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GB 2282494 A GB 2251523 A
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(54) Abstract Title: Electrical connector which can be wired externally

(57) An electrical connector 1, such as a plug or a socket, comprising
a body 10; and
at least two electrically conductive connecting formations, e.g. pins 11, 13 each for mating with a mating formation of another electrical connector,
wherein the body 10 is formed with at least two channels 42, 44, each for accommodating a conductor 24, 28, so that the conductor, once inserted into a said channel, is in, or can be brought into, electrical contact with a said connecting formation,

the connector further comprising means for fixing a portion of each conductor in respective positions so that the conductors are in electrical contact with respective ones of said connecting formations, wherein the fixing means is operable from outside the electrical connector. An exemplary embodiment is a three pin plug. Fixing means may be screws 50 accessible from the base of the plug. Screws 50 electrically connect conductors 24, 28 to pins 11, 13 via internal wiring 36, 37. A cable grip 20 may also be provided.

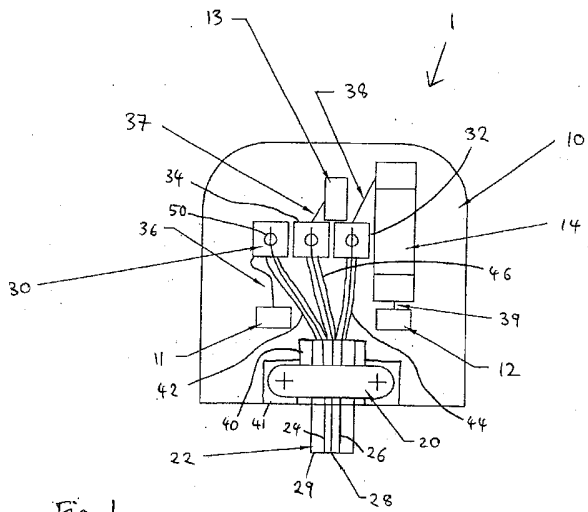


Fig. 1

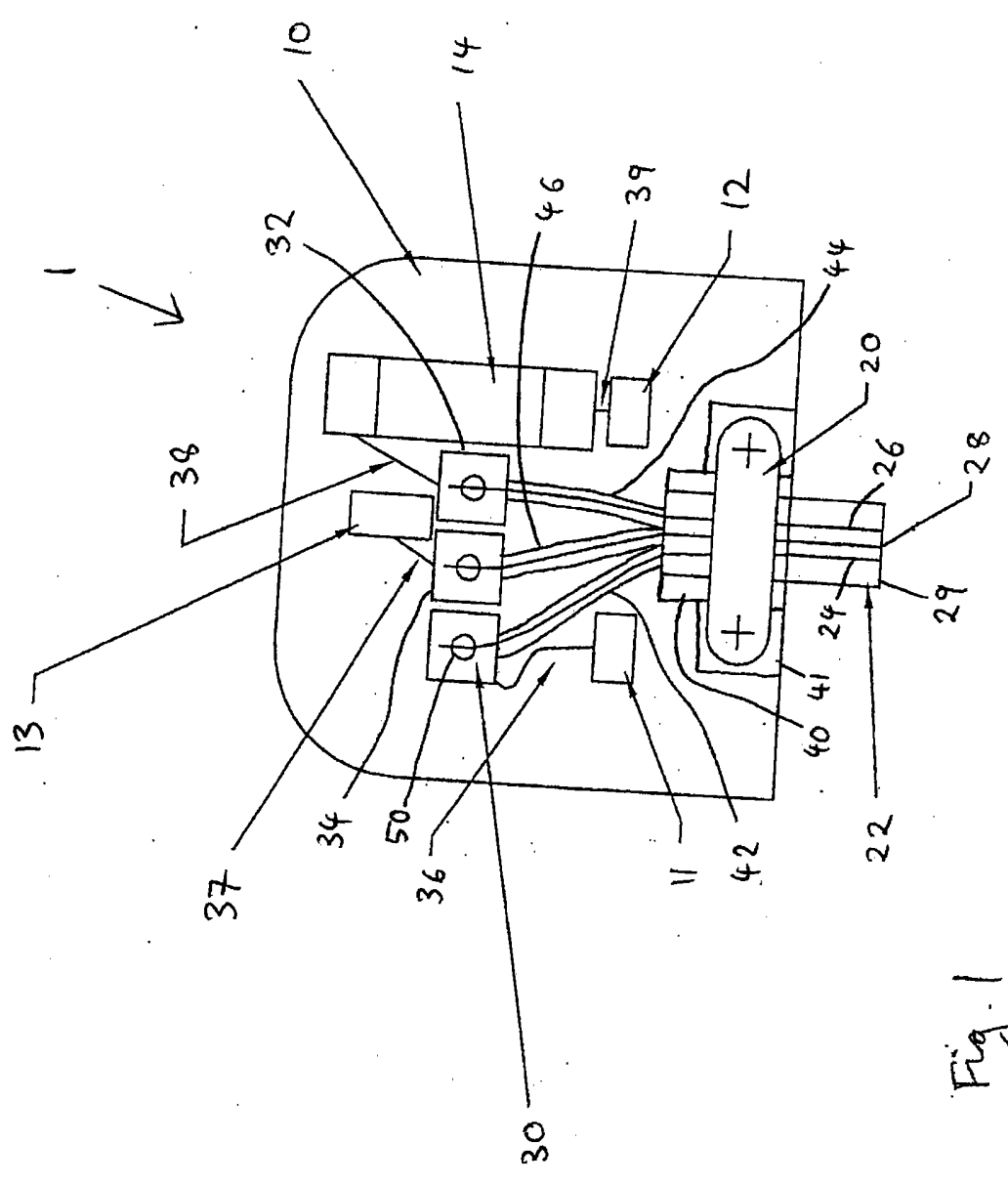


Fig. 1

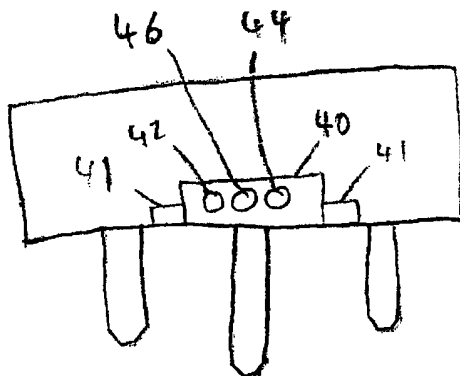


Fig. 2

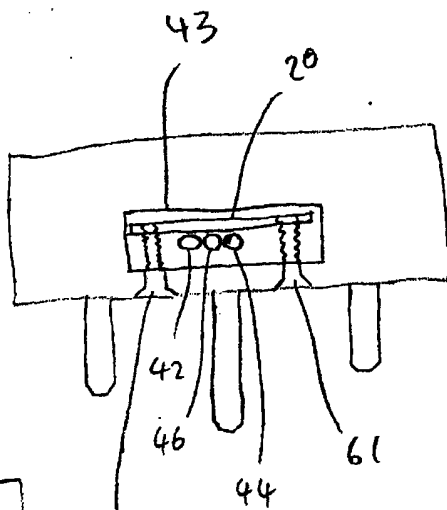


Fig. 5

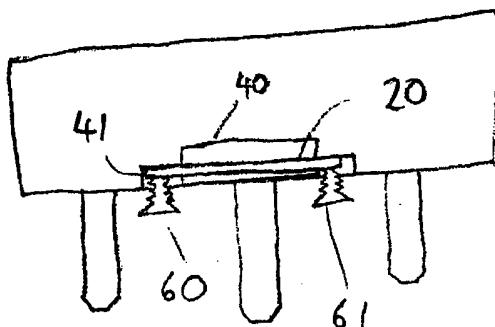


Fig. 3

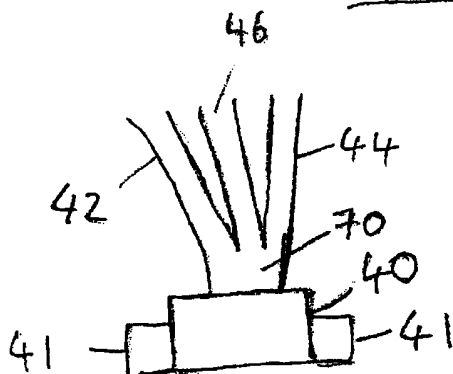


Fig. 4

Electrical Connector

The present invention relates to electrical connectors. The present invention finds particular application in mains plugs but is equally applicable to sockets such as the socket part of extension leads, or non-mains plugs and sockets. As used in the present specification, the term "electrical connector" is intended to cover mains and non-mains plugs and sockets and any other electrical device which is suitable for establishing an electrical connection with a corresponding device. In the present specification the present invention will be described with reference to a British mains plug. It will however be understood that the underlying principle can readily be applied to non-British mains plugs, to non-mains plugs and to any sockets.

Some existing mains plugs are rewirable. These usually consist of two moulded plastics halves constituting a housing, with three electrically conductive connecting formations such as three pins (neutral, live and earth) and a cable clamp. The two halves are held together by a screw. When it is desired to rewire the connector it is necessary to unscrew the screw and to separate the two halves from each other. This gives access to three connection sites to which three conductors of a cable may be secured. Once the conductors are secured at the three connection sites each conductor is in electrical contact with a respective pin. The two halves of the housing can then be joined to each other and secured by means of the screw. Once the plug has been reassembled the connection sites are not accessible from outside the plug.

Another type of plug exists, which is not designed to be rewired (commonly referred to as a "moulded plug"). This plug cannot be rewired.

The present inventor has devised a new type of rewirable plug which enables the plug to be rewired in an alternative manner. The invention aims to make the rewiring of the plug easier when compared with the rewiring of a known plug.

One or more aspect(s) is/are set out in the independent claim(s).

Some preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 shows a plug according to an embodiment of the present invention as seen from underneath.

5 Figure 2 shows a rear view of the plug shown in Figure 1, without cable clamp.

Figure 3 shows a rear view of the plug shown in Figure 1, with cable clamp.

Figure 4 shows a detail of an alternative embodiment.

Figure 5 shows a rear view of a further embodiment.

10 Referring to Figure 1, the plug 1 comprises a housing 10 which can be made e.g. from moulded plastics material, in one piece so that the housing cannot be "opened". This housing carries three electrically conductive connecting formations such as neutral pin 11, live pin 12 and earth pin 13, which are shown in section in Figure 1. These pins are arranged to be mated with a mating formation of another electrical connector such as a
15 socket. In normal use the pins 11, 12 and 13 would extend into conforming "holes" in the socket, with electrical contacts being provided in the "holes" for establishing an electrical contact with the pins when plug 1 is plugged into such a corresponding socket.

The three pins are connected to respective connection sites 30, 32 and 34 by means of
20 three respective electrical connections. The connection sites 30, 32 and 34 are arranged next to each other. The connection between neutral pin 11 and connection site 30 is made by e.g. a conducting wire 36. This conducting wire 36 is intended to remain permanently in plug 1 and may be moulded into housing 10. Similarly, the wire 37
25 connecting earth pin 13 and connection site 34 is intended to remain in plug 1 and may also be moulded into housing 10. The connection between live pin 12 and connection site 32 on the other hand is achieved via two portions of conducting wire 38 and 39 and a fuse 14 disposed between conducting wires 38 and 39. It will be appreciated that many non-British plugs do not require a fuse, and in this case live pin 12 could be
30 connected with connection site 32 by means of one conducting wire.

The plug shown in Figure 1 further comprises a cable clamp 20, which, as shown in Figure 3, can be secured to housing 10 by means of two screws 60 and 61 (these are shown in Figure 3 as having been unscrewed to some extent). Cable clamp 20 is

located in a relatively shallow recess 41 so that the cable clamp may be substantially flush with the underside of the plug when in use.

Cable clamp 20 is arranged to keep an end portion of cable 22 in place with respect to housing 10. Cable 22 (which is not part of the plug 1) comprises three conductors, 24, 26 and 28 surrounded by a sheath 29. Conductors 24, 26 and 28 project from one end of sheath 29 and extend to connection sites 30, 32 and 34 respectively. Conductors 24, 26 and 28 are fixed at connection sites 30, 32 and 34 by means of e.g. three respective screws 50 (only one referenced in Figure 1) so that an electrical connection is established between each conductor and a respective pin.

Housing 10 is formed with a relatively deep recess 40 (as shown in Figures 2 and 3), which extends "under" a central portion of cable clamp 20, and slightly further towards the centre of the plug. This recess 40 is arranged to accommodate cable 22 so that cable 22 does not project out of the underside of plug 1.

Three channels 42, 44 and 46 are formed in housing 10, one for each conductor 24, 26 and 28. These channels, which may be formed as tubes, extend from connection sites 30, 32 and 34 to recess 40, where they reach the outside surface of plug 1. Channels 42, 44 and 46 are substantially straight, whereby it is possible to feed conductors 24, 26 and 28 through a respective channel to the connection sites 30, 32 and 34. Preferably, any portion of a particular channel has an axial direction which deviates less than 45° (preferably less than 30° or 15°) from the axial direction of that portion of that particular channel which is immediately adjacent recess 40. Conductors 24, 26 and 28 can then be inserted from the outside surface (i.e. the end face of recess 40) with relative ease.

The end face of recess 40, as well as the "entrance" to the channels is best seen in Figure 2.

The channels are preferably substantially closed (laterally).

As shown in Figure 1, the distance between connection site 30 and recess 40 is approximately the same as the distance between connection site 32 and recess 40, and

between connection site 34 and recess 40. In other words, channels 42, 44 and 46 are all of about the same length. This makes it relatively straightforward to wire the plug since each conductor may protrude from the end of cable sheath 29 by approximately the same amount.

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The connection sites 30, 32 and 34 may each comprise a metal cuboid with a bore for receiving the conductors 24, 26 and 28. These cuboids may further be formed with an internal thread into which screws 50 may be threaded.

10 The heads of screws 50 are accessible from the underside of the plug 1. The heads are countersunk into housing 10 in that side of the housing from which pins 11, 12 and 13 project.

15 When the plug is plugged into a socket the heads of the screws 50 are not accessible since the underside of plug 1 would rest against the top of the socket. Hence, even if screws 50 are conductive there is no risk of electric shock to the user. However, for added safety, screws 50 may be formed fully or partly from a non-conductive material. For example, the heads of screws 50 may be coated with a non-conductive material, or the entire head and perhaps a portion of the shaft may be formed from non-conductive
20 (e.g. plastics) material. The threads of the screws are preferably made from conductive material so as to improve the electrical connection between the conductors 24, 26 and 28 and the connection sites 30, 32 and 34. However, this is not essential. As long as the screws maintain the conductors in sufficient contact with the connection sites a sufficient electrical connection is established between the conductors and the pins.
25 Hence, screws 50 may be made entirely from non-conductive material (such as plastics material).

Fuse 14 may be replaceable from the underside of the plug, as is known in the art.

30 Figure 4 shows a detailed view of a portion of the plug according to an alternative embodiment of the present invention. All details of the plug may be as described above, except that the channels 42, 44 and 46 do not start at the end surface of recess 40. Instead, they are joined at a distance from the end surface of recess 40, to form a

common, wider channel 70. This common channel 70 should however be relatively short so that conductors 24, 26 and 28 can be inserted respectively into channels 42, 44 and 46 from outside the plug with relative ease.

5 A further embodiment is illustrated in Figure 5. This essentially differs from the Figure 3 embodiment in the location of the cable clamp 20. Figure 5 shows a recess 43 in the rear face of the plug. This recess is formed in the interior of the rear face rather than at the edge thereof. Recess 43 extends approximately 5mm into the interior of housing 10. Cable clamp 20 is located within recess 43 and is held by two screws 60, 61 which
10 extend through a portion of housing 10 which in Figure 5 is shown at the bottom, "under" recess 43. Channels 42, 44 and 46 are again provided at the end face of recess 43, as described above.

In the configuration shown in Figure 5 the plug is ready for connection to cable 22. As
15 shown in Figure 5, cable clamp 20 is situated near the "top" of recess 43. Conductors 24, 26 and 28 are then inserted respectively into channels 42, 44 and 46, as described above. Cable 22 is pushed into recess 43 until sheath 29 arrives near the end face of recess 43. Screws 60 and 61 are then tightened, which moves clamp 20 downwards as screws 60 and 61 are threaded into clamp 20. As clamp 20 moves downwards cable 22
20 is gripped between cable clamp 20 and the bottom of recess 43.

According to another alternative embodiment (not illustrated) no screws 50 are provided. Instead, a mechanism is provided at connection sites 30, 32 and 34, which, on insertion of conductors 24, 26 and 28, keeps these conductors in place so as to
25 establish the required electrical connection. Such a mechanism may for example comprise a bayonet fixing or a leaf spring. These mechanisms would not necessarily have to hold conductors 24, 26 and 28 with great force since cable 22 would normally be held in place by means of cable clamp 20 so that accidental removal of any of the conductors from the connection sites is inhibited.

30

It will be appreciated that the invention can be applied to plugs or sockets having more than, or less than, 3 pins or contacts.

In the present specification reference is made to fixing means (such as screws 50) being operable from outside the electrical connector. It will be appreciated that, in some embodiments, a cover could be provided and placed over the heads of screws 50 so that the heads of screws 50 are no longer accessible once they are covered. Such
5 embodiments are intended to be encompassed by the present claims. Preferably, what is meant by "fixing means operable from outside the electrical connector" is that the fixing means can be operated without a need to open housing 10, as is necessary with conventional rewireable plugs. In turn, this preferably means that the fixing means is operable even if the connection sites 30, 32 and 34 remain substantially fully enclosed
10 by housing 10.

Although the invention has been described in terms of preferred embodiments as set forth above, it should be understood that these embodiments are illustrative only and that the claims are not limited to those embodiments. Those skilled in the art will be
15 able to make modifications and alternatives in view of the disclosure which are contemplated as falling within the scope of the appended claims. Each feature disclosed or illustrated in the present specification may be incorporated in the invention, whether alone or in any appropriate combination with any other feature disclosed or illustrated herein.

CLAIMS:

1. An electrical connector, such as a plug or a socket, for connection to at least two
conductors, comprising
5 a body; and
at least two electrically conductive connecting formations, each for mating with
a mating formation of another electrical connector,
wherein the body is formed with at least two channels, each for accommodating
a said conductor, so that a said conductor, once inserted into a said channel, is in, or can
10 be brought into, electrical contact with a said connecting formation,
the connector further comprising means for fixing a portion of each conductor in
respective positions so that the conductors are in electrical contact with respective ones
of said connecting formations, wherein the fixing means is operable from outside the
electrical connector.
15
2. An electrical connector according to claim 1, wherein the fixing means
comprises a screw accessible from outside the electrical connector.
3. An electrical connector according to claim 1 or 2, wherein no electrical
20 connection exists between any portions of the fixing means which, in use, remain
accessible from outside the electrical connector, and the electrically conductive
connecting formations or the conductors.
4. An electrical connector according to any of claims 1 to 3, wherein each channel
25 comprises a tube.
5. An electrical connector according to any of claims 1 to 4, wherein the channels
are substantially straight.
- 30 6. An electrical connector according to claim 5, wherein the axial direction of any
portions of the channels deviates less than 45° , preferably less than 30° , more preferably
less than 15° , from the axial direction of that end portion of the respective channel via
which the respective conductor is arranged to be inserted.

7. An electrical connector according to any of claims 1 to 6, further comprising a cable clamp for fixing a portion of a cable with respect to the electrical connector, the conductors forming part of, and protruding from, said cable.
- 5
8. An electrical connector according to claim 7, wherein loosening of, or removing a portion of, said cable clamp facilitates access to said channels from outside the electrical connector.
- 10
9. An electrical connector, such as a plug or a socket, for connection to at least two conductors, comprising
a body; and
at least two electrically conductive connecting formations, each for mating with a mating formation of another electrical connector,
- 15
- wherein the body is formed with at least two channels leading from an outer surface of the plug towards said connecting formations, each for accommodating a said conductor, so that a said conductor, once inserted into a said channel, is in, or can be brought into, electrical contact with a said connecting formation.
- 20
10. An electrical connector, such as a plug or a socket, for connection to at least two conductors, comprising
a body; and
at least two electrically conductive connecting formations, each for mating with a mating formation of another electrical connector,
- 25
- wherein the body is formed with at least two channels, each for accommodating a said conductor, wherein the channels have an end at, or close to, an outer surface of the plug, so that a said conductor can be inserted into a said channel from outside the plug such that a said conductor, once inserted into a said channel, is in, or can be brought into, electrical contact with a said connecting formation.
- 30
11. An electrical connector according to claim 9 or 10, further comprising means for fixing a portion of each conductor in respective positions so that the conductors are in

electrical contact with respective ones of said connecting formations, wherein the fixing means is operable from outside the electrical connector.

12. An electrical connector according to claim 11, wherein the fixing means
5 comprises a screw accessible from outside the electrical connector.

13. An electrical connector according to claim 11 or 12, wherein no electrical
connection exists between any portions of the fixing means which, in use, remain
accessible from outside the electrical connector, and the electrically conductive
10 connecting formations or the conductors.

14. An electrical connector according to any of claims 9 to 13, wherein each channel
comprises a tube.

15. An electrical connector according to any of claims 9 to 14, wherein the channels
are substantially straight.

16. An electrical connector according to claim 15, wherein the axial direction of any
portions of the channels deviates less than 45° , preferably less than 30° , more preferably
20 less than 15° , from the axial direction of that end portion of the respective channel via
which the respective conductor is arranged to be inserted.

17. An electrical connector according to any of claims 9 to 16, further comprising a
cable clamp for fixing a portion of a cable with respect to the electrical connector, the
25 conductors forming part of, and protruding from, said cable.

18. An electrical connector according to claim 17, wherein loosening of, or
removing a portion of, said cable clamp facilitates access to said channels from outside
the electrical connector.

30

19. An electrical connector, substantially as herein described with reference to, or as
illustrated in, the accompanying drawings.



For Innovation

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Examiner: Ben Munns

Claims searched: 1-19

Date of search: 15 September 2006

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-6, 9-16	US 6010347 A (LEE) see the figures, particularly figure 3 channels 141, 151 and connection screws 423, 323.
X	1-6, 9-16	US 5292263 A (MOSSER) see especially the figures.
X	1, 3, 5-8, 10, 11, 13, 15-18	GB 2282494 A (NIFCO) see especially the figures.
X	1, 4-8, 10, 11, 14-18	US 5147215 A (PRITULSKY) see especially the figures.
X	1-3, 7-13, 17, 18	GB 2251523 A (LIM) see especially the figures and page 6 line 11 to page 7 line 10.
X	1-4, 6, 9- 14, 16	US 5192234 A (HENG) see especially the figures.
X	1, 3, 4, 6, 9-11, 13, 14, 16	US 4886472 A (TSAI) see especially the figures.
X	1, 2, 5, 6, 10-12, 15, 16	GB 636821 A (CRABTREE) see the entire document.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :



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H2E
Worldwide search of patent documents classified in the following areas of the IPC
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The following online and other databases have been used in the preparation of this search report
EPODOC, WPI