"ELECTRICAL ADAPTOR "

The present invention relates to electrical adaptors for providing multiple socket outlets from a single mains electrical supply socket, and to a method of assembling such adaptors. The invention is generally used as an adaptor with multiple socket outlets connected electrically in parallel to a single set of input pins for insertion into a supply socket.

Electrical adaptors similar to the present invention include UK patents 2273825 and 2288926. The present invention seeks to provide an improved adaptor through the use of single, unitary, conductive bus bars that interconnect the earth, live and neutral input terminals with all of the corresponding output terminals. Additionally, an intermediate plate may be provided for electrically separating the live and neutral bus bar while providing support to one of the bars.

In accordance with a first aspect of the invention, there is provided an electrical mains adaptor comprising a housing of insulating material which carries an input set of mutually insulated terminals and a plurality of output sets of corresponding mutually insulated terminals and, for each of said input terminals, a single unitary conductive bus bar interconnecting that input terminal with all of the corresponding output terminals of the output sets. In an embodiment, each of the bus bars is formed as a single piece of sheet metal which is stamped to shape and bent to form the bus bar, including its corresponding output terminals, which comprise resiliently deformable electric contacts.

The connection of the conductive bus bars to the appropriate input terminals may be effected in any convenient manner, such as rivetting, soldering or bolting. Apart from this inevitable joint, there are no joints, rivetted or otherwise, between the input terminal and the corresponding output terminals. This gives improved reliability and is simpler and cheaper to produce.

In accordance with a second aspect of the invention, there is provided a method of assembling an electric mains adaptor of the type comprising a housing of insulating material which carries an input set of mutually insulated earth, live and neutral terminals and a plurality of output sets of corresponding mutually insulated earth, live and neutral terminals, said method comprising the steps of:-

a) fitting within the housing a single unitary earth bus bar and neutral bus bar and connecting same to the respective earth and neutral input terminals, said bus bars being operable to interconnect their respective input terminals with the corresponding terminals of each of the output sets of terminals;

b) connecting a single unitary live bus bar to a fuse connector which connects, by a fuse, to the live input terminal, said live bus bar being operable to interconnect the fuse connector, and hence the live input terminal, with the live terminals of each of the output sets of terminals;

c) attaching said live bus bar to an intermediate plate of insulating material and fitting the plate and live bus bar into the housing.

In order that the invention may be better understood, it will now be described by way of example only, and with reference to the accompanying drawings, in which:-

Figure 1 is an exploded view of an embodiment of an electrical adaptor according to the invention;

Figure 2 is a plan view into the interior of the rear part of the housing of the adaptor of Figure 1;

Figure 3 is a view similar to that of Figure 2, but showing the front part of the housing;

Figure 4 is a side sectional view of the adaptor of Figure 1 showing, for clarity, just the live bus bar fitted; and

Figures 5 and 6 are views similar to Figure 4, but showing just the neutral bus bar and the earth bus bar, respectively.

Referring to the drawings, the adaptor comprises a housing made of plastics material, which housing includes a front body part 1 and a rear body part 2. Front body part 1 and rear body part 2 are held together by screws 3 which pass through apertures 4 in the rear body part, and engage in blind bores (not shown) in the front body part 1.

The rear body part 2 carries pins 6, 7 and 8, which constitute the electrical plug that, in use, enters the mains supply socket (not shown). Pin 6 is the earth pin and pins 7 and 8 are the live and neutral pins, respectively. Pins 7 and 8 are provided with insulation at 9 to reduce the danger of electrocution when handling the adaptor.

Front body part 1 carries a standard 3-pin electrical socket with outlets 10, 11 and 12. The particular socket outlets as shown are for flat pins, but in an alternative embodiment, round pins may be used. The front body part may also carry an optional neon display 13.

A further standard 3-pin electrical socket outlet is carried on the top surface (not shown in Figure 1) of the adaptor. A similar 3-pin socket with outlets 14, 15 and 16 is carried on the underside surface 17.

The apertures for the socket outlet on the underside surface 17 are formed partly in front body part 1 and partly in rear body part 2. Similarly, the apertures for the socket outlet carried on the top surface of the adaptor are formed partly in front body part 1 and partly in rear body part 2.

Lying behind each of the apertures forming the socket outlets are resiliently deformable electrical contacts of respective unitary conductive bus bars 18, 19 and 20. Unitary bus bar 18 is the live bus bar and has electric contacts 18A, 18B and 18C, each corresponding to, respectively, live socket outlets 12, 15 and the live socket outlet on the top surface of the adaptor. Likewise, unitary bus bar 19 is the earth bus bar, and has electric contacts 19A, 19B and 19C, each corresponding to, respectively, earth socket outlets 10, 16 and the earth socket outlet on the top surface of the adaptor. Finally, unitary bus bar 20, is the neutral bus bar, and has electric contacts 20A, 20B and 20C, each corresponding to, respectively, neutral

socket outlets 11, 15 and the neutral socket outlet on the top surface of the adaptor.

Each of the unitary bus bars 18, 19 and 20 is formed as a single sheet of metal, which is cut or stamped to a particular shape and then bent to the configurations shown in Figure 1. As the electric contacts are also formed in one piece with the respective bus bars, each bus bar comprises a single integral unit, and not two or more members biased together or attached together by rivets or the like.

Both bus bars 18 and 20 have their electric contacts located in the same general plane, immediately above rear body part 2 although, of course, the electric contacts are oriented toward different directions. Live bus bar 18 is approximately in the shape of an L, with a vertical support 18E near electric contact 18C, which vertical support extends downwardly to the base of rear body part 2. Neutral bus bar 20 is also approximately in the shape of an L, but its vertical support 20E is at the corner of the L; vertical support 20E also extends downwardly to the base of rear body part 2. Earth bus bar 19, which is located almost wholly within the rear body part 2, is approximately in the shape of an I, with an arm 19E near electric contact 19C, which arm 19E extends upwardly in a direction towards the front body part 1. As shown, the arm 19E is approximately L-shaped and has the electric contact 19A at its upper end, in approximately the same plane as the electric contacts of the live and neutral bus bars 18 and 20.

Vertical support 20E is bent at 90° at its bottom end to form a short arm having formed therein a hole 23 that is used to join to the inner end of the neutral pin 8. To this end, the pin 8 is equipped with a short stub 25 at its inner end, which stub 25 extends through the hole 23 and attaches thereto, for example by swaging the end of stub 25. Vertical support 18E is similarly bent at 90° at its bottom end to form a short arm having a hole therein. In this case, however, the arm is connected to a fuse contact 60 by riveting through the hole in the arm and a hole 54 in contact 60. The fuse contact 60 forms the remote contact for the mains fuse (not shown),

the near contact of which comprises a similar fuse contact 62 which has a hole 70 which is engaged by a short stub 25 at the inner end of live pin 7, the two being attached together, for example by swaging the end of the stub 25. The earth bus bar 19 has hole 24 formed near electric contact 19B for joining to the inner end of pin 6, which also has a stub 26 at its inner end for extending through hole 24 and attaching thereto.

The live and neutral bus bars 18 and 20 are primarily housed within and supported by rear body part 2. To this end, the interior of rear body part 2 is provided with various walls and ribs that act to locate, secure and electrically insulate the bus bars and their respective electric contacts. These internal fittings will now be described in detail with reference to Figure 1; please note that, for purposes of clarity, many of these fittings are omitted from the remaining Figures. An internal wall 31 has transverse ribs 31A and 31B (rib 31B is hidden in Figure 1) for supporting and electrically insulating electric contact 20C. Similarly, internal wall 32 has transverse ribs 32A and 32B for supporting and electrically insulating electric contact 20B. Electric contact 20A, on the other hand, is supported and electrically insulated by a rectangular location pocket 33, which is formed by ribs parallel and transverse to rib 31A.

A slit 31C is formed between wall 31 and rib 31A and a further slit 32C is formed between wall 32 and rib 32A, both acting to receive and locate the neutral bus bar 20. As can be seen, one of the ribs forming rectangular location pocket 33 is lower than the rest so as to receive and locate contact 20A of bus bar 20.

Earth bus bar 19 largely extends along the base of rear body part 2. between rib 31A and a lower wall 35, and also between a lower wall 34 and transverse rib 32A. Hence, rib 31A also insulates neutral electric contact 20C from earth electric contact 19A while lower wall 35 insulates the earth bus bar 19 from the fuse location 36 and live bus bar 18. Lower wall 34 insulates the earth bus bar 19 from the neutral bus bar 20, while rib 32A helps to support and insulate electric contact 19B.

The live bus bar 18 is separately and additionally electrically insulated and supported by an intermediate plate 40, which is made of plastics material and is shaped to accommodate electric contacts 18A, 18B and 18C. It should be understood that while plate 40 is shown to support and electrically insulate live bus bar 18, in alternative embodiments (not shown), plate 40 could instead support and insulate neutral bus bar 20.

As shown in Figure 1, the plate 40 includes a rectangular location pocket 41, which supports and electrically insulates electric contact 18A; while electric contacts 18B and 18C are supported and electrically insulated by wall 43 and rib 44;and wall 46 and ribs 47 and 48, respectively. Formed in rectangular location pocket 41 are slits 42 for receiving and locating the bus bar 18. Wall 42 and rib 44 are also spaced apart to receive and locate bus bar 18.

Similarly, ribs 47 and 48 are separated by a slit 49 for receiving and locating live bus bar 18. Recess 50 is formed in wall 43 to provide clearance for the neutral bus bar 20 and electric contact 20B. Live bus bar 18 and neutral bus bar 20 are electrically insulated from each other since, when assembled, the top portion 71 of wall 43 lies between transverse sections 18 X, 20 X of the live bus bar 18 and the neutral bus bar 20 respectively, at which point the two bus bars overlie one another.

The aforementioned walls, ribs, and pockets are all dimensioned to securely retain the electric contacts in place so that they cannot move more than is necessary to accommodate the normal insertion of the plug pins. These dimensions are also such that the live, earth and neutral bus bars are insulated from each other by plastics material. Hence, in addition to strong mechanical support, the adaptor also provides for superior electrical performance.

Referring to rear body part 2, as can be seen, in between apertures 4, along the width of rear body part 2, are rectangular slots 28A and 29A for shutters 28B and 29B, respectively. These shutters are conventional, and are biased by springs 28C and 29C. respectively, in recesses 28D and

29D to a position where the shutters close the openings for the live and neutral pins through the housing wall. Although not shown in Figure 1, a similar rectangular slot is provided on the inside surface of front housing part 1 to accommodate shutter 30B, which is biased by spring 30C, in recess 30D.

The shutters are generally T-shaped and include cam portions 28E, 29 E and 30E, which obstruct the corresponding opening for the earth pin. In use, as a plug is inserted into, for example, socket outlets 10, 11 and 12, the earth pin enters socket outlet 10, slides along cam surface 30E and forces shutter 30B to slide open against the bias of spring 30C. With continued insertion, the shutter opens completely to allow entry of the live and neutral pins. A recess 52 in intermediate plate 40 is shaped to accommodate and locate shutter 30B, which is located on the inside surface of front body part 1. Front body part 1 additionally has stubs (not shown) for engaging springs 28C and 29C at locations corresponding to recesses 28D and 29D of shutters 28B and 29B. The inside surface of front body part 1 may also have wiring for the optional neon 13 which comprises a pair of wires 75 (Figure 3) which extend from the neon to springs 76 mounted in the front body part 1. These springs engage respective tabs 18D, 20D formed in one piece with the live and neutral bus bars 18, 20 respectively. Apart from the optional wiring for neon 13, the front body part 1 of the housing does not carry any of the interconnecting metal work.

The adaptor described above is simple and easy to assemble. A method of manufacturing an adaptor according to the present invention includes the following sub-steps:

a) Rear body part 2 is formed with the support and insulating walls and ribs, as well as the fuse location and the relevant apertures.

b) Earth pin 6 is fitted to rear body part 2 by inserting stub 26 through hole 24 of earth bus bar 19 and attaching thereto by swaging,

riveting or the like; neutral pin 8 is fitted to rear body part 2 by inserting stub 25 through hole 23 of neutral bus bar 20 and attaching thereto by swaging, riveting or the like.

c) Live pin 7 is fitted to fuse contact 60 by inserting stub 25 through hole 54 of fuse contact 60 and attaching thereto by swaging, riveting or the like. The live bus bar is then fitted to the intermediate plate 40 to create a sub-assembly of plate 40, bus bar 18 and fuse connector 60.

d) The sub-assembly from step (c) is next fitted into the open rear body part 2. The intermediate plate is supported within rear body part 2 by various ribs, such as rib 73 and is of such a size and shape as to fit securely within the rear body part 2 without needing specific securing means such as rivets or screws.

e) Shutters 28B and 29B are fitted into shutter accommodations 28A and 29A, respectively.

f) Front body part 1 is formed, complete with accommodation for shutter 30B and its corresponding spring, stubs for engaging springs 28C and 29C, blind bores for receiving screws 3 and, where desired, accommodation for the optional neon and its corresponding wiring.

g) Fitting springs 28C and 29C to the stubs, and connecting wiring for the neon where applicable.

h) Connecting front body 1 to rear body 2 by means of the four screws 3

i) Fuse locator 54 along with a fuse 74 is fitted behind fuse location 36, that is, from outside of rear housing 2, by attaching one end of the fuse to contact 60 and the other end of the fuse to contact 62. Hence, live bus bar 18 is connected to live pin 7 via the fuse.

As shown, with the use of the single unitary bus bars, except for the connections of pins 6, 7 and 8 to their respective terminals; no additional riveting is required. Hence, the assembly process for an adaptor according to the present invention is faster and simpler. As mentioned, the electrical connections are stable and reliable since the contacts are part of a single

unitary bus bar, hence giving the greatest mechanical support. Furthermore, with the use of intermediate plate 40, and the walls and ribs, the likelihood of a short circuit occurring is very small as the bus bars, when close to one another, are separated by plastics material and not just by an air gap.



CLAIMS

1. An electrical mains adaptor comprising a housing of insulating material which carries an input set of mutually insulated terminals and a plurality of output sets of corresponding mutually insulated terminals and, for each of said input terminals, a single unitary conductive bus bar interconnecting that input terminal with all of the corresponding output terminals of the output sets.

2. An electrical mains adaptor as claimed in claim 1 wherein each of the terminals of each of the output sets of terminals comprises resiliently deformable electric contacts.

3. An electrical mains adaptor as claimed in claim 2 wherein said contacts are formed integrally with the corresponding bus bar.

4. An electrical mains adaptor as claimed in claim 3 wherein each bus bar and its associated electric contacts are formed as a single piece of sheet metal which is shaped to provide the correct route for the bus bar, together with the electric contacts.

5. An electrical mains adaptor as claimed in any one of the preceding claims, wherein the output terminals correspond to female sockets for receiving mains plug pins.

6. An electrical mains adaptor as claimed in any one of the preceding claims wherein the housing is equipped with internal structures for supporting and insulating the bus bars and their corresponding output terminals.

7. An electrical mains adaptor as claimed in claim 6, wherein said internal structures include walls, ribs, and pockets, all dimensioned so as to locate said output terminals of said bus bars in their correct positions, and also support the same upon entry of a plug pin during use.

8. An electrical mains adaptor as claimed in any of the preceding claims further including an intermediate plate of insulating material for

separately and additionally supporting and insulating either the live bus bar or the neutral bus bar.

9. An electrical mains adaptor as claimed in any one of the preceding claims, wherein each set of output terminals is provided with a spring-loaded shutter assembly operable to close off the output terminals when not in use.

10. An electrical mains adaptor as claimed in any one of the preceding claims further comprising a fuse connected between fuse connectors connected respectively to the live terminal of the input set and to the live bus bar.

11. An electrical mains adaptor as claimed in any one of the preceding claims, wherein said input set comprises earth, live and neutral pins and wherein each of said output sets comprises earth, live and neutral female sockets.

12. A method of assembling an electric mains adaptor of the type comprising a housing of insulating material which carries an input set of mutually insulated earth, live and neutral terminals and a plurality of output sets of corresponding neutrally insulated earth, live and neutral terminals, said method comprising the steps of:-

a) fitting within the housing a single unitary earth bus bar and neutral bus bar and connecting same to the respective earth and neutral input terminals, said bus bars being operable to interconnect their respective input terminals with the corresponding terminals of each of the output sets of terminals;

b) connecting a single unitary live bus bar to a fuse connector which connects, by a fuse, to the live input terminal, said live bus bar being operable to interconnect the fuse connector, and hence the live input terminal, with the live terminals of each of the output sets of terminals;

c) attaching said live bus bar to an intermediate plate of insulating material and fitting the plate and live bus bar into the housing.