

A POWER CONNECTION MEMBER, CONNECTOR AND POWER CONNECTION

Technical Field

- [1] The present disclosure relates to systems for connecting electrical devices, such as circuits and loads, to a power source.

Background

- [2] During building construction, renovation and fit-out one major concern is the positioning of power connections (i.e. electrical outlets). Electrical outlets must be connected to electrical wiring that is typically hidden behind wall, floor and ceiling cladding once installed. Since the electrical wiring is difficult to access after the cladding has been installed, it is similarly difficult to relocate power outlets connected to that wiring, or to add new outlets.
- [3] It is also difficult to foresee how many outlets will be needed, and to locate power outlets in positions convenient for all intended uses. For this reason, power boards are used to provide additional outlets and extension cords are used to extend between an inconveniently located an existing outlet and the location at which a user would like that outlet to be positioned.
- [4] A similar issue occurs with the placement of power connections in vehicles, on electrical devices and other locations. Vehicles have very limited locations to which electrical wiring can be safely run that are also conveniently located and will not be disturbed by occupants and objects moving into and out of the vehicle. Similarly, the availability of space for providing outlets on laptops is becoming increasingly confined by design and device width, and may not be conveniently located for all positions in which the laptop is placed when in use.
- [5] It would be useful to provide a means for connecting to power that does not suffer from the above restrictions, or at least provides a useful alternative.

Summary

- [6] In accordance with the present disclosure, there is provided a power connection member for connection to a connector to electrically connect a power source with an electrical device, the power connection member being provided on one of the power source and the electrical device, and the connector being provided on the other of the power source and electrical device, the power connection member comprising:
- a body;

at least one power transmission track provided on the body, for contacting a respective contact on the connector, thereby to electrically connect the connector to the power connection member; and

at least one contact-inducing member provided on the body and configured to use attractive force to bias the connector into juxtaposition with the power connection member to contact the at least one power transmission track with the respective contact.

[7] In accordance with the present disclosure there is also provided a combination, a power connection member as described above and a connector for connecting to the power connection member, the connector comprising:

at least one contact for connecting to each power transmission track of the power connection member; and

an opposing contact inducing member facilitating creation of attractive force with the contact-inducing member of the power connection member, thereby to attract the power connection member and connector to maintain an electrical connection between the power connection member and connector.

[8] In the above power connection member, and combination, phrases identifying that a relevant power connection member or connector being “provided on one of the power source and the electrical device”, and similar, are taken to refer to: in the case of being provided on the power source, being located at any point on the power supply side (i.e. opposite to the electrical device side) of the electrical connection between the power connection member and connector; and, in the case of being provided on the electrical device, being located at any point on the other side of the electrical connection between the power connection member and connector. Such phrases should not be construed as limiting the relevant member or connector to being fixedly hardwired to the power source or electrical device. For example, a power connection member may comprise part of a power board between a mains wall power socket and an electrical device.

Brief Description of the Drawings

[9] Some embodiments will now be described by way of non-limiting example only and with reference to the accompanying drawings in which:

FIG. 1 is a cross-section view of a power connection member and plug while electrically connected;

FIGs. 2 to 4 show various embodiments of a power connection member in accordance with present teachings;

FIGs 5 to 7 show simplified cross-sections of power connection members with various arrangements of the contact-inducing member;

5 FIGs. 8 and 9 show arrangements of power transmission strips;

FIGs. 10 and 11 show arrangements of connectors adapted to connect to the power transmission strips;

FIG. 12 shows a further arrangement of a connector, on a power source, and a power transmission member that forms part of an electrical device;

10 FIGs. 13A to 13C show a power connection member and connector in various orientations and combinations;

FIG. 14 is a rear view of the connector shown in FIG 13C; and

FIG. 15 is a close-up cross-section view of an electrical contact or opposing contact-inducing member.

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Detailed Description

[10]FIG. 1 shows a schematic illustration of a power connection member 100. The power connection member 100 connects a power source 102 to an electrical device 104. The power connection member 100 is provided on the power source 102 insofar as it provides the power for the electrical device 104, rather than receiving that power as would the connector or plug 106 that is provided on the electrical device 104.

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[11]The power connection member 100 comprises a body 108, a contact-inducing member 110, and two power transmission tracks 112, 114.

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[12]The contact-inducing member 110 is provided on the body 108 and is configured to use attractive force, such as magnetism, to bias the connector 106 into juxtaposition with the power connection member 100 (i.e. a position at which the connector 106 is electrically connected to the power connection member 100) to contact the at least one power transmission track with the respective contact. The contact-inducing member 110 is currently embedded in the body 108. Embedding the contact-inducing member 110 isolates the contact-inducing member 110 from the ambient environment. This precludes contamination of the contact-inducing member 110 and also reduces the likelihood of damage.

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[13]In the present embodiment, the contact-inducing member comprises a material in which magnetism can be induced (e.g. a ferromagnetic material). The connector 106 therefore includes the magnet 116 that induces that magnetism and thereby attracts the contact-inducing member 110.

5 [14]While the contact-inducing member 110 may extend the full length of the power connection member 100 (e.g. as shown by contact-inducing member 202 in FIG. 2), the magnet 116 need only be sufficiently long to induce sufficient magnetism to result in a maintained connection between the power connection member 100 and the connector 106. For example, the magnet 116 may a rectangular magnet embedded in, or protruding from, the connector 106.

10 [15]A comparable arrangement may also be provided with the contact-inducing member 110 comprising the magnet and the element 116 comprising the material in which magnetism is induced. However, a ferromagnetic material is considerably cheaper to manufacture than a magnet. As such, it is envisaged that in many applications the contact-inducing member 110, being the larger of components 110, 116, will comprise the less expensive ferromagnetic material and the component 116 will comprise the magnet.

[16]It will be appreciated that more than one contact-inducing member 110 may be provided as needs be. Moreover, in some embodiments discussed with reference to FIGs. 2 to 4, the contact-inducing member 110 may also form a power transmission track.

20 [17]The power transmission tracks 112, 114 are also provided on the body 108. The power transmission tracks 112, 114 connect to the power source 102 and transmit or deliver power between the power source 102 and the connector 106, when the connector 106 is electrically connected to the power connection member 100.

25 [18] The power transmission tracks 112, 114 may be formed from any electrically conductive material. The tracks 112, 114 are elongate as shown in FIGs. 2 to 4. The tracks 112, 114 electrically connect to the power source 102 and, in effect, constitute an extension of the wires leading from the power source 102, though they are exposed along their length for connection to the connector 106. Each power transmission track is configured to provide a continuous contact surface – in other words, a contact on the connector can electrically connect to the respective power transmission track anywhere on the contact surface. This enables one of the
30 connector or power connection member to move relative to the other. In some cases, this relative movement can occur without breaking electrical contact. To this end, the contact surface may comprise a smooth metal contact.

- [19] FIGs. 2 to 4 show exemplary power connection members 200, 300, 400. In each case, the connection member 200, 300, 400 comprises an elongate body 204, 304, 404. On each elongate body 200, 300, 400 is one or more power transmission tracks 206, 208, 306, 308, 310, 406. The power transmission tracks 112, 114 of FIG. 1 were recessed into surface 118. Power transmission tracks 206, 208, 306, 308, 310, 406 may similarly be recessed, but are presently shown coplanar with, or slightly protruding from the respective surfaces 212, 312, 412.
- [20] Each power transmission track 206, 208, 306, 308, 310, 406 is elongate. Each power transmission track 206, 208, 306, 308, 310, 406 extends the full length of the respective body 204, 304, 404. In some applications, the respective track 206, 208, 306, 308, 310, 406 may extend for less than the full length of the body 204, 304 404 as indicated by the extension of the body 404 shown in broken lines in FIG. 4.
- [21] The arrangement shown in FIG. 2 comprises two power transmission tracks 206, 208 and a single contact-inducing member 202. The contact inducing member 202 is shown in broken lines as it may be embedded in the body 204, coplanar with surface 212 or protrude from the body 204 as needs be.
- [22] One of the two power transmission tracks 206, 208 may be connected to the 'hot' wire of the power source 214, and the other of the two power transmission tracks 206, 208 may be connected to the 'neutral' wire of the power source. In this regard, a power source will typically comprise either hot and neutral wires, or hot, neutral and ground wires.
- [23] If the power transmission tracks 206, 208 are so connected to the power source 214, a device connecting to the power connection member 200 will need to comprise an electrical contact (see, for example, reference numeral 1002 in FIG. 10) for each power transmission track – in other words, will need to comprise two electrical contacts. This is necessary to complete the circuit from the hot wire, through one power transmission track (e.g. track 206) connected to the hot wire, through the device, back to the other power transmission track (e.g. track 208) and on to the neutral wire of the power source 214.
- [24] In some embodiments, at least one of the power transmission tracks 206, 208 is connected to a power line communications module in the power source 214 for modulating the power supply so as to overlay data on the power supply. The power source 214 may therefore comprise an Internet router or a computer processor (e.g. where the device 200 constitutes part of a computer or laptop). Thus data can be transmitted to and/or from a power line communications enabled device (not shown) connected to the power connection member 200.

[25] As indicated by reference 216, a connection (shown in broken lines) may also be made with the contact-inducing member 202. The connection with the contact-inducing member 202 may comprise the ground wire connection with the power source 214, thus leaving the hot and neutral wires to be connected with the power transmission tracks 206, 208. It will be appreciated that if all components 202, 206, 208 are connected to the power source 214, the hot, neutral and ground wires may be connected with components 202, 206, 208 in any desired arrangement (e.g. contact-inducing member 202 may connected with any one of the hot, neutral and ground wires as needed, and the same then applies to tracks 206, 208). The contact-inducing member, if connected to the power source 214 may transmit data as discussed above with reference to power transmission tracks 206, 208.

[26] FIG. 3 shows a further power connection member 300 in which three tracks 306, 308, 310 are provided. The tracks 306, 308, 310 may be power transmission tracks connected in any desired order with hot, neutral and ground wires of the source 314. One or more of the tracks 306, 308, 310 may communicate data using power line communications techniques, or one of the tracks 306, 308, 310 may be a dedicated data track. For example, track 310 may be a data track and source 314 may comprise both a power source and a data source. In this embodiment devices connected with the power connection member 300 may be powered by the member 300 yet also receive data from the member 300. Thus power connection member 300 can operate in a manner comparable to a universal serial bus connector or Fire Wire connector, for USB sticks and Fire Wire drives configured to attach to power connection members such as those presently taught. Similarly, one of the contact-inducing members 302a, 302b may instead comprise a data communication track.

[27] In this regard, USB devices and other small electronic devices require very little power. To this end, the power transmission track or tracks may be exposed. This is because there is little or no chance of electrocution on contact with multiple tracks – for example, contacting a track connected to a hot wire and concurrently contacting a track connected to the neutral wire. Where the tracks are not exposed and the power connection member 300 comprises part of a device, such as a laptop, the power connection member 300 may be connected with a connector from which mains power can be drawn in order to charge the laptop, yet the tracks 306, 308, 310 (and potentially also 302a, 302b) may be used to power smaller devices and/or transmit data.

[28] Power connection member 300 further includes two contact-inducing members 302a, 302b.

The contact-inducing members 302a, 302b are both elongate and extend in parallel, though they may extend in different directions as needed. The number of contact-inducing members will depend on the application. Notably, a connector (not shown) need only connect to the hot and neutral wires in order to power an electrical device. Therefore, devices adapted to connect only to hot and neutral may connect to power connection member 300 despite a grounded power transmission track being provided. Simply, the grounded power transmission track will be redundant for such devices.

[29] FIG. 4 shows another embodiment of a power connection member 400. The power connection member 400 comprises a single power transmission track 406. In order to complete a circuit, two connections with the power source 414 are required. As such, the contact-inducing member 402 is also connected to the power source 414. The power transmission track 406 is, in this instance, connected to one of the hot and neutral wires of the power source 414, and the contact-inducing member 402 is connected to the other of the hot and neutral wires.

[30] FIGs. 5 to 7 show different configurations for the contact-inducing member 500, 600, 700 with respect to the surface 502, 602, 702 of the respective body 504, 604, 704. In particular, FIG. 5 illustrates a contact-inducing member 500, embedded within body 504, behind surface 502. The body 504 can be formed from a material that does not interfere with attractive forces between the contact-inducing member 500 and the magnet or otherwise of the electrical device. For example, the body 504 may be formed from plastic. FIG. 6 shows a contact-inducing member 600 the surface of which is coplanar with the surface 602 of the body 604. It will be appreciated that the closer the contact-inducing member is to the opposing contact-inducing member in the connector of an electrical device, the greater the attraction between the two. FIG. 7 shows a contact-inducing member 700 protruding from the surface 702 of the body 704. In this arrangement, the contact-inducing member may be received in a recess in the connector, or other such arrangement as will be understood by the skilled person.

[31] As mentioned with reference to FIG. 1, the contact-inducing member may in each case comprise, for example, a ferromagnetic material or a magnet. Similarly the opposing contact inducing-member (e.g. component 116 of connector 106 in FIG. 1) may be the other of the ferromagnetic material and magnet. Similarly, the power connection member and connector may each comprise a magnet, with opposite poles facing each other when the connector is in electrical contact with the power connection member. Moreover, the magnet in one of the

connector and power connection member may be hinged so that it can rotate to change the pole facing the other of the connector and power connection member. Such a rotating arrangement means that the orientation of the rotating magnet will change to ensure there is always attraction between the contact-inducing member and opposing contact-inducing member.

[32] FIG. 8 is a simplified cross-section of a power connection member 800. The member 800 comprises a body 802 in which a contact-inducing member 804 is embedded. The member 800 comprises two power transmission tracks 806, 808. Both tracks 806, 808 are recessed into the body 802. Each track 806, 808 comprises a conductive strip 810, 812 laid along the bottommost face of the respective recess 814, 816. From FIG. 12 it will be understood that the conductive strip 810, 812 may instead be on a sidewall of the respective recess.

[33] The contact-inducing member 804 is located between the power transmission tracks 806, 808.

[34] The recesses 814, 816 are of equal dimensions, including depth. Thus the power connection member 800 is adapted to electrically connect with a plug having contacts protruding an equal distance from the body of the connector. With reference to FIG. 10, a connector 1000 is shown, having contacts 1002, 1004. The contacts 1002, 1004 extend the same distance from the body 1006 of the connector 1000.

[35] Each contact comprises a conductive pad 1010 connected in a known manner to electrical wiring (not shown). The conductive pad 1010 is biased outwardly of the body 1006 in the direction of arrow X. The biasing element 1012, presently a spring backing onto a support 1014, ensures the pad 1010 remains in contact with the conductive strip or power transmission track (e.g. ref 806 in FIG. 8) even during movement of the connector 1000 along the track – for example, during sliding relocation of the connector with respect to the track. Other resilient biasing elements may be used, such as compressible pad 1102 as shown in FIG. 11.

[36] The connector 1000 comprises an opposing contact-inducing member 1008 that maintains contact between the connector and a power connection member. Thus the connector is configured or shaped to mate with the power connection member – in other words, the shape of the connector is the negative or opposite of the shape of the power connection member where the two are intended to engage.

[37] FIG. 9 shows an alternative simplified power connection member 900 in which the recesses 902, 904, 906 are of unequal depth. Moreover, there are three such recesses 902, 904, 906 and a corresponding three power transmission tracks formed by conductive strips 908, 910, 912.

[38] By making the recesses 902, 904, 906 of unequal depth, only a connector having contacts extending comparable distances into the recesses 902, 904, 906 will be able to electrically connect with the power connection member 900.

[39] The contact-inducing member 914 is located to one side of the tracks 908, 910, 912. Similarly, the opposing contact-inducing member 1104 of the connector 1100 in FIG. 11 is located to one side of contacts 1106, 1108, 1110. Contacts 1108 and 1110 are biased by springs towards connection with respective power transmission tracks. Contact 1106 is biased by a resilient pad or material 1102 towards connection with a respective power transmission track.

[40] By making contact 1110 longer than contact 1108, and contact 1108 longer than contact 1106, the connector 1110 can connect to power connection member 900 in only one orientation.

[41] FIG. 12 shows an arrangement of a power connection member 1200 provided on an electrical device 1202 and in connection with a connector 1204 through which the power connection member 1200 is connected to a power source 1210. A recess 1206 is adapted to receive contact member 1208 provided on the power source 1210. The contact member 1208 comprises multiple contacts 1212, 1214 for electrically connecting to respective power transmission tracks 1216, 1218. Since a single pin or contact member 1208 can provide multiple points of contact, it may be possible the electrical device and connector can be rotated relative to one another (e.g. where the contact member 1208 is cylindrical). For this reason contact 1216 may pass around the periphery of the contact member 1208 – in other words form a collar around a portion of the contact member 1208 – or the recess 1206 may provide a power transmission track on both sides of the recess 1206 so that the connector 1204 can remain in electrical contact with the power connection member 1200 in multiple orientations.

[42] FIG. 13B shows a power connection member 1300 in a circular arrangement. There are two power transmission tracks and one contact-inducing member. For illustrative purposes, members 1302 and 1304 will be described as the power transmission tracks and member 1306 will be described as the contact-inducing member, though they may be located interchangeably.

[43] The power transmission tracks 1302, 1304 are circular. One of the tracks 1302 is shown in broken lines to indicate that it may be absent from some arrangements where, for example, the contact-inducing member 1306 is also attached to one of the hot and neutral wires of the power source.

[44] At the back of power connection member 1300 are terminals 1308, 1310, 1312 for connecting to mains power, as shown in FIG 13A. Notably, terminal 1312 is shown in broken lines since the provision of only two members that act to transmit power (e.g. transmission tracks 1302, 1304 and contact-inducing member 1306 where it is conductive) will avoid the need for a grounded terminal. Thus the power connection member comprises the power source insofar as it is the mechanism through which an electrical device (e.g. device 1314) can connect to the power source.

[45] FIG. 13C shows an electrical device 1314 in connection with the power connection member 1300. The present device 1314 is a light sensor. Since a light sensor is most effective when facing the source of light, and the location and orientation of power outlets varies, it can be useful to be able to rotation the light sensor 1314 to face the source of light. By providing circular power transmission tracks 1302, 1304 and/or a conductive central pin or contact-inducing member 1306, electrical connection can be maintained regardless of the orientation of the light sensor 1314 relative to the power connection member 1300.

[46] The device 1314 comprises electrical contacts 1400, 1402 as shown in FIG. 14, and opposing contact-inducing member 1404. The opposing contact-inducing member 1404 extends into recessed contact-inducing member 1306 as shown in FIG. 13B. Contacts 1400, 1402 are positioned at spaced intervals around the base 1406 of the electrical device 1314 at radial distances from the opposing contact-inducing member that correspond with the radial distances of the respective power transmission tracks 1302, 1304.

[47] Notably, the central member 1306 is one of a power transmission track and contact-inducing member, and is located at a centre of rotation of the device 1314 relative to the power connection member 1300. Similarly, the contact or opposing contact-inducing member 1404 is located at the centre of rotation. Thus regardless of the orientation of the device 1314 relative to the power connection member 1300, the electrical connection will remain. To that end, in various embodiments that enable rotation, one of the contact, contact-inducing member, opposing contact inducing member or power transmission track comprises a protrusion from a centre of one of the power connection member and connector, and the corresponding one of the contact, contact-inducing member, opposing contact inducing member or power transmission track comprises a recess configured to receive the protrusion (i.e. male-female coupling). Other forms of coupling arrangement may be used. In some embodiments, there is no central connection between the power connection member and connector and all of the

contact-inducing member, opposing contact-inducing member, power transmission track(s) and contact(s) are circular.

5 [48] FIG. 15 shows an exemplary opposing contact-inducing member or electrical contact 1500 extending from the body 1502 of an electrical device 1504. The member or contact 1500 is biased outwardly by spring 1506, to ensure constant contact with the contact-inducing member or power transmission track as the case may be. Many such configurations will be apparent to the skilled person and all such configurations are intended to fall within the scope of the present disclosure.

10 [49] It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A power connection member for connection to a connector to electrically connect a power source with an electrical device, the power connection member being provided on one of the power source and the electrical device, and the connector being provided on the other of the power source and electrical device, the power connection member comprising:

a body;

at least one power transmission track provided on the body, for contacting a respective contact on the connector, thereby to electrically connect the connector to the power connection member; and

at least one contact-inducing member provided on the body and configured to use attractive force to bias the connector into juxtaposition with the power connection member to contact the at least one power transmission track with the respective contact.

2. A power connection member according to claim 1, wherein the contact-inducing member is configured for contacting a contact on the connector, thereby to electrically connect the connector to the power connection member.

3. A power connection member according to claim 1 or 2, wherein the contact-inducing member is electrically grounded to provide a ground connection for the connector when the connector is electrically connected to the power connection member.

4. A power connection member according to any one of claims 1 to 3, comprising at least two power transmission tracks.

5. A power connection member according to any preceding claim, wherein each power transmission track is connected to a respective terminal of the power source, to transmit power from the power source to the electrical device through a respective contact on the connector.

6. A power connection member according to any preceding claim, wherein the contact-inducing member is connected to a terminal of the power source, to transmit power from the power source to the electrical device through a contact on the connector.

7. A power connection member according to claim 4, wherein the power source comprises a hot terminal and a neutral terminal, and the at least two power transmission tracks connect to different ones of said terminals.

5 8. A power connection member according to any preceding claim, wherein the at least one contact-inducing member extends in parallel with the at least one power transmission track.

9. A power connection member according to claim 8, wherein the at least one contact-inducing member comprises a track.

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10. A power connection member according to any preceding claim, wherein the at least one power transmission track is elongate.

11. A power connection member according to any preceding claim, wherein the at least one
15 contact-inducing member comprises a ferromagnetic material configured to attract a magnet provided at the connector.

12. A power connection member according to claim 1, wherein the power source comprises a hot
20 terminal and a neutral terminal, the at least one power transmission track is connected to one of the hot terminal and neutral terminal and the contact-inducing member is connected to the other of the hot terminal and neutral terminal.

13. A power connection member according to any preceding claim, wherein each power
25 transmission track is configured to provide a continuous contact surface so that the connector can electrically connect to the power source by contacting anywhere on the contact surface.

14. A power connection member according to claim 13, wherein the contact surface is a substantially continuous smooth metal contact.

30 15. A power connection member according to any preceding claim, wherein the contact-inducing member is configured to attract an opposing contact-inducing member provided in the connector.

16. A power connection member according to claim 13, wherein the contact-inducing member is one of a magnet and ferromagnetic material configured to magnetically attract to the other of the magnet and ferromagnetic material provided in the opposing contact-inducing member.

5 17. A power connection member according to any preceding claim, wherein one or more of the at least one power transmission track is configured to transmit data.

18. A power connection member according to any preceding claim, wherein the contact-inducing member is configured to transmit data.

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19. A power connection member according to any preceding claim, further comprising a data transmission member.

20. A power connection member according to claim 19, wherein the data transmission member
15 comprises a track through which data is communicated between a first device comprising the power connection member and a second device comprising the connector.

21. In combination, a power connection member according to any preceding claim and a connector for connecting to the power connection member, the connector comprising:

20 at least one contact for connecting to each power transmission track of the power connection member; and

an opposing contact inducing member facilitating creation of attractive force with the contact-inducing member of the power connection member, thereby to attract the power connection member and connector to maintain an electrical connection between the power connection
25 member and connector.

22. The combination according to claim 21, wherein the power connection member and connector are adapted to rotate while maintaining electrical connection.

30 23. The combination according to claim 22, wherein the at least one power transmission track is circular.

24. The combination according to claim 22 or 23, wherein the contact-inducing member and opposing contact-inducing member are positioned in a centre of rotation of the power connection member and connector.