June 18, 1968 R. E. DAVIS 3,389,370

ELECTRICAL CONNECTOR

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FIG. 1

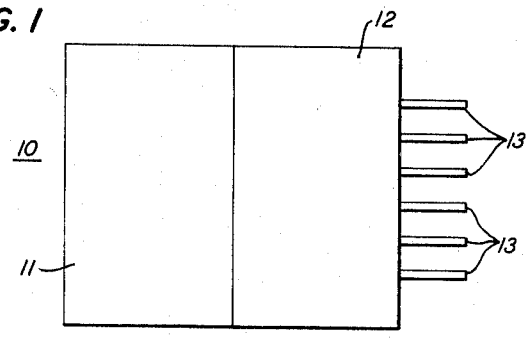


FIG. 2

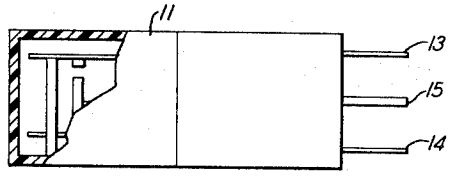


FIG. 3

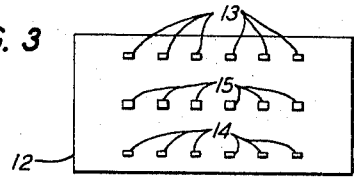


FIG. 4

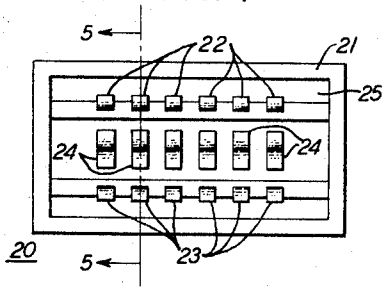
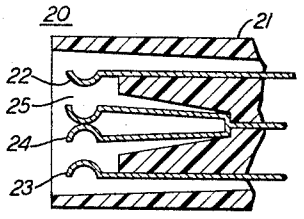


FIG. 5



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FIG. 6

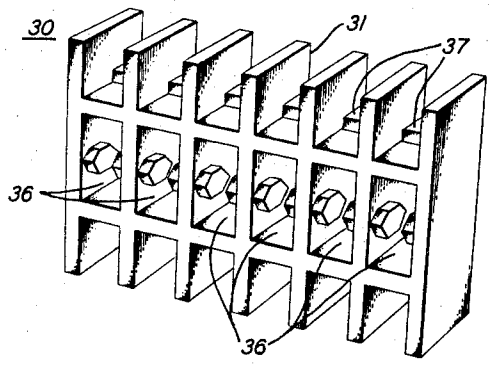


FIG. 7

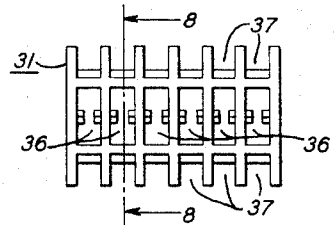


FIG. 8

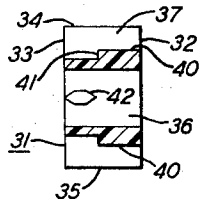
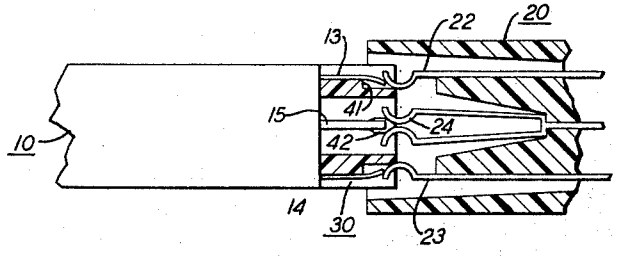


FIG. 9



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3,389,370

ELECTRICAL CONNECTOR

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Filed Jan. 4, 1966, Ser. No. 518,568
6 Claims. (Cl. 339—156)

ABSTRACT OF THE DISCLOSURE

A connector block for joining a relay to a socket is disclosed which includes tunnels and channels for accepting and joining plugs from the socket and the relay.

This invention relates to connectors and pertains particularly to connectors for joining a relay to a base.

Broadly, the object of this invention is to facilitate interconnections between plug-in relays and the sockets into which they plug.

Many arrangements are presently available for plugging relays into sockets. See, for instance, Patent 2,889,424, issued to R. F. Glore et al., wherein a relay assembly is disclosed which is adapted to be removably plugged into a socket of the type commonly used to accommodate a vacuum tube. While such relay and socket arrangements are suitable for most purposes, in order to have easy to make connections the socket-engaging plugs on the relay must have a high degree of rigidity.

High rigidity of the relay plugs, however, is not always conveniently achieved. This is particularly true where the relay has been miniaturized. For example, when relay size is substantially reduced, generally the cross section of the plugs is also reduced thereby resulting in relay plugs having little rigidity.

It is, therefore, an object of this invention to facilitate connection between a socket and a relay when the plugs on the relay are relatively flexible.

Flexible relay plugs, in addition to being difficult to insert into a socket, are also susceptible to wide fluctuations in the amount of contact resistance produced by the juncture between the socket and each flexible plug.

Accordingly, it is another object of this invention to minimize the amount by which contact resistance fluctuates among the various plug-socket junctures contained in a relay-socket combination.

In all arrangements wherein a relay is removably plugged into a socket, whether miniaturized or otherwise, wear occurs between the plugs and the electrically conducting plug engaging portions of the socket. Such wear affects contact resistance and is particularly aggravated by the gouging action produced by the plugs as they are inserted into the socket. Consequently, the usable life of the relay and socket combination is reduced where gouging is pronounced.

It is, therefore, another object of this invention to reduce wear caused by the interaction between the plugs in the relay and the electrically conducting portions of the socket.

Furthermore, it is a specific object of this invention to reduce such wear by reducing the gouging of the conducting portions of the socket caused by the plugs as they are inserted.

According to one feature of this invention, a connector member is adapted to fit between plugs on a relay and a socket for receiving the plugs so as to support the plugs as they are inserted into the socket; to hold the inserted plugs in place to maintain a particular amount of contact resistance between the plugs and the socket; and to prevent the plugs from gouging the socket as they are inserted.

According to another feature of this invention, each connector member includes a section for receiving flexible relay plugs wherein a part of the section is adapted to support the flexible plugs as they are inserted into a socket and thereafter to hold the flexible plugs in the socket with a controlled amount of force, and another part of the section is adapted to reduce gouging between the supported flexible plugs and the socket during insertion.

According to another feature of this invention, the connector member includes a wedge-shaped part for separating plug engaging contact members in the socket in advance of entry therein of the relay plugs whereby the contacts will not be gouged by the plugs.

According to one embodiment of this invention, a connector member comprises a block having two parallel side faces and two parallel end faces. A plurality of tunnels and a plurality of channels extend between the two parallel side faces. Both tunnels and channels are adapted to receive plugs from a relay and the tunnels extend through the central portion of the block while the channels are cut into the two parallel end faces.

A pair of wedge-shaped members are disposed at one end of each tunnel. The wedge-shaped members act in concert to separate contacts in the socket in advance of the entry therebetween of a relay plug. As a result, the relay plug does not gouge the contacts.

As to the channels, each has a bed which terminates in a step. Each bed is adapted to support a flexible relay plug during socket insertion and thereafter hold the inserted plug against the socket contact with a predetermined amount of force. The step in each channel, on the other hand, permits the flexible relay plug to deflect as it engages a socket contact whereby gouging of the socket contact by the flexible plug is reduced.

Other objects and features of this invention will be readily understood from the following detailed description when taken in conjunction with the drawing in which:

FIG. 1 is a plan view of a relay having a plurality of plugs adapted to be inserted into a socket;

FIG. 2 is an elevation view of the relay shown in FIG. 1 wherein part of the relay is broken away to show the inner contacts;

FIG. 3 is an end view of the relay shown in FIG. 1;

FIG. 4 is an end view of a socket containing a plurality of plug engaging contact members;

FIG. 5 is a section view taken along the line 5—5 in FIG. 4;

FIG. 6 is a perspective view of a connector member constructed in accordance with this invention;

FIG. 7 is a plan view of the connector member shown in FIG. 6;

FIG. 8 is a section view of the connector member shown in FIG. 7 wherein the section is taken along the line 8—8; and

FIG. 9 is an elevation view of a relay having plugs being inserted into a socket with the aid of a connector member wherein parts of the connector member and the socket have portions broken away to show their internal construction.

Referring now to FIG. 1, there is shown therein a relay 10 adapted to be plugged into a socket. It includes a contact end 11 and a terminal or plug end 12.

As shown in FIG. 2, the contact end 11 contains a plurality of card-responsive contacts. The contacts may conveniently be arranged as make contacts, break contacts, or any combination thereof.

As shown in FIG. 3, the terminal end 12 includes a plurality of outer plugs 13 and 14 and a plurality of inner plugs 15. All of the plugs are made of a conducting material such as copper or brass. Each, moreover, is

electrically connected to a contact similar to the ones shown in FIG. 2.

A socket 20 suitable for accepting the plugs on the relay 10 is shown in FIG. 4. The socket 20 comprises a base 21, a plurality of outer socket contacts 22 and 23, and a plurality of inner socket contacts 24. The base 21 contains a recess 25 for accommodating all of the outer and inner contacts. The base 21, moreover, may advantageously be made of any electrically nonconducting moldable material such as plastic.

The outer contacts 22 and 23 are made of electrically conducting material such as copper or brass. Moreover, each is embedded in the base 21 at one end and terminates in a lip at the other end. Each lip is arranged to bear upon an outer plug from the relay 10 and make electrical connection therewith when the outer plug is inserted into the base 21. All of the outer contacts 22 are disposed in a first common plane and all of the outer contacts 23 are disposed in a second common plane which is parallel to the first common plane. As a result, all of the outer contacts lie in two parallel rows. The two parallel rows are contained within the recess 25 so as to protect the outer contacts 22 and 23 from accidental damage.

Similarly, the inner contacts 24 are made of an electrically conducting material such as copper or brass. Each inner contact, moreover, is embedded in the base 21 at one end and terminates at the other end in a bifurcated portion having a pair of opposed lips. Each bifurcated portion is adapted to accept therebetween an inner plug 15 from the relay 10.

Like the outer contacts 22 and 23, all of the inner contacts 24 are disposed within the recess 25 for protection purposes. Furthermore, all of the inner contacts 24 lie in a common plane which is disposed parallel to the planes containing the outer contacts 22 and 23. Thus, the recess 25 contains three parallel rows of contacts.

A connector member 30 for joining the relay 10 and the socket 20 is illustrated in FIG. 6. It comprises a block 31 and is designed to be pushed into the recess 25 in the socket 20 in order to aid the relay 10 as it is connected thereto. As shown in FIG. 8, the block 31 comprises a relay face 32, a socket face 33 disposed in parallel to the relay face 32, and two parallel grooved sides 34 and 35.

A plurality of tunnels 36 are cut through the central portion of the block 31 and extend from the relay face 32 to the socket face 33. Similarly, a plurality of channels 37, also extending between the relay face 32 and the socket face 33, are disposed side by side along the grooved sides 34 and 35. The tunnels 36 are adapted to receive the inner plugs 15 on the relay 10 and the channels 37 are adapted to receive the outer plugs 13 and 14.

All of the channels 37 and all of the tunnels 36 are identical so a description of one channel suffices for all of the channels and a description of one tunnel suffices for all of the tunnels. Each channel 37 includes a bed 40 for positioning an outer plug 13 or 14, for supporting the positioned outer plug 13 or 14 during insertion, and for holding the outer plug 13 or 14 against either the outer contact 22 or the outer contact 23, as the case may be, with a predetermined amount of force after insertion.

The bed 40, furthermore, includes a recess or step 41 on its socket face end. The step 41, as illustrated in FIG. 9, provides a space for accepting the outer plug 13 or 14 and allows it to flex when it engages the outer contact 22 or the outer contact 23, respectively. The amount of flexure allowed by the space created by the step 41 is sufficient to substantially reduce gouging of the outer contacts 22 or 23 by the outer plugs 13 or 14 as they are inserted.

Each tunnel 36, on the other hand, includes two wedge members 42 adjacent to the socket face end. Each wedge member 42, moreover, is adapted to engage an inner contact 24 in the socket 20 during insertion of an inner plug 15 but prior to the time the inner contact 24 and the inserted inner plug engage each other. As a consequence, the inner plug 15 does not gouge the inner contact 24 during insertion and the usable life of the socket and plug combination is thereby extended.

When plugging the relay 10 into the socket 20, the connector member 30 is first slipped between the outer plugs 13 and 14 and around the inner plug 15. Each outer plug 13 and 14 fits in a channel 37, while each inner plug 15 extends into a tunnel 36. The outer plugs 13 and 14 frictionally hold the connector member 30 in place against the relay 10.

Next, the relay 10 and the connector member 30 are inserted into the recess 25 in the socket 20. As the relay 10 and the connector member 30 enter the recess 25, the outer contacts 22 and 23 engage the outer plugs 13 and 14. Thereafter, as the relay 10 and the connector member 30 push further into the recess 25, the outer plugs 13 and 14 deflect in response to the pressure exerted by the outer contacts 22 and 23, as shown in FIG. 9.

The deflecting spaces provided by the steps 41 are large enough to allow the outer plugs 22 and 23 to deflect substantial amounts. As a result, the gouging of the outer contacts 22 and 23 by the outer plugs 13 and 14 is reduced.

Deflection of the outer plugs 13 and 14 continues until the outer contacts 22 and 23 pass beyond the step 41 on the connector member 30. At that time, the beds 40 press the outer plugs 13 and 14 against the outer contacts 22 and 23 with a predetermined amount of force. Thus, reasonable consistency in contact resistance is obtained among the outer plug and outer contact junctions. Furthermore, the forces are sufficient to maintain a good mechanical connection between the socket 20 and the relay 10.

In the meantime, the wedge members 42 have penetrated between the bifurcated lips of the inner contacts 24 to spread them apart. With the lips on the inner contacts 24 spread apart, the inner plugs 15 enter therebetween without any gouging. Thereafter, the wedge members 42 pass beyond the lips of the inner contacts 24 and allow the lips to return toward their normal position to grip the inserted inner plug 15 in conducting relationship. The friction force exterted by the inner contacts 24 on the inner plug 15 cooperates with the friction forces holding the outer plugs in place thereby further increasing the strength of the mechanical connection between the relay 10 and the socket 20.

The foregoing has described the manner in which a relay 10 is plugged into a socket 20 with the aid of a connector member 30. Disconnection of the relay 10 from the socket 20 occurs in a similar manner when the foregoing steps are reversed.

In summary, there has been described herein an embodiment of this invention wherein the flexible plugs on a plug-in type relay are assisted into a socket and held in place therein by a connector member. In addition, the connector member substantially reduces gouging caused by the interaction of the plugs and the contacts in the socket during insertion. The disclosed embodiment, however, comprises only one aspect of this invention and many embodiments within the spirit and scope of the invention will occur to others skilled in the art.

What is claimed is:

1. A device for improving the connection between a relay removably joined to a socket by plugs attached to said relay comprising:

a connector block having a relay face, a socket face, and two parallel end faces extending between said relay face and said socket face;

a plurality of tunnels wherein each tunnel extends through said connector block from said relay face to said socket face, and includes means for receiving a relay plug and means for preventing gouging of said socket by a relay plug being inserted therein; and

a plurality of channels wherein each channel is disposed on one of said parallel end faces, extends be-

tween said relay face and said socket face and includes means for receiving a relay plug.

2. A device in accordance with claim 1 wherein said means for preventing gouging comprises a pair of wedge-shaped members disposed in opposite sides of said tunnel adjacent to said socket face on said connector block.

3. A device in accordance with claim 1 wherein each of said channels includes means for supporting a relay plug during insertion into a socket and for holding said relay plug against said socket with a predetermined amount of force after insertion therein, and means for allowing said relay plugs to deflect as they are being inserted.

4. A device in accordance with claim 3 wherein said means for supporting a relay plug during insertion into a socket and for holding said relay plug against said socket comprises a flat bed in said channel.

5. A device in accordance with claim 4 wherein said means for allowing said relay plugs to deflect during insertion comprises a recess in said flat bed.

6. A device comprising:

a socket having a recess in one end and a plurality of socket plugs projecting from the other end, said socket plugs extending through said socket and into said recess;

a relay removably joined to said socket by a plurality of relay plugs and having one face extending within recess, each of said relay plugs projecting from said one face and being in contact with a socket plug; and

a connector block for improving the junction between said socket and said relay, said connector block being removably enclosed in said recess and including means for supporting said relay plugs during insertion into said socket and for holding said relay plugs in place with a predetermined amount of force after insertion, and means for allowing said relay plugs to deflect as they are inserted into said socket.

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J. R. MOSES, *Assistant Examiner.*