

ADAPTOR LOCKING DEVICE

Field of the invention

- 5 This invention relates to a locking device, an electrical power track housing and an adaptor for use with such housing.

Background of the invention

- 10 Conventional electrical power sockets used in electrical power track distribution systems are installed and engaged through a slot in an elongated housing which houses one or more electrical conducting bus bars. The push and rotate motion for the installation and engagement of such power sockets mean that the power socket units are easily installed by a user without a tool. The rotate and pull motion for the disengagement and removal
15 of such power sockets mean that the power socket units are easily removable without a tool.

- The power socket units being easily installed and removed results in disadvantages that includes, but are not limited to, not being able to control the number of available socket
20 outlets being served by an electrical circuit breaker in an installation. This poses a potential safety hazard since users may add power socket units beyond what is supported by the electrical circuit breaker and overload the installation.

- In addition, the ease of removing the power socket units may result in the absence of the
25 power socket units due to accidental or intentional removal of the power socket units. As such, these housings are generally not suitable for use in public spaces due to the cost involved in replacing the power socket units, or the user has to bring their personal power socket unit which is inconvenient and impractical for most users.

- 30 To mitigate the problem of unwarranted removal of power socket units, some power track electrical power distribution systems design their power socket units to be

individually locked by inhibiting the rotational motion of its engagement process. Such designs prove to be un-scalable as the locking mechanism has to be installed and activated on each and every socket unit on the power track. On certain designs, the addition of a locking mechanism inhibits the electrical switching of the socket unit resulting in an always “on” state of electrical supply, which may be hazardous and wasteful.

Summary of the invention

In a first aspect, there is provided a locking device for retaining at least one adaptor received in an electrical power track housing, the locking device comprises a bolt moveable between a locked position and an unlocked position, wherein in the locked position the bolt engages a retention wall of the adaptor to retain the adaptor in the electrical power track housing, and in the unlocked position the bolt disengages the retention wall to allow release of the adaptor.

The adaptor may be referred to as a tap off point, a power socket unit, or any device which draws electrical power from the housing and system. The bolt and adaptor is adapted in to fit each other, for example their shapes. The engagement between the bolt and the retention wall includes part or whole of the bolt. When the bolt is in the locked position one or more adaptors may be simultaneously secured to the housing, i.e. the adaptor/s cannot be removed or released from the housing. Preferably, additional adaptors cannot be inserted into the housing when the bolt is in the locked position. When the bolt is in the unlocked position, the adaptor can be removed from the housing by any user, or additional adaptors can be inserted to the housing.

Preferably, the bolt is elongate and adapted to retain a plurality of adaptors in the electrical power track housing.

Preferably, the locking device further comprises a control means for moving the bolt between the locked position and the unlocked position, wherein the control means is a cam, the cam is adapted to rotate about an axis.

Preferably the locking device, further comprises a connection member connected to the bolt, the connection member is adapted to be attached to the electrical power track housing and is disposed parallel to the bolt.

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More preferably, the locking device further comprises at least one strut, wherein the at least one strut connects the bolt and the connection member to allow movement of the bolt relative to the connection member.

10 More preferably, a surface of the bolt opposes a surface of the connection member, the opposing surfaces of the bolt and the connection member are corrugated and complementary to each other.

Preferably, the bolt further comprises a projection to engage with a ridge of the electrical
15 power track housing.

In a second aspect, there is provided an electrical power track housing for receiving and maintaining electrical contact with at least one adaptor, the electrical power track housing comprises: an opening for receiving the adaptor; a slot extending from the
20 opening into the housing; at least one channel extending from the slot; each channel comprising an electrical conductor for engaging with a conductive member of the adaptor; and a locking device as in the first aspect above.

Preferably, the electrical power track housing is elongate, and the opening, the slot, and
25 the at least one channel run longitudinally along a length of the elongate housing such that the housing provides electricity to the adaptor at any point along the length of the housing.

Preferably, the electrical power track housing further comprises a ridge at a bottom part
30 of the electrical power track housing to engage with a projection of the bolt.

Preferably, the electrical power track housing further comprises a cover for covering the opening.

5 More preferably, the cover comprises a plurality of pairs of opposing panels, each pair of opposing panels are biased in a closed position by a resilient means and are pushed apart to an open position when the adaptor is inserted into the opening.

10 More preferably, the electrical power track housing further comprises first and second recesses adjacent the opening, the first recess extending from the slot towards a first side of the housing, the second recess extending from the slot towards a second side of the housing, wherein the first and second recesses oppose each other and accommodate the opposing panels such that the opposing panels slide into the respective recesses when the opposing panels are pushed apart to the open position for insertion of the adaptor into the housing.

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Preferably, in the locked position the bolt is in the slot, and in the unlocked position the bolt is in a third recess.

More preferably, the third recess is furthest from the opening.

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More preferably, the electrical power track housing further comprises a ridge in the third recess, wherein the ridge engages with a projection of the bolt.

25 In a third aspect, there is provided an adaptor for connecting to and tapping off electrical power supply from an electrical power track housing, the adaptor comprises: an axle protruding on a first side of the adaptor; a plurality of arms extending from the axle, the plurality of arms are rotatable about a central axis of the axle in the same direction; each rotatable arm comprising a conductive member for engagement with an electrical conductor in the housing to form an electrical connection when inserted into the housing; each of the conductive member is electrically connected to a second side of the adaptor to provide a power outlet, the first and second sides oppose each other; and a

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retention wall formed across a side of the axle, wherein the retention wall engages a bolt of the housing when in a locked position and retains the adaptor in the electrical power track housing, and the bolt disengages with the retention wall when in an unlocked position to allow release of the adaptor.

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The term “power outlet” refers to the part of the adaptor which a user uses to connect a plug to draw electrical power from the housing, and also includes the power outlet being integrally formed with a device, for example a light and a USB charger.

- 10 Preferably, engagement of the portion of the bolt and retention wall comprises placing the bolt in between the retention wall and the first side.

Preferably, the bolt abuts the retention wall in the locked position. The term “abuts” is not limited to contact between the bolt and notch, and includes being in proximity such that vertical movement results in the contact of the bolt and axle.

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Preferably, the plurality of arms are rotatable between a first position in which the conductive members are arranged for insertion into the housing, and a second position in which the conductive members are arranged to engage with the electrical conductors.

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More preferably, the number and profile of the plurality of arms correspond to an interior of the housing to allow a fit between the adaptor and the housing in the second position.

- 25 Preferably, there are three arms with each of the conductive member corresponding to electrical conductors in the housing to conduct live, earth and neutral respectively.

Preferably, the adaptor further comprises a protective casing for accommodating the plurality of arms in the first position, wherein the retention wall is formed across a side of the protective casing to engage with the bolt.

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Preferably, the retention wall is part of a notch in the axle, or is a lip of the axle.

The embodiments of the invention provide greater control over the addition and removal of adaptors to the housing of the electrical power distribution system, while retaining or
5 increasing the full features of the power distribution system and maintaining the scalability of implementation of the system. The locking device in the housing allows the simultaneous locking or unlocking of all the adaptors inserted into the housing, and does not require the user to individually lock and unlock each adaptor. This advantageously allows the electrical power distribution system to be used more safely by preventing
10 excess adaptors from overloading the system, and allows the housing track and system to be used in public places without the adaptors being removed unnecessarily. In the locked position, the adaptors may advantageously still be moveable along the length of the housing, retaining the flexibility of allowing users to move the adaptors along the housing track as required while preventing the unauthorised removal or addition of adaptors. The
15 embodiments of the present invention provides a low cost and effective solution to the problems faced by existing systems and housing.

Brief Description of Figures

20 In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limitative examples only preferred embodiments of the present invention, the description being with reference to the accompanying illustrative figures.

25 In the Figures:

Figure 1 is a perspective view of the adaptor and housing;

Figure 2 is an exposed perspective side view of part of the adaptor and the housing in a
30 locked position;

Figure 3 is a perspective view of the adaptor and an embodiment of the bolt in a locked position with the housing omitted;

Figure 4 is a perspective view of the adaptor and bolt in an unlocked position
5 corresponding to the embodiment in Figure 3;

Figure 5 is a cross sectional side view of Figure 3;

Figure 6 is a perspective view of the bolt in a locked position and adaptor at a first
10 position along the slot;

Figure 7 is a perspective view of the bolt in a locked position and adaptor at a second position along the slot;

Figure 8A is a top view of the adaptor and bolt in an unlocked position;

Figure 8B is a top view of the adaptor and bolt in a locked position;

Figure 9A shows an embodiment of the bolt;

Figures 9B and 9C shows the embodiment of the bolt Figure 9A in an unlocked position
20 and locked position respectively;

Figure 10 shows a top view of the embodiment of the bolt in Figure 9A with the adaptor;

Figure 11 shows a perspective view of the bolt and adaptor in Figure 10;

Figure 12A and 12B shows a cross section side view of the bolt in the unlocked position
30 and locked position respectively.

Detailed Description of The Preferred Embodiments

As used herein, the articles “a”, “an” and “the” as used with regard to a feature or element include a reference to one or more of the features or elements. As used herein, the term “and/or” includes any and all combinations of one or more of the associated
5 listed items. As used herein, the terms “first,” “second,” and “third,” etc. are used merely as labels, and are not intended to impose numerical requirements on their objects. As used herein, the terms “top”, “bottom”, “left”, “right”, “vertical” and “horizontal” are used to describe relative arrangements of the elements and features. As used herein, the term “each other” denotes a reciprocal relation between two or more objects, depending
10 on the number of objects involved.

The electrical power distribution system comprises an electrical power track housing 10 and one or more adaptors 100 to allow a user to draw electrical power from the system. The housing 10 may be formed as a single structural piece, or may be formed by an
15 assembly of any number of parts to form the housing 10 as shown in the Figures and described here below.

The housing 10 may be any suitable track housing used with such electrical power distribution system as will be explained in greater detail. Conventional adaptors used in
20 existing housing generally engage the housing by pushing and rotating the adaptor to establish the electrical connection and physically secure the adaptor to the housing. However, this makes it easy for users to add and remove the adaptors at will, leading to excess or missing adaptors in the system. This leads to potential overloading of the system and increased costs to replace the missing adaptors. Existing locking devices are
25 located on each adaptor, and requires a great amount of time and effort to individually lock each adaptor on a large scale.

A perspective view of the adaptor 100 inserted into the housing 10 is shown in Figure 1. There is an opening in the top part of the housing 10 to receive the adaptor. The slot
30 extends from the opening into the housing 10 to receive the adaptor 100, in part or whole, preferably the axle 105 of the adaptor 100. A vertical plane of the slot may be

defined from the opening to the bottom part of the housing 10 and across a length of the slot, and serves as a reference plane for the rest of the housing 10 to the slot. The housing 10 may be elongate such that it may be deployed as a power track to allow a user to tap the electrical power along the elongate power track. The housing 10 has a first longitudinal side 22 and an opposing second longitudinal side 25, both of which may be integrally formed with the top and bottom part of the housing 10. A cover 70 may be provided for the opening as shown in Figure 1 while still allowing the adaptor to be inserted into and removed from the slot. The axle 105 is shown in the slot itself with the adaptor head 107 protruding from the housing 10. The other parts of the adaptor 100 are omitted for clarity. The slot is generally between the opposing longitudinal sides 22, 25 of the housing, but the slot can be placed at either longitudinal side 22, 25 of the housing 10.

At least one channel 20 extends from the slot with each channel 20 comprising an electrical conductor. The at least one channel 20 extend sideways from the slot to the first and/or second longitudinal sides 22, 25 of the housing 10. The electrical conductors transfer electrical power from the main electrical grid to the adaptor 100, and will typically require at least two electrical conductors corresponding to live and neutral. The adaptor 100 for use with the housing contains conductive members corresponding to at least the live and neutral electrical conductors 15. A ground (or earth) electrical conductor 15 may be provided in the housing too. Preferably, three electrical conductors 15 corresponding to the live, neutral and earth state are provided. Optionally, the electrical conductor 15 may also serve as a data transfer link. The electrical conductors 15 in the housing 10 may be arranged in a multitude of configurations, and need only be complementary for use with the adaptor 100. The electrical conductors 15 should run substantially along the length of the housing to allow for the tapping of electrical power by the adaptor 100. As an example, the electrical conductor 15 is an electrical conducting bus bar.

In Figure 2, there are shown to be four channels 20 with two channels extending towards the first longitudinal side 22 and two channels 20 extending towards the second

longitudinal side 25. Three of the channels 20 may be connected to live, neutral and earth, while the fourth channel 20 is used for data. The channels 20 may be at the same height along the depth of the slot, and/or may be at different heights. Alternatively, there may be one channel 20 extending from the slot to each of the longitudinal sides 22, 25 of the housing, with optionally a ground electrical conductor present at the end of the slot, i.e. at the bottom part of the housing 10. The channels 20 extending towards only one longitudinal side 22, 25 of the slot is particularly advantageous when the slot is placed near the longitudinal side 22, 25 of the housing 10. The channels 20 and electrical conductors 15 would also run substantially along the length of the housing 10 to allow for the tapping of electrical power by the adaptor 100.

Referring to Figures 6, 11 and 12, a locking device 5 is provided for use with an electrical power track housing 10 to retain an adaptor 100 received in the housing 10. The locking device 5 comprises a bolt 30 moveable between a locked position and an unlocked position. In the locked position, the bolt 30 engages a retention wall 110 of the adaptor 100 to retain the adaptor 100 in the housing, in particular in the slot of the housing 10. In the unlocked position, the bolt 30 disengages the adaptor 100 to allow release of the adaptor 100 from the housing 10. The locking device 5 may be retrofitted to or provided with the housing 10. The bolt 30 is preferably elongate to be able to engage a plurality of adaptors 100 simultaneously in the locked position. The elongate bolt 30 should be substantially of the same length as the elongate housing 10 to lock one or more adaptors 100 along a substantial length of the housing 10, and to allow electrical power to be drawn from almost any point along the housing 10.

A control means may be provided to move the bolt 30 between the locked position and unlocked position. The control means should preferably be workable only with a key tool such that only a user with the key tool can control the position of the bolt. In an example, the control means comprises a cam 55 as shown in Figure 6, and the cam 55 is adapted to be rotated about an axis. The cam 55 may be housed within a modular end terminal 60, which may be attached to the housing 10. In an embodiment, the cam 55 may have a keyhole 75 for the key tool to be inserted in, upon which it allows the rotation of the cam

55 about the axis. Alternatively, the key tool may be used on a lock separate from the cam 55. More specifically, the cam 55 may be a C-shaped cam as seen in Figures 8A and 8B. The cam 55 preferably moves the bolt 30 between the locked position and unlocked position. Other examples of a control means include a flip/flop switch, a lever, or the bolt
5 being adapted to be pushed manually by a user.

The locking device 5 may further comprise a connection member 35 connected to the bolt 30. The connection member 35 is adapted to be attached to the housing 10 and is disposed parallel to the bolt 30. The bolt 30 should be moveable relative to the
10 connection member 35 to allow movement between the locked and unlocked positions. The connection member 35 secures the bolt 30 to the housing 10 with fasteners. For example, in Figure 2 the connection member 35 is secured to the second longitudinal side 25 of the housing 10. This has the advantage of allowing the locking device 5 to be made separately from the housing 10, and the locking device 5 may be retrofitted to the
15 housing 10. In another example, the connection member 35 is formed integrally with the housing 10 and the bolt 30 is attached to the connection member 35. The connection member 35 may be elongate with a length substantially similar to the bolt 30. The bolt 30 and connection member 35 is preferably contained within a recess 37 in the housing 10. The recess 37 may be similar to the channel 20 except for the absence of the electrical
20 conductor 15. To minimise the vertical depth (or thickness) of the housing 10, the channels 20, recess 37 and bolt 30 are preferably parallel to each other, and also preferably perpendicular to the slot. As such the bolt 30 will have a longitudinal axis along the longitudinal length of the housing 10. The recess 37 containing the connection member 35 is preferably furthest from the opening, i.e. nearer to the bottom of the
25 housing 10.

The outer parts of the housing 10 are omitted in Figures 3 to 11 to show the locking device 5 and working mechanism more clearly. Figures 3, 5 and 6 shows the locking device 5 with the bolt 30 in the locked position and in engagement with the retention
30 wall 110 of the adaptor. The engagement of the bolt 30 with the adaptor 100 includes the whole or part of the bolt 30.

The bolt 30 may be made of any suitable resilient material to resist any attempt to break the bolt 30 in the locked position. The material should also allow the bolt 30 to move easily between the locked position and unlocked position, in particular to allow the sliding motion of the bolt 30 and connection member 35. Examples of suitable material include metals (e.g. steel, aluminium etc.) and rigid plastic.

In an embodiment, a strut 40 pivotally attaches the bolt 30 and connection member 35 as shown in Figures 3, 4, 8A and 8B to allow movement of the bolt 30 relative to the connection member 35. Apertures 45 may be provided in the bolt 30 and connection member 35 to allow attachment of the strut 40 through projections from the strut 40. These projections are preferably further used to attach the connection member 35 to the housing 10. Alternatively, the end terminal/s 60 are used to attach the connection 35 and bolt 30 to the housing 10.

In Figures 3 and 4, two struts 40 are shown at each end of the bolt 30 and connection member 35, but any suitable number of strut 40 may be used. The struts 40 should preferably be attached at regular intervals for even distribution of the applied force to the bolt 30. The bolt 30 and/or connection member 35 may be formed by fastening together smaller units. Preferably, in the unlocked position the bolt 30 and connection member 35 abuts each other to minimise the dimensions of the housing 10.

By pushing the bolt 30, the strut 40 pivots about the bolt 30 and connection member 35 to move the bolt 30 from the unlocked position to the locked position. This moves at least part of the bolt 30 into the slot and engages the retention wall 110 of the adaptor 100, thus preventing the adaptor 100 from being removed from the slot. The strut 40 pivots the bolt 30 between the locked position and unlocked position by pulling or pushing the bolt 30. In the unlocked position, the bolt 30 disengages from the retention wall 110 and the adaptor 100 may be removed from the slot. It may be seen that in the locked position the bolt 30 and connection member 35 are spaced apart, whereas in the unlocked position the bolt 30 and connection member 35 are preferably abutting each

other. The displacement of the bolt 30 from the unlocked position to the locked position (and vice versa) is perpendicular to the longitudinal axis of the bolt 30. The displacement is preferably further perpendicular to the vertical plane of the slot. The displacement includes the difference in the position of the bolt 30 in the locked position and unlocked position, and is not limited to just the motion of the bolt 30 between the two positions.

In Figure 8A, the bolt 30 is in the unlocked position, the user rotates the cam 55 in a first direction (e.g. clockwise or anti-clockwise) and a first end 56 of the C-shaped cam 55 contacts and pushes the bolt 30 away from the connection member 35 and towards the retention wall 110 of the adaptor 100 . In Figure 8B, to unlock the adaptor 100, the user rotates the cam 55 opposite to the first direction used to lock the adaptor 100. A second end 57 of the C-shaped cam 55 now contacts and pushes the bolt 30 towards the connection member 35, and back to the unlocked position in Figure 8A. It is the relative motion of the bolt 30 with respect to the connection member 35 that moves the bolt 30 into the locked position to engage the retention wall. The rotational motion of the cam 55 is translated to the displacement of the bolt 30. Alternatively, the control means may act to push and pull the bolt 30 in a linear fashion.

In another embodiment, a surface of the bolt 30 opposes a surface of the connection member 35, i.e. the bolt 30 and connection member 35 each has a surface or side opposing each other. The opposing sides of the bolt 30 and connection member 35 are corrugated with teeth and complementary to each other. This allows movement of the bolt 30 relative to the connection member 35. The matching corrugated surfaces need only allow the bolt 30 and connection member 35 to slide (or move) with respect to each other to move the bolt 30 to engage with the retention wall 110 of the adaptor 100 as above. An example of matching corrugated surfaces on the bolt 30 and connection member 35 is shown in Figures 9A, 9B and 9C. The bolt 30 has alternating teeth 85 and grooves 90 which matches with the alternating teeth 85 and grooves 90 of the connection member 35. Preferably, the corrugated surfaces are angled as in this embodiment. Other examples of matching corrugated surfaces include rectangular, triangular, and sawtooth shapes. The rest of the bolt 30 and connection member 35 need

not be identical or similar, and can be of any shape to fit the rest of the housing 10 without deviating from the function of the matching corrugated surfaces. Figure 9B shows the bolt 30 in the unlocked position whereby the teeth 85 of the bolt 30 are fully received within the grooves 90 of the connection member 35 and vice versa. The teeth 85 need only be slidable or moveable within the grooves 90 and need not fit completely within or into the grooves 90 as shown in Figure 9B. The configuration of the bolt 30 and connection member 35 allows movement of the bolt 30 between the locked and unlocked positions by allowing the surface of the bolt 30 to move along the profile of the surface of connection member 35. Same as the previous embodiment, a control means (e.g. cam 55) is used to push the bolt 30 to the locked position in Figure 9C to engage with the retention wall 110 of the adaptor 100. The cam 55 pushes the bolt 30 back to disengage the bolt 30 and the retention wall 110 in the unlocked position.

Figure 10 shows a top view of the adaptor 100 and the bolt 30 with matching corrugated surfaces. The bolt 30 is in the unlocked position with the teeth 85 being received completely in the grooves 90. Figure 10 further shows complementary projections 92 and apertures as an example of a fastener to join a plurality of subunits together to form the bolt 30 and/or connection member 35. Figure 11 is a perspective view of Figure 10 but with the bolt 30 in the locked position. It can be seen in Figure 11 that the cam 55 pushes the bolt 30 to engage the retention wall 110 of the axle 105.

The adaptor 100 for use with such a housing 10 is complementarily shaped and configured to work with the housing 10. Referring to Figures 1, 2 and 5, the adaptor 100 comprises an axle 105 protruding from a first side 125 of the adaptor 100, a plurality of arms 115 extending from the axle 105, the plurality of arms 115 are rotatable about a central axis of the axle 105 in the same direction. Each rotatable arm 115 comprises a conductive member 120 for engagement with an electrical conductor 15 in the housing 10 to form an electrical connection when inserted into the housing 10. Each of the conductive member 120 is electrically connected to a second side 130 of the adaptor 100 to provide a power outlet, the first side 125 and second side 130 of the adaptor 100 oppose each other. The power outlet allows a user to connect a device to draw electrical

power from the housing 10 and system, and may be integrally formed into a device, for example a light or a USB charger.

The plurality of arms 115 are rotatable between a first position in which the conductive members 120 are arranged for insertion into the housing 10 (e.g. parallel to the length of the housing), and a second position in which the conductive members 120 are arranged to engage with the electrical conductors 15. In the second position, the circuit to the second side 130 of the adaptor is closed and the power outlet may be used.

The adaptor 100 may further comprise a switch mechanism to control an electrical flow to the power outlet in the second position. This allows the adaptor 100 and housing 10 to have a third position or state wherein the adaptor 100 is locked in the housing 10 by the locking device 5 but there is no electrical flow to the power outlet. In an embodiment, in the third position the arms 115 are rotated such that the conductive members 120 are in contact with the electrical conductors 15. The switch mechanism is in the "OFF" state and there is no electrical flow to the power outlet. It is only when the user changes the switch mechanism to the "ON" state is there electrical flow to the power outlet. Preferably, the adaptor 100 may only be locked in the second and third positions. In an embodiment, the switch mechanism may be a push-pull type switch mechanism. An indicator may be provided on a second side 130 of the adaptor 100 for indicating a live electrical connection between the adaptor 100 and housing 10. Advantageously, this allows the adaptor 100 to be locked to the housing 10 while still allowing it to be slidable along the elongate housing 10. This also allows for the adaptors 100 to be locked while switched off (i.e. the third position or state) making the housing 10 and power distribution system safer for the users.

In an embodiment, the switching mechanism comprises a toggle, a toggle finger sitting on a spring and a metal bar located on a metallic fulcrum electrically connected to the "Live" connector. When the adaptor 100 is engaged into the "ON" position by a clockwise turn, a vertical rod on the protective casing will travel in a fixed path that will push onto the toggle, swaying it right. This action causes the toggle finger to slide across the fulcrum

and tilt the metal bar to be in contact with the socket, relaying to it the “Live” connectivity. During disengagement, the anti-clockwise turn of the adaptor 100 causes the vertical rod of the protective casing to reverse its path, pulling back the toggle swaying it left. This action causes the toggle finger to slide in the other direction, disconnecting the metal bar from the contacts of the socket. At the engaged state of the switch mechanism, the spring on the toggle finger maintains a mechanical pressure on the metal and locks the toggle in the “ON” position. Due to the shape of the toggle, the vertical rod is also locked in position which in turn locks the protective casing position. A considerable amount of rotational force on the adaptor 100 is required to disengage the switching mechanism. This required amount of force biases the adaptor into the “ON” state while preventing unintended switching off of the socket.

The number and profile of the plurality of rotatable arms 115 correspond to the interior of the housing 10 (i.e. the slot and channels 20), in particular to allow a fit between the adaptor 100 and the housing 10 when the rotatable arms 115 are rotated to connect the conductive members 120 to the electrical conductors 15. The rotatable arms 115 may be configured to match the channels 20 described above. In an embodiment, there are three rotatable arms 115 with the conductive member 120 of each arm corresponding to the electrical conductors 15 to conduct live, earth and neutral respectively.

A retention wall 110 to engage the bolt 30 of the locking device 5 in the locked position is provided. The retention wall 110 is adapted to engage with the bolt 30 in the locked position, whereby the retention wall 110 in cooperation with the bolt 30 retains the adaptor 100 in the housing 10, in particular in the slot of the housing 10. The retention wall 110 is preferably formed across a side 135 of the axle 105 as shown in Figures 3 to 5. In particular, the engagement of the bolt 30 and retention wall 110 comprises placing the bolt placed in between the retention wall 110 and the first side 125 of the adaptor 100 (or adaptor head 107). In the locked position, the bolt 30 may abut the retention wall 100, which includes being in close proximity to the retention wall 110 such that movement of the adaptor 100 vertically causes the retention wall 110 to contact the bolt 30 which prevents removal of the adaptor 100 from the housing 10. In the locked

position, the bolt 30 is in the slot while the bolt 30 is preferably contained in the recess 37 in the unlocked position.

In Figures 3 to 5, the retention wall 110 is a part of a notch in the axle 105 and is the lower wall of the notch as viewed in Figure 5. The notch need only receive at least part of the bolt 30. Advantageously, the notch provides for better alignment and engagement of the bolt 30 and retention wall 110, and further restricts the vertical movement of the adaptor 100 in the slot. In another example, the retention wall 110 is a lip of the axle 105. The lip is a part which protrudes from the side 135 of the axle 105 and the bolt 30 is placed between the lip and the first side 125 of the adaptor 100.

The axle 105 may be configured to be inserted into the slot of the housing 10 through the opening. The top part of the adaptor 100 which protrudes from the housing 10 may be considered an adaptor head 107, and the first side 125 and second side 130 of the adaptor may be considered as the two opposite sides of the adaptor head 107. The rotatable arms 115 and conductive members 120 could either extend from opposite sides (as seen in Figure 5) of the axle 105 or from the same side of the axle 105 to match with the housing 10. Alternatively, a conductive member 120 could be attached at an end of the axle 105 opposite to the adaptor head 107 with the other conductive member/s 120 attached to the side of the axle 105. The rotatable arms 115 and conductive members 120 are preferably formed parallel to the first side 125 to minimise the adaptor's 100 dimensions.

In an embodiment, the adaptor 100 further comprise a protective casing. The protective casing accommodates the plurality of rotatable arms 115 when the axle is in the first position for insertion into the housing 10, and helps to align and sit the adaptor 100 in the slot. The retention wall 110 may be formed in the axle 105 and/or protective casing (when present). The axle 105 and protective casing may be of comparable height such that the retention wall 110 is formed across both the axle 105 and protective casing. Alternatively, the height of the axle 105 extends beyond the height of the protective casing such that the retention wall 110 in the axle 105 is below the protective casing such

that the protective casing will not be affected by the bolt, i.e. the protective casing is above the bolt 30 in the locked position when the adaptor 100 is inserted into the slot. Alternatively, the height of the protective casing extends beyond the height of the axle 105 such that the axle 105 is above the bolt 30 in the locked position. When the retention wall 110 is present only in the protective casing, the axle 105 need not be rotated to engage the bolt 30 since the protective casing's retention wall 110 is already aligned with the bolt. The same principle applies to the position of the lip for the axle 105 and/or protective casing. Preferably, the retention wall 110 is the same in both the axle 105 and protective casing for ease of manufacture.

Figure 12A and 12B shows the cross sectional side view of the adaptor 100 in the slot, and the bolt 30 in the unlocked position and locked position respectively (the rotatable arms 115 and conductive members 120 of the adaptor 100 are omitted for clarity). In Figure 12A, the bolt 30 is disengaged from the retention wall 110, and the adaptor 100 can be removed from the slot. In Figure 12B, a part of the bolt 30 is received in the notch in the axle 105 (i.e. the bolt 30 is in the locked position). It can be seen also that the notch must extend further into the axle 105 than the maximum travel of the bolt 30.

A projection 97 may be attached to the bolt 30, the projection 97 is used to engage with a ridge 95 of the housing 10. The projection 97 is complementary in shape to the ridge 95 to prevent the bolt 30 from extending beyond the locked position. For example, the projection 97 and ridge 95 may have an L-shaped side cross section as shown in Figure 12A and may take other shapes from what is shown herein. The ridge 95 may be formed rising from the bottom part of the housing 10, but it may also be formed as part of the dividers separating the channels 20, and the projection 97 is modified accordingly. In the unlocked position in Figure 12A, the projection 97 is disengaged from the ridge 95. As the bolt 30 moves into engagement with the retention wall 110, the projection 97 engages the ridge 95 concurrently. The ridge 95 and projection 97 may also be present with the embodiment of the strut 40 attaching the bolt 30 and connection member 35. The housing 10 may further have a guide 98 at the bottom part of the housing to ensure the

correct alignment of the adaptor 100 in the slot. The adaptor 100 is correspondingly shaped to match the guide 98.

In an embodiment, the bolt 30 is arranged to be proximal to the bottom part of the housing 10, i.e. near the bottom of the slot. This allows the ridge 95 to be formed more easily from the bottom part of the housing 10, and also to allow the axle 105 or protective casing height to be varied more readily to avoid the bolt 30. Correspondingly, the retention wall present in the axle 105 and/or protective casing must also be configured to be at a distal end of the axle 105 and/or protective casing away from the adaptor head 107.

As an example, an authorised user inserts the adaptor 100 into the housing 10 with the bolt 30 in the unlocked position. The axle 105 is rotated to align the retention wall 110 in the axle 105 with the bolt 30 and the conductive members 120 with the electric conductors 15. The authorised user may further insert as many adaptors 100 as required or up to the limit of the housing 10 or electrical circuit. The authorised user operates the key tool to rotate the cam 55 which pushes the bolt 30 (partially or in whole) into the slot to engage with the retention wall. This moves the bolt 30 into the locked position which locks the inserted adaptor/s 100 to the housing 10 simultaneously. The adaptors 100 are usable by anyone but cannot be removed from the housing 10. Advantageously, the locked adaptors 100 may still move or slide along the elongate housing to the location the user requires. To remove or add more adaptors 100, the authorised user operates the key tool to move the bolt 30 to the unlocked position. The authorised user rotates the adaptor 100 in the opposite direction and is able to remove the adaptor 100 from the housing 10.

From Figures 8A and 8B, it may be seen that there are two lateral displacements (one each in direction A and B as indicated in Figures 8A and 8B) of the bolt 30 from the locked position to the unlocked position, i.e. there is a net diagonal or inclined linear movement of the bolt 30. The displacement in direction A (parallel to the longitudinal axis of the bolt) is along or parallel to the vertical plane of the slot. The displacement in direction B is

perpendicular to the longitudinal axis of the bolt 30 and preferably perpendicular to the vertical plane of the slot, and moves the bolt 30 to engage with the retention wall. Similarly in Figures 9B and 9C, it may be seen that the bolt 30 and connection member 35 with the matching corrugated surfaces move in a similar manner. It may be seen that the bolt 30 in the locked position and the unlocked position is preferably in a plane, but the movement of the bolt 30 itself between the locked position and unlocked position need not be in the plane although it is preferably so. It is preferable that the plane is perpendicular to the vertical plane of the slot.

In an embodiment, the cover 70 comprises a plurality of pairs of opposing panels, each pair of opposing panels are biased in a closed position by a resilient means and are pushed apart to an open position when the adaptor 100 is inserted into the opening. The housing 10 may further comprise first and second recesses adjacent the opening, the first recess extending from the slot towards a first side 22 of the housing, the second recess extending from the slot towards a second side 25 of the housing 10, wherein the first and second recesses oppose each other and accommodate the opposing panels such that the opposing panels slide into the respective recesses when the opposing panels are pushed apart to the open position for insertion of the adaptor 100 into the housing 10.

The electrical power distribution system, locking device 5, housing 10, and adaptor 100 described herein provides the advantages and flexibility of a power track distribution system but provides greater control over the number of adaptors 100 that may be used with the housing 10. The locking device 5 prevents overloading of the electrical circuit in the housing 10 and provides a safer environment for all users. It also prevents the unwarranted removal of adaptors 100 making the system and housing 10 usable in more environments, for example public spaces and large offices without requiring the users to bring their own adaptor or finding insufficient number of adaptors available. The present retention or locking mechanism is able to lock multiple adaptors 100 simultaneously making it more convenient and scalable to use and manufacture.

Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications in details of design or construction may be made without departing from the present invention.

Claims

1. A locking device for retaining at least one adaptor received in an electrical power track housing, the locking device comprises a bolt moveable between a locked position and an unlocked position, wherein in the locked position the bolt engages a retention wall of the adaptor to retain the adaptor in the electrical power track housing, and in the unlocked position the bolt disengages the retention wall to allow release of the adaptor.
2. The locking device according to claim 1, wherein the bolt is elongate and adapted to retain a plurality of adaptors in the electrical power track housing.
3. The locking device according to any one of claim 1 or 2 further comprises a control means for moving the bolt between the locked position and the unlocked position, wherein the control means is a cam, the cam is adapted to rotate about an axis.
4. The locking device according to any one of claim 1 to 3, further comprises a connection member connected to the bolt, the connection member is adapted to be attached to the electrical power track housing and is disposed parallel to the bolt.
5. The locking device according to claim 4, further comprises at least one strut, wherein the at least one strut connects the bolt and the connection member to allow movement of the bolt relative to the connection member.
6. The locking device according to claim 4, wherein a surface of the bolt opposes a surface of the connection member, the opposing surfaces of the bolt and the connection member are corrugated and complementary to each other.
7. The locking device according to claim 6, wherein the bolt further comprises a projection to engage with a ridge of the electrical power track housing.

8. An electrical power track housing for receiving and maintaining electrical contact with at least one adaptor, the electrical power track housing comprises:

(a) an opening for receiving the adaptor;

(b) a slot extending from the opening into the housing;

5 (c) at least one channel extending from the slot;

(b) each channel comprising an electrical conductor for engaging with a conductive member of the adaptor; and

(c) a locking device according to any one of claims 1 to 7.

10 9. The electrical power track housing according to claim 8, wherein the electrical power track housing is elongate, and the opening, the slot, and the at least one channel run longitudinally along a length of the elongate housing such that the housing provides electricity to the adaptor at any point along the length of the housing.

15 10. The electrical power track housing according to any one of claims 8 to 9, further comprises a cover for covering the opening.

11. The electrical power track housing according to claim 10, wherein the cover comprises a plurality of pairs of opposing panels, each pair of opposing panels are biased
20 in a closed position by a resilient means and are pushed apart to an open position when the adaptor is inserted into the opening.

12. The electrical power track housing according to claim 11, further comprises first and second recesses adjacent the opening, the first recess extending from the slot
25 towards a first side of the housing, the second recess extending from the slot towards a second side of the housing, wherein the first and second recesses oppose each other and accommodate the opposing panels such that the opposing panels slide into the respective recesses when the opposing panels are pushed apart to the open position for insertion of the adaptor into the housing.

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13. The electrical power track housing according to any one of claims 8 to 12, wherein there are three channels extending from the slot, each of the electrical conductors in the three channels are connected to a main AC supply to conduct live, earth, and neutral respectively.

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14. The electrical power track housing according to any one of claims 8 to 13, wherein in the locked position the bolt is in the slot, and in the unlocked position the bolt is in a third recess.

10 15. The electrical power track housing according to claim 14, wherein the third recess is furthest from the opening.

15 16. The electrical power track housing according to any one of claims 14 to 15, further comprises a ridge in the third recess, wherein the ridge engages with a projection of the bolt.

17. An adaptor for connecting to and tapping off electrical power supply from an electrical power track housing, the adaptor comprises:

- (a) an axle protruding on a first side of the adaptor;
- 20 (b) a plurality of arms extending from the axle, the plurality of arms are rotatable about a central axis of the axle in the same direction;
- (c) each rotatable arm comprising a conductive member for engagement with an electrical conductor in the housing to form an electrical connection when inserted into the housing;
- 25 (d) each of the conductive member is electrically connected to a second side of the adaptor to provide a power outlet, the first and second sides oppose each other; and
- (e) a retention wall formed across a side of the axle, wherein the retention wall engages a bolt of the housing when in a locked position and retains the adaptor in the electrical power track housing, and the bolt disengages with the retention wall when in
- 30 an unlocked position to allow release of the adaptor.

18. The adaptor according to claim 17, wherein engagement of the portion of the bolt and retention wall comprises placing the bolt in between the retention wall and the first side.

5 19. The adaptor according to any one of claims 17 to 18, wherein the bolt abuts the retention wall in the locked position.

20. The adaptor according to any one of claims 17 to 19, wherein the plurality of arms are rotatable between a first position in which the conductive members are arranged for
10 insertion into the housing, and a second position in which the conductive members are arranged to engage with the electrical conductors.

21. The adaptor according to claim 20, further comprising a switch mechanism to control an electrical flow to the power outlet in the second position.

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22. The adaptor according to any one of claims 20 to 21, wherein the number and profile of the plurality of arms correspond to an interior of the housing to allow a fit between the adaptor and the housing in the second position.

20 23. The adaptor according to any one of claims 20 to 22, wherein there are three arms with each of the conductive member corresponding to electrical conductors in the housing to conduct live, earth and neutral respectively.

24. The adaptor according to any one of claims 20 to 23, further comprises a
25 protective casing for accommodating the plurality of arms in the first position, wherein the retention wall is formed across a side of the protective casing to engage with the bolt.

25. The adaptor according to any one of claims 17 to 24, wherein the retention wall is part of a notch in the axle or is a lip of the axle.

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26. An adaptor for use with a housing according to any one of claims 8 to 16.

27. A locking device for retaining at least one adaptor received in an electrical power track housing as substantially described herein with reference to and as illustrated by the accompanying drawings.

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28. An electrical power track housing for receiving and maintaining electrical contact with at least one adaptor as substantially described herein with reference to and as illustrated by the accompanying drawings.

10 29. An adaptor for connecting to and tapping off electrical power supply from an electrical power track housing as substantially described herein with reference to and as illustrated by the accompanying drawings.