

A CONNECTION SYSTEM

Field of the Invention

5 The present invention relates to a connection system, and refers more particularly, though not exclusively, to systems and methods of electrical connection of a supply with a load.

Background to the invention

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 It is well known to provide a plug and socket for electrical connection of a supply to an electrical appliance. For example a typical system 100 shown in Figure 1, includes a male plug 102 having two or three conductive pins 104. A female socket 106 has a corresponding number of slots 108. In operation the pins 104 are inserted into and
15 electrically contact with the slots 106.

 The prior art system 100 may have the disadvantage that during insertion or extraction, the pins 104 may be accessible or contactable by a user's fingers whilst still being energized from the supply in the slots 108. Moreover when used outdoors or in
20 wet locations, a special connector may be required to prevent water incursion.

 It may therefore be desirable to provide a connection system to overcome one or more disadvantages in the prior art.

Summary of the Invention

The present invention aims to provide a new and useful connection system. In
5 general terms in a first aspect the invention proposes a system for electrical connection
of a supply and a load, where the supply is only connected when the plug and socket are
in immediate proximity and/or contact.

The supply is connected via a magnetic switch in the socket which is actuated to
10 a closed position or state by a magnet in the plug. The attraction between the magnet
and the magnetic switch also helps holds the plug in place. The plug and socket both
have external contact pads which only contact when the plug is fully and correctly
engaged with the socket. The plug and the socket casing are watertight. Also when
correctly engaged the contact pads themselves are watertightly sealed. The first aspect
15 may have one or more of the advantages that the connection system is much more easily
engaged, that the connection system may be used in wet locations and that the safety of
the connection system is improved.

A second independent aspect of the invention proposes that a socket may have
20 an indicator which is activated when the supply is connected. The second aspect may
have the advantage that it will be clearly indicated when the supply is connected.

A third independent aspect of the invention proposes that a plug may have an external contacts and an internal magnet. The third aspect may have the advantage that the plug is more easily engaged with a socket.

5 In a first specific expression of the invention there is provided a system for electrical connection of a supply and a load comprising;

a plug having a plurality of contacts in electrical connection to the load;

a socket having a plurality of contacts adapted for electrical connection to the plug contacts;

10 wherein the socket contacts are adapted to be connected to the supply only when the plug and socket are in immediate proximity and/or in contact.

In a second specific expression of the invention there is provided an electrical socket for connection of a supply comprising:

15 one or more contact(s) for providing an electrical connection, and

an indicator adapted to be activated when the supply is connected to the contact(s).

In a third specific expression of the invention there is provide an electrical plug
20 for electrical connection of a load comprising:

one or more externally mounted contacts adapted to be electrically connected to a load, and

an internally mounted magnet.

In a forth specific expression of the invention there is provided an electrical socket for electrical connection of a supply comprising

one or more externally mounted contacts adapted for electrical connection to a plug;

5 a magnetic switch connected between the supply and the contacts,

wherein the magnetic switch is adapted to close when a plug is in immediate proximity and/or in contact.

Brief Description of the Drawings

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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 example only, a preferred embodiment(s) of the present invention, the description being with reference to the accompanying illustrative drawings, in which:

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Figure 1 is a cross section view of a prior art plug and socket.

Figure 2 is a perspective view of a connection system according to a preferred embodiment.

Figure 3(a) and 3(b) are cross section views of the connection system in Figure

20 2.

Figures 4(a), 4(b), 4(c), and 4(d) are cross section views of examples of the plug in Figure 2.

Figure 5 is an exploded view of the socket in Figure 2.

Figure 6(a), 6(b) and 6(c) are cross section views of examples of the magnetic switch in Figure 3.

Figure 7 is a perspective cutaway view of the socket in Figure 2.

Figure 8 is a simplified cross section of the connection system in Figure 2
5 showing the watertight features.

Detailed Description of the Preferred Embodiment

Figure 2 illustrates a connection system 200 including a plug 202 and a socket
10 204. In this document the terms plug and socket are used to refer to devices which provide an electrical connection, where the socket is connected to a supply and the plug is connected to a load.

The plug 202 includes a one or more contact pads 206 which match
15 complimentary contact pads 208 on the socket 204. The plug contact pads 206 are directly connected to the electrical load by a cable 210. However, prior to connection, the socket contact pads 208 are disconnected from the supply. Upon locating the plug 202 proximate to and/or in contact with the socket 204, the electrical supply is connected by a cable 212 to the socket contact pads 208.

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The internal configuration of both the plug 202 and socket 204 is shown in more detail in Figure 3(a) and 3(b). The plug 202 includes a magnet 300 inside a casing 302. The socket 204 includes a magnetic switch 304 inside a casing 306. In this document the term magnetic switch is used to refer to a normally open switch, which actuates

closed when exposed to a magnetic field, (eg: from a permanent magnet), originating on specific side of the magnetic switch, i.e. the front face.

In operation, as shown in Figure 3(a) the magnet 300 actuates the magnetic switch 304 when the plug 202 is in immediate proximity to and/or in contact with the front face 308 of the socket 204. This closes the electrical circuit between the supply cable 212 and the load cable 210. When the plug 202 is not present, as shown in Figure 3(b), the magnetic switch 304 is in an open position or state.

In Figures 4(a), 4(b), 4(c) and 4(d) the plug 202 is shown in more detail. Figures 4(a) and 4(b) show a cuboid shaped example of the plug casing 416. Figures 4(c) and 4(d) show a cylindrical shaped example of the plug casing 418.

Within the casing (416 or 418) is an internal compartment 400 in which the magnet 300 is held in place by, for example, a glue, clips or the like. Insulated wiring 402 connects the plug 202 to the load cable 210. The ends of the wiring 402 are secured in respective terminal blocks 404. The terminal blocks 404 have a conductive face 406 onto which a copper connecting strip 408 is secured to electrically connect the terminal blocks to the plug contact pads 206. Each plug contact pad 206 is formed by the end portion of the connecting strip 408. The wiring may be single phase including an earth wire, and may use insulated copper stranded wire. Typically there are three plug contact pads 206, for phase 410, neutral 412 and earth 414. The wiring 402 and connecting strip 408 thereby form a circuit to the plug contact pads 206. The casing 302 is watertight so it can be used outdoors or in wet locations. A plug indicator 415 is

energised to show when the supply is connected and is located on top of the plug 202. The indicator 415 is connected in parallel to the plug contact pads 206.

The magnet 300 is a permanent magnet, with an insulating cover (to prevent shorting against the connecting strips). Typically the magnet 300 will be arranged within the casing 302 to be as close as possible to the plug contact pads 206 to maximise the attraction force at the magnetic switch 304. The magnetic attraction also assists in holding the plug in position relative to the socket 204.

Figure 5 shows the socket 204 in more detail. Within the casing 306 there is an internal compartment 500 to encase the magnetic switch 304. Insulated wiring 502 connects the supply cable 212 to the magnetic switch 304. The ends of the wiring 502 are secured in respective terminal blocks 504. The terminal blocks 504 have a conductive face 506 onto which a copper contactor strip 508 is secured to electrically connect the terminal blocks 504 to the magnetic switch 304. The wiring 502 and contactor strip 508, thereby forming a circuit to the magnetic switch 304.

Figures 5 and 6(a) show an example of the magnetic switch 304 in more detail. Each contactor strip 508 is biased to be in a normally open position proximate the corresponding socket contact pad 208. An actuator 600 includes a temporarily magnetisable core 602 (eg: steel with high iron content), encased in an insulating cover 604 and suspended by a spring 606. The spring 606 rests against a plastic ring 607 which encircles the socket contact pads 208 and is secured to the core 602. The insulating cover 604 includes guides 608 through which each contactor strip 508 is

secured. The end 610 of each contactor strip is aligned with a respective socket contact pad 208. Therefore when the magnet 300 is in proximity, the magnetic attraction force on the core 602 overcomes the restoring force of the spring 606 so that the cover 604 forces the ends 610 of each contactor strip into contact with the respective socket
5 contact pad 208, thereby closing the circuit.

In Figure 6(b) an alternative magnetic switch 304 configuration is shown. An angled portion 612 at the end of each contactor strip lines up with a conducting bridge 614 on the insulating cover 604. The conducting bridge 614 also lines up with a
10 respective socket contact pad 208. The angled portion 612 is adjacent and slightly higher than the respective socket contact pad 208. The insulating cover 604 includes guides 608 through which each contactor strip 508 can freely slide. Therefore when the magnet 300 is in proximity, the magnetic force on the core 602 overcomes the restoring force of the spring 606, so that the conducting bridge 614 is forced into contact with the
15 respective angled portion 612 and socket contact pad 208, thereby closing the circuit.

Figure 6(c) shows a further alternative magnetic switch 304 configuration. In this case a temporarily magnetisable core 615, with terminal blocks 616 attached, is slidable relative to the socket contact pads 208. A sliding guide 618 limits the
20 movement of the core 615, and a spring 620 biases the core 615 to a normally open position away from the socket contact pads 208. The terminal blocks 616 line up with the socket contact pads 208, so that when the magnet 300 pulls the core 615 inwards, the terminal blocks 616 are forced into contact with the socket contact pads 208, thereby closing the circuit.

Figure 7 shows the front side 308 of the socket 204 in more detail. The socket contact pads 208 are centrally located, and may for example have a vertical or horizontal orientation.

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When the plug 202 is connected to the socket 204, an indicator 702 is energised to show when the supply is connected. The indicator 702 includes an illuminated ring 704. One or more lamps or LEDs 708 inside the casing 306 are connected in parallel with the socket contact pads 208. Part of the ring 704 is located close to the lamp 708, thereby being illuminated. . The red light may be generated either from the ring 704 being red plastic or being clear plastic with the lamp 708 itself being red.

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Figure 7 also shows an illuminated square 706 which located directly above the lamp 708. Also push a manual switch 710 is provided on the front side 308 of the socket 204. The switch 710 may be connected between the in the phase wire between the supply cable 212 and the socket contact pads 208. The switch 710 is actuated by a push button, which is externally sealed with a water tight rubber cover.

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Figure 8 shows the plug 202 and socket including watertight feature so that they can be used outdoors or in wet locations. For example rubber seals 800 are used to seal the any joints or openings. Also the surface 802 surrounding the plug contact pads 206 and the surface 804 surrounding the socket contact pads 208 is rubber. The rubber surfaces 802, 804 have a watertight fit, when the plug 204 is correctly engaged with the socket 204, to prevent water getting on the contact pads.

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Both the plug and socket may be manufactured from moulded plastics and then assembled with the internal components. The wiring and contacts will depend on the current requirements of the application, for example single phase 15A for domestic
5 applications, and three phase 40A for commercial applications.

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

Claims:

1. A system for electrical connection of a supply and a load comprising;
a plug having a plurality of contacts to electrically connect to the load;
5 a socket having a plurality of contacts to electrically connect to the plug contacts;
a magnetic switch to electrically connect between the supply and the socket contacts, and
a magnet,
10 wherein the magnetic switch is adapted to close when the magnet is in immediate proximity and/or in contact, the plug contacts and the socket contacts include a water tight seal and the magnetic attraction between the magnet and the magnetic switch holds the plug in position relative to the socket.
- 15 2. The system as claimed in claim 1 wherein the plug contacts and the socket contacts are externally mounted on the plug and socket respectively.
3. The system as claimed in claim 2 wherein the magnetic switch comprises a moveable core adapted to be attracted to the magnet, and a plurality of supply contacts
20 connected to the supply, wherein the core moving towards the magnet closes a circuit between the supply contacts and the socket contacts.
4. The system as claimed in any one of the preceding claims wherein the socket is substantially watertight.

5. The system as claimed in any one of the preceding claims wherein the plug is substantially watertight.
- 5 6. The system as claimed in claim 1 wherein the surfaces surrounding the plug contacts and the socket contacts is rubber.
7. The system as claimed in any one of the preceding claims wherein the socket comprises an indicator adapted to be activated when the supply is connected to the
10 socket contacts.
8. The system as claimed in any one of the preceding claims wherein the plug comprises an indicator adapted to be activated when the supply is connected to the plug contacts.
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9. The system as claimed in claim 7 wherein the indicator comprises a ring around the contacts.
10. The system as claimed in claim 9 wherein the indicator includes a solid square
20 adjacent the contacts.
11. The system as claimed in claim 10 wherein the indicator includes a light source which illuminates the ring and solid square.

12. The system as claimed in any one of claims 9 to 11 wherein the indicator emits visible red light when activated.