

Connector Bridge Having Folding Pins

Background of the invention

The invention relates to a connector bridge for an electrical plug to connect electrical devices, in particular household devices, with an AC power socket, wherein the plug is formed as a unit by an injection moulded connector bridge connected with the end piece of a three-wire connection cable for the device, wherein the connector bridge is formed from a dimensionally stable insulator for receiving and fixing a line pin, a neutral pin, and a earth pin, wherein the line, neutral and earth pin are moulded into or onto the insulator in through-holes of the insulator that correspond to the cross-section of the pins in one and the same operation as the injection moulding process of the insulator, wherein the line, neutral and earth pins on the one hand, compared to the connector bridge and the plug, project far enough, to be inserted into the socket, and on the other hand are connected by connection points with the corresponding terminals of the connection cable, wherein the connection points to be connected with the connection cable of the device are inside of the contour of the connector, and wherein the line and neutral pin each comprises a rectangular cross-section with the dimensions (6.35 x 3.98 x 17.7 mm (+ /- 0.08 x 0.13 x 0.5 mm) and the earth pin comprises a rectangular cross-section with the dimensions 3.975 x 7.93 x 22.73 mm (+ /- 0.08 x 0.13 x 0.5 mm).

This kind of connector bridge is described e.g. in DE 198 01 896 C1 and DE 100 51 348 C2.

They are used primarily in Great Britain and the English language area. The characteristic feature of these plugs is that the earth pin serves as a mechanic
 5 unlocking device when the appliance plug is inserted in the socket of the electrical current or power supply network. The earth pin is longer than both the line and the neutral pin. The two other pins can be inserted properly only when the earth pin is inserted.

According to the British standard BS 1363, the line and the neutral pin have to be
 10 rectangular with the measures $3.98 \times 6.35 \times 17.7 \text{ mm}$ ($\pm 0.08 \times 0.13 \times 0.5 \text{ mm}$). At the plug side, 9.35 mm ($\pm 0.15 \text{ mm}$) have to be insulated. The earth pin has to be fixed in the middle above the other two pins at a distance of 22.23 mm ($\pm 0.13 \text{ mm}$). This pin has to be rectangular as well, with the measures $3.975 \times 7.93 \times 22.73 \text{ mm}$ ($\pm 0.08 \times 0.13 \times 0.5 \text{ mm}$), but without insulation.

15 In addition to the mechanic fuse described above, for reasons of security, today's appliance plugs consist of cast or injection moulded plugs in the interior of which the electric connection between the connecting cable for the appliance to be connected on the one hand, and the connection or plug pins for the socket are encapsulated on the other hand. In general, the cable cannot be disconnected
 20 from the plug. Various forms of connection devices facilitate the secure connection of the cable. On the plug side, the plug pins may be connected either by crimp contacts or by rivet contacts.

These and similar connector bridges are installed in large numbers in the production of appliance plugs. Since, in the fiercely competitive market, even small
 25 differences in price severely affect competitiveness, developments that aim at saving costs or material play a major role in this technological area.

Thus, in GB 2 092 836 A a plug is described that uses pins that are folded by pressed parts. Without a doubt, this leads to considerable savings of material.

However, unlike today's systems, this is a mounting system where the plug pins and contacts are not encapsulated by a casting process. It follows that, in contrast to modern plug systems, it is not ensured that individual conducting wires protrude from the interior of the casing to the outside. Further, due to their construction, these folding pins are mechanically unstable. Moreover, moisture may invade the interior of the plug through the large cavities. In addition, due to its construction, the system is not suitable for mass production, since the partial insulation of the line and the neutral pin described in the above mentioned standard BS 1363 cannot easily be implemented. For this reason, the construction described in GB 2 092 836 A has to be considered as outdated, such that the person skilled in the art would not search for improvements of the actual plug system in this field.

Based on standard-compliant constructions as described in DE 198 01 896 C1 and DE 100 51 348 C2, it has been attempted to save on material by milling and filling the otherwise solid plugs with synthetic materials, as shown e.g. in DE 10 2007 009 422 A1. Because of the intricate processing, this method of economizing on material adversely affects the speed of production, and thus finally affects to cost of production. While solid plug pins reach production numbers of about 80 to 100 per minute, the milled plug pins are produced at a rate of only 60 to 80 pieces per minute.

Aim of the invention

The aim of the present invention is, in contrast, to improve a standard connector bridge of the kind described above by simple technological means, with little effort and in a cost-effective way, such that a considerable extent of material can be saved in the production of the connector bridge, without compromising on quality and security according to the state of the art. Further, the construction of the invention is simple and cost-effective.

Brief description of the invention

This problem is solved by the invention in a surprisingly simple and effective way by constructing the line, neutral, and earth pins as foldable pins consisting of an initially flat stamped sheet of sheet metal that is being unfolded into its final shape, where the cavities are filled with synthetic material during the process of injection moulding the insulation case in a way that the line , neutral , and earth pins attain their final shape after the injection moulding process.

Compared to the solid construction, the production from a stamped sheet substantially economizes on material. Because of the machine conducted folding and the available machines, production speed is increased considerably. The necessary stability and the sealing of the cavities of the foldable pins is carried out in a particularly simple and cost effective way, simultaneously to the casting process that encapsulates the entire plug anyway.

The invention thus exhibits a large cost advantage over connector bridges according to the state of the art, because of the marginal effort and the rapid production.

Preferred specifications of the invention

A particularly preferred specification of the connector bridge according to the invention is characterized by the fact that the flat stamped sheet from which the earth pin is being unfolded into its final shape is rectangular prior to the unfolding, with a long centre axis and a short centre axis. At the long flanks of the stamped sheet, two U- or V-shaped cut-outs are intended that are mirror-symmetrical to the long and the short centre axis. After the unfolding of the stamped sheet, the cut-outs form tapered inserts at the socket end of the earth pin. Such inserts are compulsive according to the above mentioned British standard BS 1363. They are easily implemented in the way described above.

Preferably, the rectangular stamped sheet exhibits two L-shaped free-punches at its long end that are arranged mirror-symmetrically to the long centre axis. At the opposite end there is a profiled free-punch starting from the long centre axis and extending mirror-symmetrically to both sides of the axis. The L-shaped free-

5 punches allow in a surprisingly simple way for creating a rivet or crimped sleeve which is then in its final shape inserted into the profiled free-punch in order to prevent it from sliding sideways.

Optimally, the profiled free-punch described above is shaped in a way that it exhibits two cams that are arranged mirror-symmetrically to the long centre axis.

10 These cams serve as bolts in the final shape, that prevent the closed bending contour from springing back in a particularly effective and simple way.

In a particularly advantageous extension of the specifications described above, the profiled free-punch exhibits a tongue that is cut out mirror-symmetrically to the long centre axis, that forms a supporting rib of the earth pin. This specification is to

15 be preferred since the supporting rib absorbs the process forces induced by riveting and crimping, thus preventing an unintended bending of the bending contour during the processing.

In another advantageous specification of the connector bridge according to the invention, the flat stamped sheet, from which the line or the neutral pin are

20 unfolded into their final shape, has an rectangular shape with a long centre axis and a short centre axis, prior to the unfolding. This enables the production of line and neutral pins by the same advantageous method used for the earth pin.

In a preferred extension of the specification described above, the flat stamped sheet for the line or the neutral pin exhibits long holes that run mirror-

25 symmetrically to the long and the short centre axis, at a distance to the short centre axis, that will later, during the casting process, make the synthetic material flow optimally around the parts to be insulated. Another advantage of this specification is an additional economizing on material.

An extension of the specifications mentioned above that is especially preferred is one where the stamped sheet for the line or the neutral pin exhibits a profiled cut-out at its long side that starts from the long centre axis and extends mirror-symmetrically to both sides of the long centre axis. The profiled cut-out exhibits a tongue that is cut out mirror-symmetrically to the long centre axis that forms a supporting rib for the line or the neutral pin after the unfolding. Analogous to the earth pin, the supporting rib absorbs the process forces that result from riveting and crimping.

It is considered particularly advantageous if the line and the neutral pin exhibit cavities at their sides in the section where the cable is connected, where the cavities absorb the insulating synthetic material during the casting process according to BS 1363.

Another advantageous specification of the invention is characterized by the line and the neutral pin exhibiting a press-forming of preferably 0.5 to 0.3 mm on at least one of the lateral flanks. This further facilitates the production process of the partial insulation mentioned above.

In a preferred specification of the connector bridge according to the invention, the line, neutral, and earth pin exhibit a hollow-rivet at their ends at the connection side. With the hollow-rivet, the plug side current-conducting contacts can easily be riveted.

In an alternative specification, the line, neutral, and earth pin exhibit a crimped sleeve at their cable-connecting ends. This helps to easily crimp the current-conducting contacts, analogous to the preceding specification.

Preferably, the flat stamped sheets for the line, neutral, and earth pin consist of sheet brass, which is preferred as a basic material for the current-conducting parts because of its good electric properties, as well as its mechanical stability properties and its relatively insignificant susceptibility to corrosion.

A preferred specification provides an electric fuse that prevents excessive current feed. This is prescribed by the British standard BS 1363. Therefore, this specification is compulsory for connector bridges that are intended to be used in Great Britain.

- 5 The present invention also includes a foldable pin, modified according to the invention, for the installation as a line, neutral, or earth pin into a connector bridge of the kind described above, where the foldable pin, consisting of an initially flat stamped sheet of sheet metal, is unfolded into its final shape and, during the process of the injection of the insulator, its cavities are filled up with synthetic
10 material in a way that the line, neutral, or earth pin achieves its final shape after the injection process.

Further advantages of the invention follow from the description and the drawings. Analogously, the above-mentioned and further listed properties may be used either separately or in any conceivable combination. The specifications shown and
15 described above are not to be considered as a final listing. Instead, they are exemplary of the description of the invention.

Drawings and detailed description of the invention

It shows:

- Fig. 1a a perspective view on an embodiment of the power plug according to
20 the invention comprising a connection cable side rivet sleeve;
- Fig. 1b as Fig. 1a, but comprising current rails;
- Fig. 1c as Fig. 1b, but comprising rivet sleeve;
- Fig. 1d a perspective view of an embodiment of the power plug according to the invention comprising connection cable side crimped sleeve;
- 25 Fig. 2a partially cut perspective view of the embodiment as in Fig. 1c

- Fig. 2b top view of the embodiment as in Fig. 1c
- Fig. 2c back view of the embodiment as in Fig. 1c
- Fig. 2d side view of the embodiment as in Fig. 1c
- Fig. 3a perspective view of the flat sheet of the line or neutral pin unfolded in
5 three dimensional shape;
- Fig. 3b first folding step during the processing of the flat sheet as Fig. 4a;
- Fig. 3c cutting of the later counter bearing for the rivet sleeve;
- Fig. 3d second folding step: unfolding of the later contact surface for the
connection cable side contact;
- 10 Fig. 3e forming of the rivet sleeve;
- Fig. 3f folding of the first later tapered insert of the socket side contact surface;
- Fig. 3g unfolding of the long side of the earth pin by 90°;
- Fig. 3h folding of the second later tapered insert of the socket side contact
surface;
- 15 Fig. 3i closing of the folded shape to a final three dimensional shape of the
earth pin according to the invention;
- Fig. 4a perspective view of the earth pin according to the invention comprising
rivet sleeve, as in 3i;
- Fig. 4b as 4a, but longitudinal cut;
- 20 Fig. 4c as 4a, but comprising rivet sleeve;
- Fig. 4d as 4c, but in longitudinal cut;
- Fig. 5a perspective view of the earth pin comprising crimped sleeve;

Fig. 5b as 5a, but in longitudinal cut;

Fig. 6 a perspective view of the line or neutral pin according to the invention in unfolded shape comprising rivet sleeve;

Fig. 6b as 6a, but in longitudinal cut;

5 Fig. 6c as 6a, but comprising rivet sleeve;

Fig. 6d as 6c, but in longitudinal cut;

Fig. 7a perspective view of line or neutral pin according to the invention in unfolded shape comprising crimped sleeve;

Fig. 7b as 7a, but in longitudinal cut.

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Fig. 1a shows a connector bridge 1 according to the invention, comprising an insulator 2 of electrically insulated material with pins 3 a, b, c of electric conducting material. The contact surface of the earth pin 3a comprises the longitudinal sides of the pin in its entire length. The contact surfaces of the line pin 3b and the
15 neutral pin 3c are surrounded by an insulation 4, placed at half the length of the pin. The contact cable side contact 5 is shaped as a rivet sleeve 6a.

In Fig. 1b, additional current rails 7 for power supply are installed and brought into contact with the contact cable side contact 5 that has the shape of a rivet sleeve 6a.

20 In Fig. 1c, current rails 7 are riveted 6b to the contact cable side contact 5.

In a variant of the plug according to the invention, the contact cable side contact 5 is shaped as a crimped sleeve 8 (Fig. 1d).

In Fig. 2a, the installation of the contact cable side contact 5 with riveted current rails 7 is shown again as a partially cut view. Fig. 2b – d show the construction

according to the invention from different perspectives. These drawings also clarify the construction of the tapered inserts 9.

Figures 3a to 3i show the folding process from the flat stamped sheet 10 into the final three dimensional shape of an earth pin 3a according to the invention. The latter comprises V-shaped cut-outs 11 that form the tapered inserts 9 after the
 5 folding process, as well as L-shaped free punches 12 that enable the forming of the rivet sleeve or the crimped sleeve. Further, a profiled cut-out 13 is intended that shall contain the rivet sleeve or the crimped sleeve at a later stage. This cut-out also comprises the cams 14 that shall prevent the final folded shape from
 10 springing back. At the first folding step, a part of the contact cable side edge 15 is unfolded by 90°. In order to absorb the process forces induced by riveting or crimping, a counter bearing 16 is cut out for the later rivet sleeve or crimped sleeve. A further unfolding of the intended contact surface for the contact cable side edge 15 follows. In another cut, the rivet sleeve 6a is formed. A folding of the
 15 intended tapered insert 9 of the contact cable side contact surface follows, as well as an unfolding of the longitudinal side of the earth pin by 90°, and a folding of a second intended tapered insert 9 of the contact cable side contact surface. Finally, the foldable form is closed in order to form the final three dimensional object. This demonstrates how the rivet sleeve 6a is placed in the profiled cut-out 13, and is
 20 locked by the cams 14 (Fig. 4 a, b). During the further processing, the rivet sleeve 6a is riveted 6b (Fig. 4 c, d).

In analogous manner, the earth pin 3a is constructed, where the contact cable side contact 5 is shaped as a crimped sleeve (Fig. 5 a, b).

Equivalently to the folding process of the earth pin 3a, the cutting of the line pin 3b
 25 or the neutral pin 3c is unfolded. The difference to the shape of the cutting 10 of the earth pin 3a is that the cutting comprises long holes 17, press formings 18, and cut-outs 19 (Fig. 6a), that are particularly advantageous with respect to the casting process of the compulsory insulation 4. In addition, further material is saved by these measures.

Fig. 6 a shows a line pin or neutral pin according to the invention, comprising the rivet sleeve 6a, where the long holes 17 and pressed formings 18 can be seen more clearly in the longitudinal cut (Fig. 6 b). During the further processing, the rivet sleeve 6a is riveted 6b (Fig. 6 c, d).

- 5 Analogously, the final shape of the line pin or the neutral pin with crimped sleeve 8 is produced (Fig. 7a, b).

Reference sign list

- 1 Connector bridge
- 2 Insulator
- 3a Earth pin
- 3b Line pin
- 3c Neutral pin
- 4 Insulation according to BS 1363
- 5 Connection cable side contact
- 6a Rivet sleeve
- 6b Hollow rivet
- 7 Current rail
- 8 Crimped sleeve
- 9 Tapered insert
- 10 Flat sheet of the earth pin according to the invention
- 11 V-shaped cut-outs
- 12 L-shaped free punches
- 13 Profiled cut-out
- 14 Cams
- 15 Connection cable side edge
- 16 Counter bearing for absorbing process forces
- 17 Long holes
- 18 Press formings
- 19 Cut-outs

Claims

1. Connector bridge for an electrical plug to connect electrical devices, in particular household devices, with an AC power socket, wherein the plug is formed as a unit by an injection moulded connector bridge connected with the end piece of a three-wire connection cable for the device, wherein the connector bridge is formed from a dimensionally stable insulator for receiving and fixing a line pin, a neutral pin, and an earth pin, wherein the line, neutral and earth pin (3b,3c, 3a) are moulded into or onto the insulator in through-holes of the insulator that correspond to the cross-section of the pins in one and the same operation as the injection moulding process of the insulator (2), wherein the line, neutral and earth pins (3b,3c, 3a) on the one hand, compared to the connector bridge and the plug, project far enough, to be inserted into the socket, and on the other hand are connected by connection points with the corresponding terminals of the connection cable, wherein the connection points to be connected with the connection cable of the device are inside of the contour of the connector, and wherein the line and neutral pin (3b,3c) each comprises a rectangular cross-section with the dimensions $6.35 \times 3.98 \times 17.7 \text{ mm} (+/- 0.08 \times 0.13 \times 0.5 \text{ mm})$ and the earth pin (3 (a) comprises a rectangular cross-section with the dimensions $3.975 \times 7.93 \times 22.73 \text{ mm} (+/- 0.08 \times 0.13 \times 0.5 \text{ mm})$, characterized in that the line, neutral and earth pin are each built as a foldable pin, initially unfolded from a flat stamped sheet metal into its final three-dimensional shape and during the injection process of the insulator is filled in its cavities and intermediary spaces with plastics, that after the injection process the line, neutral or earth pin (3 b, c, a) has its final shape.
2. Plug-bridge according to claim 1, characterized in that the flat stamped sheet, from which the earth pin is unfolded into its final three-dimensional shape, has the form of an oblong rectangle with a

long centreline axis and a short centreline axis before the unfolding possesses, and that at the long flank-sides of the stamped sheet two approximately U - or V- shaped cut-outs (11) mirror-symmetrically to the long centreline axis and to the short centreline axis are provided, which after the unfolding of the stamped sheet form tapered inserts (9) at the socket end of the earth pin.

3. Plug-bridge according to claim 2, characterized in that the oblong rectangular stamped sheet comprises two L-shaped free-punches (12) arranged mirror-symmetrically with respect to the long centreline axis of the rectangle and on the opposite end a profiled cut-out (13) extending mirror-symmetrically from the long centreline axis towards both sides of the long centreline.

4. Plug-bridge according to claim 3, characterized in that the profiled cut-out (13) comprises two cams (14) positioned mirror-symmetrically to the long centreline axis.

5. Plug-bridge according to any one of claims 3 or 4, characterized in that the profiled cut-out (13) comprises a tongue (16) being punched free and extending mirror-symmetrically to the long centreline axis which forms a support rib of the earth pin after the unfolding of the stamped sheet.

6. Plug-bridge according to any one of the proceeding claims, characterized in that the flat stamped sheet, from which the line pin or the neutral pin are unfolded into its final three-dimensional shape, has the shape of an oblong rectangle with a long centreline axis and a short centreline axis before unfolding.

7. Plug-bridge according to claim 6, characterized in that the flat stamped sheet for the line pin or the neutral pin comprises longitudinal holes (17) extending mirror-symmetrically to the long and to the short centreline axis at a distance from the short centreline axis.

- 5 8. Plug-bridge according to any one of claims 6 or 7, characterized in that the stamped sheet for the line pin or the neutral pin comprises at its longitudinal end a profiled cut-out (13) with a punched-free tongue free-cut from the long centreline axis, extending towards both sides of the long centreline axis mirror-symmetrically mirror-symmetrically to the long centreline axis forming a support rib (16) of the line pin and the neutral pin, respectively, after unfolding of the stamped sheet.
- 10 9. Plug-bridge according to any one of the proceeding claims, characterized in that the line pin and the neutral pin comprise lateral cut-outs (19) in the section on the connection cable side.
- 15 10. Plug-bridge according to any one of the proceeding claims, characterized in that the line pin and the neutral pin comprises a press-forming (18) at least on one of the lateral flanks preferably from 0,5mm on 0,3mm.
11. Plug-bridge according to any one of claims 1 to 10, characterized in that the line, neutral, and earth pin (3 b, c, a) in each case comprise a hollow-rivet (6b) on its connection cable side end (15).
- 20 12. Plug-bridge according to any one of claims 1 to 10, characterized in that the line, neutral, and earth pin (3 b, c, a) in each case comprise a crimped sleeve (8) on its connection cable side end (15).
13. Plug-bridge according to any one of the proceeding claims, characterized in that the stamped sheet for the line, neutral, and earth pin (3 b, c, a) are comprised of sheet brass.
- 25 14. Plug-bridge according to any one of the proceeding claims, characterized in that a fuse is provided against excessive current throughput.

- 5 15. Foldable pin to be mounted as a line, neutral, or earth pin (3 b, c, a) in a plug-bridge in accordance with one of the proceeding claims which is unfolded from an initially flat stamped sheet metal into its final three-dimensional shape and is filled with plastic during the injection process of the insulator in its hollow spaces and gaps such that after the injection process the line, neutral and earth pin, respectively, has its final shape.