

Connector bridge having closed folding pins

Background of the invention

The invention relates to a connector bridge for an electrical device connector for connecting electrical devices, in particular household appliances, to a plug socket of an alternating current network, the device connector being formed as a unit by the connector bridge which is connected to the end piece of a three-core connection cable for the device and which is extrusion-coated in an injection mould, and which is itself constructed from a dimensionally stable insulation member for receiving and fixing a rectangular phase conductor pin, neutral conductor pin and earth conductor pin, the phase, neutral and earth conductor pins also being injection moulded in/on in the same operating step as the injection moulding of the insulation member in openings of the insulation member corresponding to the cross-section thereof, the phase, neutral and earth conductor pins projecting relative to the connector bridge and the device connector to a sufficient extent to be introduced into the plug socket, the phase conductor pin, neutral conductor pin and earth conductor pin each having inclined introduction members, the phase conductor pin and neutral conductor pin each having insulation at the insulation member side and the phase conductor pin, neutral conductor pin and earth conductor pin each being in the form of a folding pin which is drawn into its definitive spatial shape from an initially flat punched component comprising metal sheet, is folded and is filled with plastics material in its empty and intermediate spaces during the injection moulding process of

the insulation member in such a manner that, after the injection moulding process, the phase, neutral and earth conductor pins have the definitive contour thereof.

Such a connector bridge is described, for example, in DE 10 2009 049 369 A1.

They are used in particular in Great Britain and in English-speaking territories. The particular feature of these connectors is that the earth-conductor pin acts as a mechanical unlocking member when the device connector is inserted into the plug socket of the current or voltage supply network. This earth conductor pin is constructed so as to be longer than the phase and neutral conductor pins, and only after this earth conductor pin has been inserted is it possible for the other two pins also to be able to be inserted correctly.

According to the British Standard BS 1363, phase conductors and neutral conductors are intended to be constructed in a rectangular manner with the dimensions 3.98 x 6.35 x 17.7 mm (+/- 0.08 x 0.13 x 0.5 mm), 9.35 mm (+/- 0.15 mm) having to be insulated at the conductor side. The earth conductor pin is intended to be fitted in the centre over the other two pins with a spacing of 22.23 mm (+/- 0.13 mm). This pin is also constructed in a rectangular manner, with the dimensions 3.975 x 7.93 x 22.73 mm (+/- 0.08 mm x 0.13 x 0.5 mm) but without any insulation.

In addition to the mechanical securing described above, current device connectors, for reasons of electrical safety, comprise cast or injected connector members, inside which the electrical connection between the connection cable for the

device to be connected, on the one hand, and the connection or connector pins for the plug socket, on the other hand, are enclosed. Generally, the cable cannot be separated from the connector. Different types of auxiliary connection means facilitate the secure connection of the conductor cables. The connector pins may be connected at the connector side by means of both crimp and rivet contacts.

These and similar connector bridges are constructed in large batch quantities during the production of device connectors. Since, in the highly competitive market, relatively small price differences already have a considerable effect on competitiveness, developments for saving costs or material in this technical field have particularly great significance.

There is thus described in GB 2 092 836 A a connector which uses connector pins folded from punched components. This undoubtedly leads to considerable saving of material. However, this is an assembly system in which the connector pins and connector-side contacts are not encapsulated in the casting operation as is conventional nowadays. In this construction, in contrast to modern connector systems, it is thereby not ensured that individual connector wires protrude outwards from the inner side of the housing. Furthermore, these folding pins are mechanically unstable owing to their construction and, in addition, moisture can reach the inner side of the connector through the large empty spaces. In addition, this system, owing to its construction, is not suitable for large-scale production since, in this instance, the partial insulation of the phase conductor and neutral connector stipulated in the above-mentioned standard BS 1363 also cannot be implemented in a simple manner. For this reason, the construction described in GB 2 092 836 A must be

considered to have become obsolete so that the person skilled in the art in the relevant field would not look for any suggestions here for improvements of the current connector system.

Based on constructions in accordance with the standards, as described in DE 198 01 896 C1 and DE 100 51 348 C2, attempts have been made to save material, inter alia, by milling and filling the otherwise solid connector pins with plastics material, as shown, for example, in DE 10 2007 009 422 A1. However, this method of saving material, owing to the complex processing, has a disadvantageous effect on production speed and consequently ultimately also on the production costs. Whilst, for the solid connector pins, production figures of approximately from 80 to 100 pieces per minute are achieved, they are still only from 60 to 80 pieces per minute for the milled connector pins.

DE 43 14 195 A1 describes a connector pin which is formed from a rolled sheet metal strip. The inner side of the connector pin may also be cast with plastics material. In this manner, however, only round pin forms can be produced.

DE 2009 049 369 A1 describes a connector bridge having folding pins which receive their definitive outer shape during injection moulding. In particular in this instance, a large amount of material is saved. However, the inclined introduction members of the connector pins, owing to the folding process, have at the narrow sides of the pins, gaps which are then filled with plastics material during the injection moulding operation. However, such plastics inserts may be found to be disadvantageous in extreme situations with high currents and high temperatures. In addition, at these

locations, no contacting is also possible. Therefore, such connector pins are no longer permitted by the authorities in Great Britain.

Object of the invention

In this regard, an object of the present invention is to improve a generic connector bridge of the type described in the introduction with the most simple technical means possible in an uncomplicated and cost-effective manner so that a considerable amount of material can further be saved during the production of the connector bridge but the connector pins do not have any plastics inserts in the region of the connector-socket-side contacting.

Brief description of the invention

This object is achieved according to the invention in a manner which is both surprisingly simple and effective in that, after the connector bridge has been extrusion-coated, at the plug-socket-side all the surfaces of the phase, neutral and earth conductor pins produced in that manner, including the inclined introduction members, at least as far as the insulation at the insulation member side comprise the metal sheet.

Owing to the production from a punched component, a considerable amount of material is saved in comparison with the solid construction. Owing to the mechanical folding and the machines available for this purpose, the production speed can further thereby be increased considerably. The necessary stability and empty space sealing of the folding pins is carried out in this instance in a particularly simple and

cost-effective manner in a step with the casting method, with which the entire connector is cast in any case. Compared with solid metal pins, 60% of material is thus saved, and a contribution is thus made to the efficient use of resources required by the European Commission.

The folding pins of DE 10 2009 049 369 A1 are produced from a rectangular punched component and folded in such a manner that the two narrow side edges lock at the connector side (in the form of a rivet or crimp sleeve and locking edge). The inclined introduction members are folded from the centre of the punched component. There is then inevitably produced a gap at the narrow side of the folded pin, which is then filled with plastics material.

In the present invention, however, the punched component is locked at the narrow sides in a positive-locking and non-positive-locking manner during folding. The cable-side connection sleeve is in this instance punched and folded from the centre of the punched component instead of being folded from the end of the strip. Owing to the fact that the short side edges of the rectangular punched component form the inclined introduction members, it is possible for all the surfaces in the plug-socket-side contact region to be formed from the punched component and consequently for inserts of plastics material to be prevented on all surfaces which have contact with current-carrying components of the plug socket.

Owing to the type of folding, it is also now possible to produce the punched components directly from a long, rectangular metal sheet. Previously, the punched components first had to be punched and subsequently folded individually. This is now possible in one operating step owing to the new

folding method. A production of from 320 to 360 pieces per minute appears achievable, compared with from 70 to 80 pieces per minute with solid material pins. This means a reduction of the production time by approximately 75% for the same number of pieces.

Preferred embodiments of the invention

A particularly preferred embodiment of the connector bridge according to the invention is characterised in that the flat punched component, from which the phase, neutral and earth conductor pins are drawn and folded into the definitive spatial shape thereof, is a long metal sheet having the width of double the length of the phase, neutral and earth conductor pins before the punching and folding operation. Long metal sheets can thus be fed into the processing machine. This makes production and handling easier. Since the metal sheets have the exact width of double the length of the respective pins, the quantity of "metal waste" during production is drastically reduced.

A preferred development of this embodiment is characterised in that a large number of sheet metal strips are punched out of the long metal sheet, with a web remaining at the centre of the transverse axis and forming the connector-side end of the phase, neutral and earth conductor pins after the folding operation. The folding pins themselves are not punched out, but instead the intermediate spaces. There remains at the centre a web from which the "future" pin members extend in the manner of wings. Only after the folding of the pins is the web separated and a separate pin is consequently produced. The quantity of material not used is thereby further reduced and the production is made more effective and rapid.

Another embodiment is characterised in that a conical hole which forms a rivet sleeve after the folding operation is punched into the web with a punching machine which tapers forwards. The rivet sleeve does not have to be soldered, welded or screwed, but instead is integrated in the folding pin.

A development of the previous embodiments is characterised in that the phase, neutral and earth conductor pins (3b, c, a) are folded from the sheet metal pieces remaining between the punched-out sheet metal strips. The quantity of material not used is thereby further reduced and the production is made more effective and rapid.

In another advantageous embodiment, the phase, neutral and earth conductor pins (3b, c, a) have projections and cut-outs at the folding seams, with the projections coming to rest in a deformed state in the cut-outs during the folding operation and consequently allowing a positive-locking and non-positive-locking connection. This enables an even more stable locking of the two halves of the folding pin.

An embodiment is also advantageous which is characterised in that there are punched out of the flat punched component for the phase conductor pin or the neutral conductor pin in a mirror-symmetrical manner relative to the longitudinal axis elongate holes which are positioned after the folding operation at the wide sides of the rectangular phase conductor pin or the neutral conductor pin and which subsequently allow the plastics material to flow around the locations intended to be insulated in a particularly optimum

manner during the injection operation. Another advantageous effect of this embodiment is an additional saving of material.

Another preferred embodiment is characterised in that the phase conductor pin (3b) and the neutral conductor pin (3c) have lateral cut-outs in the connection-cable-side portion thereof, which receive the insulating plastics material in accordance with BS 1363 during the casting operation.

An embodiment of the connector bridge according to the invention is also preferred in which the phase conductor pin and the neutral conductor pin have an impression, preferably of from 0.5 mm to 0.3 mm, at least at one lateral flank. The production process of the previously mentioned part-insulation is thereby simplified even further.

It is also advantageous for the phase, neutral and earth conductor pins (3b, c, a) each to have a hollow rivet at the connection-cable-side end thereof. With such an embodiment, the current-carrying contacts can be riveted in a simple manner at the connector side.

In another embodiment, the flat punched components for the phase, neutral and earth conductor pins (3b, c, a) comprise electrically conductive material, preferably brass sheet, which, owing to the good electrical conductivity and mechanical stability properties and the relatively low tendency towards corrosion thereof, is preferred as the starting material for the current-carrying components.

There is further preferred an embodiment which is characterised in that an electrical fuse is provided to prevent excessively high current flow. This is stipulated in

the mentioned British Standard BS 1363. Therefore, this embodiment is obligatory in connector bridges which are intended for use in Great Britain.

Other advantages of the invention will be appreciated from the description and the drawings. The above-mentioned features and those set out below can also be used individually or together in any combination. The embodiments shown and described are not intended to be understood to be a conclusive listing but instead are of exemplary nature for describing the invention.

Drawings and detailed description of the invention

In the drawings:

Figure 1 is a three-dimensional illustration of an embodiment of a network device connector having a connector bridge according to the invention;

Figure 2 is the partially sectioned three-dimensional illustration of the embodiment as in Figure 1;

Figure 3 is a three-dimensional illustration of an embodiment of a network device connector having a connector bridge according to the invention from a viewing angle different from that in Figure 1;

Figure 4 is a three-dimensional view of the blank of a phase or neutral conductor pin folded into the spatial shape;

Figure 5 is a three-dimensional view of the blank of an earth conductor pin folded into the spatial shape;

Figure 6 is the three-dimensional illustration of the punching and folding process of an earth conductor pin according to the invention;

Figure 7 is an enlarged cut-out of the three-dimensional illustration of the punching and folding operation of an earth conductor pin according to the invention when viewed from a different perspective from that in Figure 5.

Figure 1 is a three-dimensional illustration of an embodiment of a network device connector 1 having a connector bridge according to the invention having an insulation member 2 of electrically insulating material and having connector pins 3a, b, c of electrically conductive material. The contact face of the earth connector pin 3a comprises the longitudinal sides of the pin over the entire length thereof. The contact faces of the phase conductor pin 3b and the neutral conductor pin 3c are surrounded with an insulation 4 over approximately half the length thereof. All the surfaces which could have contact with current-carrying components at the plug socket side are of metal, in particular the inclined introduction members 5. In accordance with the requirements of the British authorities, the connector pins 3a, b, c according to the invention do not have plastics surfaces where the current-carrying counter-contacts of the plug socket have contact with the connector pins 3a, b, c.

The connector pins 3a, b, c have on the seams 6 projections 7a and corresponding recesses 7b. This enables a particularly secure positive-locking and non-positive locking action.

In the connector bridge according to the invention there is provided for a fuse a retention member 8 which cannot be reached when the device connector is inserted.

Figure 2 shows the structure of a network device connector 1 having a connector bridge according to the invention, again

as a partially sectioned illustration. In this illustration, it is possible to see clearly the fuse retention member 8 and the rivet sleeves 9 with which the connector pins 3a, b, c are riveted to conductor rails 10 (Figure 3). The conductor rails 10 lead the current to the corresponding crimp sleeves 11 (Figure 3) in order to connect the strands of a network cable.

Figure 4 is a three-dimensional view of the blank of a phase or neutral conductor pin 3b, c folded into the spatial shape. Here, it can clearly be seen that the contact surfaces at the connector-socket-side end of the phase or neutral conductor pin 3b, c completely comprise metal. In this instance, the projections 7a and recesses 7b engage one inside the other along the fold seam 6 in order to lock the folding pin in a positive-locking and non-positive-locking manner. The British standard BS 1363 stipulates for the phase or neutral pin 3b, c that 9.35 mm (+/- 0.15 mm) of insulation 4 (indicated with broken lines) have to be arranged at the connector side. So that the insulation 4 can be carried out in one operating step with the injection of the insulation member 2 (Figure 1), the folded punched component of the phase or conductor pin 3b, c has elongate holes 12. Through these elongate holes 12, the injection moulding mass can better reach the interior of the phase or neutral conductor pin 3b, c. Lateral cut-outs 13 and impressions 14 assist in producing the insulation 4 in a clean manner and in maintaining the stipulated contours. Owing to the illustrated structure, the injection-moulded mass can flow inside the phase or neutral conductor pin 3b, c but, owing to the metal surface of those surfaces which come into contact with the current-carrying components of the plug socket, which metal surface is locked in a positive-locking

and non-positive-locking manner, no plastics material comes into contact with these current-carrying components.

Although the earth conductor pin 3a illustrated in Figure 5 does not come into contact with permanently current-carrying components of the plug socket, it must be able to discharge static charges or fault currents where applicable. For this reason, the British authorities also demand of this pin a closed metal casing without plastics inclusions.

In the folding pin set out in DE 10 2009 049 369 A1, the narrow sides are open after folding. After injection moulding, such connector pins consequently have plastics surfaces at the narrow sides, which is inadmissible in the opinion of the British authorities. Even if such folding pins were to be developed with wings in order to close the sides, the inclined introduction members of the narrow sides would still have plastics surfaces for design reasons.

It can readily be seen that the earth conductor pin 3a illustrated in Figure 5, including the inclined introduction members 5, has metal surfaces all the way round. The projections 7a engage in the recesses 7b and close the earth conductor pin 3a along the fold seam 6 in a positive-locking and non-positive-locking manner. Filling holes 15 which are later surrounded by the insulation member 2 (Figure 1) ensure that the injection-moulded mass can reach the inner side of the earth conductor pin 3a and thus imparts to it additional stability.

Figure 6 is the three-dimensional illustration of the punching and folding operation of an earth conductor pin 3a according to the invention. In this instance, the filling

holes 15 are first punched out of a long metal sheet 16, preferably a brass sheet. The metal sheet 16 has in this instance double the width B of the length L of the future earth conductor pin 3a. After the filling holes 15 have been punched out, the intermediate spaces 17 between the earth conductor pins 3a are punched out. The intermediate spaces 17 are kept as small as possible for economic and ecological reasons in order to reduce the metal waste produced. The outer contours of the earth conductor pin 3a with the projections 7a and recesses 7b which engage one inside the other during folding can already be seen clearly. With a conically tapering punching tool, the rivet sleeve 9 is now partially punched out from and partially pressed in the remaining web 18.

The narrow sides are subsequently bent up. The web 18 is again narrowed to the width of the future thickness D of the earth conductor pin 3a.

The folding up of the earth conductor pin 3a is carried out along the edges 19 of the web 18. The projections 7a engage in the recesses 7b and lock the earth conductor pin in a positive-locking and non-positive-locking manner.

In Figure 7, the process is illustrated from another viewing angle. From this viewing angle, the partially punched-out, partially pressed-in rivet sleeve 9 can be seen particularly clearly.

The phase and neutral conductor pins 3b, 3c are folded in a similar manner, with the elongate holes 12 being punched in place of the filling holes 15 and in addition the cut-outs 13 and impressions 14 being punched out or stamped.

List of reference numerals

1	Network device connector
2	Insulation member
3a	Earth conductor pin
3b	Phase conductor pin
3c	Neutral conductor pin
4	Insulation according to BS 1363
5	Inclined introduction member
6	Fold seam
7a	Projection
7b	Recess
8	Fuse retention member
9	Rivet sleeve
10	Conductor rail
11	Crimp sleeve for cable strand
12	Elongate hole
13	Cut-out
14	Impression
15	Filling hole
16	Long metal sheet
17	Intermediate spaces
18	Web
19	Folding edges
L	Length of the respective connector pin 3a, b, c
B	Width of the metal sheet 16
D	Thickness of the respective connector pin 3a, b, c

Patent Claims

1. Connector bridge for an electrical device connector (1) for connecting electrical devices, in particular household appliances, to a plug socket of an alternating current network, the device connector (1) being formed as a unit by the connector bridge which is connected to the end piece of a three-core connection cable for the device and which is extrusion-coated in an injection mould, and which is itself constructed from a dimensionally stable insulation member (2) for receiving and fixing a rectangular phase conductor pin (3b), neutral conductor pin (3c) and earth conductor pin (3a), the phase, neutral and earth conductor pins (3a, b, c) also being injection moulded in/on in the same operating step as the injection moulding of the insulation member (2) in openings of the insulation member (2) corresponding to the cross-section thereof, the phase, neutral and earth conductor pins (3a, b, c) projecting relative to the connector bridge and the device connector (1) to a sufficient extent to be introduced into the plug socket, the phase conductor pin (3b), neutral conductor pin (3c) and earth conductor pin (3a) each having inclined introduction members (5), the phase conductor pin (3b) and neutral conductor pin (3c) each having insulation (4) at the insulation member side and the phase conductor pin (3b), neutral conductor pin (3c) and earth conductor pin (3a) each being in the form of a folding pin which is drawn into its definitive spatial shape from an initially flat punched component comprising metal sheet (16), is folded and is filled with plastics material in its empty and intermediate spaces during the injection moulding process of the insulation member (2) in such a manner that, after the injection moulding process, the phase, neutral and earth conductor pins (3a, b, c) have the definitive contour thereof,

characterised in that,
after the connector bridge has been extrusion-coated, at the plug socket side all the surfaces of the phase, neutral and earth conductor pins (3a, b, c) produced in that manner, including the inclined introduction members (5), at least as far as the insulation (4) at the insulation member side comprise the metal sheet (16).

2. Connector bridge according to claim 1, characterised in that the flat punched component, from which the phase, neutral and earth conductor pins (3a, b, c) are drawn and folded into the definitive spatial shape thereof, is a long metal sheet (16) having the width (B) of double the length (L) of the phase, neutral and earth conductor pins (3a, b, c) before the punching and folding operation.

3. Connector bridge according to claim 2, characterised in that a large number of sheet metal strips (17) are punched out of the long metal sheet (16), with a web (18) remaining at the centre of the transverse axis and forming the connector-side end of the phase, neutral and earth conductor pins (3a, b, c) after the folding operation.

4. Connector bridge according to claim 3, characterised in that a conical hole which forms a rivet sleeve (9) after the folding operation is punched into the web (18) with a punching machine which tapers forwards.

5. Connector bridge according to either claim 3 or claim 4, characterised in that the phase, neutral and earth conductor pins (3b, c, a) are folded from the sheet metal pieces remaining between the punched-out sheet metal strips (17).

6. Connector bridge according to any one of the preceding claims, characterised in that the phase, neutral and earth conductor pins (3b, c, a) have projections (7a) and cut-outs (7b) at the folding seams (6), with the projections (7a) coming to rest in a deformed state in the cut-outs (7b) during the folding operation and consequently allowing a positive-locking and non-positive-locking connection.

7. Connector bridge according to any one of the preceding claims, characterised in that elongate holes (12) which are positioned after the folding operation at the wide sides of the rectangular phase conductor pin (3b) or the neutral conductor pin (3c) are punched out of the flat punched component for the phase conductor pin (3b) or the neutral conductor pin (3c) in a mirror-symmetrical manner relative to the longitudinal axis of the phase conductor pin (3b) or the neutral conductor pin (3c).

8. Connector bridge according to any one of the preceding claims, characterised in that the phase conductor pin (3b) and the neutral conductor pin (3c) have lateral cut-outs (13).

9. Connector bridge according to any one of the preceding claims, characterised in that the phase conductor pin (3b) and the neutral conductor pin (3c) have an impression (14), preferably of from 0.5 mm to 0.3 mm, at least at one lateral flank.

10. Connector bridge according to any one of the preceding claims, characterised in that the phase, neutral and earth conductor pins (3b, c, a) each have a hollow rivet (9) at an end thereof at the insulation member side.

11. Connector bridge according to any one of the preceding claims, characterised in that the flat punched components for the phase, neutral and earth conductor pins (3b, c, a) comprise electrically conductive material, preferably brass sheet.

12. Connector bridge according to any one of the preceding claims, characterised in that an electrical fuse is provided to prevent excessively high current flow.