

Box connector

Known connectors for connection wires, usually soldered, suffer from the disadvantage, that separate connection wires cannot easily and quickly be connected or upon repair replaced, in particular in case several wires have to be connected with one connection pad of the printed circuit board.

The present invention relates to a box connector having insulation piercing contacts comprising a box formed of electrically conducting sheet material and being of polygon shape and having in opposite flat side walls slots constituting the insulation piercing contacts, which slots run from the top of the box over a predetermined length towards the bottom of the box.

Box connectors which accommodate one or more connectors are already known, eg from DE—A—213 1769 (rectangular box), EP—A—5350 and FR—A—2378390 (circular boxes). The last document discloses several conductors pushed into the same slot, the box being screwed or riveted to, or pushed into a supporting plate.

The box connector of the present invention is characterized in that slots of belonging pairs are formed in two opposite side walls and in which the two belonging slots of any pair end at the same level measured in the direction towards the bottom of the box, but at a different level to the slots of any other pair in any other opposite side walls, and in which at the bottom of the box connection strips are formed on opposite side walls, which connection strips initially approach one another and then bent to run downwardly besides one another.

Where in the above and here below the words "top" and "bottom" are used, it is meant those portions of the box, which after mounting this box connector on a printed circuit board are positioned farthest away from and nearest the board surface respectively.

The horizontal cross section of the box through the raised side walls may be shaped as a circle or an ellipse, as in the prior art, but in this invention it is a polygon e.g. a rectangle, in particular, however, a square.

By using pairs of slots terminating at different levels several connection wires can be connected to the box connector, which connection wires are pushed from above in the slots and stacked on one another. In case wire ends only are inserted in each slot a relatively large number of connection wires can be connected with each box connector. Generally each connection wire will pass completely through the box connector, so that in case of a box connector of rectangular cross section two connection wires can be connected, crossing one another.

Upon insertion of the wires in the slots first the sharp edges of the slots will cut the insulation, after which these sharp edges will dig into

the connection wire cores. Thus an electrical contact can be brought about very quickly, being of excellent quality and reliability.

In general the box connectors of the present invention will be inserted with the bottom connection strips in connection openings of printed circuit boards and thereafter soldered into these openings.

The connection strips extending from opposite side walls are preferably first bent forming a first angle, so that neck portions of these strips approach one another, and upon approaching one another the strips are rebent forming a second angle, so that the strips stretch downwardly side by side in touch with one another, in which at least the bent portions of the first angle are located above the lower edge of the box, in which recesses are formed in the side walls, where the bent portion of the first angle of each strip is connected with the belonging side wall, the arrangement being such that the lower edge of the box, upon assembling and wire insertion constitutes a bearing edge for the printed circuit board, limiting the stress transmitted to the soldered joint. Upon insertion of the connection wires in the slots the box connector will be pressed immediately on the upper surface of the printed circuit board, so that the forces and stress transmitted to the soldered joint will be limited.

In order that the box connector will not drop out of the opening prior to soldering, the connection strip preferably will be provided with equally formed broadened portions or knobs where these connection strips touch one another. These broadened portions will provide for a press-fit or clamping action of the connection strips within the openings of the printed circuit board, prior to and during the soldering operation.

Preferably the box connector of the present invention will be used together with a plastic housing, the inner dimensions of which correspond with the outer dimensions of the box connector, such that the housing can be mounted over the box connector from the top. The side walls of this plastic housing comprise transverse grooves, which run from the lower edge of the housing to the top of the housing over a certain distance, which grooves upon mounting the housing over the box connector will coincide with the slots of the insulation piercing contacts and will leave these slots free. The grooves in the plastic housing preferably will be of a width which is equal to the diameter of a connection wire including the wire insulation, to be inserted in the slots of the insulation piercing contacts. Also the grooves at their top ends preferably will be of half circular shape, forming a thrust surface, so that this thrust surface can press upon the connection wires for inserting connection wires in the slots of the insulation piercing contacts. Therefore these

connection wires can be inserted in the slots by means of this plastic housing. Because the slots in the box connector terminate at different levels, in order to place the wires above one another, the belonging grooves in the plastic housing also have to terminate at their top ends at different levels.

The plastic housing simultaneously will hold the connection wires in the final inserted position. To this end the box connector can be provided at at least one side wall of a notch or catch for latching the plastic housing on the box connector, which catch preferably consists of a bent out strip portion of the box connector sheet material, the inner surface of the plastic housing comprising belonging recesses accepting the catch after mounting the plastic housing over the box connector. This prevents unwanted removal of the housing from the box connector, so that the connection wires are kept in place.

The box connector of the present invention also provides for connecting flat cables. As a matter of course the individual wires of such flat cables have to be separated from one another prior to connection to the box connector.

The present invention now will be further elucidated with reference to the drawings; showing as an example some embodiments of the box connector of the present invention.

Fig. 1 shows to an enlarged scale in perspective view a solderable box connector of the present invention;

Fig. 2 shows the punched out flat, electrically conducting blank of resilient sheet material prior to bending;

Fig. 3 shows a perspective view of the box connector of the present invention, seen from another side as in Fig. 1, and having some additional members;

Fig. 4 shows the plastic housing for the box connector of the present invention, partly cut away;

Fig. 5 shows the plastic housing in perspective view;

Fig. 6 shows several box connectors of the present invention, each of which having mounted thereon a plastic housing;

Fig. 7 shows to an enlarged scale a box connector of the present invention, partly in cross section, mounted on a printed circuit board, prior to the insertion of a connection wire;

Fig. 8 shows the same view as Fig. 7, after insertion of a connection wire;

Fig. 9 shows a top view and two side views respectively of a box connector of the present invention;

Fig. 10 shows in perspective view a part of a printed circuit board, mounted thereupon two box connectors of the present invention, each of which having connected therewith connection wires;

Fig. 11 and 12 show views of box connectors of the present invention with plastic housings mounted there on;

Fig. 13a—d show embodiments of connection strips or tails.

The box connector of the present invention, shown in Fig. 1 preferably is formed of electrically conducting, resilient sheet material from which first a blank, as shown in Fig. 2, is formed, for instance by punching. To form the rectangular box of Fig. 1 this blank will be folded thereupon by 90° bends along lines 8, 9 and 10.

The flat blank of Fig. 2 and therefore also the box connector of Fig. 1 comprises four insulation piercing contacts 1, 2, 3 and 4 respectively, the insulation piercing contacts 1 and 2 forming a first pair of opposite contacts in Fig. 1 and the insulation piercing contacts 3 and 4 forming the second pair of opposite contacts. Each contact comprises a pair of raised beams 20, 21 and 22, 23 respectively, from which in Fig. 1 and 2 two are referred to only with reference numbers. Two adjoining beams each constitute one insulation piercing contact.

As is shown in Fig. 1 and 2 the box connector comprises two pairs of this similar insulation piercing contacts, mainly differentiating from one another by the depth of the slot. The deep slots in the contacts 1 and 2, seen from above, first comprise two relatively remote opposite edges 25, 26, next two beveled edges 27, 28, approaching one another and thereupon two edges 29, 30, closely facing each other and forming the actual insulation piercing contact.

The edges 29 and 30 of the slots are sharpened, so that these edges will dig in a conducting core as soon as this core is pressed down between the edges 29 and 30. At the lower end each slot terminates in a half circular edge 7, supporting the wire eventually after pressing down completely.

In the half circular lower edge or support 7 of the slot it merges a sheared serration 5, followed by a slot hole 6. The serration 5 and hole 6 provide for a higher resiliency, so that the beams 22, 23 and 20, 21 respectively more easily can be moved from one another upon insertion of a core and will not be pushed transversely away from one another. The serration or slit 5 and hole 6 also enlarge the spring path of the insulation piercing contacts within the planes of beams 20, 21 and 22, 23 respectively.

Between adjacent insulation piercing contacts at the bent portions of the box slots 31 are applied, which also contribute to the spring action of each insulation piercing contact. These slots 31 can be of a width different from the width shown in the Figures and are not absolutely necessary. After bending the flat blank of Fig. 2 in the box of Fig. 1 and also in case slots 31 are absent, sufficient spring action can be obtained for particular purposes within the plane of beams 20, 21 and 22, 23 respectively.

The essential functional difference between the insulation piercing contacts formed by

beams 20, 21 and 22, 23 is, as stated above, the difference of the levels of the lower half circular edges 7 of the slots, so that connection wires can be placed above one another in the box connector, as will be discussed later.

At the lower ends of each box connector two strips 12 are formed upon punching the blank, which strips are bent as shown in Fig. 1 prior to or after bending the blank to obtain the rectangular box, shown in Fig. 1. First these strips 12 are bent 90° towards one another and next, after approaching one another sufficiently rebent 90°. Now the strips 12 are touching one another. Between the two 90° bends in each strip it remains a neck portion 11. Fig. 1 shows, that the bends and neck portion 11 are located above the lower edge 14 of the box connector. In order to obtain this higher location of the neck recesses 32 have to be formed where the strips are connected to the box side walls.

The flat blank of Fig. 2 will be bent as said above 90° until the outer left edge approaches the outer right edge of this flat blank, shown in Fig. 1 at the right-hand side. These adjoining edges may be left unconnected, so that a slot is formed, but also can be soldered, if necessary, for certain applications.

By means of strips 12 the box connector of the present invention can be connected to a connection opening of the printed circuit board. The strips 12 comprise lead-ins 13, consisting of beveled edges, facilitating the insertion of the connection strips 12 in the opening of the printed circuit board.

Fig. 3 shows in perspective view a box connector of the present invention in which the connection strips 12 forming the tail comprise broadened portions or knobs 15. These knobs provide a press-fit in the printed circuit board hole, so that the box connector cannot be removed from this hole prior to soldering the connection strips to the electrical connection portions or pads of the printed circuit board. Also during the soldering operation these knobs 15 are useful in locking and holding the connector.

The box connector of Fig. 3 further comprises an outwardly bent strip or catch 16, applied at the continuous slot between adjoining side walls of the box connector, corresponding with the right-hand and left-hand edges of the blank in Fig. 2. The strip 16 locks the plastic housing 33, which upon insertion of connection wires or after insertion of connection wires can be placed over the box connector.

This plastic housing 33 is shown in Fig. 4, 5 and 6.

Fig. 4 shows the housing 33 in perspective view, in which one corner is cut away. The housing 33 consists of a rectangular box, closed at the upper end, whereas in four raised side walls transverse grooves 17 are formed. These grooves correspond with the slots of the insulation piercing contacts in the box connector and leave free the sharp edges of these slots when

the housing 33 is mounted from above over the box connector.

In the embodiment of Fig. 4 each side wall further comprises a groove or slot 18, which may accommodate completely the beams 20, 21 and 22, 23 respectively of each insulation piercing contact upon placing the housing on the box connector. These beams now are supported at each side surface, so that upon insertion of connection wires in the slots of the insulation piercing contact by pushing down the housing 33, these beams cannot bend with respect to one another out of the plane of each side wall.

The plastic housing 33 also forms a strain relief for the connection wires which strain relief further is supported by the strip 16 of the box connector, which as shown in Fig. 6, is received in one of the recesses 34 in the inner wall of housing 33. The slot or groove 18 here extends through the adjoining outer housing wall and merges in the outer surfaces of said adjoining wall, at the left-hand side in Fig. 6. The resilient side strip 19 of the housing 33, obtained by the outwardly extending groove or slot 18 comprises at its inner surfaces recesses 34. When the housing 33 is placed over the box connector the edge of one of these recesses 34 will be caught behind the end of the outwardly bent strip 16 of the box connector. Now the housing 33 cannot be pulled off anymore for instance by a force acting on the connection wires having a force component directed upwardly.

In Fig. 5 and 6 two recesses 34 are shown. The lowermost recess is used to hold the plastic housing in a preloaded position on the box connector. This is of advantage, because now the housing and box connector are firmly united which can be useful for shipping or certain manufacturing steps. After positioning such box connector together with preloaded plastic housing on a printed circuit board and after soldering, the connection wires need be inserted only in the groove in the plastic housing above the insulation piercing contacts, after which the plastic housing can be pushed downwardly for insertion of the connection wires in the slots of the insulation piercing contact, upon which the strip 16 will be caught in the upper recess 34.

Also at the other side or edge of the housing 33 an extended groove 18 can be applied which may cooperate with another outwardly bent strip 16.

Fig. 6 shows a number of adjoining plastic houses. Each housing comprises integrally formed triangular notches 50. In general several housings 33 will be moulded simultaneously, in which the separate housings 33 are connected to one another by means of these triangular notches 50. Also by means of these notches connecting several housings, one row of box connectors can be mounted simultaneously on a printed circuit board. The mutual distance

between these box connectors will be equal to the center distance of the circular connection holes in the printed circuit board. Also by this mutual connection by means of these notches 50 a much stronger total assembly is obtained, accepting higher forces if pulling forces act on the connection wires. As a matter of course the housing may be separated from one another by breaking these notches 50.

Fig. 7 and 8 show box connectors according to the present invention in side elevation, partly in cross section upon inserting a connection wire. The connection wire termination process can be subdivided into three separate steps. First the box connector, for instance carrying the plastic housing in preloaded position with strip 16 in the first or lower recess 34, is mounted on the printed circuit board and if necessary soldered. Next the connection wires are placed in the slots of the insulation piercing contacts or inserted in the openings of the transverse grooves in the plastic housing above the insulation piercing contacts. Thereafter a plastic housing is placed on each box connector if absent, which housing thereafter is pressed downwardly until the strip 16 will be received in the second or upper recess 34 in the resilient strip 19.

In Fig. 7 and 8 the box connectors are soldered on the printed circuit board 35 comprising the wiring 36, from which in Fig. 7 and 8 the connection pads are shown only. The connection strips 12 of the box connectors are inserted in the hole 38 of printed circuit board 35, until the lower edge 14 bears upon the upper surface of the printed circuit board 35. By means of the knobs 15 in Fig. 3, which are not shown in Fig. 7 and 8, the box connector will be locked and held for the time being. These knobs 15 are slightly broader than the diameter of the hole 38. Thereafter the connection strips or tail 12 are soldered to the connection pad or connection ring of the wiring portion of the printed circuit board by means of solder 37.

By pressing the connection strips or tail 12 into the hole 38, but also after the soldering operation, some clearance 39 may exist between the lower edge 14 of the box connector and the upper surface of the printed circuit board. In case a connection wire 40 having a core 41 and insulation 42 is pressed now from above between the edges 29 and 30 of the insulation piercing contact a strong mechanical stress may be transmitted to the solder joint, but in particular to the connection pad 36 of the printed circuit, which can be very disadvantageously for the adherence of the pad 36 to the circuit board 35, and which also may be detrimental for the electrical performance of the printed circuit. Also the electrical resistance of the soldered joint can be influenced disadvantageously. Therefore the connection strips 12 are bent towards one another through the neck portion 11, so that an intermediate resilient portion is obtained, by means of which

upon pressing down the box connector the lower edge 14 will be pressed upon the upper surface of printed circuit board 35 by further bending the neck portion 11. The pressure now will be accepted mainly by the printed circuit board 35 and to a much less extent by the soldering junction 37 and the printed connection pad 36. Mechanical stress generated in this connection pad 36 or in the solder junction can be very detrimental towards electrical performance of the printed circuit.

As soon as the wire 40 is pressed downwardly the outer surface of the insulation 42 will be pressed between the edges 25 and 26 at the upper side of the insulation piercing contact. Next the insulation 42 meets the sharp edges 27 and 28, so that the insulation will be cut. Upon further pressing down, vide Fig. 8, core 41 is pressed between the sharp edges 29 and 30, which dig into the material of core 41. The wire 40 is pressed downwardly that far, until the insulation 42 is stopped by the rounded lower portion 7, which means that the end position of the core in the insulation piercing contact is reached. The serration 5 and slot hole 6 constitute a rotation point for the edges 29 and 30, which rotation point now being displaced further downwardly with respect to the rounded portion 7. This increases the spring action or elasticity of the insulation piercing contact.

The plastic housing 33 is not essential for the box connector of the present invention. However, this housing facilitates insertion of the connection wires 40 in the insulation piercing contacts and moreover constitutes a strain relief whilst also the appearance of the printed circuit board is improved therewith.

Fig. 9 shows a top view and two side views respectively of a box connector of the present invention without plastic housing, mounted on the printed circuit board 35. Fig. 9 shows, that the knob 15 which is clamped within the hole of the printed circuit board 35 holds the box connector in place. The side elevations further show the different levels of the insulation piercing contacts 1, 2 and 3, 4 respectively, applied in raised opposite side walls.

Fig. 10 shows two box connectors of the present invention in perspective view, mounted on a board 35 having at the lower side a printed circuit (not shown). At the right-hand side in Fig. 10 are shown two connection wires 40 inserted in the box connector, until said wires rest in the rounded lower ends of each slot of the belonging insulation piercing contacts. At the left-hand side in Fig. 10 the housing 33 is positioned over the box connector in its lowermost position. The strip 16 is located now in the uppermost or second recess 34 of the resilient strip 19.

The connection wires 40 can be pressed within each insulation piercing contact by means of a particular tool. However, it is also possible first to position the connection wires

according to the right-hand portion of Fig. 10 within the broader slot portions of each insulation piercing contact, after which these conductors are pressed downwardly by means of the housing 33 between the approaching beveled edges and eventually in the narrow slot, formed by the opposite edges of the insulation piercing contact. Upon pressing the connection wire downwardly the electrical contact is brought about between the edges 29 and 30 of the slots. As soon as the plastic housing is pressed downwardly from the preloaded position, the outwardly bent strip 16 will be received in the upper recess 34, so that the housing 33 is locked on the insulation piercing contacts and also the connection wires 40 are held down in their final position.

Fig. 10 shows two box connectors of the present invention, each having accepted in crossed fashion two connection wires. As a matter of course also four individual wires can be connected with the box connector, which means one wire end connected in each of the four insulation piercing contacts. In a polygonal box connector having more than four sides, as a matter of course, a larger number of conductors can be terminated, in which these conductors also can be stacked on one another, or it can be connected again one connection wire with each of the insulation displacement contacts.

Fig. 11 and 12 show side views of different sides of box connectors of the present invention, over which plastic housings 33 are placed, in Fig. 11 in preloaded position and in Fig. 12 in the end position. In the preloaded position according to Fig. 11 connection wires can be easily slid through the slots or openings 17 formed by the transverse grooves in the box connector. In this preloaded position the strip 16 is received in the lowest or first recess 34 in strip 19 of housing 33. After introducing the necessary number of conductors these conductors have to be pressed between the slots of the insulation piercing contacts, which can be done by pressing the housing 33 further downwardly as said above, until the end position of Fig. 12 is reached. By pressing down this plastic housing the necessary electrical connection between the cores of the conductors 40 and the box connector of the present invention is brought about. In this end position of the plastic housings the strips 16 are received in the second or uppermost recess 34, vide to the left in Fig. 12.

Fig. 13a through 13d show a number of embodiments of a connection strip 12 of the tail, by means of which the box connector of the present invention can be connected in the holes of the printed circuit board. The solder operation may be omitted in case through-metallized holes in the printed circuit board are used which means holes being internally clad with a continuous electrically conducting connection layer 43. The sharp edges of these strips 12 dig easily in the internal cladding 43 of these holes

upon pushing the strips through the holes and bring about an excellent and continuous electrical connection with the printed circuit on the board.

In the embodiment of Fig. 13a, showing a cross section of the strips about halfway the hole 38, the connection strips 12 have been bent such, that their convex sides are facing one another and their hollow sides are directed outwardly. The outer edges of these strips 12 bring about the electrical connection with the internal cladding layer 43.

Fig. 13b shows an embodiment having connection strips 12 bent in a V-shape, the apexes of which are facing one another.

In the two above embodiments the two strips 12 also can be bent such in their longitudinal direction that these strips 12 as long as not inserted in the hole 38 are curved elastically away from one another.

The connection strips further can be provided with small side strips bent outwardly, for instance such as strip 16 at the side wall of the box connector. These strips 44, vide Fig. 13c, can be directed inwardly, which means in the direction towards the adjacent strip 12, so that these connection strips 12 are pressed under spring action away from one another and the strip edges come into contact with the internal cladding 43 upon introducing the tail into the hole 38 and bring about the electrical connection. Also these connection strips 12 can be provided with strips 44 which are bent outwardly, vide Fig. 13d, so that these strips 44 bring about the contact with the cladding 43. In this case of Fig. 13d, as a matter of course, strips 44 should be bent outwardly near the free ends of the connection strips 12 and means directed upwardly towards the box connector itself, in order to facilitate the insertion of the tail in the holes 38.

As a matter of course the present invention is not limited to the embodiments of the connection strips 12 as shown and discussed here.

The slots of the insulation piercing contacts also can be of different width, so that connection wires having different cross sections of the cores as well as the total diameter, can be terminated.

The above described invention as shown on the drawings provides a solderable box connector by means of which connection wires can be terminated very quickly and very easy. In particular these connection wires can be removed easy upon repairs and replaced by new connection wires. Box connectors can be delivered with or without plastic housing 33 which is optional. Upon supply with plastic housing 33 this will be in general in preloaded position upon the box connector, so that these plastic houses cannot be lost, whereas the box connector and housing are united such already, that the termination of the connection wires is extremely facilitated.

As a matter of course the present invention is

not limited to the shown embodiments, so that amendments are possible without leaving the scope of the present invention.

Claims

1. A box connector having insulation piercing contacts, comprising a box formed of electrically conducting sheet material and being of polygon shape and having in opposite flat side walls (1, 2; 3, 4) slots constituting the insulation piercing contacts, which slots run from the top of the box over a predetermined length towards the bottom (14) of the box, characterized in that slots of belonging pairs are formed in two opposite side walls (1, 2) and in which the two belonging slots of any pair end at the same level, measured in the direction towards the bottom of the box, but at a different level to the slots of any other pair in any other opposite side walls (3, 4), and in which at the bottom (14) of the box connection strips (12) are formed on opposite side walls (3, 4), which connection strips initially approach one another and then are bent to run downwardly besides one another.

2. A box connector as claimed in claim 1 characterized in that the connection strips (12) extending from opposite side walls at the lower side of the box connector are first bent forming a first angle, so that the neck portion (11) of these strips approach one another, and upon approaching one another the strips are rebent forming a second angle, such that the strips stretch downwardly side-by-side in touch with one another (12), in which at least the bent portions (11) of the first angle are located above the lower edge (14) of the box, in which recesses (32) are formed in the side walls where the bent portion of the first angle of each strip is connected to the belonging side wall, the arrangement being such that the lower edge of the box upon assembly and wire insertion constitutes a support edge against the printed circuit board, limiting the stress transmitted to the solder joint.

3. A box connector as claimed in claim 1 and 2, characterized in that the slots of the insulation piercing contacts comprise a wider portion near the top of the box, whereas in the lower end these slots are half-circular rounded (7), in which a circular hole (6) is made in the sheet material of the side wall below the half circular lower slot end, a serration (5) connecting the hole (6) with said lower slot end (7).

4. A box connector as claimed in one of the preceding claims, characterized in that the box consists of a number of flat side walls, which are connected with one another at their vertical edges by bent portions (10) of the sheet material and that these bent connection portions comprise slots (31), stretching from the top of the box over a certain distance towards but not as far as the bottom of the box.

5. A box connector as claimed in one of the

preceding claims, characterized in that the connection strips (12) stretch downwardly in touch with one another and comprise broadened portions (15) for holding the connection strips in the holes of a printed circuit board prior to the soldering operation.

6. A box connector as claimed in any one of the preceding claims, comprising a box-shaped plastic housing (33) for at least partly receiving the box connector, which plastic housing can be mounted over the box connector with its open lower side, in which the side walls of this housing comprise transverse slots (17) stretching from the lower edge of the housing towards the top of the housing, which slots after the plastic housing has been placed over the box connector coincide with the slots of the insulation piercing contacts and expose these slots, characterized in that said housing is of polygon shape, corresponding to the shape of the box connector, and comprising double side walls formed by an intermediate slot (18) running parallel to the side wall surface for slidably receiving the side walls of the box connector and the insulation piercing contacts, in which the transverse slots in opposite side walls of said housing each end.

7. A box connector as claimed in claim 6, characterized in that at least one side wall of the box connector comprises a raised tag (16) for locking a plastic housing on the box connector, which tag consists of an outwardly bent strip portion of the sheet material, in which the inner wall of the plastic housing comprises recesses (34) for receiving said tag and for holding the plastic housing on the box connector.

8. A box connector as claimed in any one of claims 6 or 7, characterized in that break-away triangular notches (50) are formed at the side walls of the plastic housing, which may serve as support notches for adjoining plastic housings of adjoining box connectors.

9. A box connector as claimed in one of claims 1 to 8, characterized in that the box is of a square horizontal cross section and that the slots of the insulation piercing contacts are formed in the middle of each side of this box.

10. A box connector as claimed in any one of the preceding claims, characterized in that the connection strips (12) are concave in a direction perpendicular to their longitudinal direction, the hollow sides being directed outwardly.

11. A box connector as claimed in any one of claims 1 to 9, characterized in that the connection strips (12) are of V-shaped cross section in a direction perpendicular to their longitudinal direction, the apexes of these V's being directed to one another.

12. A box connector as claimed in one of claims 1 to 9, characterized in that the connection strips (12) comprise strip portions (44) bent out of the plane of each connection strip, which strip portions can be directed towards the adjoining connection strip or away from this adjoining connection strip.

not limited to the shown embodiments, so that amendments are possible without leaving the scope of the present invention.

Claims

1. A box connector having insulation piercing contacts, comprising a box formed of electrically conducting sheet material and being of polygon shape and having in opposite flat side walls (1, 2; 3, 4) slots constituting the insulation piercing contacts, which slots run from the top of the box over a predetermined length towards the bottom (14) of the box, characterized in that slots of belonging pairs are formed in two opposite side walls (1, 2) and in which the two belonging slots of any pair end at the same level, measured in the direction towards the bottom of the box, but at a different level to the slots of any other pair in any other opposite side walls (3, 4), and in which at the bottom (14) of the box connection strips (12) are formed on opposite side walls (3, 4), which connection strips initially approach one another and then are bent to run downwardly besides one another.

2. A box connector as claimed in claim 1 characterized in that the connection strips (12) extending from opposite side walls at the lower side of the box connector are first bent forming a first angle, so that the neck portion (11) of these strips approach one another, and upon approaching one another the strips are rebent forming a second angle, such that the strips stretch downwardly side-by-side in touch with one another (12), in which at least the bent portions (11) of the first angle are located above the lower edge (14) of the box, in which recesses (32) are formed in the side walls where the bent portion of the first angle of each strip is connected to the belonging side wall, the arrangement being such that the lower edge of the box upon assembly and wire insertion constitutes a support edge against the printed circuit board, limiting the stress transmitted to the solder joint.

3. A box connector as claimed in claim 1 and 2, characterized in that the slots of the insulation piercing contacts comprise a wider portion near the top of the box, whereas in the lower end these slots are half-circular rounded (7), in which a circular hole (6) is made in the sheet material of the side wall below the half circular lower slot end, a serration (5) connecting the hole (6) with said lower slot end (7).

4. A box connector as claimed in one of the preceding claims, characterized in that the box consists of a number of flat side walls, which are connected with one another at their vertical edges by bent portions (10) of the sheet material and that these bent connection portions comprise slots (31), stretching from the top of the box over a certain distance towards but not as far as the bottom of the box.

5. A box connector as claimed in one of the

preceding claims, characterized in that the connection strips (12) stretch downwardly in touch with one another and comprise broadened portions (15) for holding the connection strips in the holes of a printed circuit board prior to the soldering operation.

6. A box connector as claimed in any one of the preceding claims, comprising a box-shaped plastic housing (33) for at least partly receiving the box connector, which plastic housing can be mounted over the box connector with its open lower side, in which the side walls of this housing comprise transverse slots (17) stretching from the lower edge of the housing towards the top of the housing, which slots after the plastic housing has been placed over the box connector coincide with the slots of the insulation piercing contacts and expose these slots, characterized in that said housing is of polygon shape, corresponding to the shape of the box connector, and comprising double side walls formed by an intermediate slot (18) running parallel to the side wall surface for slidably receiving the side walls of the box connector and the insulation piercing contacts, in which the transverse slots in opposite side walls of said housing each end.

7. A box connector as claimed in claim 6, characterized in that at least one side wall of the box connector comprises a raised tag (16) for locking a plastic housing on the box connector, which tag consists of an outwardly bent strip portion of the sheet material, in which the inner wall of the plastic housing comprises recesses (34) for receiving said tag and for holding the plastic housing on the box connector.

8. A box connector as claimed in any one of claims 6 or 7, characterized in that break-away triangular notches (50) are formed at the side walls of the plastic housing, which may serve as support notches for adjoining plastic housings of adjoining box connectors.

9. A box connector as claimed in one of claims 1 to 8, characterized in that the box is of a square horizontal cross section and that the slots of the insulation piercing contacts are formed in the middle of each side of this box.

10. A box connector as claimed in any one of the preceding claims, characterized in that the connection strips (12) are concave in a direction perpendicular to their longitudinal direction, the hollow sides being directed outwardly.

11. A box connector as claimed in any one of claims 1 to 9, characterized in that the connection strips (12) are of V-shaped cross section in a direction perpendicular to their longitudinal direction, the apexes of these V's being directed to one another.

12. A box connector as claimed in one of claims 1 to 9, characterized in that the connection strips (12) comprise strip portions (44) bent out of the plane of each connection strip, which strip portions can be directed towards the adjoining connection strip or away from this adjoining connection strip.



13. A box connector as claimed in one of claims 1 to 9, characterized in that the connection strips (12) are curved away from one another over at least a portion of their length.

Patentansprüche

1. Ein dosenförmiger Verbinder mit Isolierunglochungskontakten, aus einer Dose, die aus einem elektrisch leitenden flächenhaften Material geformt ist und von einer Polygonform ist und entgegengesetzte flache Seitenwand-(1, 2; 3, 4)-schlitze aufweist, welche die Isolierunglochungskontakte bilden, welche Schlitze von der Oberseite der Dose über eine bestimmte Länge zum Boden (14) der Dose verlaufen, dadurch gekennzeichnet, daß Schlitze von zugehörigen Paaren in zwei entgegengesetzten Seitenwänden (1, 2) geformt sind und in welchen die beiden zugehörigen Schlitze eines Paares in der gleichen Höhe enden, gemessen in der Richtung zum Boden der Dose, jedoch in einer verschiedenen Höhe zu den Schlitzen eines anderen Paares in anderen entgegengesetzten Seitenwänden (3, 4) und in welchen am Boden (14) der Dosen Verbindungstreifen (12) an entgegengesetzten Seitenwänden (3, 4) geformt sind, welche Verbindungstreifen sich anfänglich einander nähern und dann gebogen sind, so daß sie nebeneinander nach unten verlaufen.

2. Ein dosenförmiger Verbinder nach Anspruch 1, dadurch gekennzeichnet, daß die Verbindungstreifen (12), die sich von entgegengesetzten Seitenwänden an der Unterseite des dosenförmigen Verbinders erstrecken, zuerst gebogen sind, um einen ersten Winkel zu bilden, so daß sich die Halsteile (11) dieser Streifen einander nähern und beim Annähern aneinander die Streifen zur Bildung eines zweiten Winkel zurückgebogen sind, so daß sich die Streifen nebeneinander nach unten erstrecken in Berührung miteinander (12), wobei mindestens die gebogenen Teile (11) des ersten Winkels oberhalb der Unterkante (14) der Dose angeordnet sind, in welchen Ausnehmungen (32) in den Seitenwänden geformt sind, wo der gebogene Teil des ersten Winkels jedes Streifens mit der zugehörigen Seitenwand verbunden ist, wobei die Anordnung derart ist, daß die Unterkante der Dose beim Zusammenbau und der Drahteinführung eine Stützkante gegen die Printplatte bildet, wodurch die auf die Lötstelle übertragene Spannung begrenzt wird.

3. Ein dosenförmiger Verbinder nach Anspruch 1 und 2, dadurch gekennzeichnet, daß die Schlitze der Isolierunglochungskontakte einen breiteren Teil in der Nähe des oberen Endes der Dose aufweisen, während im unteren Ende diese Schlitze halbkreisförmig gerundet (7) sind, wobei ein kreisförmiges Loch (6) in dem flächenhaften Material der Seitenwand unterhalb des halbkreisförmigen unteren Schlitzendes vorgesehen ist und ein Schnitt (5)

das Loch (6) mit dem unteren Schlitzende (7) verbindet.

4. Ein dosenförmiger Verbinder nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Dose aus einer Anzahl flacher Seitenwände besteht, die miteinander an ihren vertikalen Kanten durch gebogene Teile (10) des flächenhaften Materials verbunden sind, und daß diese gebogenen Verbindungsteile Schlitze (31) aufweisen, die sich vom oberen Ende der Dose über einen bestimmten Abstand in Richtung zum Boden der Dose jedoch nicht so weit erstrecken.

5. Dosenförmiger Verbinder nach einem der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Verbindungstreifen (12) sich nach unten in Berührung miteinander erstrecken und verbreitete Teile (15) aufweisen, um die Verbindungstreifen vor dem Lötvorgang in den Lochungen einer Printplatte zu halten.

6. Ein dosenförmiger Verbinder nach einem oder mehreren der vorangehenden Ansprüche, mit einem dosenförmigen Plastikgehäuse (33) zur mindestens teilweisen Aufnahme des dosenförmigen Verbinders, welches Plastikgehäuse über den dosenförmigen Verbinder mit seiner offenen Unterseite angeordnet werden kann, wobei die Seitenwände dieses Gehäuses Querschlitze (17) aufweisen, die sich von der Unterkante des Gehäuses in Richtung zur Oberseite des Gehäuses erstrecken, welche Schlitze, nachdem das Plastikgehäuse auf den dosenförmigen Verbinder aufgesetzt worden ist, mit den Schlitzen der Isolierunglochungskontakte zusammenfallen und diese Schlitze freihalten, dadurch gekennzeichnet, daß das Gehäuse eine Polygonform hat, die der Form des dosenförmigen Verbinders entspricht, und Doppelseitenwände aufweist, die durch einen Zwischenschlitz (18) gebildet werden, welcher parallel zur Seitenwandfläche verläuft zur gleitenden Aufnahme der Seitenwände des dosenförmigen Verbinders und der Isolierunglochungskontakte, in welchen die Querschlitze in entgegengesetzten Seitenwänden des Gehäuses je enden.

7. Ein dosenförmiger Verbinder nach Anspruch 6, dadurch gekennzeichnet, daß mindestens eine Seitenwand des dosenförmigen Verbinders eine angehobene Lippe (16) zur Verriegelung eines Plastikgehäuses am dosenförmigen Verbinder aufweist, welche Lippe aus einem auswärts gebogenen Streifenstück des flächenhaften Materials besteht, wobei die innere Wand des Plastikgehäuses Ausnehmungen (34) zur Aufnahme der Lippe und um das Plastikgehäuse auf dem dosenförmigen Verbinder zu halten, aufweist.

8. Dosenförmiger Verbinder nach einem der Ansprüche 6 oder 7, dadurch gekennzeichnet, daß abgekürzte dreieckige Nasen (50) an den Seitenwänden des Plastikgehäuses geformt sind, die als Abstütznasen für benachbarte Plastikgehäuse von benachbarten dosenförmigen Verbindern dienen können.



9. Ein dosenförmiger Verbinder nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Dose einen quadratischen waagrechten Querschnitt hat und daß die Schlitz der Isolierungskontakte in der Mitte jeder Seite dieser Dose geformt sind.

10. Ein dosenförmiger Verbinder nach einem oder mehreren der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die Verbindungstreifen (12) in einer Richtung senkrecht zu ihrer Längsrichtung konkav sind, wobei die hohlen Seiten nach außen gerichtet sind.

11. Ein dosenförmiger Verbinder nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Verbindungstreifen (12) einen V-förmigen Querschnitt in einer Richtung senkrecht zu ihrer Längsrichtung haben, wobei die Scheitel des V zueinander gerichtet sind.

12. Ein dosenförmiger Verbinder nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Verbindungstreifen (12) Streifenteile (44) aufweisen, die aus der Ebene jedes Verbindungstreifens herausgebogen sind, welche Streifenteile zu dem benachbarten Verbindungstreifen hin oder von diesem benachbarten Verbindungstreifen weg gerichtet sein können.

13. Ein dosenförmiger Verbinder nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die Verbindungstreifen (12) über mindestens einen Teil ihrer Länge voneinander weg gekrümmt sind.

Revendications

1. Connecteur à contacts perceurs d'isolant, en boîte faite d'un matériau en feuille électriquement conducteur en forme de polygone et comportant dans des parois latérales plates opposées, des fentes constituant les contacts perceurs d'isolant et partant du sommet de la boîte pour s'étendre sur une longueur déterminée en direction de sa base caractérisé en ce que des fentes de paires correspondantes sont formées dans deux parois latérales opposées (1, 2) et les deux fentes correspondantes d'une paire quelconque se terminant au même niveau, mesuré dans la direction de la base de la boîte, mais à un niveau différent de celui des fentes de toute autre paire dans de quelconques autres parois latérales opposées (3, 4), tandis que sont formées à la base (14) de la boîte sur des parois latérales opposées (3, 4) des barrettes de connexion (12) qui se rapprochent mutuellement au départ et s'incurvent ensuite pour se prolonger vers le bas côte-à-côte.

2. Connecteur en boîte selon la revendication 1, caractérisé en ce que les barrettes de connexion (12) partant de parois latérales opposées du côté inférieur du connecteur en boîte sont coudées une première fois pour former un premier angle de sorte que les portions étranglées (11) de ces barrettes se rapprochent mutuellement et, à leur rapproche-

ment mutuel, lesdites barrettes sont coudées une deuxième fois pour former un deuxième angle de sorte que les barrettes s'étendent vers le bas côte-à-côte en se touchant mutuellement (12), en ce que l'une au moins des portions coudées (11) du premier angle est situé au-dessus du bord inférieur (14) de la boîte, en ce que des échancrures (32) sont formées dans les parois latérales à l'endroit où la portion coudée du premier angle de chaque barrette se raccorde à la paroi latérale correspondante, et en ce que l'agencement est tel que le bord inférieur de la boîte, lors de l'assemblage et de l'insertion de fil, constitue un bord de support contre une carte de circuit imprimé, en limitant l'effort transmis au joint soudé.

3. Connecteur en boîte selon la revendication 1 ou 2, caractérisé en ce que les fentes des contacts perceurs d'isolant comprennent une portion plus large au voisinage du sommet de la boîte, tandis que dans l'extrémité inférieure ces fentes sont arrondies en demi-cercle (7) et en ce qu'un trou circulaire (6) est ménagé dans le matériau en feuille de la paroi latérale au-dessous de l'extrémité de fente inférieure en demi-cercle, une dentelure (5) reliant le trou (6) à ladite extrémité de fente inférieure (7).

4. Connecteur en boîte selon la revendication 1, 2 ou 3, caractérisé en ce que la boîte est formée par plusieurs parois latérales plates qui sont raccordées entre elles par leurs bords verticaux par des portions pliées (10) du matériau en feuille et en ce que ces portions de raccordement pliées comprennent des fentes (3) partant du sommet de la boîte et s'étendant sur une certaine distance en direction de la base de la boîte mais sans atteindre celle-ci.

5. Connecteur en boîte selon l'une quelconque des revendications précédentes, caractérisé en ce que les barrettes de connexion (12) s'étendent vers le bas en se touchant mutuellement et comprennent des portions élargies (15) propres à retenir les barrettes de connexion dans les trous d'une carte de circuit imprimé avant l'opération de soudage.

6. Connecteur en boîte selon l'une quelconque des revendications précédentes, comprenant un capuchon en matière plastique (33) de forme parallélépipédique propre à recevoir au moins partiellement le connecteur en boîte et pouvant être monté par-dessus celui-ci par son côté inférieur ouvert, les parois latérales de ce capuchon comprenant des fentes transversales (17) partant du bord inférieur du capuchon en s'étendant en direction du sommet du capuchon, lesquelles fentes après mise en place du capuchon en matière plastique par-dessus le connecteur en boîte coïncident avec les fentes des contacts perceurs d'isolant et exposent ces fentes, caractérisé en ce que ledit capuchon (33) est de forme polygonale, correspondant à la forme du connecteur en boîte, et comprenant des parois latérales doubles formées par une fente intermédiaire



(18) s'étendant parallèlement à la surface de paroi latérale pour recevoir à coulissement les parois latérales du connecteur en boîte et les contacts perceurs d'isolant, et en ce que les fentes transversales dans des parois latérales opposées dudit capuchon s'y terminent chacune.

7. Connecteur en boîte selon la revendication 6, caractérisé en ce que l'une au moins des parois latérales du connecteur en boîte comprend une languette débordante (16) propre à bloquer un capuchon en matière plastique sur le connecteur en boîte, laquelle languette est formée par une portion de barrette du matériau en feuille incurvée vers l'extérieur, et en ce que la paroi intérieure du capuchon en matière plastique comprend des cavités (34) pour la réception de ladite languette et le blocage du capuchon en matière plastique sur le connecteur en boîte.

8. Connecteur en boîte selon la revendication 6 ou 7, caractérisé en ce que des dents triangulaires cassables (50) sont formées sur les parois latérales du capuchon en matière plastique et peuvent servir de dents de support pour des capuchons en matière plastique contigus de connecteurs en boîte contigus.

9. Connecteur en boîte selon l'une quelconque des revendications précédentes, caracté-

térisé en ce que la boîte est de section horizontale carrée et en ce que les fentes des contacts perceurs d'isolant sont formées dans le milieu de chaque côté de cette boîte.

10. Connecteur en boîte selon l'une quelconque des revendications précédentes, caractérisé en ce que les barrettes de connexion (12) sont concaves dans une direction perpendiculaire à leur direction longitudinale, les côtés creux étant dirigés vers l'extérieur.

11. Connecteur en boîte selon l'une quelconque des revendications 1 à 9, caractérisé en ce que les barrettes de connexion (12) sont à profil en V dans une direction perpendiculaire à leur direction longitudinale, les pointes de ces V étant situées en regard les unes des autres.

12. Connecteur en boîte selon l'une quelconque des revendications 1 à 9, caractérisé en ce que les barrettes de connexion (12) comprennent des portions de barrette qui sont écartées par courbure du plan de chaque barrette de connexion et qui peuvent être orientées de façon à se rapprocher de la barrette de connexion contiguë ou à s'en éloigner.

13. Connecteur en boîte selon l'une quelconque des revendications 1 à 9, caractérisé en ce que les barrettes de connexion (12) sont incurvées de façon à s'écarter l'une de l'autre sur au moins une portion de leur longueur.



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