

ADJUSTABLE-ANGLE LUMINAIRES

Technical field

[01] The present invention relates to luminaires which may be adjusted to provide different angles of illumination.

Background

[02] Embedded (or recessed) luminaires have become popular for their neat and unobtrusive aesthetic appearance. A common form of embedded luminaire is a downlight. Downlights are typically installed into a ceiling cavity, with the light source (for example, a halogen bulb) positioned within the embedded luminaire and above the ceiling level. This enables light to shine from a position in the ceiling, with very little of the luminaire visible or protruding from the ceiling.

[03] Recessed luminaires which are fixed in position in a ceiling cavity illuminate a room at a fixed angle, usually directly downwardly. On occasion, it may be preferable to be able to adjust the illumination angle.

[04] Previous attempts to provide adjustable-angle luminaires have included, in a gimbal-type arrangement, allowing the lamp or other light source to rotate about a single axis relative to the luminaire housing.

Summary of the invention

[05] The present invention provides, in a first aspect, a luminaire for embedded installation in a mounting surface, the luminaire including:

- a light source housing having a curved outer surface; and
- a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire; and

wherein the light source housing is retained in the mounting component by snap-fit

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engagement, such that the light source housing is maintained in the desired orientation by friction.

- [06] The present invention also provides, in a second aspect, a kit for a luminaire, the luminaire, when assembled, being installable in a mounting surface, the kit including:
- a light source housing having a curved outer surface; and
 - a mounting component for retaining the luminaire in the mounting surface;
- wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire; and
- wherein the light source housing is retainable in the mounting component by snap-fit engagement, such that, in use, the light source housing is maintained in the desired orientation by friction.

- [07] In a third aspect, the present invention provides a method of assembling a luminaire, the luminaire including: a light source housing having a curved outer surface; and a mounting component for retaining the luminaire in a mounting surface, the mounting component having an inner surface which is contoured to match the curved outer surface of the light source housing, the method including the step of:
- snap-fitting the light source housing into the mounting component to thereby retain the light source housing in the mounting component, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation by friction.

- [08] The light source housing is preferably substantially spherical or part-spherical, for example taking the form of a truncated sphere or truncated spheroid.

- [09] Preferably, the mounting component has an outer surface which is substantially circular in cross-section.

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- [010] The snap-fit engagement may be provided by two or more arms formed in and/or projecting from the mounting component, the arms being resiliently deflectable to allow the light source housing to be pushed into the mounting component. The arms may each have a curved surface which is contoured to match the curved outer surface of the light source housing. Preferably, there are four such arms regularly spaced around the periphery of the mounting component.
- [011] Alternatively, at least one void can be formed in either the light source housing or the mounting component to allow flexure thereof during assembly and provide said snap-fitting engagement. Preferably, the at least one void is a plurality of narrow voids formed in the light source housing and more preferably, four voids are formed.
- [012] Alternatively, the snap-fit engagement may be achieved by other methods. In one embodiment, curved outer surface of the light source housing is defined by a resiliently flexible wall which can be flexed inwardly to permit insertion of the light source housing into the mounting component. The wall can include a plurality of resilient wall members separated by voids. In another embodiment, the outer surface of the light source housing and the inner surface of the mounting component are defined by closefitting overlapping walls. In another embodiment, the inner surface of the mounting component is defined by at least one resilient finger, which in use extends at least partially around the curved surface of the light source housing.
- [013] The mounting component may include a lower section for retaining or assisting to retain the mounting component by a friction fit in the mounting surface. The resilient arms may project from the lower section. The lower section may be an annular sidewall, and upper ends of the arms may project above the annular sidewall.
- [014] In certain embodiments, the mounting component also includes an upper section extending from the lower section. The upper section may substantially surround an upper part of the light source housing so as to reduce or prevent ingress of dust and other contaminants into the light source housing. The resilient arms may be formed in the upper section.

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[015] Preferably, the light source housing includes an LED light source. The luminaire may include a heat sink extending from the light source housing, and the heat sink may be affixed to or integral with the light source housing.

[016] The light source housing may include a beam shaping component. In particularly preferred embodiments, the beam shaping component is adjustable to change the illumination characteristics of the luminaire. Preferably, a distance of the beam shaping component from the light source is adjustable. In one preferred form, the beam shaping component is retained in the light source housing by screw-threaded engagement, and the distance is adjustable by screwing or unscrewing the beam shaping component.

[017] Preferably, the mounting component includes a peripheral lip which is configured to rest against the mounting surface when the luminaire is installed.

[018] In preferred embodiments, the luminaire includes a fascia component. The fascia component may be integral with the mounting component. Alternatively, the fascia component may be detachable from the mounting component. For example, the fascia component may be attached to the mounting component by screw-threaded engagement. The screw-threaded engagement may be by way of engagement with a thread on the peripheral lip of the mounting component. In this way, different fascia components can be used with the same luminaire, thereby allowing the appearance of the luminaire and/or optical effects produced by the luminaire, when installed in the mounting surface, to be readily altered.

[019] In another aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

- a light source housing having a curved outer surface; and

- a mounting component for retaining the luminaire in the mounting surface;

- wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation; and

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wherein the light source housing includes a light source and a beam shaping component which is adjustable to change the illumination characteristics of the luminaire.

[020] Preferably, a distance of the beam shaping component from the light source is adjustable. In one preferred form, the beam shaping component is retained in the light source housing by screw-threaded engagement, and the distance is adjustable by screwing or unscrewing the beam shaping component.

[021] In a third aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

a light source housing having a curved outer surface; and

a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation; and

wherein the mounting component includes a first part and a second part, the curved outer surface of the light source housing being retained between the first part and the second part.

[022] In certain embodiments, the first part is a first ring shaped to fit around an upper part of the curved outer surface of the light source housing, and the second part is a second ring shaped to fit around a lower part of the curved outer surface. The first ring may be attached to the second ring by screw-threaded engagement. In other embodiments, the first part is a first half-ring and the second part is a second half-ring, and the first half-ring and the second half-ring are joined in a vertical plane. The first half-ring may be attached to the second half-ring by a fastener such as a pin. The fastener may be spring-loaded.

[023] In a yet further aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

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a light source housing having a curved outer surface; and
a mounting component for retaining the luminaire in the mounting surface;
wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire; and
wherein the mounting component includes means for releasably attaching a fascia component.

[024] The present invention, in certain embodiments, extends to any inventive combination of features set out above or in the following description. Although illustrative embodiments of the invention are described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to these precise embodiments. As such, many modifications and variations will be apparent to the practitioners skilled in the art. Furthermore, it is contemplated that a particular feature described either individually or as part of an embodiment can be combined with other individually described features, or parts or other embodiments, even if the other features and embodiments make no mention of the particular feature. Thus, the invention extends to such specific combinations not already discussed.

Brief description of the drawings

[025] Embodiments of the invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings in which:

[026] Figure 1 is a top perspective view of a luminaire;

[027] Figure 2 is a side projection view of the luminaire of Figure 1;

[028] Figure 3 is a cross-section through the line A-A of Figure 2;

[029] Figure 4 is an exploded view of the luminaire;

[030] Figures 5(a) to 5(j) show fascia components suitable for use with the luminaire of Figures 1 to 4;

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- [031] Figure 6 is a side view of another embodiment of a luminaire;
- [032] Figure 7 is an exploded view of the luminaire of Figure 5;
- [033] Figure 8 is a side view of a further embodiment of a luminaire;
- [034] Figure 9 is a cross-section through the line A-A of Figure 8;
- [035] Figure 10 is an exploded view of the luminaire of Figures 8 and 9;
- [036] Figure 11 is a side view of yet another embodiment of a luminaire;
- [037] Figure 12 is a cross-section through the line B-B of Figure 11;
- [038] Figure 13 is another side view of the luminaire of Figures 11 and 12;
- [039] Figure 14 is an exploded perspective view of yet another embodiment of a luminaire;
- [040] Figure 15 is an exploded side view of the luminaire of Figure 14;
- [041] Figure 16 is a cross-section through line A-A of Figure 15;
- [042] Figure 17 is a perspective view of an alternative light source housing/mounting component pair for use with a luminaire;
- [043] Figure 18 is a side view of the alternative light source housing/mounting component pair of Figure 17;
- [044] Figure 19 is an exploded side sectional view, taken through line A-A of Figure 18, of the alternative light source housing/mounting component pair of Figure 17 in a disassembled state;
- [045] Figures 20 and 21 are side sectional views, taken through line A-A of Figure 18, of the alternative light source housing/mounting component pair of Figure 17 in an assembled state;

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- [046] Figure 22 is a perspective view of a further alternative light source housing/mounting component pair for use with a luminaire;
- [047] Figure 23 is a side view of the alternative light source housing/mounting component pair of Figure 22;
- [048] Figure 24 is a sectional side view, taken through line A-A of Figure 23, of the alternative light source housing/mounting component pair of Figure 22;
- [049] Figure 25 is a perspective view of a further alternative light source housing for use with a luminaire;
- [050] Figure 26 is a side view of the alternative light source housing of Figure 25, the light source housing being received in a corresponding mounting component;
- [051] Figure 27 is a sectional side view, taken through line A-A of Figure 26, of the alternative light source housing/mounting component pair of Figure 25;
- [052] Figure 28 is a perspective view of a further alternative mounting component for use with a luminaire;
- [053] Figure 29 is a side view of the mounting component of Figure 28;
- [054] Figure 30 is a plan view of the mounting component of Figure 28 with a light source housing received therein;
- [055] Figure 31 is a side view of the mounting component of Figure 28 with a light source housing received therein;
- [056] Figure 32 is a sectional side view, taken through the line A-A of Figure 31, of the light source housing/mounting component pair of Figure 31;
- [057] Figure 33 is another side view of the light source housing/mounting component pair of Figure 31;
- [058] Figure 34 is a sectional side view, taken through the line B-B of Figure 33, of the

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light source housing/mounting component pair of Figure 31;

[059] Figure 35 is a perspective view of a further alternative light source housing for use with a luminaire;

[060] Figure 36 is a side view of the light source housing of Figure 35;

[061] Figure 37 is a side view of the light source housing of Figure 35 received in a mounting component; and

[062] Figure 38 is a sectional side view, taken through the line A-A of Figure 37, of the light source housing/mounting component pair of Figure 37.

Detailed description

[063] Referring initially to Figures 1 to 4, there is shown a luminaire 100 including a heat sink 110 extending from a light source housing 120. The heat sink 110 may be integrally formed with the light source housing 120, but is preferably formed as a separate component which may be mechanically coupled to the light source housing 120 in any suitable fashion, for example by screw-threaded engagement, snap-fit, etc.

[064] The light source housing 120 has a curved outer surface which is retained by snap-fit engagement with a mounting component 130. Located within housing 120 are a light source 150 (which may include one or more LEDs) and a beam shaping component 160 including a lens section 164 which focuses light from the light source 150. A chamber inside the light source housing 120 may include reflective walls 152 for reflecting stray light into lens section 164.

[065] The mounting component 130 has a substantially circular cross-section for mounting the luminaire 100 within a circular hole in a ceiling, for example. The mounting component may have one or more resiliently biased arms (not shown) for retaining the luminaire 100 within the ceiling in recessed fashion with a fascia component 140 abutting the ceiling.

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[066] The mounting component 130 has four resilient arms 132 extending upwardly therefrom, the arms being configured to first deflect outwardly, and then snap back into place to retain the housing 120, when the housing 120 is pushed downwardly into the mounting component.

[067] The heat sink 110 has a cavity 112 which can be used to house various electronic components of the luminaire 100. The heat sink 110 may also include, at its upper end, a cap 114 which may be removed to provide greater access to cavity 112 for insertion or removal of components in the cavity. The cap includes an aperture to permit passage of cabling.

[068] As best seen in Figures 3 and 4, the mounting component 130 has a curved inner surface 136 which is contoured to conform to the curved outer surface of the light source housing, such that the mounting component 130 forms a close fit with the light source housing 120. The arms 132 also have respective inner surfaces 138 which conform to the curved outer surface of the light source housing 120. Accordingly, the light source housing 120 is frictionally held in place by mounting component 130 and arms 132.

[069] When it is desired to change the illumination angle of the luminaire, a user can grip an exposed part of the housing 120 (or a component attached to the housing 120) from below the ceiling, and apply a force to rotate the housing 120 to the desired orientation. Due to the ball-and-socket type configuration provided by the matching curved surfaces of the housing 120 and mounting component 130, the housing 120 (and heat sink 110 to which it is attached) can be tilted in any desired tilt direction.

[070] The rotation or tilt applied by the user will tend to slightly deflect one or more of the arms 132. When the user ceases to apply the force, the resilient arms return towards their undeflected positions and fully engage the outer surface of housing 120, thereby assisting to retain the housing 120 in the desired orientation.

[071] A further advantage of providing a tight fit between the mounting component 130 and the housing 120 is that air flow into the ceiling cavity above the luminaire is

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minimised.

[072] The light source housing 120 is preferably a truncated sphere, but can have other external surface shapes (e.g. a truncated spheroid) provided the housing 120 can still be rotated within the mounting component 130 over the desired range of angles.

[073] In addition to adjustment of the angle of illumination, the beam characteristics of luminaire 100 may also be adjusted, by virtue of an adjustable beam shaping component 160. The beam shaping component 160 has an outer thread 162 which mates with an internal thread 122 of the light source housing 120. Accordingly, the distance between light source 150 and lens section 164 of beam shaping component 160 can be easily altered, by screwing or unscrewing the beam shaping component 160, thereby adjusting the breadth of the illuminating beam. It will be appreciated that many other means of adjusting the distance between the light source 150 and lens section 164 may also be employed.

[074] Advantageously, the luminaire 100 includes an interchangeable fascia component 140 which attaches to the mounting component 130. The outward appearance of the luminaire may be readily altered by removing the fascia component 140, without removing the luminaire from the mounting surface, and replacing it with a different fascia component which is capable of mechanically coupling to the mounting component 130.

[075] For example, the fascia component 140 may have a screw thread on an internal surface 142 which engages with a mating screw thread 134 on a peripheral lip 131 of the mounting component 130. In alternative embodiments, other mechanical couplings of a fascia component with a mounting component may be possible, for example a snap fit or interference fit. However, a screw thread engagement is particularly advantageous because it allows the fascia component 140 to be more readily removed when the luminaire is installed with the fascia and peripheral lip 131 of the mounting component abutting a ceiling or other mounting surface.

[076] While the luminaire 100 will typically be installed with a fascia such as fascia

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component 140, it will be appreciated that the luminaire may also be installed without any fascia component 140, for a “trimless” appearance. If a fascia is not installed a seal between the mounting component 130 and the mounting surface can still be maintained (thereby ensuring little or no gap between the mounting component 130 and the mounting surface) by virtue of the lip 131 of the mounting component 130 being seated against the mounting surface.

[077] Figures 5(a) to 5(j) show various examples of alternative fascia components which may be used with the luminaire 100.

[078] Fascia component 200 has an opaque surface 202 with a circular cut-out section 204. The use of the circular cut-out 204 in an opaque surface 202 reduces glare, and reduces the beam width emitted by the luminaire 100. Fascia component 210 is similar to fascia component 200, but has an oblong cut-out 214 in an opaque surface 212. The oblong cut-out 214 also allows the direction of illumination to be adjusted in a limited range when the fascia component 210 is in place. It will be appreciated that opaque surfaces 202, 212 may also be made partially transparent (or may be formed of a transparent material with surface roughening to scatter light produced by the luminaire) whilst retaining the glare-reduction capabilities of the fascia components 200, 210.

[079] Fascia component 220 is similar to fascia component 200, but has a wider circular cut-out section 224 formed in the surface 222. As such, it allows the direction of illumination to be adjusted when in place on the luminaire 100, whilst also reducing glare and without substantially detracting from the “trimless” appearance of the luminaire 100.

[080] Fascia component 230 has a surface 232 in which are formed a series of holes 234 and smaller holes 232. The holes 232, 234 can be placed so as to produce a beam having a desired pattern.

[081] Fascia component 240 has a tapered sidewall 242, the internal surface 244 of which has a metallic or other reflective layer formed thereon (e.g., by vacuum metallisation) to create a reflective surface for reflection of the beam onto an adjacent surface (e.g. a

wall, or the surface of a nearby object). The direction of illumination may be altered (by rotation of the housing 120 as described above), while fascia 240 is installed, in order to alter the intensity and shape of the reflected light.

[082] Fascia component 250 is hollow and has a transparent annular sidewall 252, and front surface 254. A reflective conical element (not shown) is located on the reverse side of front surface 254, and acts to reflect the beam through the sidewall 252 so as to create a diffused lighting effect on the mounting surface.

[083] Fascia component 260 has a cylindrical body 262 formed of a surface-roughened (e.g., by sandblasting) transparent material such as acrylic. The surface roughening creates a diffused lighting effect.

[084] Fascia component 270 has a convex transparent outer surface 272 on which is applied a thin diffusing film, causing the beam to be diffused to provide an omnidirectional lighting effect.

[085] Fascia components 280 and 290 each include a ring which reduces glare from the luminaire beam. Fascia component 280 has a sharp bevel 282 and fascia component 290 has a recessed bevel 292, to provide different aesthetics.

[086] The skilled person will appreciate that the various features of the fascia components 200 to 290 as described and illustrated can be combined and interchanged in any number of ways, to produce different aesthetic and lighting effects as desired. In addition, although each fascia component 200 to 290 is shown having a circular cross-section, other cross-sectional shapes are possible. For example, a square fascia may be used, provided it has a circular internal thread or other suitable means for connecting the fascia to the peripheral lip 131 of the luminaire 100.

[087] Turning now to Figures 6 and 7, there is shown an alternative embodiment of a luminaire 300, which in most respects is similar to the luminaire 100 shown in Figures 1 to 4. Luminaire 300 includes a heat sink extending from a light source housing 320 which is retained by snap-fit engagement in a mounting component 330 by resilient arms 332. The mounting component 330 has a peripheral lip 331 around which extends

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a screw thread 334 for attaching a fascia component such as the fascia component 140 used with the luminaire of Figures 1 to 4, or any one of the fascia components 200 to 290 shown in Figures 5(a) to 5(j), for example.

[088] The light source housing 320 of luminaire 300 includes a beam shaping component 360 with a lens section 364, similar to the beam shaping component 160 of luminaire 100. The beam shaping component is adjustable to change a distance between the lens section 364 and a light source (preferably one or more LEDs) located within the housing 120.

[089] The mounting component 330 includes a lower portion 330a which, when the luminaire 300 is installed in a mounting surface, forms an interference fit with a circular hole in the mounting surface. Extending from the lower portion 220a is an upper portion 330b in which the resilient arms 332 are formed. The upper portion 330b surrounds an upper part of the light source housing 320 (apart from in the region of cut-out portions 338) so as to reduce the ingress of dust or other contaminants into the light source housing 320.

[090] The upper portion 330b includes two cut-out portions generally indicated at 338 (only one of which is shown) located on opposite sides of the mounting component 330. Each cut-out portion 338 has a pair of narrow tongues 339 to fit in corresponding grooves of a spring-clip fitting (not shown) to allow spring clips to be attached to the luminaire 300 for retaining it in the mounting surface.

[091] Upper portion 330b has a tapered sidewall 336. The upper end of the sidewall 336 is narrower than the lower portion 330a, facilitating the insertion of the luminaire 300 into the circular hole in the mounting surface whilst still permitting an interference fit with lower portion 330a when the luminaire is fully inserted.

[092] The operation of luminaire 300 during adjustment of the illumination angle by a user is similar to that of luminaire 100. That is, the user applies a force to the housing 320 (for example, by gripping a surface of beam shaping component 360) to tilt it to a desired orientation, thereby slightly deflecting one or more of the resilient arms 332.

When the user ceases to apply the force, the arms 332 once again frictionally engage with the housing 320 surface to maintain the housing 320 in the desired orientation.

[093] Referring to Figures 8 to 10, there is shown another alternative embodiment of a luminaire 400, including a heat sink 410, a light source housing 420, and a mounting component 430 which is formed in two parts 430a, 430b. The first part 430a is a first half-ring and the second part 430b is a second half-ring. The first 430a and second 430b half-rings are joined along a vertical plane in order to retain the curved outer surface of light source housing 420 therebetween. A fascia component 140 can be attached to a peripheral lip 431 of the mounting component 430a, 430b after the mounting component is assembled around housing 420. Any of the fascia components shown in Figures 5(a) to 5(j) may alternatively be used, for example.

[094] The heat sink 410 and light source housing 420, including the electrical and optical components that they house, may be substantially identical to those of the luminaire 100, the main difference between the luminaire 100 and the luminaire 400 being the manner in which the housing 420 is retained by the mounting component 430.

[095] Each of the first 430a and second 430b half-rings of mounting component 430 has a respective inner surface 436a, 436b which is shaped to complement (half of) the outer surface of housing 420. Accordingly, when the half-rings are fastened around housing 420, they form a tight fit with the housing to substantially prevent any airflow through the luminaire 400 into the space behind the mounting surface, as discussed above.

[096] The first and second half-rings 430a and 430b are fastened together by means of spring-loaded fasteners. The spring-loaded fasteners include threaded rods 426 received in respective pairs of guide sleeves 424a and 424b located on the outer surface of half-rings 430a and 430b. Each threaded rod 426 has a head 429 which bears against an end of a guide 424a of half-ring 430a. The other end of each rod receives a spring 427 (which bears against guide 424b) and a nut 428 threaded onto the rod 426 to complete the fastening operation. The spring 427 ensures that the head 429 abuts guide 424a, and allows the tightness of the mounting component 430 about housing 420 to be adjusted.

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[097] Yet another embodiment of the invention is depicted in Figures 11 to 13, in which a luminaire 500 includes a heat sink 510 extending from a light source housing 520. The heat sink may be mechanically coupled to the light source housing by screw-threaded engagement, for example. Heat sink 510 has a cavity for housing electronic components required for operation of the luminaire, for example circuitry for controlling one or more LEDs of a light source contained within the light source housing 520.

[098] The light source housing 520 includes a beam shaping component 560 with a lens portion 564. The light source housing 520 is retained within a mounting component 530 which is formed in two parts 530a and 530b. The first part 530a has a pair of mounting clips 570 attached thereto, and circumferentially surrounds and is in contact with an upper part of the light source housing 520. The second part 530b circumferentially surrounds and is in contact with a lower part of the housing 520. The second part 530b is coupled to the first part 530a by screw-threaded engagement.

[099] Yet another embodiment of the invention is depicted in Figures 14 to 16, in which a luminaire 600 includes a heat sink 610 extending from a light source housing 620 and a mounting component 630. The heat sink may be mechanically coupled to the light source housing by screw-threaded engagement, for example. Heat sink 610 has a cavity for housing electronic components required for operation of the luminaire, for example circuitry for controlling one or more LEDs of a light source contained within the light source housing 620. The luminaire 600 includes a LED mount 625 and an end cap 626.

[0100] A fascia component 640 is provided, which in the illustrated embodiment is integrally formed with the mounting component 630, though it will be appreciated that the fascia component 640 may be a separate part that can be fixed to the mounting component. The fascia component 640, whether integrally formed with or separate to the mounting component 630, may take the form of any of the fascia components shown in Figures 5(a) to 5(j), for example.

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[0101] The heat sink 610 and light source housing 620, including the electrical and optical components that they house, may be substantially identical to those of the luminaires 100 or 400, the main difference being the manner in which the housing 620 is retained by the mounting component 630.

[0102] As per the above described luminaires, a generally spherical end 621 of the light source housing 620 is configured to be received by the mounting component 630, which is a correspondingly shaped so as to provide a close fit so that movement between the mounting component 630 and the light source housing 620 is restricted by friction.

[0103] The spherical end 621 has a plurality of voids 635 formed therein and extending inwardly from an outer periphery 622 of the light source housing 620. The voids 635 may take many forms such as, for example, gaps, slits or apertures, and may be formed during a moulding operation or in secondary operation post moulding, such as a machining or cutting operation, for example.

[0104] In the illustrated embodiment, the light source housing 620 is provided with 4 voids, though it will be appreciated that the number and size of the voids may be varied. In this regard, it may be preferable to provide between 1 and 10 voids in the light source housing 620. Tabs 636 are formed between the voids 635 and the tabs 636 move radially inwardly and outwardly to allow for flexing of the light source housing 620 so that an outer periphery 622 of the generally spherical end 621 can expand and/or contract to allow the light source housing 620 and the mounting component 630 to be assembled together in snap fitting arrangement.

[0105] In the depicted embodiment, voids 635 are formed in the light source housing 620, though it will be appreciated that voids may similarly be formed in the mounting component 630 so that the mounting component 630 flexes during assembly. Furthermore, voids may be formed in both the light source housing 620 and the mounting component 630.

[0106] Although the light source housing 620 is illustrated as being above the mounting

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component 630 in the exploded view, during assembly the heat sink 610 is inserted through the mounting component 630 from below and the light source housing 620 moved upwardly to bring the light source housing 120 into snap fitting engagement with the mounting component.

[0107] The above described luminaires are all capable of adjustment so as to vary the orientation of the light beam. It will be appreciated that the capacity for adjustment may be achieved in a variety of ways and Figures 17 to 38 illustrate further housing/mounting component pairs that provide alternative methods of adjustment. It will be appreciated that the previously described and illustrated luminaires may be modified to incorporate the features to be further described below and illustrated in Figures 17 to 38.

[0108] Figures 17 to 21 illustrate a first alternative housing/mounting pair in which a light source housing 720 and mounting component 730 is provided. An outer wall 721 of the light source housing 720 is resiliently flexible so that it can be manipulated between a first, compressed condition 720a and a second, natural or expanded condition 720b. As can be seen from Figures 17 to 20b, the light source housing 720 is held in the first, compressed condition and brought into contact with, so as to be received by, the mounting component 730. As illustrated in Figure 20, once the light source housing 720 has been received in the mounting component 730 it is released from the compressed condition 720a and takes the natural/expanded condition 720b in which the light source housing 720 is retained in the mounting component 730.

[0109] It will be appreciated that the light sourcing housing 720 will be formed of a material having suitable elastic properties so that the outer wall 721 may move between the first, compressed condition 720a and the second, natural or expanded condition 720b with relative ease, though resist movement from the second condition so as to stay retained in the mounting component 730.

[0110] Figures 22 to 24 illustrate a second alternative housing/mounting pair in which a light source housing 820 and mounting component 830 is provided. The light source housing 820 and the mounting component 830 are each configured so that portions

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which interface are complimentary shaped so that the light source housing 820 can be received in the mounting component 830 in a manner which allows the orientation of the light source housing 820 to be readily adjusted. The light source housing 820 is frusto-spherical and an inner surface of the outer wall 821 provides a surface against which a surface of outer wall 823 of the mounting component 830 can bear.

[0111] The mounting component 830 is also frusto-spherical and is sized so that the outer surface of the outer wall 823 is closefitting to and tightly received against an inner surface of the outer wall 823 of the light source housing 820, thereby providing retention of the light source housing 820 yet allowing sliding movement between the light source housing 820 and the mounting component 830 to allow the orientation of the light beam to be varied.

[0112] It will be appreciated that either or both of the light source housing 820 and mounting component 830 will be formed of a resilient material to facilitate assembly and provide retention post assembly.

[0113] Figures 25 to 27 illustrate a further alternative light source housing/mounting component pair in which a light source housing 920 and mounting component 930 is provided. Again, the light source housing 920 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 930, thereby providing retention of the light source housing 920 yet allowing sliding movement between the light source housing 920 and the mounting component 930 to allow the orientation of the light beam to be varied.

[0114] In the illustrated alternative, the frusto-spherical portion is formed by an upturned wall 921 of the light source housing 920. As the wall terminates at a free surface, it is resilient and can flex to allow assembly of the light source housing 920 and the mounting component 930. It will again be appreciated that either or both of the light source housing 920 and mounting component 930 can be formed of a resilient material to facilitate assembly and provide retention post assembly.

[0115] Figures 28 to 34 illustrate a further alternative light source housing/mounting

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component pair in which a light source housing 1020 and mounting component 1030 is provided. Again, the light source housing 1020 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 1030, thereby providing retention of the light source housing 1020 yet allowing sliding movement between the light source housing 1020 and the mounting component 1030 to allow the orientation of the light beam to be varied.

[0116] In the illustrated embodiment, the mounting component is formed with a wall 1031 which provides a surface against which a frusto-spherical portion of the light source housing 1020 can be received. The wall 1031 is truncated, as can be seen in Figure 30, so that it does not extend completely around the light source housing 1020. The mounting component 1030 is also formed with voids 1032 so as to form resilient fingers 1033 that, in use, extend around the light source housing 1020 to retain the light source housing 1020 and the mounting component 1030 together. The fingers 1031 are cantilevered members that flex to allow assembly of the light source housing 1020 and mounting component 1030.

[0117] Figures 35 to 38 illustrate a further alternative light source housing/mounting component pair in which a light source housing 1120 and mounting component 1130 is provided. Again, the light source housing 1120 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 1130, thereby providing retention of the light source housing 1120 yet allowing sliding movement between the light source housing 1120 and the mounting component 1130 to allow the orientation of the light beam to be varied.

[0118] The light source housing 1120 has voids 1121 formed in an outer surface thereof, with resilient walls 1123 being disposed between the voids 1121. In the illustrated embodiment, three voids 1121 are provided, though it will be appreciated that arrangements having two or more voids may also function satisfactorily.

[0119] An outer surface of the resilient walls 1123 is generally frusto-spherical which is configured to be received in a spherical socket portion of the mounting component 1130. The resilience of the walls 1123 acts to retain the light source housing 1120 and

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the mounting component 1130 together, though allowing assembly of the light source housing 1120 and mounting component 1130.

[0120] In each of the alternative light source housing/mounting component pairs illustrated in Figures 17 to 38, it will be appreciated that the arrangements operate in a similar manner to a ball and socket type joint to allow changes of orientation of the light beam in multiple dimensions. In this regard, the light source housing and mounting component pair provides rotation about both longitudinal and transverse axis.

[0121] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

[0122] Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

[0123] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge, in the field of endeavour to which this specification relates.

ADJUSTABLE-ANGLE LUMINAIRES

Technical Field

[01] The present invention relates to luminaires which may be adjusted to provide different angles of illumination.

Background

[02] Embedded (or recessed) luminaires have become popular for their neat and unobtrusive aesthetic appearance. A common form of embedded luminaire is a downlight. Downlights are typically installed into a ceiling cavity, with the light source (for example, a halogen bulb) positioned within the embedded luminaire and above the ceiling level. This enables light to shine from a position in the ceiling, with very little of the luminaire visible or protruding from the ceiling.

[03] Recessed luminaires which are fixed in position in a ceiling cavity illuminate a room at a fixed angle, usually directly downwardly. On occasion, it may be preferable to be able to adjust the illumination angle.

[04] Previous attempts to provide adjustable-angle luminaires have included, in a gimbal-type arrangement, allowing the lamp or other light source to rotate about a single axis relative to the luminaire housing.

Summary of the invention

[05] The present invention provides, in a first aspect, a luminaire for embedded installation in a mounting surface, the luminaire including:

a light source housing having a curved outer surface;

and a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire; and

wherein the light source housing is retained in the mounting component by snap-fit engagement, such that the light source housing is maintained in the desired orientation by friction.

[06] The present invention also provides, in a second aspect, a kit for a luminaire, the luminaire, when assembled, being installable in a mounting surface, the kit including:

a light source housing having a curved outer surface;

and a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire; and

wherein the light source housing is retainable in the mounting component by snap-fit engagement, such that, in use, the light source housing is maintained in the desired orientation by friction.

[007] In a third aspect, the present invention provides a method of assembling a luminaire, the luminaire including: a light source housing having a curved outer surface; and a mounting component for retaining the luminaire in a mounting surface, the mounting component having an inner surface which is contoured to match the curved outer surface of the light source housing, the method including the step of:

 snap-fitting the light source housing into the mounting component to thereby retain the light source housing in the mounting component, such that the light source housing is rotatable within the mounting component to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation by friction.

[008] The light source housing is preferably substantially spherical or part-spherical, for example taking the form of a truncated sphere or truncated spheroid.

[009] Preferably, the mounting component has an outer surface which is substantially circular in cross-section.

[010] The snap-fit engagement may be provided by two or more arms formed in and/or projecting from the mounting component, the arms being resiliently deflectable to allow the light source housing to be pushed into the mounting component. The arms may each have a curved surface which is contoured to match the curved outer surface of the light source housing. Preferably, there are four such arms regularly spaced around the periphery of the mounting component.

[011] Alternatively, at least one void can be formed in either the light source housing or the mounting component to allow flexure thereof during assembly and provide said snap-fitting engagement. Preferably, the at least one void is a plurality of narrow voids formed in the light source housing and more preferably, four voids are formed.

[012] Alternatively, the snap-fit engagement may be achieved by other methods. In one embodiment, curved outer surface of the light source housing is defined by a resiliently flexible wall which can be flexed inwardly to permit insertion of the light source housing into the mounting component. The wall can include a plurality of resilient wall members separated by voids. In another embodiment, the outer surface of the light source housing and the inner surface of the mounting component are defined by closefitting overlapping walls. In another embodiment, the inner surface of the mounting component is defined by at least one resilient finger, which in use extends at least partially around the curved surface of the light source housing.

[013] The mounting component may include a lower section for retaining or assisting to

retain the mounting component by a friction fit in the mounting surface. The resilient arms may project from the lower section. The lower section may be an annular sidewall, and upper ends of the arms may project above the annular sidewall.

[014] In certain embodiments, the mounting component also includes an upper section extending from the lower section. The upper section may substantially surround an upper part of the light source housing so as to reduce or prevent ingress of dust and other contaminants into the light source housing. The resilient arms may be formed in the upper section.

[015] Preferably, the light source housing includes an LED light source. The luminaire may include a heat sink extending from the light source housing, and the heat sink may be affixed to or integral with the light source housing.

[016] The light source housing may include a beam shaping component. In particularly preferred embodiments, the beam shaping component is adjustable to change the illumination characteristics of the luminaire. Preferably, a distance of the beam shaping component from the light source is adjustable. In one preferred form, the beam shaping component is retained in the light source housing by screw-threaded engagement, and the distance is adjustable by screwing or unscrewing the beam shaping component.

[017] Preferably, the mounting component includes a peripheral lip which is configured to rest against the mounting surface when the luminaire is installed.

[018] In preferred embodiments, the luminaire includes a fascia component. The fascia component may be integral with the mounting component. Alternatively, the fascia component may be detachable from the mounting component. For example, the fascia component may be attached to the mounting component by screw-threaded engagement. The screw-threaded engagement may be by way of engagement with a thread on the peripheral lip of the mounting component. In this way, different fascia components can be used with the same luminaire, thereby allowing the appearance of the luminaire and/or optical effects produced by the luminaire, when installed in the mounting surface, to be readily altered.

[019] In another aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

a light source housing having a curved outer surface;

and a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation; and

wherein the light source housing includes a light source and a beam shaping component which is adjustable to change the illumination characteristics of the

luminaire.

[020] Preferably, a distance of the beam shaping component from the light source is adjustable. In one preferred form, the beam shaping component is retained in the light source housing by screw-threaded engagement, and the distance is adjustable by screwing or unscrewing the beam shaping component.

[021] In a third aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

a light source housing having a curved outer surface;

and a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire, the light source housing being maintained in the desired orientation; and

wherein the mounting component includes a first part and a second part, the curved outer surface of the light source housing being retained between the first part and the second part.

[022] In certain embodiments, the first part is a first ring shaped to fit around an upper part of the curved outer surface of the light source housing, and the second part is a second ring shaped to fit around a lower part of the curved outer surface. The first ring may be attached to the second ring by screw-threaded engagement. In other embodiments, the first part is a first half-ring and the second part is a second half-ring, and the first half-ring and the second half-ring are joined in a vertical plane. The first half-ring may be attached to the second half-ring by a fastener such as a pin. The fastener may be spring-loaded.

[023] In a yet further aspect, the present invention provides a recessed luminaire for embedded installation in a mounting surface, the luminaire including:

a light source housing having a curved outer surface;

and a mounting component for retaining the luminaire in the mounting surface;

wherein the mounting component has an inner surface which is contoured to match the curved outer surface of the light source housing, such that the light source housing is rotatable within the mounting ring to a desired orientation to adjust an angle of illumination of the luminaire; and

wherein the mounting component includes means for releasably attaching a fascia component.

[024] The present invention, in certain embodiments, extends to any inventive combination of

features set out above or in the following description. Although illustrative embodiments of the invention are described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to these precise embodiments. As such, many modifications and variations will be apparent to the practitioners skilled in the art. Furthermore, it is contemplated that a particular feature described either individually or as part of an embodiment can be combined with other individually described features, or parts or other embodiments, even if the other features and embodiments make no mention of the particular feature. Thus, the invention extends to such specific combinations not already discussed.

Brief description of the drawings

[025] Embodiments of the invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings in which:

[026] Figure 1 is a top perspective view of a luminaire;

[027] Figure 2 is a side projection view of the luminaire of Figure 1;

[028] Figure 3 is a cross-section through the line A-A of Figure 2;

[029] Figure 4 is an exploded view of the luminaire;

[030] Figures 5(a) to 5(j) show fascia components suitable for use with the luminaire of Figures 1 to 4;

[031] Figure 6 is a side view of another embodiment of a luminaire;

[032] Figure 7 is an exploded view of the luminaire of Figure 5;

[033] Figure 8 is a side view of a further embodiment of a luminaire;

[034] Figure 9 is a cross-section through the line A-A of Figure 8;

[035] Figure 10 is an exploded view of the luminaire of Figures 8 and 9;

[036] Figure 11 is a side view of yet another embodiment of a luminaire;

[037] Figure 12 is a cross-section through the line B-B of Figure 11;

[038] Figure 13 is another side view of the luminaire of Figures 11 and 12;

[039] Figure 14 is an exploded perspective view of yet another embodiment of a luminaire;

[040] Figure 15 is an exploded side view of the luminaire of Figure 14;

[041] Figure 16 is a cross-section through line A-A of Figure 15;

[042] Figure 17a is a perspective view of an alternative light source housing/mounting component pair for use with a luminaire in a compressed condition;

[043] Figure 17b is a perspective view of an alternative light source housing/mounting

component pair for use with a luminaire in an expanded condition;

[044] Figure 18 is a side view of the alternative light source housing/mounting component pair of Figures 17a and 17b;

[045] Figure 19 is an exploded side sectional view, taken through line A-A of Figure 18, of the alternative light source housing/mounting component pair of Figures 17a and 17b in a disassembled state;

[046] Figures 20 and 21 are side sectional views, taken through line A-A of Figure 18, of the alternative light source housing/mounting component pair of Figures 17a and 17b in an assembled state;

[047] Figure 22 is a perspective view of a further alternative light source housing/mounting component pair for use with a luminaire;

[048] Figure 23 is a side view of the alternative light source housing/mounting component pair of Figure 22;

[049] Figure 24 is a sectional side view, taken through line A-A of Figure 23, of the alternative light source housing/mounting component pair of Figure 22;

[050] Figure 25 is a perspective view of a further alternative light source housing for use with a luminaire;

[051] Figure 26 is a side view of the alternative light source housing of Figure 25, the light source housing being received in a corresponding mounting component;

[052] Figure 27 is a sectional side view, taken through line A-A of Figure 26, of the alternative light source housing/mounting component pair of Figure 25;

[053] Figure 28 is a perspective view of a further alternative mounting component for use with a luminaire;

[054] Figure 29 is a side view of the mounting component of Figure 28;

[055] Figure 30 is a plan view of the mounting component of Figure 28 with a light source housing received therein;

[056] Figure 31 is a side view of the mounting component of Figure 28 with a light source housing received therein;

[057] Figure 32 is a sectional side view, taken through the line A-A of Figure 31, of the light source housing/mounting component pair of Figure 31;

[058] Figure 33 is another side view of the light source housing/mounting component pair of Figure 31;

[059] Figure 34 is a sectional side view, taken through the line B-B of Figure 33, of the light source housing/mounting component pair of Figure 31;

- [060] Figure 35 is a perspective view of a further alternative light source housing for use with a luminaire;
- [061] Figure 36 is a side view of the light source housing of Figure 35;
- [062] Figure 37 is a side view of the light source housing of Figure 35 received in a mounting component; and
- [063] Figure 38 is a sectional side view, taken through the line A-A of Figure 37, of the light source housing/mounting component pair of Figure 37.

Detailed description

- [064] Referring initially to Figures 1 to 4, there is shown a luminaire 100 including a heat sink 110 extending from a light source housing 120. The heat sink 110 may be integrally formed with the light source housing 120, but is preferably formed as a separate component which may be mechanically coupled to the light source housing 120 in any suitable fashion, for example by screw-threaded engagement, snap-fit, etc.
- [065] The light source housing 120 has a curved outer surface which is retained by snap-fit engagement with a mounting component 130. Located within housing 120 are a light source 150 (which may include one or more LEDs) and a beam shaping component 160 including a lens section 164 which focuses light from the light source 150. A chamber inside the light source housing 120 may include reflective walls 152 for reflecting stray light into lens section 164.
- [066] The mounting component 130 has a substantially circular cross-section for mounting the luminaire 100 within a circular hole in a ceiling, for example. The mounting component may have one or more resiliently biased arms (not shown) for retaining the luminaire 100 within the ceiling in recessed fashion with a fascia component 140 abutting the ceiling.
- [067] The mounting component 130 has four resilient arms 132 extending upwardly therefrom, the arms being configured to first deflect outwardly, and then snap back into place to retain the housing 120, when the housing 120 is pushed downwardly into the mounting component.
- [068] The heat sink 110 has a cavity 112 which can be used to house various electronic components of the luminaire 100. The heat sink 110 may also include, at its upper end, a cap 114 which may be removed to provide greater access to cavity 112 for insertion or removal of components in the cavity. The cap includes an aperture to permit passage of cabling.
- [069] As best seen in Figures 3 and 4, the mounting component 130 has a curved inner surface 136 which is contoured to conform to the curved outer surface of the light source housing, such that the mounting component 130 forms a close fit with the light source housing 120. The arms 132 also have respective inner surfaces 138 which conform to the curved outer surface of the light source housing 120. Accordingly, the light source housing 120 is frictionally held in place by mounting component 130 and arms 132.

- [070] When it is desired to change the illumination angle of the luminaire, a user can grip an exposed part of the housing 120 (or a component attached to the housing 120) from below the ceiling, and apply a force to rotate the housing 120 to the desired orientation. Due to the ball-and-socket type configuration provided by the matching curved surfaces of the housing 120 and mounting component 130, the housing 120 (and heat sink 110 to which it is attached) can be tilted in any desired tilt direction.
- [071] The rotation or tilt applied by the user will tend to slightly deflect one or more of the arms 132. When the user ceases to apply the force, the resilient arms return towards their undeflected positions and fully engage the outer surface of housing 120, thereby assisting to retain the housing 120 in the desired orientation.
- [072] A further advantage of providing a tight fit between the mounting component 130 and the housing 120 is that air flow into the ceiling cavity above the luminaire is minimised.
- [073] The light source housing 120 is preferably a truncated sphere, but can have other external surface shapes (e.g. a truncated spheroid) provided the housing 120 can still be rotated within the mounting component 130 over the desired range of angles.
- [074] In addition to adjustment of the angle of illumination, the beam characteristics of luminaire 100 may also be adjusted, by virtue of an adjustable beam shaping component 160. The beam shaping component 160 has an outer thread 162 which mates with an internal thread 122 of the light source housing 120. Accordingly, the distance between light source 150 and lens section 164 of beam shaping component 160 can be easily altered, by screwing or unscrewing the beam shaping component 160, thereby adjusting the breadth of the illuminating beam. It will be appreciated that many other means of adjusting the distance between the light source 150 and lens section 164 may also be employed.
- [075] Advantageously, the luminaire 100 includes an interchangeable fascia component 140 which attaches to the mounting component 130. The outward appearance of the luminaire may be readily altered by removing the fascia component 140, without removing the luminaire from the mounting surface, and replacing it with a different fascia component which is capable of mechanically coupling to the mounting component 130.
- [076] For example, the fascia component 140 may have a screw thread on an internal surface 142 which engages with a mating screw thread 134 on a peripheral lip 131 of the mounting component 130. In alternative embodiments, other mechanical couplings of a fascia component with a mounting component may be possible, for example a snap fit or interference fit. However, a screw thread engagement is particularly advantageous because it allows the fascia component 140 to be more readily removed when the luminaire is installed with the fascia and peripheral lip 131 of the mounting component abutting a ceiling or other mounting surface.
- [077] While the luminaire 100 will typically be installed with a fascia such as fascia component 140, it will be appreciated that the luminaire may also be installed without any fascia component 140, for a "trimless" appearance. If a fascia is not installed a seal between the mounting component 130 and the mounting surface can still be

maintained (thereby ensuring little or no gap between the mounting component 130 and the mounting surface) by virtue of the lip 131 of the mounting component 130 being seated against the mounting surface.

- [078] Figures 5(a) to 5(j) show various examples of alternative fascia components which may be used with the luminaire 100.
- [079] Fascia component 200 has an opaque surface 202 with a circular cut-out section 204. The use of the circular cut-out 204 in an opaque surface 202 reduces glare, and reduces the beam width emitted by the luminaire 100. Fascia component 210 is similar to fascia component 200, but has an oblong cut-out 214 in an opaque surface 212. The oblong cut-out 214 also allows the direction of illumination to be adjusted in a limited range when the fascia component 210 is in place. It will be appreciated that opaque surfaces 202, 212 may also be made partially transparent (or may be formed of a transparent material with surface roughening to scatter light produced by the luminaire) whilst retaining the glare-reduction capabilities of the fascia components 200, 210.
- [080] Fascia component 220 is similar to fascia component 200, but has a wider circular cut-out section 224 formed in the surface 222. As such, it allows the direction of illumination to be adjusted when in place on the luminaire 100, whilst also reducing glare and without substantially detracting from the “trimless” appearance of the luminaire 100.
- [081] Fascia component 230 has a surface 232 in which are formed a series of holes 234 and smaller holes 232. The holes 232, 234 can be placed so as to produce a beam having a desired pattern.
- [082] Fascia component 240 has a tapered sidewall 242, the internal surface 244 of which has a metallic or other reflective layer formed thereon (e.g., by vacuum metallisation) to create a reflective surface for reflection of the beam onto an adjacent surface (e.g. a wall, or the surface of a nearby object). The direction of illumination may be altered (by rotation of the housing 120 as described above), while fascia 240 is installed, in order to alter the intensity and shape of the reflected light.
- [083] Fascia component 250 is hollow and has a transparent annular sidewall 252, and front surface 254. A reflective conical element (not shown) is located on the reverse side of front surface 254, and acts to reflect the beam through the sidewall 252 so as to create a diffused lighting effect on the mounting surface.
- [084] Fascia component 260 has a cylindrical body 262 formed of a surface-roughened (e.g., by sandblasting) transparent material such as acrylic. The surface roughening creates a diffused lighting effect.
- [085] Fascia component 270 has a convex transparent outer surface 272 on which is applied a thin diffusing film, causing the beam to be diffused to provide an omnidirectional lighting effect.
- [086] Fascia components 280 and 290 each include a ring which reduces glare from the luminaire beam. Fascia component 280 has a sharp bevel 282 and fascia component

290 has a recessed bevel 292, to provide different aesthetics.

- [087] The skilled person will appreciate that the various features of the fascia components 200 to 290 as described and illustrated can be combined and interchanged in any number of ways, to produce different aesthetic and lighting effects as desired. In addition, although each fascia component 200 to 290 is shown having a circular cross-section, other cross-sectional shapes are possible. For example, a square fascia may be used, provided it has a circular internal thread or other suitable means for connecting the fascia to the peripheral lip 131 of the luminaire 100.
- [088] Turning now to Figures 6 and 7, there is shown an alternative embodiment of a luminaire 300, which in most respects is similar to the luminaire 100 shown in Figures 1 to 4. Luminaire 300 includes a heat sink extending from a light source housing 320 which is retained by snap-fit engagement in a mounting component 330 by resilient arms 332. The mounting component 330 has a peripheral lip 331 around which extends a screw thread 334 for attaching a fascia component such as the fascia component 140 used with the luminaire of Figures 1 to 4, or any one of the fascia components 200 to 290 shown in Figures 5(a) to 5(j), for example.
- [089] The light source housing 320 of luminaire 300 includes a beam shaping component 360 with a lens section 364, similar to the beam shaping component 160 of luminaire 100. The beam shaping component is adjustable to change a distance between the lens section 364 and a light source (preferably one or more LEDs) located within the housing 120.
- [090] The mounting component 330 includes a lower portion 330a which, when the luminaire 300 is installed in a mounting surface, forms an interference fit with a circular hole in the mounting surface. Extending from the lower portion 220a is an upper portion 330b in which the resilient arms 332 are formed. The upper portion 330b surrounds an upper part of the light source housing 320 (apart from in the region of cut-out portions 338) so as to reduce the ingress of dust or other contaminants into the light source housing 320.
- [091] The upper portion 330b includes two cut-out portions generally indicated at 338 (only one of which is shown) located on opposite sides of the mounting component 330. Each cut-out portion 338 has a pair of narrow tongues 339 to fit in corresponding grooves of a spring-clip fitting (not shown) to allow spring clips to be attached to the luminaire 300 for retaining it in the mounting surface.
- [092] Upper portion 330b has a tapered sidewall 336. The upper end of the sidewall 336 is narrower than the lower portion 330a, facilitating the insertion of the luminaire 300 into the circular hole in the mounting surface whilst still permitting an interference fit with lower portion 330a when the luminaire is fully inserted.
- [093] The operation of luminaire 300 during adjustment of the illumination angle by a user is similar to that of luminaire 100. That is, the user applies a force to the housing 320 (for example, by gripping a surface of beam shaping component 360) to tilt it to a desired orientation, thereby slightly deflecting one or more of the resilient arms 332. When the user ceases to apply the force, the arms 332 once again frictionally engage with the housing 320 surface to maintain the housing 320 in the desired

orientation.

- [094] Referring to Figures 8 to 10, there is shown another alternative embodiment of a luminaire 400, including a heat sink 410, a light source housing 420, and a mounting component 430 which is formed in two parts 430a, 430b. The first part 430a is a first half-ring and the second part 430b is a second half-ring. The first 430a and second 430b half-rings are joined along a vertical plane in order to retain the curved outer surface of light source housing 420 therebetween. A fascia component 140 can be attached to a peripheral lip 431 of the mounting component 430a, 430b after the mounting component is assembled around housing 420. Any of the fascia components shown in Figures 5(a) to 5(j) may alternatively be used, for example.
- [095] The heat sink 410 and light source housing 420, including the electrical and optical components that they house, may be substantially identical to those of the luminaire 100, the main difference between the luminaire 100 and the luminaire 400 being the manner in which the housing 420 is retained by the mounting component 430.
- [096] Each of the first 430a and second 430b half-rings of mounting component 430 has a respective inner surface 436a, 436b which is shaped to complement (half of) the outer surface of housing 420. Accordingly, when the half-rings are fastened around housing 420, they form a tight fit with the housing to substantially prevent any airflow through the luminaire 400 into the space behind the mounting surface, as discussed above.
- [097] The first and second half-rings 430a and 430b are fastened together by means of spring-loaded fasteners. The spring-loaded fasteners include threaded rods 426 received in respective pairs of guide sleeves 424a and 424b located on the outer surface of half-rings 430a and 430b. Each threaded rod 426 has a head 429 which bears against an end of a guide 424a of half-ring 430a. The other end of each rod receives a spring 427 (which bears against guide 424b) and a nut 428 threaded onto the rod 426 to complete the fastening operation. The spring 427 ensures that the head 429 abuts guide 424a, and allows the tightness of the mounting component 430 about housing 420 to be adjusted.
- [098] Yet another embodiment of the invention is depicted in Figures 11 to 13, in which a luminaire 500 includes a heat sink 510 extending from a light source housing 520. The heat sink may be mechanically coupled to the light source housing by screw-threaded engagement, for example. Heat sink 510 has a cavity for housing electronic components required for operation of the luminaire, for example circuitry for controlling one or more LEDs of a light source contained within the light source housing 520.
- [099] The light source housing 520 includes a beam shaping component 560 with a lens portion 564. The light source housing 520 is retained within a mounting component 530 which is formed in two parts 530a and 530b. The first part 530a has a pair of mounting clips 570 attached thereto, and circumferentially surrounds and is in contact with an upper part of the light source housing 520. The second part 530b circumferentially surrounds and is in contact with a lower part of the housing 520. The second part 530b is coupled to the first part 530a by screw-threaded engagement.
- [0100] Yet another embodiment of the invention is depicted in Figures 14 to 16, in which a

luminaire 600 includes a heat sink 610 extending from a light source housing 620 and a mounting component 630. The heat sink may be mechanically coupled to the light source housing by screw-threaded engagement, for example. Heat sink 610 has a cavity for housing electronic components required for operation of the luminaire, for example circuitry for controlling one or more LEDs of a light source contained within the light source housing 620. The luminaire 600 includes a LED mount 625 and an end cap 626.

- [0101] A fascia component 640 is provided, which in the illustrated embodiment is integrally formed with the mounting component 630, though it will be appreciated that the fascia component 640 may be a separate part that can be fixed to the mounting component. The fascia component 640, whether integrally formed with or separate to the mounting component 630, may take the form of any of the fascia components shown in Figures 5(a) to 5(j), for example.
- [0102] The heat sink 610 and light source housing 620, including the electrical and optical components that they house, may be substantially identical to those of the luminaires 100 or 400, the main difference being the manner in which the housing 620 is retained by the mounting component 630.
- [0103] As per the above described luminaires, a generally spherical end 621 of the light source housing 620 is configured to be received by the mounting component 630, which is a correspondingly shaped so as to provide a close fit so that movement between the mounting component 630 and the light source housing 620 is restricted by friction.
- [0104] The spherical end 621 has a plurality of voids 635 formed therein and extending inwardly from an outer periphery 622 of the light source housing 620. The voids 635 may take many forms such as, for example, gaps, slits or apertures, and may be formed during a moulding operation or in secondary operation post moulding, such as a machining or cutting operation, for example.
- [0105] In the illustrated embodiment, the light source housing 620 is provided with 4 voids, though it will be appreciated that the number and size of the voids may be varied. In this regard, it may be preferable to provide between 1 and 10 voids in the light source housing 620. Tabs 636 are formed between the voids 635 and the tabs 636 move radially inwardly and outwardly to allow for flexing of the light source housing 620 so that an outer periphery 622 of the generally spherical end 621 can expand and/or contract to allow the light source housing 620 and the mounting component 630 to be assembled together in snap fitting arrangement.
- [0106] In the depicted embodiment, voids 635 are formed in the light source housing 620, though it will be appreciated that voids may similarly be formed in the mounting component 630 so that the mounting component 630 flexes during assembly. Furthermore, voids may be formed in both the light source housing 620 and the mounting component 630.
- [0107] Although the light source housing 620 is illustrated as being above the mounting component 630 in the exploded view, during assembly the heat sink 610 is inserted through the mounting component 630 from below and the light source housing 620

moved upwardly to bring the light source housing 120 into snap fitting engagement with the mounting component.

- [0108] The above described luminaires are all capable of adjustment so as to vary the orientation of the light beam. It will be appreciated that the capacity for adjustment may be achieved in a variety of ways and Figures 17 to 38 illustrate further housing/mounting component pairs that provide alternative methods of adjustment. It will be appreciated that the previously described and illustrated luminaires may be modified to incorporate the features to be further described below and illustrated in Figures 17 to 38.
- [0109] Figures 17 to 21 illustrate a first alternative housing/mounting pair in which a light source housing 720 and mounting component 730 is provided. An outer wall 721 of the light source housing 720 is resiliently flexible so that it can be manipulated between a first, compressed condition 720a and a second, natural or expanded condition 720b. As can be seen from Figures 17 to 20b, the light source housing 720 is held in the first, compressed condition and brought into contact with, so as to be received by, the mounting component 730. As illustrated in Figure 20, once the light source housing 720 has been received in the mounting component 730 it is released from the compressed condition 720a and takes the natural/expanded condition 720b in which the light source housing 720 is retained in the mounting component 730.
- [0110] It will be appreciated that the light sourcing housing 720 will be formed of a material having suitable elastic properties so that the outer wall 721 may move between the first, compressed condition 720a and the second, natural or expanded condition 720b with relative ease, though resist movement from the second condition so as to stay retained in the mounting component 730.
- [0111] Figures 22 to 24 illustrate a second alternative housing/mounting pair in which a light source housing 820 and mounting component 830 is provided. The light source housing 820 and the mounting component 830 are each configured so that portions which interface are complimentary shaped so that the light source housing 820 can be received in the mounting component 830 in a manner which allows the orientation of the light source housing 820 to be readily adjusted. The light source housing 820 is frusto-spherical and an inner surface of the outer wall 821 provides a surface against which a surface of outer wall 823 of the mounting component 830 can bear.
- [0112] The mounting component 830 is also frusto-spherical and is sized so that the outer surface of the outer wall 823 is closefitting to and tightly received against an inner surface of the outer wall 823 of the light source housing 820, thereby providing retention of the light source housing 820 yet allowing sliding movement between the light source housing 820 and the mounting component 830 to allow the orientation of the light beam to be varied.
- [0113] It will be appreciated that either or both of the light source housing 820 and mounting component 830 will be formed of a resilient material to facilitate assembly and provide retention post assembly.
- [0114] Figures 25 to 27 illustrate a further alternative light source housing/mounting component pair in which a light source housing 920 and mounting component 930 is

provided. Again, the light source housing 920 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 930, thereby providing retention of the light source housing 920 yet allowing sliding movement between the light source housing 920 and the mounting component 930 to allow the orientation of the light beam to be varied.

- [0115] In the illustrated alternative, the frusto-spherical portion is formed by an upturned wall 921 of the light source housing 920. As the wall terminates at a free surface, it is resilient and can flex to allow assembly of the light source housing 920 and the mounting component 930. It will again be appreciated that either or both of the light source housing 920 and mounting component 930 can be formed of a resilient material to facilitate assembly and provide retention post assembly.
- [0116] Figures 28 to 34 illustrate a further alternative light source housing/mounting component pair in which a light source housing 1020 and mounting component 1030 is provided. Again, the light source housing 1020 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 1030, thereby providing retention of the light source housing 1020 yet allowing sliding movement between the light source housing 1020 and the mounting component 1030 to allow the orientation of the light beam to be varied.
- [0117] In the illustrated embodiment, the mounting component is formed with a wall 1031 which provides a surface against which a frusto-spherical portion of the light source housing 1020 can be received. The wall 1031 is truncated, as can be seen in Figure 30, so that it does not extend completely around the light source housing 1020. The mounting component 1030 is also formed with voids 1032 so as to form resilient fingers 1033 that, in use, extend around the light source housing 1020 to retain the light source housing 1020 and the mounting component 1030 together. The fingers 1031 are cantilevered members that flex to allow assembly of the light source housing 1020 and mounting component 1030.
- [0118] Figures 35 to 38 illustrate a further alternative light source housing/mounting component pair in which a light source housing 1120 and mounting component 1130 is provided. Again, the light source housing 1120 is provided with a frusto-spherical portion which is configured to be received in a correspondingly shaped portion of the mounting component 1130, thereby providing retention of the light source housing 1120 yet allowing sliding movement between the light source housing 1120 and the mounting component 1130 to allow the orientation of the light beam to be varied.
- [0119] The light source housing 1120 has voids 1121 formed in an outer surface thereof, with resilient walls 1123 being disposed between the voids 1121. In the illustrated embodiment, three voids 1121 are provided, though it will be appreciated that arrangements having two or more voids may also function satisfactorily.
- [0120] An outer surface of the resilient walls 1123 is generally frusto-spherical which is configured to be received in a spherical socket portion of the mounting component 1130. The resilience of the walls 1123 acts to retain the light source housing 1120 and the mounting component 1130 together, though allowing assembly of the light source housing 1120 and mounting component 1130.

- [0121] In each of the alternative light source housing/mounting component pairs illustrated in Figures 17 to 38, it will be appreciated that the arrangements operate in a similar manner to a ball and socket type joint to allow changes of orientation of the light beam in multiple dimensions. In this regard, the light source housing and mounting component pair provides rotation about both longitudinal and transverse axis.
- [0122] While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.
- [0123] Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.
- [0124] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge, in the field of endeavour to which this specification relates.