

ELECTRICAL OUTLET MOUNTS AND ILLUMINATION FOR CONDUCTIVE PANEL ASSEMBLIES

FIELD OF THE INVENTION

[001] The present invention relates to an AC/DC electrical mount for externally or internally mounting on a pair of conductive panes or conductive material on a pair of non-conductive pane's surface for powering electrical/electronic elements. The invention facilitates quick, and easy installation and allows access to the power supply at any location along the panes while offering an attractive finish with unobstructed view that favours installation in both commercial and domestic environment.

BACKGROUND

[002] The electrical system of any commercial or domestic space is a complex system of electrical wiring that terminates in light fittings, ceiling fans, switches or power points (wall outlets). Cable trucking is commonly used to hide and protect these wires but are generally considered an unsightly distraction to the aesthetics of the space. Various methods are commonly employed to hide electrical wiring and their conduits such as the use of a false ceiling to hide wiring to light fixtures, concealing trucking in cornices, carpentry, floor or within wall slots covered with plastering. Such installation requires additional maintenance and trap dirt easily.

[003] An elegant method of installing wiring is the use of "invisible" wiring systems consisting of very thin copper tracks that are barely noticeable once painted over. Such wiring is offered by specialist lighting providers such as http://www.hogarthlighting.co.uk/technical/invisible_wire.

[004] On the other end of the spectrum, the presence of wires is embraced and the proprietor of the commercial or domestic space adopts an industrial look by emphasising the trunking pipes with colour or material and turning them around as a design feature within the space. Such installation is labour intensive and involves an element of design which drives up cost.

[005] The layout of lighting and in general, the location of terminal electrical points based on all of the above described methods has to be considered at the initial stage of the interior design of any space since they are fixed once the wiring has been routed. Any repositioning of such points typically requires a professional electrician to rewire the electrical wiring.

[006] Some flexibility in the positioning of light fixtures is provided by electrical track lighting system where light fixtures are attached anywhere on a continuous track device which contains electrical conductors. This is in contrast to directly routing electrical wiring to individual light positions. Tracks can either be mounted to ceilings or walls, lengthwise down beams, or crosswise across rafters or joists. They can also be hung with rods from especially high places like vaulted ceilings. However, the positioning of light fixtures on such tracks are ultimately limited by the dimensions and positioning of the track. Wiring that supplies power to the track system still requires to be hidden/protected by conventional methods as previously discussed.

[007] Electrified tracks such as the Kontakt-Bord® by N&L ElektrotechnikGmbH and the GSS system™ by Eubiq Pte Ltd also available in the market that allow users to add, remove and reposition power outlets and various electrical appliances directly. The grooves that receives the power outlets and electrical appliances trap dirt and insects and are hard and hazardous to clean. The positioning of the outlets and appliances are also limited by the dimensions and positioning of the tracks.

[008] The present invention is based on the same principles of the inventor's earlier invention "LIGHT EMITTING DIODE PACKAGES AND THEIR USES" that has been granted in Singapore and Taiwan as patent number 2011027430 and patent number I491080 respectively. It discloses a novel mount for drawing power from a pair of conductive panes or conductive material on a pair of non-conductive pane's surface. The mount can be used to power electrical/electronic elements on the exposed surface of the panes or within the panes. The panes are envisioned to be installed in various parts of a building such as a ceiling, partition, window or wall or as a standalone display without the need for wiring across the surface.

[009] The invention is aesthetically pleasing with clean and unobstructed view for panes that are non-opaque since the panes are free of wires or trunking, easy to maintain, facilitates easy installation of electrical/electronic elements such as light fixtures across the entire surface where repositioning of such elements can easily be achieved by a layperson since no wiring and trunking is needed. Translucent patterns, images or pictures may further be applied to the exposed panel surface for decorative purposes.

SUMMARY OF THE INVENTION

[0010] In the present invention, novel electrical outlet mounts are disclosed for drawing power from a pair of spaced apart conductive panels or conductive material on a pair of non-conductive panels' surface secured by a frame or any other element of assembly. The space between the two panels electrically isolates them from one another, these two panels being active conductors and arranged to receive either Direct Current (DC) or Alternating Current (AC) from a power source, for example, for Singapore 230 volts at 50 Hz or DC of up to 120 V may be supplied to the conductive panels.

[0011] The electrical outlet mount has a back end and a front end, a first electrical contact element located at the back end arranged for electrical contact with a first conductive panel and a second electrical contact element located towards the front end, in spaced arrangement from the first electrical contact element for electrical contact with a second conductive panel.

[0012] The first and second conductive panels are spaced apart and arranged in a face-to-face relation. The two electrical contact elements of the outlet mount provide power lead-in to electrical/electronic elements and are arranged to define two substantially planar but spaced apart conducting planes, in mating relation with the pair of conducting panels or conductive material on a pair of non-conductive panels' surface.

[0013] The disclosed electrical mount is adapted to provide power lead in to electrical/electronic elements such as LED lights wholly disposed within the space between the panels as well as elements disposed externally to such space. In the case of the latter, an electrical receptacle is located in an opening located at the front end of the electrical mount.

[0014] Depending on the type of electrical/electronic element that is powered by the electrical mount, the electrical receptacle may be a threaded standard light socket such as E26/27, E12, SES/E14, a bayonet connector such as BC/B22, pin-type connector, a quick coupling light fixture connector or any types of customised socket.

[0015] For the electrical mount that powers elements disposed externally to the space between the panels, the electrical mount fits within an opening in the second conductive panel, such that the electrical receptacle is accessible from the exposed side of the second conductive panel. Typically, the electrical outlet mount is cylindrical in shape. However, rectilinear or outlet mounts

of other shapes are possible. The pair of conductive panels may be installed as the ceiling of a room, a room partition, feature wall, furniture, for use in signage, advertising boards, or simply as windows.

[0016] For establishing good electrical contact with the first panel, the first electrical contact may be a leaf, arched shaped, domed shaped, coiled spring or any other spring-like shape. The second contact element may be an integral fin extending transversely from the main axis of the mount. The second electrical contact element may at the same time be adapted to retain the electrical mount in the opening of the second panel.

[0017] The electrical outlet mount may be mounted on the opening of the second conductive panel by interference fit, where the hole is cut to closely match the exterior dimension of the electrical mount.

[0018] Where the electrical outlet mount is cylindrical, a threaded female coupling ring (fastener) adapted to be connected to threads located on the external surface of the front end of the electrical mount may be provided. Engaging and further turning of the coupling ring (fastener) in the tightening direction on the electrical mount tightens the second contact element against the inner conductive surface of the second panel, leading to good electrical contact between the second contact element and the second panel.

[0019] Other forms of coupling mechanism may be contemplated, such as ratchet and paw engagement commonly seen in cable ties between the coupling member and distal end of the electrical mount. Such coupling mechanism will be applicable to rectilinear or mounts of other shapes. When the coupling member is made of metal (non-metal material can be used as well), a protective insulator cap is provided. For a splash proof or even water proof installation, a gasket seal/O-ring may additionally be provided to seal the insulator cap. When the electrical receptacle is adapted to receive a light element, the insulator cap may be integrally formed with a light reflector. This light reflector can be further sealed with transparent cover for splash proof usage. This insulator cap and light reflector can be in any form or shaped for aesthetic purposes.

[0020] For electrical loads of higher amperage, sections of the panel assembly that make electrical contact with the electrical outlet mount can also be further enhanced with conductive materials, e.g. silver conductive frit.

[0021] In another embodiment, the present invention provides a panel assembly comprising two spaced apart, non-opaque panels arranged in a face-to-face relation, wherein each of the two inside surfaces of the panel assembly has an electrically conductive layer; and an electrical mount mounted within the space between the panels, in electrical contact with both spaced apart panels, so that a power supply, connectable to said electrically conductive layers, delivers electric power to power electrical/electronic elements such as LED lights wholly disposed within the space between the panels.

[0022] In yet another embodiment, the present invention provides a panel assembly comprising two spaced apart, non-opaque panels arranged in a face-to-face relation, wherein each of the two inside surfaces of the panel assembly has an electrically conductive layer; and an electrical outlet mount mounted on an opening of the second panel and in electrical contact with both spaced apart panels, so that a power supply, connectable to said electrically conductive layers, delivers electric power to power an electrical receptacle located at a front end of the electrical mount.

Brief Description of the Drawings

[0023] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0024] FIG. 1 is a partial exploded plan view of an electrical outlet mount according to an embodiment of the present invention.

[0025] FIG. 2 is a plan view of the electrical outlet mount of FIG 1 after panel 20 has been secured in position.

[0026] FIG. 3 is a plan view of the electrical outlet mount of FIG 1 whereby a lamp reflector is integrally formed with the insulator cap.

[0027]

[0028] FIG. 4 shows a lamp reflector with gasket/O-ring and fully sealed transparent cover on the front end for splash proof usage.

[0029] FIG. 5 illustrates the side and corresponding front view of a panel assembly with a number of electrical outlet mounts mounted on the assembly.

[0030] FIG. 6 illustrates a double-glazed window pane with lighted firefighting access triangle powered by a border of solar panels.

[0031] FIGs. 7A – 7C illustrates various of ways of supplying power to the lighted firefighting access triangle of FIG. 6

DETAILED DESCRIPTION

[0032] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0033] FIG 1 is a partial exploded plan view of an electrical outlet mount **100** mounted on a panel assembly comprising a pair of conductive panels **10** and **20**. The panel assembly may be installed vertically in a room as a wall partition, wall feature or as a double glaze window pane. When installed horizontally, the panel assembly may function as the ceiling of a room. Panels **10** and **20** can be made of non-conductive material such as glass, polycarbonate, acrylic, plastic, wood with conductive material applied on the inner surface or with metallic strips bonded on the inner surface. The conductive material may additionally be conductive tape, glue or ink. Where the panels are made of non-opaque material such as glass, polycarbonate, acrylic, plastic, the conductive material is preferably transparent conductive oxide (TCO) coating such as indium tin oxide (ITO) so that light passing across the panels is not obscured.

[0034] The main body **90** of electrical outlet mount **100** is a cylindrical metal ring with threads located on the external surface of its front end and its interior walls. An annular conductive fin **50** located near the back end extends from the external surface of the main body **90**, transversely to the metal ring's central axis X-X'. First electrical contact **40** is a metal cap designed to fit over the back end of main body **90**, and electrically insulated from main body **90** by electrical insulator **60** sandwiched between the first electrical contact **40** and main body **90**.

[0035] Electrical contact **40** is arranged for contact with the inner surface of panel **20**. For reliable electrical contact with panel **20**, one or more resilient members in the form of a leaf spring bias electrical contact **40** against the inner surface of panel **20**. The space defined by the interior walls of the main body **90**, electrical insulator **60** and electrical contact **40** forms electrical receptacle **70** which is adapted to receive a standard E27 bulb. Another resilient member of electrical contact **40** extends through a gap in the electrical insulator **60** into receptacle **70** for electrical contact with the bottom terminal contact of the E27 bulb.

[0036] Annular conductive fin **50** functions as the second electrical contact of the electrical outlet mount **100** for electrical contact with the inner surface of panel **10**. As conductive fin **50** and main body **90** are integrally formed, electric charge can flow between the inner surface of panel **10** and the interior walls of main body **90**.

[0037] When electrical mount **100** is mounted onto the panel assembly, main body **90** is inserted through an opening formed in panel **10** such that its front end extends out from the exposed side of panel **10** and conductive fin **50** abuts against the inner surface of panel **10**. Electrical insulator **60** and first electrical contact **40** may be fitted onto the back end of main body **90** before or after insertion of main body **90** into the opening of panel **10**. Screws indicated by dotted lines extending across aligned through holes in electrical insulator **60** and main body **90** may be used to releasably secure electrical insulator **60** to main body **90**.

[0038] On the exposed side of panel **10**, a fastener **30** with mating thread couples with the front end of main body **90**. Engaging and further turning of fastener **30** in the tightening direction draws conductive fin **50** tightly against the inner surface of panel **10**, ensuring good electrical contact between conductive fin **50** and the inner surface of panel **10**. The inner surface of panel **10** that comes into contact with conductive fin **50** may be coated with silver conductive frit for enhanced conductivity when the intended electrical load is of high amperage. Fastener **30** may be coupled with main body **90** of electrical outlet mount **100** through other fastening means such as ratchet and paw or snap fit. As fastener **30** is typically made of metal, a protective insulator cover **80** is provided to fit over fastener **30**, shielding users from inadvertent contact. The insulation cover **80** can be in any design, form or shape for aesthetic purposes.

[0039] After electrical insulator **60** and electrical contact **40** has been fitted onto the main body, panel **20** is secured in position relative to panel **10**. The dimensions of mount **100** is arranged such

that a close fit is established between panel **20** and flat bottom end of mount **100** after panel **20** is secured in position as shown in FIG 2. Specifically, after panel 20 is secured in position, the depth of the section of mount 100 that extends into the internal space of the panel assembly (D_m) is essentially the same as the distance between panel 10 and panel 20 (D_p). It is however not critical D_m and D_p are exactly the same, a slight difference is acceptable as long as electrical contact **40** can maintain good electrical contact with panel **20**. A DC or AC current is passed across the panel assembly and powers the bulb that is inserted into the electrical receptacle **70**. When the current is AC, preferably panel **20** is connected to live wire and panel **10** connected to the neutral wire.

[0040] Referring to FIGs 3 and 4, the same mount **100** is shown with a lamp reflector integrally formed with protective insulator cover **80**. As seen in FIG 3, an O-ring **85** may be provided to insulator cover **80** to create a fluid-tight seal. The lamp reflector is also further sealed with a transparent cover **95** for splash-proof usage. Transparent cover **95** is not limited to any size or shape.

[0041] FIG 5 provides the side and corresponding front view of a panel assembly installed with a number of electrical outlet mounts **100**. The panel assembly is made of glass and the interior surface of the assembly **15** is coated with transparent conductive oxide (TCO) coating such as indium tin oxide (ITO). Electrical receptacle **70** of the first electrical outlet mount **100** powers a light bulb. With suitable adapters, the other three electrical outlet mounts **100** can have other usages or purposes, e.g. by using a USB power adapter (E27/USB), mounts **100** are adapted to receive and power USB devices power.

[0042] Alternatively, an adaptor with car charger socket (12V/24V) arranged with a E27 base can be used on the electrical mount **100**. When the power input is AC, such adaptor includes an AC to DC power converter to convert the output to the corresponding socket voltage.

[0043] Due to the transparency of the panel assembly, mounts **100** appear floating in space with no apparent wires leading to the mounts. This interesting and attractive way of powering lights, USB devices and other electrical/electronic elements can have many applications in residential and commercial buildings and even art installations. The surface of a glass panel assembly may also be decorated for example by etching or paint for improved aesthetic appeal. When the panel assembly is installed as the ceiling and the mounts are used to power lights, the transparency of the panel makes the ceiling appear higher than it is, thus allowing rooms with low ceilings appear less claustrophobic.

[0044] The main advantage of the invention, however is that re-wiring is not necessary if mounts **100** are repositioned anywhere on the exposed side of the panel assembly. The panel assembly may also be made of other material such as wood with a thin layer of metal bonded on its interior surface, or other types of non-conductive material as determined by the design or purpose of panel.

[0045] FIG 6 shows a double-glazed window pane with lighted firefighting access signage **200** and a solar panel border. The firefighting access signage **200**, solar panel **250** and rechargeable battery **260** are completely embedded within the space between the two layers of glass.

[0046] As seen in FIGs 7A to 7C which is the side on view of an embedded lighted firefighting access signage **200**, various means of powering the firefighting access signage **200** may be employed. The lower face of window pane of FIGs 6A to 6C is the exterior facing side of the window pane. FIG 7A is the side-on view of FIG 6. Solar cells which may be mono/poly crystalline cells, thin film solar cells such as amorphous silicon, cadmium telluride forming solar panel **250** disposed within the window pane arranged around the border of the window pane to charge lithium-ion batteries **260** similarly disposed within the window pane. Transparent solar cells that absorb only infrared and ultraviolet light may be used for unobstructed view through the pane. Alternatively, as shown in FIG 7B, the rechargeable battery is placed externally to the window pane, which is ideal when transparent solar cells are used. The rechargeable battery may also be charged by external power source to act as power backup in case of solar panel failure. As shown in FIG 7C, the firefighting access signage **200** can also simply be powered by the mains using an AC/DC adaptor **270**.

[0047] The fire access signage **200** comprises a number of connected light elements, preferably LEDs housed in a red or orange, translucent non-conductive housing. The colour and dimension of the signage is adapted to comply with local regulations such as Section 4.2.3(d) of "Chapter 4, SITE PLANNING EXTERNAL FIRE FIGHTING PROVISION" from the Singapore Civil Defence Force. Cathode terminals of the light emitting elements are linked to a common terminal, which is then electrically connected to a first contact element **210** lying essentially in same plane as the exterior facing side of the firefighting access signage **200**. Similarly, anode terminals of the light emitting elements are linked to a common terminal which is then electrically connected to the second contact element **220** lying essentially in same plane as the interior facing side of the firefighting access signage **200**.

[0048] First contact element **210** or both contact elements **210** and **220** may be formed with a leaf spring for reliable electrical contact with the inner conductive layers of the panel assembly. Such fire access signage **200** provides easy visual of the fire access windows both externally and internally during emergency. The self-powered embodiments of FIG 6A and 6B ensures that the signage is lit even during periods of interrupted mains supply.

[0049] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the present invention. For example, a panel assembly similar to FIG 7C where light elements are completely embedded within the space between two layers of glass may be used in ovens to provide illumination to the cooking area. For such instances, additional insulation will be provided to isolate the light elements from potential damage by the elevated temperatures generated by the oven.

Claims

1. An electrical mount for installation in a panel assembly of two spaced apart panels arranged in a face-to-face relation, where each of the two inside surfaces of said panel assembly has an electrical conductive layer, the mount comprising:
a main body, its back end disposed in the space between the two panels and its front end extending out on the exposed surface of the second panel from an opening in the second panel;
an electrical receptacle disposed in the front end of the main body; and
two contact elements supported by said main body for power lead-in to said electrical receptacle, wherein said two contact elements define two substantially planar but spaced apart contact planes.
2. An electrical mount according to claim 1, wherein said electrical receptacle is a threaded standard light socket such as E26/27, E12, SES/E14, a bayonet connector such as BC/B22, pin-type connector or a quick coupling light fixture connector or any other types of customised sockets.
3. An electrical mount according to claim 1 or 2, wherein the first of the said two contact element is disposed at the back end of said main body and the second contact element is spaced apart from and in a plane parallel to the first contact element.
4. An electrical mount according to claim 3, wherein the first of the said two contact elements comprises a spring member.
5. An electrical mount according to claim 4, wherein said spring member is a leaf, arch-shaped, dome-shaped, coiled spring or other spring-like shape.
6. An electrical mount according to any of one of claims 3-5, wherein the second contact element is a fin integral to said main body, extending transversely from the main axis of the main body.
7. An electrical mount according to claim 6, wherein the second contact element is adapted to retain the electrical mount in the opening of the second panel.

8. An electrical mount according to any of one of claims 1-7, additionally comprising a fastener to fasten the second contact element to the conductive surface of the second panel.
9. An electrical mount according to claim 8, wherein said fastener couples with the front end of said main body of the electrical mount by screw thread or ratchet and paw engagement.
10. An electrical mount according to claims 8 or 9, additionally comprising an insulator cap to insulate a user from physically contacting said fastener.
11. An electrical mount according to claim 10, wherein the insulator cap is provided with a gasket seal or O-ring for splash proof or waterproof installation.
12. An electrical mount according to claims 10 or 11, wherein the insulator cap is integrally formed with a light reflector.
13. An electrical mount according to claim 12, wherein the light reflector is in any form, shape, size or material.
14. An electrical mount according to claims 12 or 13, wherein the light reflector is sealed with a transparent cover for splash proof usage.
15. A conductive panel assembly comprising:
two spaced apart panels arranged in a face-to-face relation, where each of the two inside surfaces of said panel assembly has an electrically conductive layer, and
electrical mounts according to any of claims 1-14 such that an AC or DC power supply, connectable to said electrically conductive layers deliver electric power to electrical/electronic elements connected to said electrical receptacle.
16. A conductive panel assembly according to claim 15, wherein said panels comprise transparent glass, plastic, wood or any non-conductive materials.
17. A conductive panel assembly according to claims 15 or 16, wherein said electrical conductive layer is transparent, the conductive layer comprising transparent conductive oxide (TCO) coating such as indium tin oxide (ITO).

18. A conductive panel assembly according to claims 15 or 16, wherein said electrical conductive layer is conductive strip, tape, ink or glue.
19. A conductive panel assembly according to any of claims 15-18, wherein sections of said panel assembly that make contact with said electrical outlet mount is additionally coated with transparent conductive coating of higher conductivity, such as silver conductive frit.
20. Adapters for electrical mounts according to claims 2-14 to convert the receptacle of said electrical mount to cigarette lighter socket female or USB female receptacles.
21. An illuminated conductive panel assembly comprising:
two spaced apart, non-opaque panels arranged in a face-to-face relation, where each of the two inside surfaces of said panel assembly has a transparent electrically conductive layer; and
an electrical mount mounted within the space between the panels, in electrical contact with both spaced apart panels, so that a power supply, connectable to said electrically conductive layers, delivers electric power to power light emitting elements wholly disposed within the space between the panels.
22. A conductive panel assembly according to claim 21, wherein the light emitting element is a firefighting access signage.
23. A conductive panel assembly according to claims 21 or 22, wherein the power is supplied by a solar panel disposed within the space between the panels.
24. A conductive panel assembly according to claim 23, additionally comprising a rechargeable battery, the rechargeable battery charged by said solar panel and powering the light emitting elements during periods of darkness.
25. A conductive panel assembly according to claim 24, wherein the rechargeable battery is additionally charged by external power source.

- 26. A conductive panel assembly according to claims 24 or 25, wherein said the rechargeable battery may be housed within the conductive panel assembly or disposed externally to the conductive panel assembly.
- 27. A window pane comprising conductive panel assembly according to any of claims 21-26.
- 28. A ceiling comprising conductive panel assembly according to any of claims 15-19 and 21.
- 29. An oven comprising conductive panel assembly according to any of claims 15-19 and 21.