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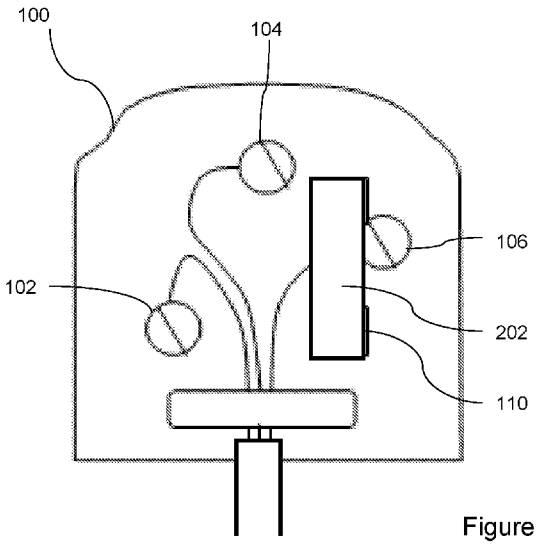

Figure 2

(57) Abstract: An electrical power plug, socket, insert for the plug or socket or appliance, and electrical power and plug systems are disclosed. The plug comprises a housing, a plurality of pins for mating with an electrical power socket, the plurality of pins comprising a live pin, a live terminal, for connection to an electrical device and a power management device, electrically coupled to the live terminal. The power management device may be controllable, and may comprise a controller for controlling a power input from the live terminal to an electrical device. The power management device may comprise a measuring device, such as a metering device, measuring one or more of power, voltage, and current.

ELECTRICAL POWER PLUG, SOCKET, INSERT AND SYSTEMS

FIELD OF THE INVENTION

This invention is directed to systems for controlling appliances remotely, for example by enabling communication with said appliances. In particular, it relates to inserts for appliances and for electrical power plugs and sockets, systems comprising such inserts, plugs and sockets, and appliances and devices using the same.

BACKGROUND OF THE INVENTION

Energy saving strategies for both domestic and industrial use are well known. One common process is monitoring of energy usage, or so-called smart metering, typically by installation of one or more devices measuring power, voltage and current in designated places in a power system.

In a known domestic system, a plug-in device is inserted between the plug of an appliance, and a power outlet. The device plugs into the power outlet, and in an outward facing housing provides the slots for the appliance plug to engage.

The device then measures energy usage by the appliance, as electrical load is drawn from the power outlet, through the plug-in device, to the appliance. Metering devices in the plug-in measure the necessary parameters during use of the appliance, and data can be collected and transmitted to a recording hub by a wireless communication device in the plug-in device. The plug-in device can also shut off the power supply to the appliance.

However, these plug-in devices are bulky, and can mean that an appliance plug protrudes out into a room too much, or cannot be fitted around existing fixtures or fittings, furniture, or adjacent sockets. The plug-in devices are relatively costly to manufacture and therefore to purchase.

In addition, it may be possible for a device, interposed between a plug and a power outlet, which is able to control (e.g. shut off) a power supply to the plug, to interfere with the fuse of the plug, for example to blow the fuse unnecessarily.

Various metering and sensor devices are known to the art, some of which incorporating circuit breakers or the like, or are able to wirelessly communicate data. However, these do not appear to be applicable to domestic or industrial energy monitoring systems, or are unable to shut off a power supply, or require manual operation of some components.

It would be an advantage to provide a plug or socket which can be controlled so as to change the power to a device, without having to switch the socket off, or remove the plug. It would also be an advantage to be able to update existing devices to introduce the ability to control such devices remotely. For example it would be useful to be able to internet-enable existing devices so as to allow them to communicate with or to be controlled by a central hub.

The present invention aims to address these problems and provide improvements upon the known devices and methods.

STATEMENT OF INVENTION

Aspects and embodiments of the invention are set out in the accompanying claims.

In general terms, one embodiment of a first aspect of the invention can provide an electrical power plug, comprising: a housing; a plurality of pins for mating with an electrical power socket, the plurality of pins comprising a live pin; a live terminal, for connection to an electrical device; and a power management device, electrically coupled to the live terminal.

This allows for power management components to be housed within the plug itself, so that no intervening device is required between the plug and the power outlet socket, saving space and the additional expense of the intervening device, and allowing the plug and socket to work together as before. The power management device can be suitably contained and/or enclosed by the housing of the plug. Preferably, the power management device is a controllable power management device.

Suitably, the power management device comprises a measuring device. Preferably, the measuring device comprises a metering device, configured to measure one or more of: power; voltage; and current.

Thus when an appliance connected to the plug is in use and drawing power from an outlet, the power management device can measure the power/voltage/current being used by the appliance. For example, the voltage may be measured by a power adaptor device in the power management device. The current may be measured by a current transformer (CT) sensor. The power may be calculated from the voltage and current measurements.

Suitably, the measuring device is configured to measure one or more of: temperature; and humidity.

In an embodiment, the power management device comprises a controller for controlling a power input from the live terminal to an electrical device. Preferably, the controller is adapted to switch on or off a power input from the live terminal. The controller may be adapted to control or ramp the power input, for example to reduce power input to a fraction of that available. In one example, this may be used to dim a lamp appliance connected to the plug.

Suitably, the plug further comprises a switch mounted on an outer side of the housing, for actuating the controller. The switch may be connected to the controller directly, for example by a line or wire from the switch into the housing. The switch may alternatively communicate wirelessly with the controller.

In an embodiment, the power management device comprises a communication device. Preferably, the communication device comprises a wireless communication device, such as a radio transceiver. Alternatively, the communication device may comprise a wired communication line. The communication device may communicate with a central hub. The hub may collect measurement, control, and/or overcurrent data from the power management device.

In an embodiment, the power management device comprises an overcurrent protection device. Preferably, the overcurrent protection device is resettable.

This allows for the power management device to be used in a type of plug which would otherwise be fused. This also allows for the power management device to combine the measurement and/or control features with the ability to protect from overcurrent. The overcurrent protection device may be a fuse, a resettable fuse (such as a polymeric positive temperature coefficient device (PPTC) or mechanical trip) or a circuit breaker. The protection device may be automatically resettable, for example a PPTC or auto-reset circuit breaker.

In an embodiment, the plug further comprises an enclosure for a removable component, and the power management device removably occupies the enclosure.

Preferably, the power management device occupies the enclosure in place of the removable component. This allows the power management device to replace a replaceable part of the plug, so that the power management device can be

retrofitted to an existing plug, so that the whole plug need not be replaced. The plug may be a standardised plug, with such a replaceable component.

Preferably, the removable component is an overcurrent protection device. Suitably, the power management device is disposed between the live pin and the live terminal. The enclosure for the removable component may be so disposed between the live pin and the live terminal, with the power management device coupled to the enclosure.

For example, the plug may be of a type having a cartridge fuse (e.g. British Standard (BS) 1363), which may be removed and replaced with the power management device combining measurement/control features with an overcurrent protection capability.

One embodiment of a second aspect of the invention can provide an insert for an electrical power plug, the plug comprising: a housing; a plurality of pins for mating with an electrical power socket, the plurality of pins comprising a live pin; and a live terminal, for connection to an electrical device, the insert comprising a power management device, the device configured to be electrically coupled to the live terminal of the plug.

The insert may alternatively be for an electrical power socket, such as that of the embodiment below.

One embodiment of a third aspect of the invention can provide an electrical power socket, comprising: a housing; a plurality of slots for mating with the pins of an electrical power plug, the plurality of slots comprising a live slot; a live terminal, for connection to an power source; and a power management device, electrically coupled to the live slot.

One embodiment of a fourth aspect of the invention can provide an electrical power plug system comprising: a plug according to the embodiment described above in which the plug comprises a controller; and a switch for actuating the controller.

One embodiment of a fifth aspect of the invention can provide an electrical power system comprising an electrical plug according to any of the above embodiments of the first aspect of the invention, and an electrical power socket according to the third aspect of the invention.

One embodiment of a sixth aspect of the invention can provide an electrical appliance comprising a plug according to any of the above embodiments of the first aspect of the invention, connected to an electrical device.

A seventh aspect of the invention provides an appliance management device suitable for attachment to an appliance, especially a domestic appliance. In particular, the appliance management device comprises a control means for controlling at least one aspect of the appliance's functionality. The control means may control the appliance's functionality by any appropriate method. It may communicate with the appliance, for example, it may be in communication with the controls of the appliance, either directly or indirectly. The control means may be for controlling any aspect of the functionality of the appliance. For example, it may be for controlling the power to the appliance, for example for turning the appliance on or off or for ramping the power to the device. Alternatively, the appliance management device may be for managing any other aspect of the activity of the appliance, such as volume, speed, particularly functions such as programme choice, etc.

In an embodiment, the appliance management device comprises a communication device. Preferably, the communication device comprises a wireless communication device, such as a radio transceiver. Alternatively, the

communication device may comprise a wired communication line. The communication device may communicate with a central hub. The hub may collect measurement, control, and/or overcurrent data from the appliance management device. The communication device may comprise the control means or the control means may comprise the communication device or the two may be separate. They are though, preferably, in communication, such that the communication device may communicate with the control means, in particular such that it may activate or instruct the control means based on input from an external source, such as a hub.

The appliance management device is suitable for attachment to an appliance. It may be suitable for insertion into a socket on an electrical appliance, such as a USB socket, a memory card socket such as a SD card slot or other socket. The appliance management device is preferably contained in or enclosed by a housing allowing the device to fit into and/or interact with the socket or otherwise attach to the appliance.

Suitably, the appliance management device comprises a measuring device. Preferably, the measuring device comprises a metering device, configured to measure one or more of: power; voltage; and current. Thus when an appliance connected to the plug is in use and drawing power from an outlet, the appliance management device can preferably measure the power/voltage/current being used by the appliance. For example, the voltage may be measured by a power adaptor device in the appliance management device. The current may be measured by a current transformer (CT) sensor. The power may be calculated from the voltage and current measurements.

Suitably, the measuring device may be configured to measure one or more of: temperature; and humidity.

Suitably, the device further comprises a switch mounted on an outer side of the housing, for actuating the appliance management device. The switch may be connected to the appliance management device directly, for example by a line or wire from the switch into the housing. The switch may alternatively communicate wirelessly with the controller.

Also provided is a system for enabling communication with an electrical appliance, the system comprising an appliance management device according to the seventh aspect of the invention and a hub for communicating with the appliance management device. The above aspects and embodiments may be combined to provide further aspects and embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a diagram illustrating an electrical plug;
Figure 2 is a diagram illustrating an electrical plug having a power management device insert, according to an embodiment of the invention;
Figure 3 is a diagram illustrating internal components of a power management device insert according to an embodiment of the invention;
Figure 4 is a diagram illustrating an electrical socket having a power management device insert, according to an embodiment of the invention; and
Figure 5 is a diagram illustrating an alternative arrangement for an electrical plug having a power management device insert, according to an embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

In general terms embodiments of the invention are aimed at providing an insert, or an electrical plug (or socket) which can be used for controlling power to an appliance, and measuring various electrical parameters, and communicating (e.g. to enable control and transmit measurements) wirelessly with, for example, a monitoring hub.

In one embodiment of the invention, this is done by replacing a removable component of a plug or socket with an insert, which contains the power management devices required for the above features. In a particular embodiment, the component replaced is a fuse, such as a cartridge fuse. The replacement insert contains all the technology (radio chip, control, measurement) built into a housing, which may be made to look like a fuse, so that a user can simply replace the existing fuse with the insert. The features previously requiring an unwieldy plug-in device can therefore be completely hidden inside the plug or socket.

The combination of control and/or metering functions with the use of an overcurrent device to replace a fuse, allows the miniaturisation of the power management device into the plug, without compromising the overcurrent protection.

The insert can control (on/off/dim) and measure (amps, volts, watts). It can communicate wirelessly using an established method such as Z-Wave or Zigbee.

Figure 1 is a diagram illustrating internal features of a three-pin plug 100 (for example, a standard BS 1363 plug). The power cord of the appliance on which the plug is mounted enters the plug at the base. The usual screw mounts for the terminals are illustrated, respectively for the neutral (102), earth (104) and live (106) terminals. The live terminal has the usual cartridge fuse (108) associated with it, typically rated at 3A or 13A. The cartridge fuse is mounted in an enclosure 110, comprising a pair of sprung clamps which grip the ends of the

cylindrical cartridge. The fuse is therefore positioned with one end coupled to the live terminal, and the other coupled to the live pin. In the usual manner, this provides overcurrent protection, as the fuse will blow before excess current can travel from the live pin to the live terminal of the appliance power cord.

Figure 2 illustrates a similar plug, however here the cartridge fuse has been replaced by an insert (202). This is similarly mounted in the enclosure 110, although in this embodiment, the insert fills the entire space within the enclosure, and the space allowed within the plug interior for the fuse, which a typical cartridge fuse may not.

The insert, in similar fashion to the cartridge fuse it replaced, has contacts on each side of each end, so that it can be electrically coupled to the live pin and the live terminal. This ensures that the overcurrent protection features of the insert can be used, to maintain the plug's protection now that the fuse is removed.

In an alternative embodiment, the contacts are (additionally or alternatively) on the ends of the insert, or in other forms and positions, adaptable to differing enclosure designs in different plugs.

The power management devices of the insert can be powered by a small on-chip battery. Alternatively, they may draw a small amount of power from the live pin, via the contacts. In such an embodiment as the insert is in-line with the positive side it may only be powered when the electrical device is plugged in and working. If unplugged, or turned off (either at the socket or by the insert's on/off switching feature) the insert will not typically be powered. One alternative to this provides a wire from the insert that connects to the negative terminal in the socket, so that power can be drawn from the negative side. An earth connection can be provided if necessary.

Figure 3 illustrates one arrangement of the internal components of the insert 202 of Figure 2, here designated 302, in an embodiment of the invention. A printed circuit board 304 (PCB) runs along the inner length of the insert, here shown side-on, with components of the power management device(a) mounted on both faces. A resettable fuse (308), here a PPTC, provides the overcurrent protection. The PPTC core changes phase on overcurrent, increasing resistance, and later reverts to its normal conducting state once the overcurrent is removed. The PPTC is electrically connected to the PCB and to each end of the insert (for example, via connecting wires 314) so that the inputs to its terminals are (a) the live pin and (b) the live terminal of the plug.

Alternatively, a circuit breaker can be used. A resettable breaker can reset automatically (in similar manner to the resettable fuse) once the overcurrent state is removed. Alternatively, a lever on a manual reset breaker can be made accessible on the outside of the insert, or a lever or button can be provided on the outside of the plug, electrically connected through the housing to the breaker of the insert. The breaker may also be resettable remotely, by wireless communication. In another alternative, for example in a device or situation where overcurrent is rare, a simple fuse (a blowable fuse wire) can be used instead. This provides a cheaper insert.

A controller 306 is also mounted on the PCB – this provides the means to switch the power to the live terminal, and hence to the appliance, on and off. The controller 306 can also vary the power output to the live terminal, for example to provide a dimmer for a lamp. Simple transistors/gates and potentiometers can be used as these can be easily miniaturised. In embodiments, some of the functionality of the fuse/breaker 308 and controller 306 can be combined – for example a mechanical trip could be used for the overcurrent protection, and this trip made part of the controller.

A metering device (312) is mounted, in electrical contact at least with the live terminal, in order to measure electrical parameters. In this embodiment, the metering device comprises a simple AC voltage adaptor for measuring voltage at the live terminal, and a current transformer (CT) sensor for measuring the applied current. Such simple components can be made small enough to fit inside the dimensions of the insert. Other known devices for metering and multi-metering are known, and can be applied here, if they can be made sufficiently small.

The measurement devices in the insert can include devices for measurement of other ambient information, such as temperature, pressure and humidity. Although the insert is inside the plug, temperature, pressure and humidity inside are commonly similar to the surrounding room, at least after a short period (e.g. 30 minutes). Miniature thermometers, barometers and hygrometers are known to the art. This ambient information can be used to complement the electrical readings taken, for example to inform the usage of the appliance – data matching a high temperature to a use of an air conditioning unit, for example, may be used to inform the hub, which may control power to the unit preferentially (via the insert controller) in such conditions.

The communication device 310 in this embodiment includes a radio transceiver, and an antenna. This allows communication for the insert, and the devices inside it, with an external transceiver, for example one in a central monitoring hub. The communication protocol used can be any of the known types, such as Z-Wave, Zigbee, Bluetooth, WiFi, or any applicable radio communication protocol.

Many of the components of the insert can use the communication device to communicate with the hub. For example, the overcurrent device 308, if a resettable breaker, can be made to respond to a communication signal from the hub to actuate or reset the breaker. The device 308 can also update the hub with a status (actuated, nominal, reset).

The controller 306 similarly can respond to communicated instructions received by the communication device, to turn the power on or off, or provide a dimming effect.

The metering device 312 can communicate all measurement data to the hub via the communication device. In addition, the metering device can respond to instructions from the hub to measure any of the parameters at a given time (for example instantaneously, to give an up to date reading) or to add or remove measurement of any of the parameters.

Complex timings and control procedures for the controller, metering device and other features of the power management device can be communicated to the communication device from the hub – there may not be room for local storage and processing of such procedures on the PCB. The hub may be constituted in a number of ways, for example as a control box mounted in a domestic or industrial environment, or a software application on a mobile device – further details are provided in later sections.

In an alternative embodiment, the communication device (310) may comprise a wired communication line, rather than a wireless transceiver. For example, a power-line communication protocol can be used, such as X10 or a broadband over power-line (BPL) protocol, such as IEEE 1901. A modulated carrier signal can be transmitted from the communication device via the connecting wires 314, the terminals and the lines installed in a corresponding socket, and thereby around a power-line network (such as that found in a domestic setting) to the hub, and to other devices. A device to generate the modulated signals to transmit the data can be incorporated into the communication device 310.

In a further alternative, the communication line from the communication device (310) may be wired to an external connection. This may for example be an

external port on the plug, into which a further device, such as a communication hub or device, can be inserted.

The PCB 304 of the insert 302 is connected to the contacts of the insert by connecting wires 314 at the top and bottom of the board. Alternatively or additionally, the connecting wires can connect to the sides of the insert, as shown by the dotted line 316, if the contacts on the insert are on the sides.

A manual switch (not shown) is included for the plug, for actuating a resettable overcurrent device 308, or the controller 306, or both. This is because the switch of the socket into which the plug is to be inserted may now not provide the usual switching functionally required for the appliance connected to the plug. A manual press-button or triggerable switch is provided which connects to the insert so the user can turn the device and/or the appliance on/off either with that new switch, in addition to being able to activate the device or appliance via the hub/control box or via an app on the mobile/tablet device. The switch is more usefully external to the plug, so that it can be accessed without opening the plug. In one embodiment, an extra switch device is provided in close proximity to the insert, and communicates wirelessly with the insert devices. This embodiment employs a piezoelectric design, where a physical pressing action generates enough energy to briefly send a signal to the insert. This device can be attached to the outside of the plug (for example by peel off backing tape), or even on a wall or other fixture near the plug/socket, for example within a minimum distance of the outlet. This switch may need to be pre-paired with the insert during manufacture, so that communication between the separate switch and the insert is unique to that switch/insert set, to avoid problems where multiple switches and plug inserts exist in a location.

The insert may comprise other components, such as those mentioned above but not specifically indicated in Figure 3. For example, the PCB may include a battery or means for drawing power from the live pin. The board may have a

processor and/or a storage means mounted on it, for providing storage and processing of programming instructions for devices on the board, so that some instructions do not have to be provided from the hub. For example, the communication device may receive software updates from the hub or from an updating device or network, which updates are then loaded on the storage means and processed by the processor.

Alternatively to the arrangement shown in Figure 3, the components may be arranged on a series of circular boards, disposed along the length of the cylindrical insert, joined by braces and line connections. In other alternatives, the dimensions and geometry of the insert may differ, for example the insert may be of cuboid, or octagonoid shape, which will nevertheless provide housing for the components and coupling to the live pin and live terminal.

In one alternative embodiment to that illustrated in Figure 2, the insert may be installed in the socket, rather than in the plug. Figure 4 illustrates such an embodiment, a rear view of a socket (400) housing an insert (408) in place of a cartridge fuse or the like. The power lines for the socket are attached to each of the neutral (406), earth (404) and live (402) terminals. The insert (408) is in this case mounted in the socket, mounted in an enclosure 410 which ensures that the insert is, in similar fashion to the plug of Figure 2, positioned with one end coupled to the live terminal, and the other coupled to the live slot or socket, providing the overcurrent protection.

In a further alternative embodiment (not shown), an insert may be installed in a domestic appliance, via, for example, a socket such as a USB socket or memory card socket or via any other means to allow it to communicate with the circuitry of the appliance. The insert may comprise a controller, for example as described above, or otherwise embodied and a communication device. It may also comprise the other features as described in the other insert embodiments. The insert is arranged to allow interaction of the controller and/or the communication device with the circuitry of the appliance, so as to allow that appliance to be

controlled via the controller and/or for the communication device to communication with the appliance. In particular, it is arranged to allow wireless internet communication between the appliance and a hub. In particular it is arranged to allow communication between such a hub and the appliance to allow the functions of the appliance to be controlled from the hub.

The hub (not shown) with which the insert communicates has a communication capability, for example a wireless radio device and protocol, a processor and storage for managing data for and from inserts, and for programming control procedures for the inserts and communicating instructions to them. The hub may manage a number of inserts in the installed environment, for example a number of appliances and/or power outlets in a home.

The hub may have a physical separate enclosure located in the environment of the inserts/plugs/sockets being used. For example, it may be in a control box located in the home, or incorporated into a fuse box. The hub may also be embodied in a mobile communication device, such as a mobile telephone or tablet device. These would use the communication, processing and storage capabilities already present in that device to manage the system, with software installed on the device in the form of an app. The user may interact with the app or control box view energy usage information, and to program the insert, for example to program switching on/off times for appliances in a home, or to measure energy usage of particular devices at particular times.

In an alternative embodiment, the aims of the invention can be addressed by simply modifying a plug (or manufacturing a new plug) to include power management features into the plug. This can be done by inserting devices for these features into a plug, for example by simply attaching an additional enclosure onto a plug, and connecting the devices inside to the live pin and live terminal inside the plug. Alternatively a plug could be manufactured with the components installed. This embodiment may be simpler to use for new

manufacturing of appliances and their plugs. However, it may be more difficult for end users to change a plug, rather than simply change a fuse for an insert.

One alternative embodiment is illustrated in Figure 5b, below a section of a standard plug in Figure 5a. In the standard plug (500), as also shown in Figure 1, the cartridge fuse (506) is arranged in an enclosure formed by sprung clamps (504) in contact with the live pin (502) of the plug.

In the alternative embodiment, in contrast to the above embodiments in which the insert replaces the cartridge fuse in a standard plug, here the insert is housed in the main body of the plug, and fits alongside the existing fuse within the plug so that the existing fuse continues to be used. In the example of this embodiment illustrated in Figure 5b, the insert (508) is again a similar size to the fuse (506), but may be differently shaped (for example somewhat flattened) in order to fit within the overall plug enclosure. In this example it is positioned to the left of the fuse in the body of the plug enclosure. The insert may also include a centre hole to accommodate the screw fixture maintaining the two halves of the plug together.

The insert nevertheless requires access to the live terminal, and the fuse must still be useable. This is achieved in this example by a set of contacts (510) extending from the insert (508), to form a curved sandwich (e.g. of copper, insulation, copper) which fits inside and follows the form of the pair of sprung clamps (504) which previously gripped the ends of the cylindrical cartridge fuse. The fuse is now clamped by the curved form of the sandwich (512) inserted into the sprung clamps (504), and the fuse is re-inserted into the sandwich clamp. The lower contact of the sandwich is in contact with the live pin (502) via the sprung clamp, and the upper contact of the sandwich is in contact with the fuse. Therefore the fuse becomes in series with the insert device (508) as it has no direct electrical connection with the live pin clamps. Thus the fuse can still be

used, and the insert is in contact with the live pin in order to make metering measurements.

Embodiments of the invention are of course applicable to different types of plugs and sockets, with differing numbers of pins or arrangement of components. The power management device and/or insert will be disposed in contact with the live terminal in order to carry out the control and metering functions.

Embodiments of the invention may be used in industrial environments, wherever a plug-socket system or the like is used. These embodiments may use specially manufactured plugs and/or sockets, or inserts to the same, by replacing a fuse or other replaceable component. For example, in the IEC 60309 standard the power management device can be disposed between the live terminals from the load and the live pin(s), for example connected to each of the three live pins in a 3P+E type plug. In similar fashion to the embodiments above, the power provided to the load and the measurement of the electrical parameters can be controlled.

Embodiments of the in

It will be appreciated by those skilled in the art that the invention has been described by way of example only, and that a variety of alternative approaches may be adopted without departing from the scope of the invention, as defined by the appended claims.

CLAIMS

1. An electrical power plug, comprising:

a housing;

a plurality of pins for mating with an electrical power socket, the plurality of pins comprising a live pin;

a live terminal, for connection to an electrical device; and

a power management device, electrically coupled to the live terminal.

2. A plug according to Claim 1, wherein the power management device is a controllable power management device.

3. A plug according to Claim 1 or Claim 2, wherein the power management device comprises a measuring device.

4. A plug according to Claim 3, wherein the measuring device comprises a metering device, configured to measure one or more of: power; voltage; and current.

5. A plug according to Claim 3 or Claim 4, wherein the measuring device is configured to measure one or more of: temperature; and humidity.

6. A plug according to any preceding claim, wherein the power management device comprises a controller for controlling a power input from the live terminal to an electrical device.

7. A plug according to Claim 6, wherein the controller is adapted to switch on or off a power input from the live terminal.

8. A plug according to Claim 6 or Claim 7, further comprising a switch mounted on an outer side of the housing, for actuating the controller.

9. A plug according to any preceding claim, wherein the power management device comprises a communication device.

10. A plug according to Claim 9, wherein the communication device comprises a radio transceiver.

11. A plug according to any preceding claim, wherein the power management device comprises an overcurrent protection device.

12. A plug according to Claim 11, wherein the overcurrent protection device is resettable.

13. A plug according to any preceding claim, further comprising an enclosure for a removable component,

and wherein the power management device removably occupies the enclosure.

14. A plug according to Claim 13, wherein the power management device occupies the enclosure in place of the removable component.

15. A plug according to Claim 14, wherein the removable component is an overcurrent protection device.

16. A plug according to any preceding claim, wherein the power management device is disposed between the live pin and the live terminal.

17. An insert for an electrical power plug, the plug comprising: a housing; a plurality of pins for mating with an electrical power socket, the

plurality of pins comprising a live pin; and a live terminal, for connection to an electrical device,

the insert comprising a power management device, the device configured to be electrically coupled to the live terminal of the plug.

18. An electrical power socket, comprising:

a housing;

a plurality of slots for mating with the pins of an electrical power plug, the plurality of slots comprising a live slot;

a live terminal, for connection to an power source; and

a power management device, electrically coupled to the live slot.

19. An electrical power plug system comprising: a plug according to Claim 6; and a switch for actuating the controller.

20. An electrical power system comprising an electrical plug according to any of the Claims 1 to 16, and an electrical power socket according to Claim 18.

21. An electrical appliance comprising a plug according to any of the Claims 1 to 16 connected to an electrical device.

22. An appliance management device suitable for insertion into a an electrical appliance, the device comprising a communication device for communicating with a hub and a controller for controlling at least one aspect of the functionality of the electrical appliance.

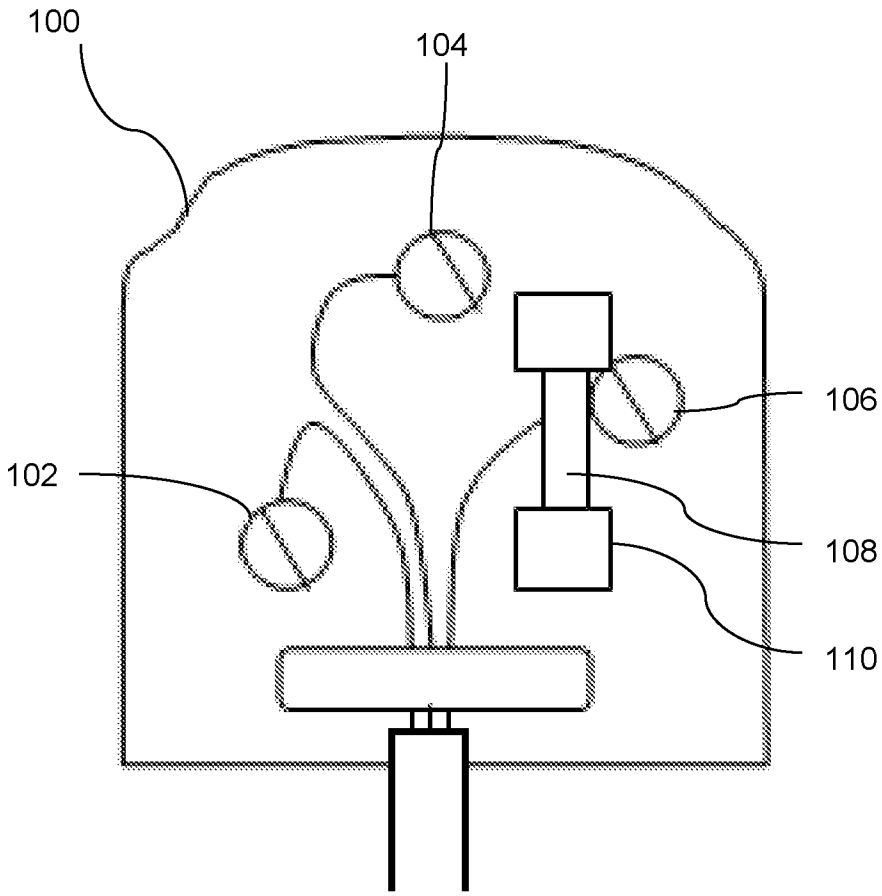

Figure 1

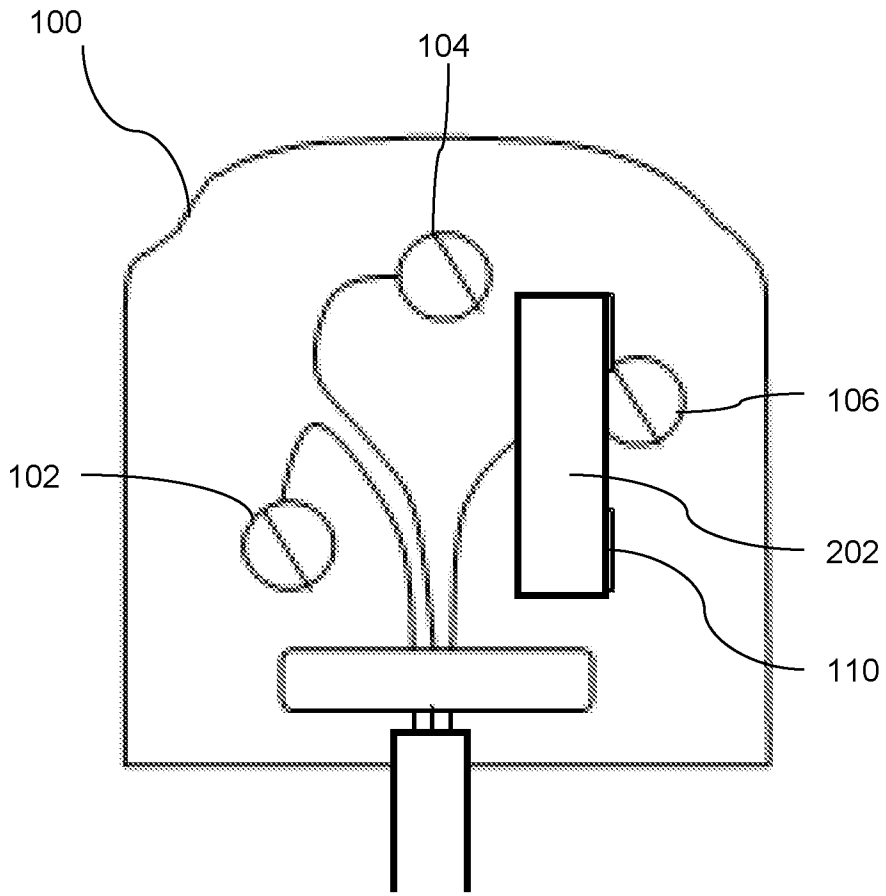

Figure 2

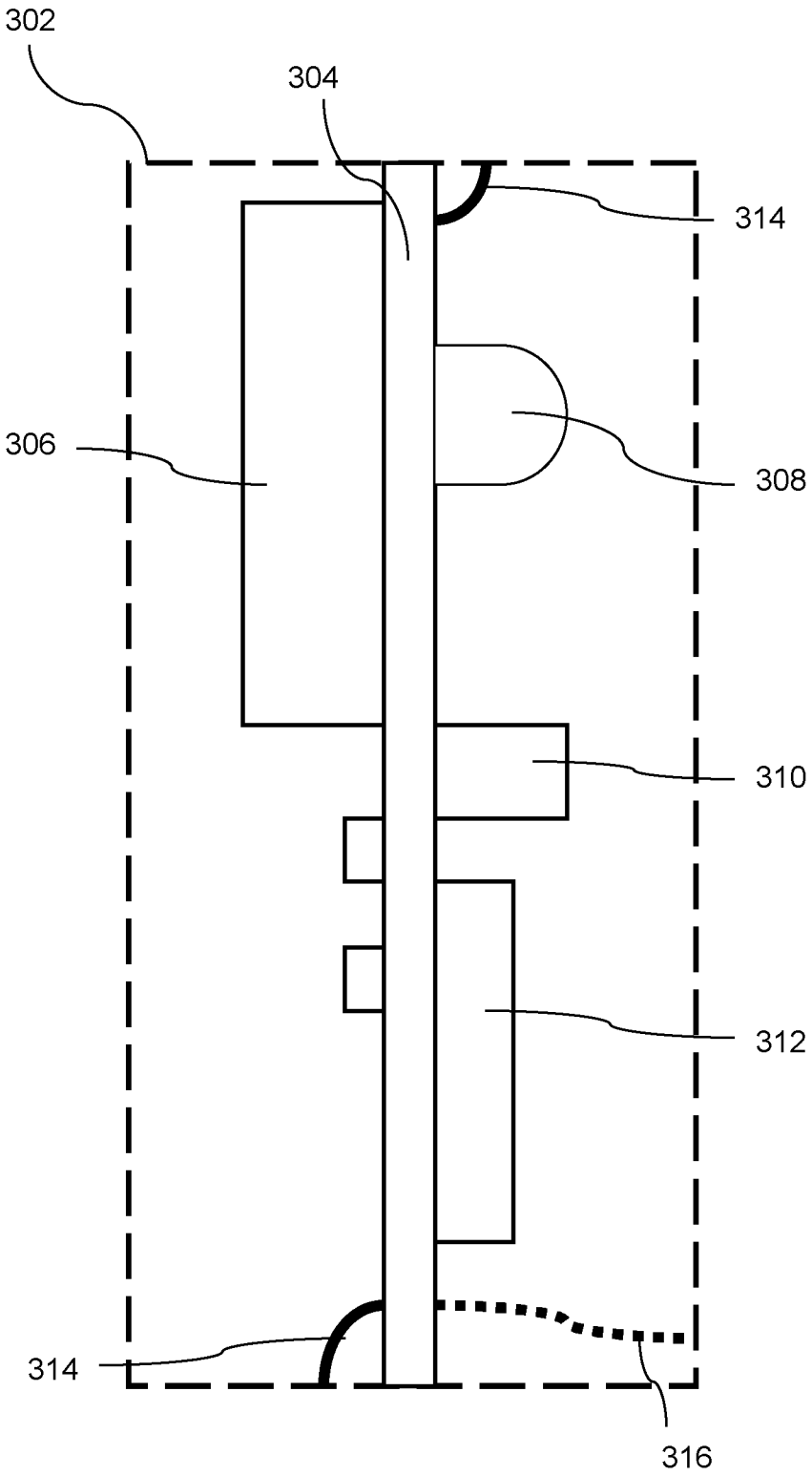

Figure 3

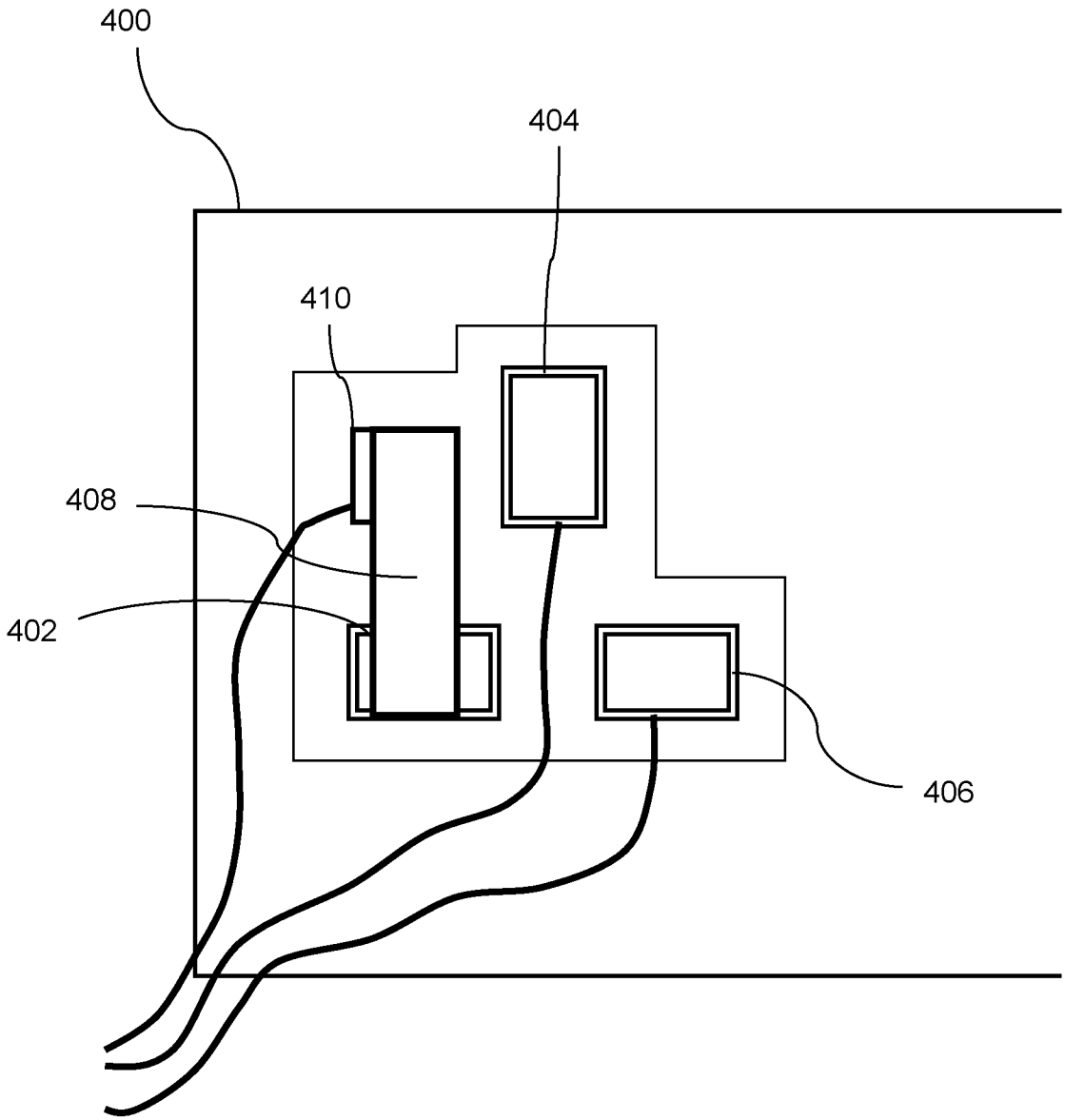

Figure 4

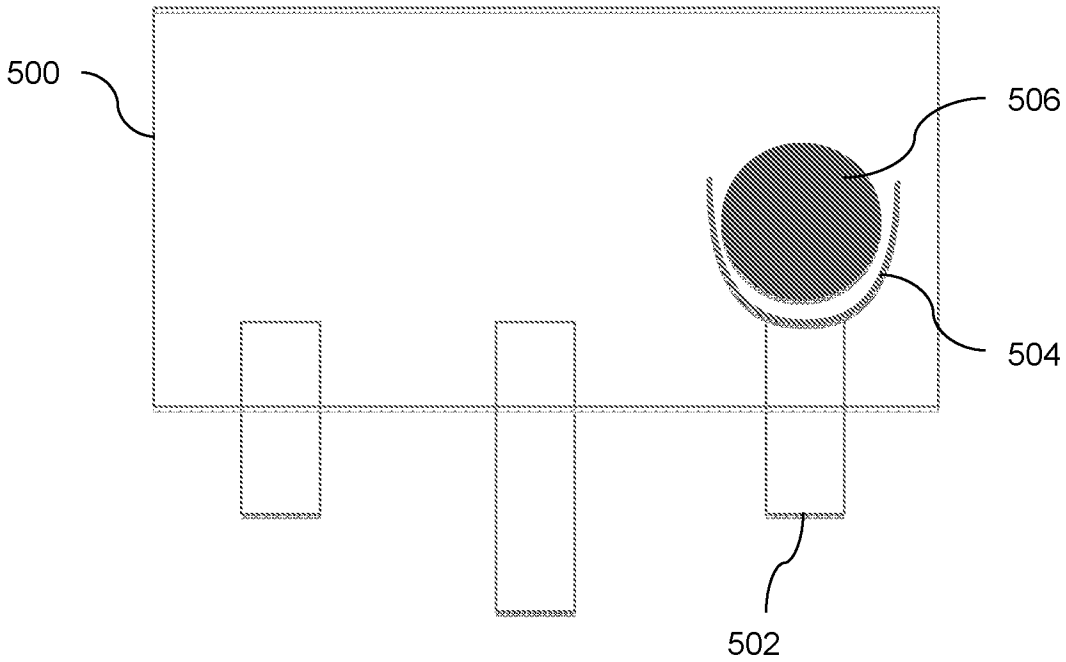

Figure 5a

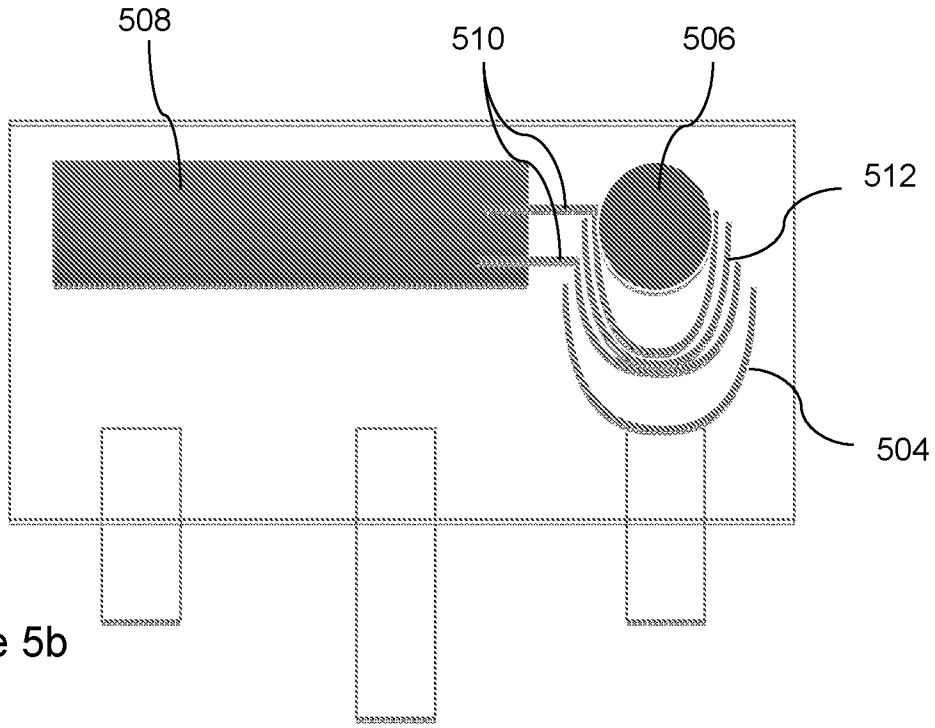

Figure 5b

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2015/050206

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/66 H01R24/30 H01R24/78 H01R103/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R H02J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 2009/002076 A2 (LIM SEONG-KYU [KR]) 31 December 2008 (2008-12-31) abstract figures 1-2	1-19,21, 22 20

X A	US 4 307 925 A (DREW DOUGLAS) 29 December 1981 (1981-12-29) abstract figures 1-5	1,6-8, 11,12, 16,17 2-5,9, 10, 13-15, 18-22

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 April 2015	04/05/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pugliese, Sandro

2

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2015/050206

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 2008/113052 A1 (ZONIT STRUCTURED SOLUTIONS LLC [US]; CHAPEL STEVE [US]; PACHOUD WILLIA) 18 September 2008 (2008-09-18)	18
Y	abstract	20
A	page 12, line 17 - page 13, line 5 figures 1A,1B,9	1-17,19, 21,22

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A	abstract figures 1-8	2-5, 9-15,18, 20-22

A	US 2010/280674 A1 (JALILI REZA [US]) 4 November 2010 (2010-11-04) abstract figures 1-8 paragraphs [0016] - [0019]	1-22

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US 2010280674 A1	04-11-2010	NONE	