An Electrical Fitting Adapted to be Recessed in a Partition and Support an Electrical and/or Electronic Device

The present invention relates to an electrical fitting adapted to be recessed in a partition/panel and support an electrical or electronic device. In particularly, but not exclusively, the invention relates to a down light fitting comprising one or more solid state light sources.

US8240871 describes a bezel that is incorporated with a heat sink arranged, in one embodiment, to be mounted into and mate with corresponding vanes in a light bulb so that heat from the bulb is transferred to the heat sink. The heat sink and bulb are then mounted into a can that is supported onto a rearward side of the panel. This arrangement requires a relatively bulky and expensive light unit which incorporates a heat sink and electronics of its own.

GB2462155 relates to a recessed light fitting having a plate member arranged to occlude an aperture in the ceiling through which the fitting is recessed. Onto a rearward side of this plate is mounted a printing circuit board driving LEDs that are arranged to provide light through holes in the plate. Mounted to the other side of the PCB is a heat sink. The heat sink is provided with spring clamping means so that a traditional can is not required. This allows the heat sink to operate more effectively to dissipate heat from the PCB. Power is supplied to the PCB through wiring that passes through a channel in the heat sink.

A problem with this design is that if the PCB or LEDs fail, or if a different bezel is desired, it is necessary to remove and replace the whole unit. It can be difficult to remove the unit from the ceiling without the clamping springs damaging the panel around the aperture. Further, the holes in the plate may also retard the plate's ability to provide optimum fire resistance.

The present invention was devised with the aim of overcoming or at least ameliorating some these aforementioned problems.

According to the invention there is provided an electrical fitting adapted to be recessed in a panel and support an electrical and/or electronic device; the fitting comprising a first unit, the first unit having: means to be secured to the panel; a body; means to releasably support a second unit on a first side of the panel; and a heat sink arranged on a first side of the body and in thermal contact with the body to dissipate heat away on a second, opposite, side of the panel; the second unit comprising the electrical or electronic device; and the means to releasably support the second unit supports the second unit against a second side of the body so that heat from the electrical or electronic device can conduct through the body and into the heat sink.

~~an electrical fitting adapted to be recessed in a panel and support an electrical and/or electronic device; the fitting comprising a first unit having means to be secured to the panel; a body; a heat sink arranged on a first side of the body and in thermal contact with the body to dissipate heat away on a second side of the panel; and comprising means to releasably support, against a second side of the body, a second unit comprising the electrical or electronic device, so that heat from the electrical or electronic device can conduct through the body and into the heat sink.~~

Through use of the invention it is possible to remove and replace the electrical/electronic unit without the need to remove the whole fitting from the panel, thereby greatly simplifying the process of replacing the electrical/electronic device and/or bezel (where applicable) whilst avoiding causing damage to the panel through removal of the fitting.

In a preferred embodiment the electrical/electronic unit includes a light source, preferably a solid state light source such as a light emitting diode and associated printed circuit board upon which it is mounted.

As heat is transferred through the body to the heat sink where it may be dissipated into air on the opposite side of the body/panel to the second unit, there is no need to provide the second unit with its own heat sink. This simplifies the second unit so that it can be both cheaper to make and smaller.

Typically, electrical power is supplied to the second unit through the first unit. If, as is desired in preferred embodiments, the circuitry required to provide the driving voltage to the printed circuit board holding the light emitting diode(s) is arranged such that the driving voltage is provided from the first unit to the second unit, there is also no need for the second unit to comprise this circuitry which simplifies the second unit further. The circuitry may be incorporated as part of the first unit, or may be separate, with the first unit arranged to be connected to an electrical output of the circuitry. When separate, this circuitry may be used to drive the light sources of multiple fittings.

The body may comprise an electrical contact against which a corresponding electrical contact of the second unit, when supported, rests in order to provide electrical power to the second unit. This means that the second unit can be freely removed and replaced without need for rewiring.

Preferably a face of the second side of the body is provided with, and optionally defines, at least one of the electrical contacts. The face may be arranged to lie against a corresponding face of the second unit so that heat can conduct there between. Thus the face provides a dual function.

It is possible for the body and heat sink to be formed as a single piece or to be comprised from separated pieces. Where it is the later, it is preferred that the body and the heat sink are mounted together so as to be in good thermal contact.

Advantageously the body, when the fitting is installed, extends beyond the periphery of the aperture to face the first side of the panel. To do this the body may be provided with a peripheral flange. This enables the body to form part of the means to secure the first unit to the panel. Preferably, the body extends substantially around the periphery of the aperture so that a seal can be formed between the body and the first side of the

panel. This allows the body to act to seal the aperture in the panel in order to retard the passage of fire from one side of the panel to the other.

Advantageously, the first unit comprises clamping means to clamp the first unit against a first side and a second side of the panel. Preferably the clamping means comprises clamping members arranged, when installed, to engage against the second side of the panel. The clamping members may be mounted directly to the heat sink; this removes the need for a can that would reduce the effectiveness of the heat sink to dissipate heat into the air on the second side of the panel.

It is preferred that the first unit is secured to the panel through a clamping action between the clamping members on the second side of the panel and the body on the first side of the panel. The body may be pressed directly against the first side of the panel, though in certain embodiments material, such as an intumescent material (moulded or otherwise), may sit between the body and the panel.

In a preferred embodiment the heat sink acts to provide an electrical connection to the second unit. Preferably the clamping means also acts to provide an electrical connection to the second unit. This removes the need to provide the fitting with additional wiring.

To improve fire rating properties, it is preferred that the electrical fitting comprises an intumescent material to retard the passage of fire through a gap between the panel and the fitting. The intumescent material may also be arranged to electrically insulate parts of the first unit having different electrical polarities.

In order to improve heat transfer from the heat sink, it is preferred that the heat sink comprises fins.

It is preferred that the body comprises means to releasably support the second unit. To do this the body may comprises a fitting means such one or more clips or protrusions to engage with corresponding clips/protrusions of the second unit. Alternatively or in addition, the body may comprise a threaded portion to engage with a thread of the second unit. It is preferred that the means to releasably support the second unit is provided by the peripheral flange of the body.

The second unit may comprises a bezel in which the lighting source is mounted, the bezel preferably comprises means for mounting the second unit to the first unit and being arranged, when so mounted to substantially cover the whole of the body so as to provide an aesthetically pleasing cover.

According to a second aspect of the invention there is provided a second unit suitable to be releasably mounted to the first unit, the second unit comprising an electrical and/or electronic device, a thermally conductive contact surface arranged, when mounted to the first unit to lie against the body of the first unit in order to transfer heat from the second unit into the body, the second unit further comprising an electrical contact through which electrical power is supplied from the first unit to the second unit; and wherein the second unit comprises a bezel in which the light source is mounted. ~~.~~

The contact surface may comprise and/or define the electrical contact through which electrical power is supplied from the first unit to the second unit.

~~It is preferred that the second unit comprises a~~The bezel may ~~having~~ have means for mounting the second unit to the body of the first unit. The bezel may be arranged and sized to substantially wholly cover the body when the second unit is mounted to the body.

The invention will now be described by way of example with reference to the following figures in which:

Figure 1 is a perspective view of a down lighter recessed in a panel, the panel being shown in cross-section through the aperture;

Figure 2 is a perspective exploded view of the down lighter of Fig 1;

Figure 3 is side view cross-section of the down lighter recessed in the panel;

Figure 4 is a perspective top view of the light unit for mounting on the fitting of the down lighter;

Figure 5 is a perspective view of a second embodiment of a down lighter;

Figure 6 is a perspective exploded view of the down lighter of Fig 5;

Figure 7 is a side view cross-section of the second embodiment of down lighter recessed in the panel; and

Figure 8 is a perspective top view of the light unit of the second embodiment for mounting on the fitting of the down lighter

The fixture comprises a fitting 1, which is adapted to pass through an aperture 2A within a panel 2 and be secured thereto, and a light unit 3 comprising at least one light emitting diode (LED) 23 that can be releasably mounted to the fitting 1.

The fitting 1 comprises a heat sink 4, which also forms the main body of the fitting 1. To promote heat transfer from the heat sink 4 to the surrounding air, the outer surface of heat sink 4 defines radially extending vanes 4A. The heat sink 4 is mounted (preferably by fixings though additionally/alternatively with adhesive) to an upperside of an end plate 5 having a central recess 5A, a outer recess 5B, peripheral rim 5C and an aperture 5D. Mounted to the underside of the peripheral rim 5C are two clips 5E. The underside (as viewed in Figs 2 & 3) of the end plate 5 provides an interface against which light unit 3 is mounted and through which heat from the light unit 3 is conducted to the heat sink 4 and through which electrical power is supplied to the LEDs 23.

Mounted to the top of the heat sink 4 is a housing 40 holding circuitry to drive the LEDs 23 of the light unit 3. The circuitry is arranged to be connected to a power source, such as mains electricity supply via wiring mounted behind the panel 2. The

circuitry may comprise a transformer to convert the main supply to a voltage suitable to power the LEDs 23, and/or a AC/DC converter.

Passing though the aperture 5D and extending through the heat sink 4 is a threaded bolt 6 having a head 6A. The bolt 6 is mounted so as to be electrically isolated from the heat sink 4 and free to rotate about its primary axis with little or no translational movement relative to the heat sink 4. The bolt head 6A is arranged to sit within the central recess 5A so as to form an electrical terminal for contact with the second unit 3.

Mounted onto the thread of the bolt 6 is a nut 7 having a corresponding inner thread. Seated over the nut 7 are two clamping arms 8 which extend away from the bolt 6 in diametrically opposing directions. Also secured to the nut 7 is a leaf spring 9 that acts to bias the clamping arms 8 radially outwardly. The clamping arms 8 are mounted within and extend radially outwards from the outer periphery of the heat sink 4 through a slot 4B which also acts to restrict rotation of the arms 8, spring 9 and nut 7 whilst the bolt 6 is rotating. Rotation of the bolt 6 thus causes the nut 7, clamping arms 8 and spring 9 to be drawn upwards or downwards along the slot 4B depending on the direction of rotation of the bolt 6.

Supported on an upper side (as viewed in Fig 3) of the end plate 5 is a moulding 10 of intumescent material. The moulding 10 comprises a central aperture 10A, aligned with aperture 5D of plate 5, through which bolt 6 passes. The bolt 6 is electrically isolated from the plate 5 by an electrically insulating washer 6B. The bolt head 6A/washer 6B act to occlude aperture 5C.

To mount the fitting 1 to the panel 2, the fitting 1 is passed through aperture 2A from the underside (as viewed in Fig 1 & 3) of the panel 2 until upper face of rim 5C abuts the lower side 2C of panel 2. As the fitting 1 is passed through, clamping members 8 retract radially inwards as they come into contact with the peripheral wall of aperture 2A. Once clear of the aperture 2A, they spring open under bias from spring 9 so that the distance between the radial extremities of the clamping members 8 is longer than

the diameter of the aperture 2A. Bolt 6 is then rotated, using a tool or by hand, so as to draw the clamping members 8 along the slot and downwards against the upper side 2B (as viewed in Fig 1) of the panel 2. The fitting 1 is retained to the panel 2 through a clamping action of the clamping members 8 against the upper side 2B of the panel 2 and the peripheral rim 5C against the lower side 2C of the panel 2. Once installed, the end plate 5, which is seated (and so preferably sealed) against the lower side 2C of the panel, acts to occlude aperture 2A to provide a fire resistant barrier across the aperture 2A.

The intumescent moulding 10 sits within the aperture 2A in order to retard the passage of fire through the aperture 2A should the clamping action fail to seal the plate 5 against the underside 2C of panel 2.

To remove the fitting 1, the bolt 6 is rotated in the opposite direction to before. This causes the nut 7 to rise along the thread and the clamping arms 8 to move along the slot away from the upper surface 2B of panel 2. Further rotation of the bolt 6 causes arms 8 to urge against an upper edge 4C of slot 4B of heat sink 4 causing the arms 8 to rotate downwards and radially inwards towards bolt 6. Once the clamping arms 8 have pivoted sufficiently that the distance between their extremities is less than the diameter of the aperture 2A, the fitting 1 can be drawn through the aperture 2A and removed from the panel 2 with minimal risk of damage to the panel 2.

The positive electrical terminal from the output of circuitry in housing 40 is connected to the bolt 6 so that the bolt head 6A forms a positive terminal; the negative terminal is connected to the heat sink 4 so that the plate 5, which is electrically connected to the heat sink 4, acts as a negative electrical terminal. In alternative embodiments the polarity of these terminals could be swapped.

The clamping arms 8, being mounted to the bolt 6 may be arranged to be electrically insulated from the bolt 6. Notwithstanding, the panel 2, usually being formed of an insulating material such as plaster, provides electrical isolation between the clamping arms and the heatsink4/plate5.

The heat sink 4, end plate 5 and bolt/screw 6 are preferably formed of steel or other metal in order that they are good electrical conductors, and in the case of the plate 5 and heat sink 4, good conductors of heat as well. The preferred choice for the plate and bolt is steel as it has a melting point above 900^{o}C.

The light unit 3 comprises a bezel 30, a lens 32, LEDs 23/PCB 31 and~~,~~ electrical connector 33 mounted to an upper side of the PCB 31. Also attached to upper side of the PCB 31 is an annular layer of thermally and electrically conducting material 34 which acts as a second electrical contact.

The electrically conducting material preferably comprises a high thermal conductive graphite sheet or membrane such as supplied by Tanyuan Technology Development Co. Ltd. under the name TGSTM, or T-GON-810 supplied by DK Thermal.

To mount the light unit 3 to the fitting 1, the unit 3 is placed against the underside of end plate 5 and rotated so that clips 5E slide under projections 30A of bezel 30. In the mounted configuration, the upper side of plate 30 sits within recess 5B. The bezel 30 covers the whole of the plate 5 to provide a cosmetic finish.

When the light unit 3 is mounted to the end plate 5, the electrical contact 33 makes contact with bolt head 6A and the annular material 34 makes contact with the underside face plate 5 thereby forming an electric circuit to power the LED 23/PCB 31. Heat from the LED23/PCB 31 conducts into the heat sink 4 via the interface between the annular layer 34, and the end plate 5. The annulus 34 provides a large area to interface with plate 5 to provide good conduction of heat from the light unit 3 to plate 5 and into the heat sink 4.

The light unit 3 can be similarly removed from the fitting 1 when required, e.g. to paint the panel around the fitting, because one or more of the LEDs has failed or if a different shape/colour of bezel is desired, by rotating the unit 3 in the opposite direction to before until the unit 3 is released from clips 5E.

Figures 5 – 8 illustrate an alternative embodiment. Equivalent parts are similarly numbered. The fitting 100 is adapted to be mounted and clamped to the panel 2 in the same way.

The fitting 100 comprises an end plate 5 that omits the outer recess, and thus has a comparatively flat underside as compared with the plate of the first embodiment. The bolt head 6A sits within a central recess such that its face lies substantially flush with the underside of plate 5. Mounted to the underside of the plate 5 is an annular member 43. The radially inward facing wall of the annular member 43 is provided with a thread 43A. The annual member 43 is also provided with two conductive tracks 42, 42A for electrical connection with the light unit 300 to provide power thereto. Preferably the tracks 42, 43 are formed as two co-axial rings. An electrical connection is provided between the tracks 42, 42A and the circuitry in housing 40 by wires (not shown) that extend through heat sink 4, and end plate 5.

As the annular member 43 is mounted to the underside of plate 5, it need not be formed of a material that acts as a fire barrier. Consequently, the annual member 43 is preferably comprised from a moulding of synthetic plastics material. An annular layer of graphite membrane 34A is mounted to the underside of end plate 5 so as to face into the aperture through the annular member 43. The aperture in the annular graphite membrane provides access to the bolt head 6A to enable operation of the clamping mechanism.

An intumescent moulding 10 is supported around the heat sink 4 by an interference fit. Preferably the intumescent material is positioned such that when the fitting is mounted to the panel, the intumescent material sits within the aperture 2A. Alternatively or in addition, a ring of intumescent material (not shown) may be supported between upward facing side of the end plate 5 and the downward facing side of the panel. In this latter variation, the end plate 5 may be provide with an annual channel in its upper face to house the intumescent material so that the end plate 5 will lie flush with the panel 2.

The light unit 300 comprises a bezel 30 having an outer rim 30A and an inner rim 30B, the inner rim having on its radially outward wall a tread 44. The light unit 300 further comprises lens 32, LEDs 23 & PCB 31 that sit within the inner rim 30B. Mounted to the upper side of the PCB 31 is a layer of graphite membrane 34B. Two electrical contacts 41, 41A extend radially away from PCB 31, passing through inner rim 30B and comprise an upwardly extending portion.

To mount the light unit 300 to the fitting 100, the unit 300 is placed against the underside of end plate 5 and rotated so that threads 43A of the annual member 43 and 44 of the bezel 30 engage. When mounted, the PCB 31 and possibly to an extent the LED 23, sit within the central recess provided by annular member 43 such that the graphite membranes 34A 34B are in contact to provide efficient heat transfer between the light unit 300 and end plate 5. The electrical contacts 41, 41A make contact with respective tracks 42 42A in order to provide electrical connection to the light unit 300.

The graphite membranes 34A 34B are compressible. When the light fitting 300 is tighten against the end plate 5, the graphite members can compress to allow the edge of rim 30A of bezel to extend slightly beyond the top face of the end plate 5. This enables the bezel to be pushed further towards and sit flush against the panel 2, as is aesthetic pleasing, in the instances the underside of the panel is not completely even.

In alternative embodiments, the end plate 5 may not be plate like, and/or may be integrally formed with the heat sink 4 or fixed to heat sink 4 by other means.

It is also possible in certain embodiments that the end plate 5 need not define the inner recess 5A.. The fitting may comprise more than two clamping members 8. Alternatively the fitting may be secured to the panel in some other way.

The bolt 6 could be replaced with any suitable elongate threaded member. The intumescent moulding is an optional component.

The fitting 1 and unit 3 may be secured together using means other than clips 5E or screw fastening.

Unit 3 may hold an electrical or electronic device other than or in addition to a light source such as a sensor, e.g. a smoke or heat sensor.

Claims

1. An electrical fitting adapted to be recessed in a panel and support an electrical and/or electronic device; the fitting comprising a first unit, the first unit having:

(i) means to be secured to the panel;

(ii) a body;

(iii) means to releasably support a second unit on a first side of the panel; and

~~(i)~~(iv) a heat sink arranged on a first side of the body and in thermal contact with the body to dissipate heat away on a second, opposite, side of the panel; ~~and~~

~~(iv) comprising means to releasably support a second unit;~~

the second unit comprising the electrical or electronic device; and

the means to releasably support the second unit, supports the second unit~~,~~ against a second side of the body~~,~~ ~~a second unit comprising the electrical or electronic device,~~ so that heat from the electrical or electronic device can conduct through the body and into the heat sink.

~~1.~~2. An electrical fitting according to claim 1 comprising means to be connected to an electrical power supply and wherein electrical power is supplied to the second unit through the first unit.

~~2.~~3. An electrical fitting according to claim 2 wherein the body comprises an electrical contact against which an electrical contact of the second unit, when supported, is brought into contact in order to provide electrical power to the second unit.

~~3.~~4. An electrical fitting according to claim 3 wherein a face of the second side of the body defines the electrical contact.

4.5. An electrical fitting according to claim 3 or 4 wherein the face is arranged to lie against a corresponding face of the second unit, when so supported, so that heat can conduct through the faces.

5.6. An electrical fitting according to any previous claim wherein the body, when the fitting is installed, extends beyond the periphery of the aperture to face the first side of the panel.

6.7. An electrical fitting according to claim 6 wherein the body extends substantially around the periphery of the aperture.

7.8. An electrical fitting according to any previous claim wherein the first unit comprising clamping means to clamp the first unit against a first and second sides of the panel.

8.9. An electrical fitting according to claim 8 comprising clamping members arranged, when installed, to rest against the second side of the panel.

9.10. An electrical fitting according to claim 9 wherein the clamping members are mounted to the heat sink.

10.11. An electrical fitting according to claim 8, 9 or 10 wherein the first unit is secured to the panel through a clamping action between the clamping members on the second side of the panel and the body on the first side of the panel.

11.12. An electrical fitting according to any previous claim wherein the heat sink acts to provide an electrical connection between a power supply and the second unit.

12.13. An electrical fitting according to claim 12 wherein the heat sink is electrically insulated from the clamping means, the later also forming part of the electrical connection between the power supply and the second unit.

~~13.~~14. An electrical fitting according to any previous claim comprising an intumescent material to retard the passage of fire through a gap between the panel and the electrical fitting.

~~14.~~15. An electrical fitting according to claim 14 wherein the intumescent material also acts to electrically insulate portions of the first unit which act to different electrical polarities.

~~15.~~16. An electrical fitting according to any previous claim wherein the electrical device comprises a light source.

~~16.~~17. An electrical fitting according to claim 16 wherein the light source comprises one or more solid state light sources.

~~17.~~18. An electrical fitting according to any previous claim wherein the first unit comprises circuitry that provides a suitable voltage to drive the light source.

~~18.~~19. An electrical fitting according to any previous claim wherein the heat sink comprises fins to improve heat transfer to air on a second side of the panel.

~~19.~~20. An electrical fitting according to any previous claim wherein the body comprises means to releasably support the second unit.

~~20.~~21. An electrical fitting according to any previous claim comprising the second unit which comprises a bezel in which the lighting source is mounted, the bezel having means for mounting the second unit to the first unit and being arranged, when so mounted, to substantially wholly cover the exposed face of the body.

~~21.~~22. An electrical fitting according to claim 5 wherein the face of the second side of the body and/or the corresponding face of the second unit is/are comprised in part~~-~~ from a compressible graphite membrane material.

~~22.~~23. An electrical fitting according to any claim 1 - 22 wherein the body is provided with a thread for releasable engagement with a thread portion of the second unit to releasably retain the second unit to the first unit.

~~23.~~24. An electrical fitting according to any claim 3 – 23 wherein the body comprises an annular member mounted to the second side of the body, the annular member having an electrical contact against which an electrical contact of the second unit, when supported, is brought into contact in order to provide electrical power to the second unit.

~~24.~~25. An electrical fitting according to any claim 1 – 23 wherein the body comprises an annular member mounted to the second side of the body, the annular member having a radially inward facing wall provided with a thread for retaining the second unit via a corresponding thread.

~~25.~~26. An electrical fitting according to any previous claim wherein the body is arranged, when installed, to sit at least partially on a first side of the panel and to substantially wholly occlude an aperture in the panel through which the electrical fitting is recessed.

~~26.~~27. An electrical fitting according to any previous claim wherein the body is supported within an aperture in the panel.

~~27.~~28. A second unit ~~suitable to be~~that is releasably ~~mounted~~ mountable to ~~the~~ a first unit of any claim 1 - ~~27~~20, the second unit comprising a~~n electrical and/or electronic~~light source ~~device~~, a thermally conductive contact surface arranged, when mounted to the first unit to lie against the body of the first unit in order to transfer heat from the second unit into the body, the second unit further comprising an electrical contact through which electrical power is supplied from the first unit to the second unit; and wherein the second unit comprises a bezel in which the light source is mounted.~~.~~

~~28.~~29. A second unit according to claim 28 wherein the contact surface also comprises and/or defines the electrical contact through which electrical power is supplied from the first unit to the second unit.

~~29.~~30. A second unit according to claim 28 or 29 ~~comprising a~~wherein the bezel ~~having~~ has means for mounting the second unit to the body of the first unit.

~~30.~~31. A second unit according to claim ~~29~~ 30 wherein the bezel is arranged and sized to substantially wholly cover the body when the second unit is mounted to the body.

~~31.~~32. A second unit according to claim ~~30 or 31~~2830 or 31 wherein the bezel comprises an upwardly extending rim having a means to be mounted to the body of the first unit.

~~32. A second unit according to claim 32~~ 31 ~~wherein the bezel comprises an upwardly extending rim having means to be mounted to the body of the first unit.~~