally non-conductive bolt **28**, “sweating,” i.e., condensation build-up, cannot occur.

[0054] FIG. **11** shows a partial side view of one of lens assemblies **26** for surface mounted light fixture **20**. Inside of the refrigerated space, gasket **116** protects against water entering the backside, i.e., second side **32**, of heat dissipating structure **22** if and/or when light fixture **20** is cleaned by, for example, pressure washing. However, in the event that water does penetrate around gasket **116**, apertures **62** in planar surface **60** of projection regions **34** located around sockets **36** function as weep holes thus allowing the water to drain by gravity flow.
[0055] Lens assembly **26** includes a lens **128** coupled to a surrounding lens frame **130**. Installation of lens assembly **26** to heat dissipating structure **22** overlying socket **36** entails placement of a gasket **132** interposed between lens frame **130** and planar surface **60** of projection region **34** surrounding socket **36**. Lens frame **130** may then be attached to heat dissipating structure **22** by, for example, non-corrosive screws (not shown). Lens assembly **26** with the intervening gasket **132** effectively seals socket **36** from water. Additionally, lens frame **130** extends partially over apertures **62** so that apertures **62** are not exposed to a direct spray of water. However, a remaining channel **134** around lens frame **130** still allows for the drainage of water from apertures **62**.
[0056] Lens **128** may be a simple glass and/or plastic material flat lens. Alternatively, lens **128** may be a specialized lens having the capability of refracting light above a horizon line in order to avoid a “cave effect” lighting scenario. The optics of lens **128** may be variably constructed in order to achieve a particular lighting pattern. In an embodiment, a variable construct of lens **128** may include a generally hemispherical portion **136** surrounded by a series of concentric rings **138** with substantially identical, sharply peaked, symmetrical cross sections **140**. Concentric rings **138** are, in turn, surrounded by an outer concentric ring **142** with a substantially flat surface **144**.
[0057] Although each feature of construction of lens **128** contributes to the light output over most output angles, each feature is used primarily to control the light output over a narrow range. For example, hemispherical portion **136** primarily contributes light output in a range from normal (zero degrees) to about forty degrees. Concentric rings **138** primarily contribute light output in a range from approximately forty degrees to approximately ninety degrees, and outer ring **142** with flat surface **144** primarily contributes light output in a range from approximately ninety degrees to one hundred and twenty degrees.
[0058] A magnitude of the effect of each type of construction of lens **128** can be controlled by the relative surface area taken up by that construction. An optimization process may be used to achieve the overall desired angular output. In an optimization process, for example, primary variables can be the relative areas of each type of construction (i.e., hemispherical portion **136**, peaked concentric rings **138**, and outer ring **142** with flat surface **144**), and/or the apex (included) angle for series of sharply peaked rings **138**. The construction of lens **128** can enable the refraction of light above a horizon line, i.e., greater than ninety degrees, in order to avoid a “cave effect” lighting scenario. However, those skilled in the art will recognize that lens **128** may have alternative construction configurations then that which was disclosed.
[0059] In operation, light sources **40** generate heat when illuminated. Heat generally travels from hot to cooler regions. By virtue of their placement in sockets **36** of heat dissipating structure **22**, light sources **40** are sunk into a thermal mass, i.e. heat sink **66**. Heat generated by light sources **40** travels by conduction through the starburst configuration of fins **70** (FIG. **5**). Fins **70** convey the heat to the outer skin of projection regions **34**, i.e., to first side **30** of heat dissipating structure **22**. Thus, fins **70** can efficiently remove heat from a junction **146** between light sources **40** and heat sink **66** to first side **30** of heat dissipating structure **22**. An additional contributor to lowering the temperature at junction **146** is ceiling panel **98** onto which light fixture **20** is mounted. Heat trapped between fins **70** and ceiling panel **98** may be absorbed by the thermally conductive skin or surface of ceiling panel **98**, and is conducted into the cooled environment.
[0060] FIG. **12** shows a block diagram of a wiring configuration **148** for multiple surface mounted light fixtures **20**. In some configurations, there may be a need for multiple light fixtures **20** in order to sufficiently light a refrigerated environment **150**. In the illustrated wiring configuration **148**, a

separate power supply **152** is electrically connected with two light fixtures **20**. Power supplies **152** are placed outside of and above refrigerated environment **150** in plenum space **100**. Light fixtures **20** are electrically connected to power supplies **152** via wiring that is also located outside of and above refrigerated environment **150** in plenum space **100**.

[0061] Thus, power supplies **152** are external to light fixtures **20** so that any heat produced by power supplies **152** does not compromise the lifespan of light sources **40** (FIG. **1**). Additionally, power supplies **152** are external to refrigerated environment **150** so that any heat produced by power supplies **152** is not conducted through light fixture **20** and into refrigerated environment **150**. Power supplies **152** may supply power to light sources **40**, occupancy sensor(s) **46** (FIG. **1**), photocell(s), and other devices that may be used in refrigerated environment **150**. Power supplies **152** may be in communication with local or remote controls, and may operate by line voltage, low voltage, or a combination thereof. A backup power supply (not shown), such as a battery, may be used to operate light fixtures **20** where emergency illumination is required.

[0062] FIG. **13** shows a block diagram of another wiring configuration **154** for a system of surface mounted light fixtures **20**. In the illustrated wiring configuration **154**, a separate power supply **152** is electrically connected with two light fixtures **20**. Like wiring configuration **148** (FIG. **12**), power supplies **152** are placed outside of and above refrigerated environment **150** in plenum space **100** so that any heat produced by power supplies **152** does not adversely affect the lifespan of light sources **40** and/or so that any heat produced by power supplies **152** is not conducted into refrigerated environment **150**. However, pairs of light fixtures **20** are electrically connected to one another in a serial arrangement via a wiring conduit **156**. Thus, only one of light fixtures **20** from each pair of light fixtures **20** is directly connected to one of power supplies **152**.

[0063] As discussed previously in connection with FIG. **2**, in some embodiments, junction box **42** (FIG. **2**) may include openings **47** (see FIGS. **2-3**) extending through one or more of its side walls. These openings **47** can be utilized to direct wiring and moisture resistant conduit, referred to herein as wiring conduit **156**, between junction boxes **42** of adjacent light fixtures **20**. For example, one end of a wiring conduit **156** may be coupled at an opening **47** (shown in FIGS. **2-3**) in junction box **42** of one of light fixtures **20**, and an opposing end of wiring conduit **156** may be coupled at another opening **47** in another junction box **42** in an adjacent light fixtures **20**. Any unused openings **47** in junction box **42** may be sealed using, for example, plugs (not shown) in order to maintain the moisture resistance of light fixtures **20**. As such, electrical interconnection is provided between electronic assemblies (FIG. **1**) of light fixtures **20** via wiring conduit **156** located inside of refrigerated environment **150**. Although two wiring configurations **148** (FIG. **12**) and **154** are shown, those skilled in the art will recognize that that a system of multiple light fixtures **20** sufficient to light refrigerated environment **150** can be coupled with an external power source in a multitude of configurations.

[0064] FIG. **14**A shows a partial top view of a light source **40** module of the light emitting heat dissipating apparatus **22**. For clarity, the figure shows the portion of the surface **78** covering removed, exposing the fins **70** and the outer frame **56**. The light source emitting heat dissipating apparatus **22** module comprises a recessed lensed **26** opening having at least a first wall that terminates at a substantially perpendicular second wall. A light source **40** is coupled to the second wall surface. This second wall surface is the room facing side of the heat sink **66**. The opposite side of the surface retaining the light source is the side of the heat sink **66** that faces the structure which the light emitting apparatus heat dissipating **22** is mechanically or electromechanically coupled to. At least one power consuming device aside from the light source **40** is coupled to the apparatus **22** interior surfaces and/or interior and exterior surfaces. Exterior mounted devices can be coupled to the apparatus **22** directly and/or having at least one elongated mechanical or electromechanical coupler. At least one adjacent exterior side of the walled enclosure has a plurality of heat dissipating fins **70**, unitary form with the heat sink **66** extending outwardly, and at least one fin **70** coupled to the heat sink **66** extends beyond the light source **40** toward the illuminated room. The heat generated by the light source **40** travels by conduction laterally through the heat sink **66** to the at least one coupled fin **70**, wherein air flowing through at least one aperture **62** disposed between at least two fins **70** removes heat by convection.

[0065] FIG. **14**B shows a transverse section through the lighting module. The recessed lensed **26** opening is shown with a light source **40** coupled to a surface which is the room facing side of a heat sink **66**. The opposite side of the light source **40** retaining heat sink **66** surface is the side of the heat sink **66** facing the structure to which the light emitting heat dissipating apparatus **22** is coupled. Adjacent to the exterior walls of the recessed enclosure, fins **70** unitarily formed with the heat sink **66** extend outwardly. The fins **70** originate below the heat sink **66** surface retaining the light source **40** and extend beyond the light source **40** toward the illuminated room. A surface **78** unitarily formed with the fins **70** partially covers the fins **70** facing the illuminated room, having aperture **62** openings enable free through air flow between the fins. Heat generated by at least one light source **40** is sunk into the heat sink **66** and then by conduction travels laterally toward the apparatus **22** outer frame **56** and then travels to the substantially perpendicularly to the heat sink **66** fins **70**. Air flowing through the apertures **62** to between the fins **70** then removes the fins' heat by convection.

[0066] FIG. **15** is a side section view of a light emitting apparatus presented as a simplified diagram of previously disclosed structures. The light emitting apparatus has a first housing **215** which has a substantially inverted U-shaped cross-section defined by a second wall **210** and a first wall **205**. A light source **40** is disposed in a socket **36** of the first housing **215** and includes a LED attached to the second wall **210**. A unitary heat sink **66** has heat dissipating fins **70** integrally formed with an outer surface of the first housing **215**. A lens assembly **26** with an optical lens is part of a cover that at least partially covers the open end of the first housing **215**. There is at least one through opening **62** (sometimes called a through aperture) between the first wall **205** of the first housing **215** and a perimeter of the light emitting apparatus. A light source power supply **152** is disposed in a second housing **220** and provides electrical power to the light source **40** via a conductor **225** disposed in the mechanical extender **28**, which spaces the first housing **215** from the second housing **220** by an extender extension distance **230**. Edges of the fins **70** extend away from a floor **200**, which is on a room side **201** direction of the light emitting apparatus. The fins **70** also extend outward and down toward the room so heat generated by the light source **40** is conducted through the heat sink **66** and the first housing wail to at the fins **70** and/or a region of the light emitting apparatus that is closer to a floor **200** than the light source **40**.

[0067] In summary, embodiments entail a surface mounted light fixture and a heat dissipating structure for the light fixture. The heat dissipating structure includes projection regions surrounding a centrally located junction box. A socket is formed at an apex of each projection region, and each socket is configured to receive an LED light source. The junction box provides a housing for power and control to the multiple light sources and additional electrical components, such as an occupancy sensor. In addition, openings in the junction box allow for the provision power and control within an environment to other light fixtures in a system configuration. A heat sink is formed in an internal cavity of each projection region. The heat sink includes fins arranged in a starburst pattern around each of the sockets so as to form an X-brace configuration. The combination of the X-brace configuration of fins and the junction box yields a rigid, low profile light fixture, capable of uniform and efficient heat extraction and dissipation. Additionally, the X-brace configuration, junction box, inclusion of gaskets, and mounting methodology produces a tight and uniform seal to a ceiling panel, with a single hole extending through the ceiling panel, so as to largely prevent water entry into the light fixture. Furthermore, the isolated and protected power wire way system through an internal passage in the bolt and into the junction box, as well as the channels extending between the junction box and each socket, provides effective routing for electrical power from an external power source to the light sources and further protects critical electrical components from moisture. A rigid, moisture resistant, low profile structure capable of effectively conducting heat away from the LED light source yields improvements in lamp energy efficiency, enhanced lifespan for the LED light sources, and can be readily implemented in commercial venues, such as refrigerated coolers, clean rooms, hazardous environments, and so forth.

[0068] Although the preferred embodiments of the invention have been illustrated and described in detail, it will be readily apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims. For example, the design of light fixture may be scaled up or down to accommodate different light source outputs.

Claims

1. A planar light emitting device comprising: a housing having a recessed cavity defined by at least one wall extending between an apex surface and an open aperture; a heat sink integrated with the housing; a light source coupled to the apex surface and configured to emit light through the open aperture toward a floor surface; a light-transmissive lens that covers the open aperture; at least one heat dissipating fin that extends outwardly from an exterior surface of the at least one wall of the recessed cavity; a presence detection sensor; and a sensor mounting surface configured to retain the presence detection sensor, wherein the heat sink thermally conducts heat generated by the light source to the at least one wall of the recessed cavity and the at least one heat dissipating fin toward the floor below, and the light source is controlled by the presence detection sensor to adjust illumination based on occupant detection of the presence detection sensor.

2. The planar light emitting device of claim 1, further comprising communication electronics coupled to the housing that receives and transmits data transmitted to and from the planar light emitting device.

3. The planar light emitting device of claim 1, wherein the at least one heat dissipating fin tapers distally from the at least one wall of the recessed cavity toward a peripheral edge of the housing.

4. The planar light emitting device of claim 1, further comprising a primary power connector positioned on a first side of the housing opposite the apex surface.

5. The planar light emitting device of claim 4, further comprising an auxiliary power connector positioned on a lateral side of the housing adjacent to the primary power connector.

6. The planar light emitting device of claim 1, wherein the heat sink, the at least one wall of the recessed cavity, or at least one heat dissipating fin comprise a monolithic metallic material.

7. The planar light emitting device of claim 1, further comprising a removable panel disposed on at least one exterior surface of the housing.

8. The planar light emitting device of claim 7, further comprising at least one auxiliary electrical device mounted to the removable panel.

9. A planar light emitting device comprising: a housing having a recessed cavity defined by a cavity wall that extends between an apex surface and an open aperture; a heat sink integrated with the housing; a light source coupled to the apex surface and configured to emit light through the open aperture toward a floor below, the light source comprising a plurality of LEDs; a lens that covers the open aperture and comprising optics that redirect light from the plurality of LEDs to achieve a predetermined lighting pattern below the planar light emitting device; at least one heat dissipating fin that extends outwardly from an exterior surface of the cavity wall; a sensor disposed on the housing, the sensor being at least one of a presence detection sensor and a light detection photocell; and a sensor mounting surface configured to retain the sensor, wherein the heat sink thermally conducts heat generated by the light source to the cavity wall and the at least one heat dissipating fin toward the floor below, and the light source is configured to be controlled by the sensor to adjust illumination based on at least one of occupant detection by the presence detection sensor, or ambient light level detected by the photocell.

10. The planar light emitting device of claim 9, further comprising communication electronics coupled to the housing that receives and transmits data transmitted to and from the planar light emitting device.
11. The planar light emitting device of claim 9, wherein the at least one heat dissipating fin tapers distally from the at least one wall of the recessed cavity toward a peripheral edge of the housing.
12. The planar light emitting device of claim 9, further comprising a primary power connector positioned on a first side of the housing opposite the apex surface.
13. The planar light emitting device of claim 12, further comprising an auxiliary power connector positioned on a lateral side of the housing adjacent to the primary power connector.
14. The planar light emitting device of claim 9, wherein the heat sink, the cavity wall, or at least one heat dissipating fin comprise a monolithic metallic material.
15. The planar light emitting device of claim 9, further comprising a removable panel disposed on at least one exterior surface of the housing.
16. The planar light emitting device of claim 15, further comprising at least one auxiliary electrical device mounted to the removable panel.
17. A planar light emitting device comprising: a housing having a recessed cavity defined by a cavity wall that extends between an apex surface and an open aperture; a heat sink integrated with the housing; a light source coupled to the apex surface and configured to emit light through the open aperture toward a floor surface, the light source comprising a plurality of LEDs; a lens that covers the open aperture and comprising optics that direct light from the plurality of LEDs to below the planar light emitting device; a plurality of heat dissipating fins that extend outwardly from an exterior surface of the cavity wall and interconnected by a surface material; a gasket disposed between the housing and the light source; a sensor disposed on the housing, the sensor being one of a presence detection sensor and a light detection photocell; and a sensor mounting surface configured to retain the sensor, wherein the heat sink thermally conducts heat generated by the light source to the cavity wall and the heat dissipating fins to below the planar light emitting device, and the light source is configured to be controlled by the sensor to adjust illumination based on at least one of occupant detection of the presence detection sensor, or ambient light level detected by the photocell.
18. The planar light emitting device of claim 17, further comprising communication electronics coupled to the housing that receives and transmits data transmitted to and from the planar light emitting device.
19. The planar light emitting device of claim 17, wherein the at least one heat dissipating fin tapers distally from the at least one wall of the recessed cavity toward a peripheral edge of the housing.
20. The planar light emitting device of claim 17, further comprising a primary power connector positioned on a first side of the housing opposite the apex surface.
21. The planar light emitting device of claim 17, wherein the surface material that interconnects the plurality of heat dissipating fins has a plurality of openings that enable a free flow of air upward from below the planar light emitting device to above the planar light emitting device.