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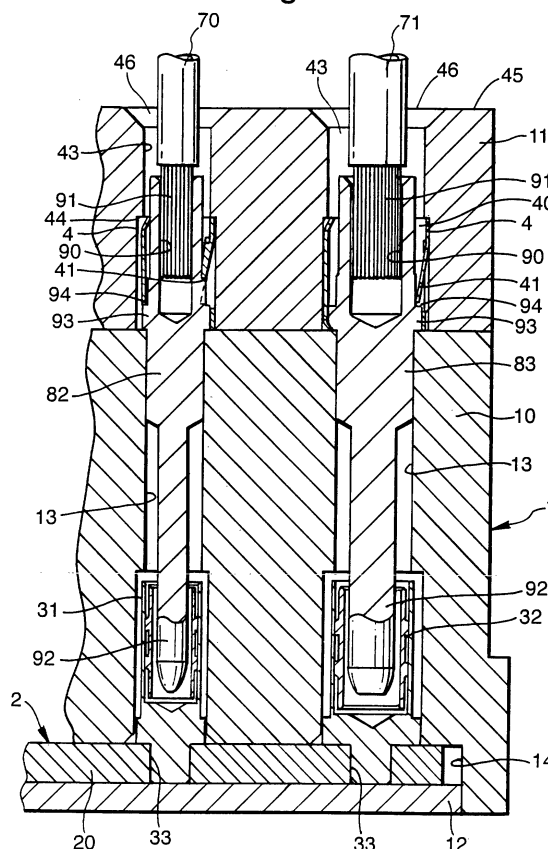
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(54) **Electrical connector assemblies**

(57) An electrical busbar terminal assembly has several hyperboloid spring sockets 21 to 32 mounted on a metal bar 20 spaced along its length. The sockets 21 to 32 extend along respective bores 13 of an insulating lower body 10 and the bar 20 extends along the bottom of the body being covered by a cover plate 12. The two end sockets 21 and 32 are larger than the others 22 to 31 and receive input power contacts 72 and 83 so that power is distributed from these sockets via the bar 20 to contacts 73 to 82 inserted in the other sockets. Catches 4 with inturned teeth 41 retain the contacts 72 to 83 after insertion. The catches 4 are located in bores in an upper closure 11 bonded to the lower body 10 and are trapped between the lower body and a step 44 in the upper closure. The catches 4 are electrically isolated from the sockets 21 to 32 until after insertion of a contact 72 to 83.

Fig.4.



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Description

[0001] This invention relates to electrical connector assemblies of the kind including an outer, electrically-insulating housing opening at one end and closed at its opposite end, and a contact assembly within the housing and including a plurality of electrical contacts and a conductor interconnecting the contacts with one another, the contact assembly being arranged electrically to contact respective cooperating contacts inserted in the housing through the open end such that power supplied to one of the cooperating contacts flows to others of the cooperating contacts via the contact assembly

[0002] Busbar connector assemblies have a power input socket and two or more power output sockets. A power source is connected with the assembly via a power line having a plug at one end, which is inserted in the input socket. Power is distributed to several pieces of electrical equipment via power lines plugged into the output sockets. The input and output sockets are usually fixed to a solid metal rod, or busbar, at their lower end by which power is supplied from the input sockets to the output sockets. The sockets are contained within an electrically-insulative housing having openings along its top through which the upper ends of the sockets are accessed.

[0003] The plugs and sockets are constructed such as to avoid inadvertent separation during use. The socket takes the form of a metal sleeve extending close to the open, upper end of the housing and having a locking catch at its upper end designed to latch onto a specially-shaped formation on the outside of the plug. Once inserted, a special tool is needed to release the catch and remove the plug. Busbar connectors of this kind are sold by Burndy/Framatome Connectors International.

[0004] Several problems exist with conventional busbar connector assemblies. In particular, the plugs need to be of a special design in order to lock in the sockets and these are usually expensive. Other problems arise as a result of the locking catch being provided directly on the socket, which means that the catch itself is electrically live during use. Consequently, the distance between the openings at the top of the housing and the electrically-live internal components is relatively short. This increases the risk of inadvertently contacting the live components. Another problem is that any arcing between the plugs and sockets during insertion and withdrawal, when the assembly is live, occurs relatively close to the exposed parts of the assembly. A further disadvantage is that the plug is electrically connected to the socket when only a short length of the plug is inserted, and that a relatively large part of the length of the plug is exposed and live.

[0005] It is an object of the present invention to provide an alternative electrical power terminal assembly.

[0006] According to the present invention there is provided an electrical power terminal assembly of the above-specified kind, characterised in that the contact

assembly is located away from the open end of the housing with the conductor protected by an electrically-insulating member, that the terminal assembly includes a plurality of catches located within the housing spaced from the contact assembly, that the catches engage the cooperating contacts and restrain withdrawal of the cooperating contacts, and that the catches are electrically isolated from the contacts of the contact assembly prior to insertion of the cooperating contacts.

[0007] The contacts of the contact assembly are preferably sockets such as hyperboloid spring sockets. At least one contact of the contact assembly may have a larger diameter than the others and receive a power input contact. Preferably the assembly has two contacts of larger diameter located at opposite ends of the assembly. The conductor is preferably a metal bar and the contacts of the contact assembly are preferably mounted in respective holes in the bar. The housing may include a lower body and an upper closure, the contacts of the contact assembly extending in bores in the lower body and the catches being trapped between the lower body and the upper closure. The catches may include a sleeve having an inclined tooth arranged to engage a part of a cooperating contact inserted in the assembly.

[0008] A busbar connector terminal assembly according to the present invention, will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of the assembly;

Figure 2 is a perspective, cut-away view of the assembly;

Figure 3 is an exploded view of the assembly from one end; and

Figure 4 is a sectional side elevation view of a part of the assembly.

[0009] The busbar assembly comprises an outer housing 1 of an electrically-insulative material, an electrical socket assembly 2 within the lower end of the housing, and a number of retention clips or catches 4 located towards an upper end of the housing.

[0010] The housing 1 is of a generally rectangular shape comprising a main, lower body 10, an upper closure 11 and a bottom cover 12, all of an electrically-insulative plastics material, although it would be possible for the housing to be of a metal with an insulating insert. The main body 10 has twelve parallel bores 13 arranged side-by-side and extending up the entire height of the main body. The electrical socket assembly 2 is fitted in the main body 10 and is retained by the bottom cover 12, which fits in a rectangular recess 14 extending across the lower end of the body.

[0011] The socket assembly 2 includes a bar 20 of plated brass or other electrically-conductive material,

which has a rectangular section and extends across the entire width of the housing 1, in the recess 14. The socket assembly 2 also includes twelve electrical sockets 21 to 32 equally spaced along the bar 20 and pressed into holes 33 through the bar so that they project at right angles and align with respective ones of the bores 13 in the main body 10 of the housing 1. The sockets 21 and 32 at opposite ends of the assembly 2 are slightly larger in diameter than the others 22 to 31 and are adapted to receive the input power to the busbar assembly. The sockets 21 to 32 are of the hyperboloid spring element kind, such as sold by Hypertac Limited of England under the Hypertac trade mark (Hypertac is a Registered Trade Mark of Hypertac Limited). The sockets have a cylindrical sleeve and several spring wires extending within the sleeve, which make electrical connection with a contact pin inserted in the socket. Hyperboloid sockets have a relatively high current rating and are highly reliable in adverse circumstances, although other sockets could be used. Typically, each socket 21 to 32 is about 10mm long whereas the housing 1 is about 35mm high, so it can be seen that the upper end of each socket is spaced from the upper, open end of the bores 13 by a considerable distance.

[0012] The retention clips 4 are in the form of short cylindrical sleeves 40 of a spring metal having three teeth 41 spaced around their circumference. The teeth 41 incline inwardly at their lower end at an angle of about 10°. The retention clips 4 are located at the lower end of the upper closure 11, in respective bores 43, which align with the bores 13 in the main body 10 of the housing. The lower end of each bore 43 is slightly enlarged to receive the clips 4 and to form a shallow annular step 44 about midway along its length. Each clip 4 is, therefore, trapped between a step 44 and the upper end of the main body 10. The clips 4 are electrically isolated from the socket assembly 2 until bridged by an inserted contact pin. The bores 43 in the upper closure 11 open on the upper face 45 of the housing 1 via a row of twelve openings 46.

[0013] The upper closure 11 and bottom cover 12 are bonded to the main body 10 such as by welding or an adhesive or solvent, so that the socket contact assembly 2 and the retention clips 4 are securely retained.

[0014] Externally, opposite ends of the housing 1 have an integral lug 50 with a vertical aperture 51 in which is received a metal mounting bracket 52.

[0015] The busbar assembly is used to make connection between twelve power lines 60 to 71 each of which is terminated by a male contact in the form of a crimp pin 72 to 83. The crimp pins 72 to 83 are of a conventional kind, such as MIL-C 39029 and are made of plated, machined brass. The pins are of circular section, the rear end of each having a cylindrical recess 90 within which an exposed conductor 91 in a power line 60 to 71 is inserted and crimped. The forward end of each pin is reduced in diameter to form a contact portion 92 of the appropriate size to make sliding connection in the ap-

propriate socket 21 to 31. A shallow annular flange 93 projects externally around each pin 72 to 83 at the lower end of the crimp recess 90, the dimensions and location of the flange being selected so that the upper edge 94 of the flange is engaged by the teeth 41 of the retention clip 4 when the pin is inserted in full electrical contact with the socket 21 to 31. The pins 72 and 83 are connected to input power lines 60 and 71 and are larger in diameter than the other pins 73 to 82, which are connected to output power lines 61 to 70. The bores 43 in the upper closure 11 are sufficiently long to ensure that the upper end of the pins 72 to 83 are entirely recessed within the bores.

[0016] In use, power from a power source (not shown) is supplied to the assembly on lines 60 and 71, via pins 72 and 83. These electrically connect with the sockets 21 and 32 at opposite ends of the assembly 2, so that power connection is established to the bar 20 and hence to each of the other sockets 22 to 31. The power thereby flows via the pins 73 to 82 to the output power lines 61 to 70 and hence to the electrical equipment supplied by those lines. The pins 72 to 83 can be removed from the terminal assembly by means of a conventional extraction tool having a channel of part-circular section that is threaded along the power line 60 to 71 into the upper part of the bore 43 and into the sleeve 40 of the retention clip 4 to push out the teeth 41, clear of the flange 93.

[0017] The hyperboloid sockets used in the assembly give a considerably improved electrical connection with the pins compared with previous assemblies. The pins can be conventional, thereby keeping costs to the user to a minimum. By separating the mechanical retention of the inserted contacts from the electrical interconnection, live components can be spaced from the open end of the housing. Thus, there is little risk of inadvertently contacting an unused, live power output socket. Connection can be made to the busbar assembly when live more safely than previously because very little of the inserted pins is exposed outside the housing when they are inserted far enough to contact the sockets. Furthermore, because contact is made and broken deep within the housing, any arcing is also contained away from the open end of the housing.

[0018] Instead of a bar, the sockets could be electrically interconnected by other means, such as a wire. The contacts within the housing need not be sockets; they could, for example, be male components arranged to contact sockets inserted within the housing.

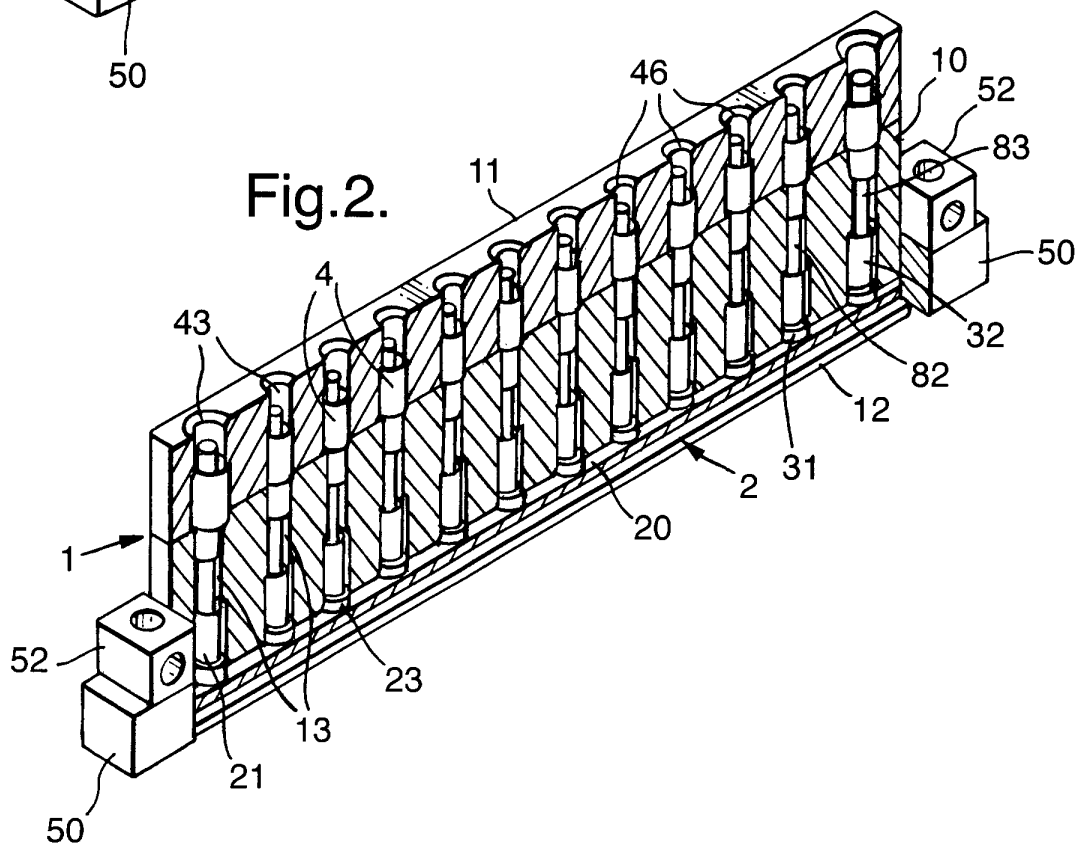
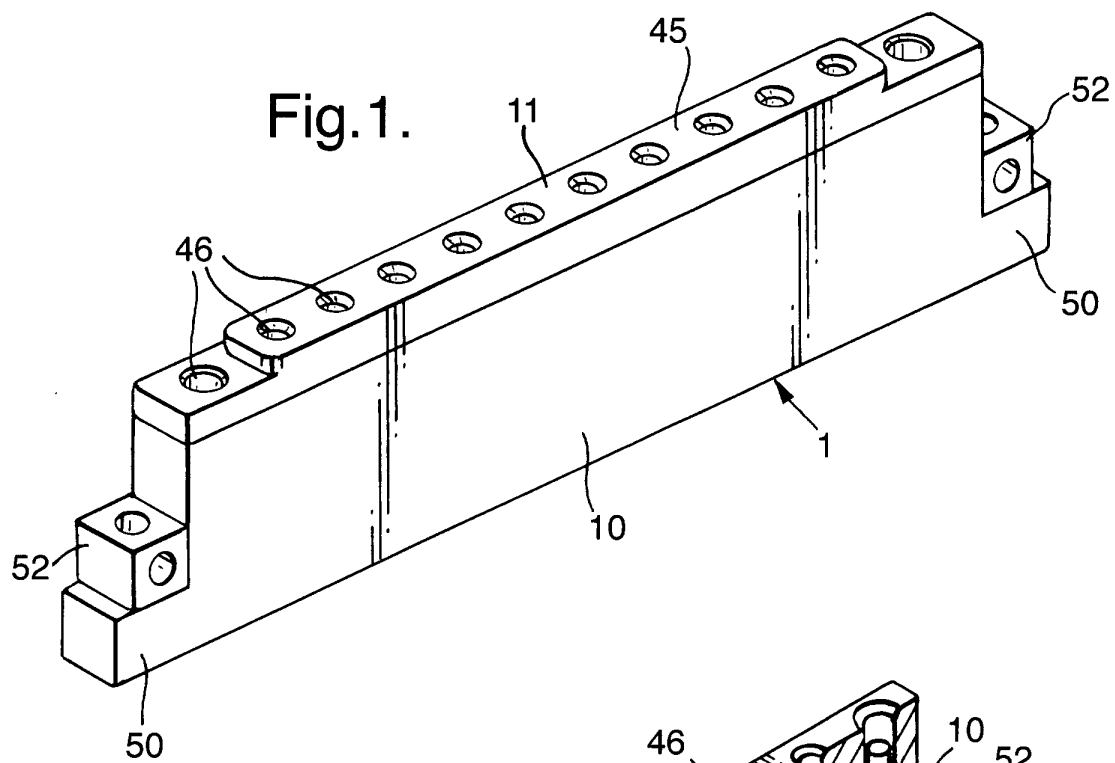
Claims

1. An electrical power terminal assembly including an outer, electrically-insulating housing (1) opening at one end and closed at its opposite end, and a contact assembly (2) within the housing and including a plurality of electrical contacts (21 to 32) and a conductor (20) interconnecting the contacts with one

another, the contact assembly (2) being arranged electrically to contact respective cooperating contacts (72 to 83) inserted in the housing through the open end (11) such that power supplied to one of the cooperating contacts (72 to 83) flows to others of the cooperating contacts via the contact assembly (2), characterised in that the contact assembly (2) is located away from the open end of the housing with the conductor (20) protected by an electrically-insulating member (12), that the terminal assembly includes a plurality of catches (4) located within the housing (1) spaced from the contact assembly (2), that the catches (4) engage the cooperating contacts and restrain withdrawal of the cooperating contacts, and that the catches (4) are electrically isolated from the contacts (21 to 32) of the contact assembly (2) prior to insertion of the cooperating contacts (72 to 83).

to engage a part (94) of a cooperating contact (21 to 32) inserted in the assembly.

2. An assembly according to Claim 1, characterised in that the contacts of the contact assembly (2) are sockets (21 to 32).
3. An assembly according to Claim 2, characterised in that the sockets are hyperboloid spring element sockets (21 to 32).
4. An assembly according to any one of the preceding claims, characterised in that at least one contact (21, 32) of the contact assembly (2) has a larger diameter than the others (22 to 31) and receives a power input contact (72, 83).
5. An assembly according to Claim 4, characterised in that the assembly includes two contacts (21 and 32) of larger diameter located at opposite ends of the assembly.
6. An assembly according to any one of the preceding claims, characterised in that the conductor is a metal bar (20).
7. An assembly according to Claim 6, characterised in that the contacts (21 to 32) of the contact assembly (2) are mounted in respective holes (33) in the bar (20).
8. An assembly according to any one of the preceding claims, characterised in that the housing (1) includes a lower body (10) and an upper closure (11), that the contacts (21 to 32) of the contact assembly (2) extend in bores (13) in the lower body, and that the catches (4) are trapped between the lower body (10) and the upper closure (11).
9. An assembly according to any one of the preceding claims, characterised in that the catches (4) include a sleeve (40) having an inclined tooth (41) arranged



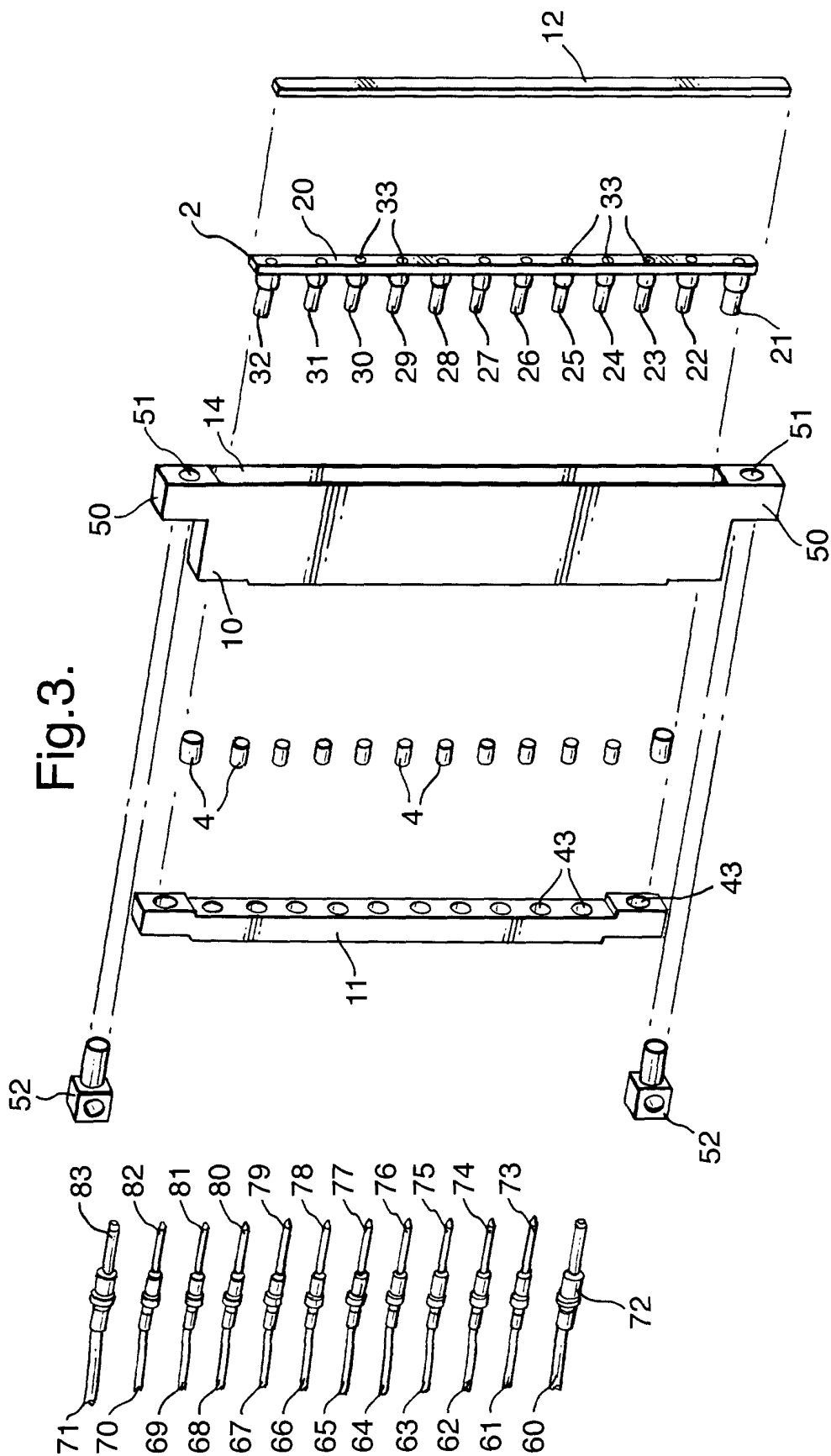


Fig.4.

