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Electrical connector with an element which positions the connection
5 pins.

The invention relates to an electrical connector, comprising a housing of electrically insulating material with a connection side and a contact side, and provided with a number of contact elements of
10 electrically conducting material accommodated in channels and, each with a contact end situated at the contact side of the housing, for contacting a further connector, and a connection end provided with an L-shaped connection pin, having a fixed leg fixed to the connection end of the contact element extending from the connection pin output
15 side of the housing lying opposite the contact side, a bend and a free leg for mounting on a printed circuit board substantially perpendicular to the fixed leg and extending to beyond the connection side of the housing running at right angles to the connection pin output side, and comprising a bending anvil having a curved bending
20 face for bending the connection pins to an L-shape.

So-called rectangular connectors, i.e. connectors with rectangular connection pins, are often asked for by consumers, in particular connectors with a small pitch distance. This makes it difficult to maintain the correct positions of the parts of the
25 connection pins over the entire length of the connectors not only during manufacture, but also during packaging and transportation, in order to permit correct positioning of the soldering ends of the connection pins relative to holes in a printed circuit board. Additional complications are the curvature of the printed circuit
30 board, and the correct position of the soldering ends of the connection pins, in particular when there is a small pitch distance, which is, of course, associated with holes of small diameter.

Another problem encountered in the production of the above-mentioned connectors with small pitch distance is accurate bending of
35 the connection pins at right angles, in order to achieve the correct position of the soldering ends of the connection pins here.

In this connection it is observed that the invention pertains to a right-angle connector for miniaturized connector for high I/O

applications. The right-angle tail is an extension of the terminal contact, and is of thin-stock (rectangular 0.35 x 0.15 mm width: thickness) material. By virtue of the close mutual spacings of tails (1.27 x 1.27 mm), and due to its slender configurations, without
5 additional means such tails can be skew with large true-position in accuracy of pin-tip with respect to the theoretical 1.27 x 1.27 mm raster, even before the 90° bending. This situation becomes more aggravated after the bend. Such miniature connectors due to the delicate tails, results in in-advertent problems during placement on
10 PC Boards.

Right-angle connectors are known from the U.S. Patents 5,112,234 and 5,032,085 but in contrast to present invention these prior art reference pertain to relatively thick-stock material with round cross-section of tail. The U.S. Patent 4,697,864 seems to pertain to
15 connectors slightly corresponding to the connector of the invention. However, all the tails known from the prior art references are unsupported and free standing in air in the area of 90° bend zone.

The object of the invention is to provide an electrical connector of the type mentioned in the preamble, in which the above-mentioned
20 problems are avoided and the connection pins can be bent in a simple and accurate way at such a right angle that the correct position of the connection ends of the connection pins is maintained even after the bending action and during transport.

Another aim of the inventor was to facilitate the fitting of the
25 connector on printed circuit boards.

This object and aim are achieved according to the invention through the fact that between the connection pin output side (11) and the bending anvil a positioning element 14 of electrically insulating material is provided, said positioning element 14 has bores 16
30 extending perpendicular to the plane of the connection pin output side 13 of the connector housing 2 for accommodating and holding the fixed legs 10 of the connection pins 9 and that the bores 16 merge into the respective curved bending faces 18 of the anvil.

Electrical connectors provided with a positioning element of
35 electrically insulating material surrounding the connection pins for holding them in position are known per se in practice, and are often called "wafers" in the trade literature.

In practice, two types of positioning elements surrounding the

connection pins of a connector can be distinguished, viz. elements which essentially surround the connection ends of the connection pins, and elements extending between the connection pins over the entire connection side of the connector.

5 Elements of the first-mentioned type are known from US Patent Specification US-A-4,686,607, and their purpose is essentially to prevent deviations in the predetermined mutual pitch distance between the connection ends, e.g. as a result of bending thereof, during transportation or assembly of the connector, in order to facilitate
10 the electrical connection of the connection ends of the pins in correspondingly situated apertures and/or to connection faces on a printed circuit board, which is advantageous in particular in the case of connectors with a large number of contact elements and in the case of mechanical mounting by means of e.g. an assembly robot.

15 The elements of the second type are known from US Patent Specification US-A-4,986,772, and provide not only the desired positioning of the connection ends of the connection pins, but also electrical and mechanical protection of the connection pins, so that e.g. short-circuiting between individual connection pins is
20 effectively prevented. Accidental contact of one or more connection pins can also be prevented effectively in this way. It will be clear that the elements of the second type are larger in size than the elements of the above-described first type. The elements of the second type can also be used to insert the contact elements into the housing.

25 In order to guarantee optimum positioning of the connection ends of the connection pins, it is advantageous to keep the element as close as possible to the ends of the connection pins during transportation and assembly of the connectors. For mounting on a printed circuit board, the element must then be slid up along the
30 connection ends, so that it rests on the board. The connection ends are then free for connection thereof to the corresponding connection faces of the printed circuit board.

The known positioning elements are, however, located after the bends of the connection pins.

35 First by locating the positioning element between the connection pin output side of the connector and the anvil and by having the bores of the positioning element merges as directly as possible into the respective curve bending faces of the anvil the requisit pitch of the

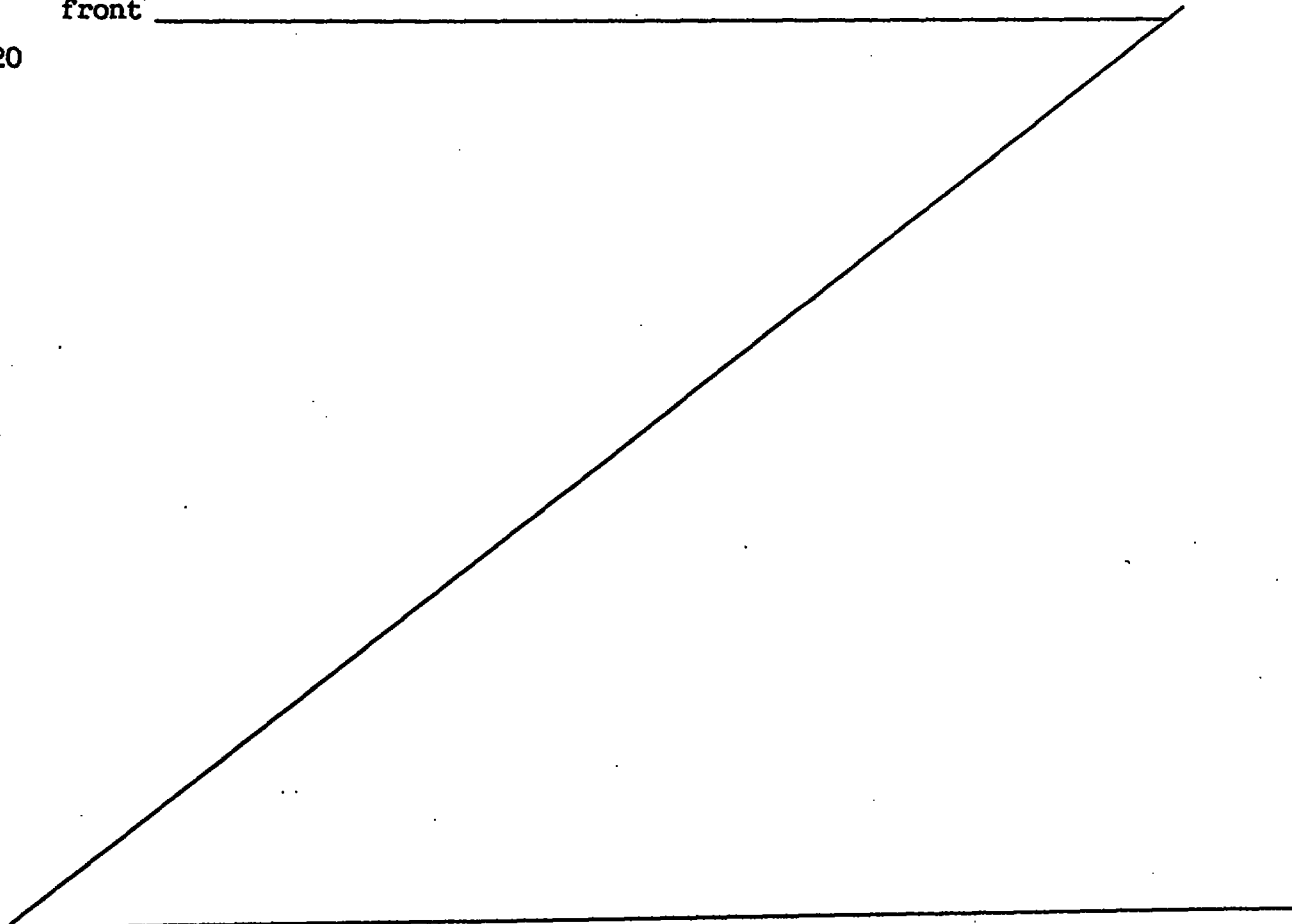
free pin tips is obtained.

This ensures that the soldering legs of the connection pins are aligned in the correct position before they are bent, following which they are bent accurately at an angle of 90° , and these correctly bent
5 legs are then shielded and accommodated in the bending anvil.

The assembly, consisting of the connector, the positioning element and the anvil can then be placed as one unit on the printed circuit board without additional operations, prior to the soldering process.

10 The bending anvil is a separate component of the connector, so that the connector housing and the anvil can be produced of different materials. This is advantageous because for the connector housing a cheaper material can be selected than for the anvil. The anvil can be
15 manufactured from material of higher quality in order to prevent the anvil from distortion during bending, while precise tolerances for the final shape of the bended tails can be met. Furthermore, the separate anvil has the advantage that it collects firstly all (possible mis-
positioned) pin tips by rectangular (frustum) lead-in's located in front

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CLAIMS

1. Electrical connector, comprising a housing (2) of electrically insulating material with a connection side and a contact side, and
5 provided with a number of contact elements (6) of electrically conducting material accommodated in channels (5) and, each with a contact end (7) situated at the contact side (8) of the housing (2), for contacting a further connector, and a connection end provided with an L-shaped connection pin (9), having a fixed leg (10) fixed to the
10 connection end of the contact element (6) extending from the connection pin output side (11) of the housing (2) lying opposite the contact side (8), a bend and a free leg (12) for mounting on a printed circuit board substantially perpendicular to the fixed leg (10) and extending to beyond the connection side (13) of the housing (2)
15 running at right angles to the connection pin output side (8), and comprising a bending anvil having a curved bending face (18) for bending the connection pins (9) to an L-shape, characterized in that between the connection pin output side (11) and the bending anvil a positioning element (14) of electrically insulating material is
20 provided, said positioning element (14) has bores (16) extending perpendicular to the plane of the connection pin output side (13) of the connector housing (2) for accommodating and holding the fixed legs (10) of the connection pins (9) and that the bores (16) merge into the respective curved bending faces (18) of the anvil.

25 2. Connector according to claim 1, wherein the curved bending face (18) of the bending anvil is the bottom face of grooves (17) having walls parallel to the axes of the bores (16) in the positioning element (14), each said groove (19) accommodating a free leg of a connection pin.

30 3. Connector according to claim 1, wherein the connector housing (2) is provided with a number of rows of connector elements (6), and the connection pins (9) thereof are arranged in rows and in positions staggered from row to row, wherein the bores have the corresponding staggered positions wherein the curved bending face (18) of the
35 bending anvil is provided with grooves (17) which extend at right angles to the lengthwise direction of the bending anvil and each accommodate a free leg (12) of a connection pin (9), and wherein the distance of the grooves (17) intended for the connection pins of one

row differs from that of the grooves (17) for the connection pins of the adjacent row from the connection pin output side (11) of the connector housing (12).

4. Connector according to claim 2 or 3, wherein the bottom of each groove (17) passes gradually by way of a curved part into the appropriate bore (16) in the positioning element (14) and that each groove (17) extends further to the plane of the connection side (13) of the housing (2).

5. Connector according to claim 4, wherein the bottom of the part of the groove beyond the curved bending face (18) has a shorter distance from the connection pin output side (13) of the housing (2) than the point of the face of the curved bending face (18) having the longest distance to said output side (13).

6. Connector according to one of claims 1-5, wherein the positioning element (14) and the bending anvil form one unit.

7. Connector according to one of the preceding claims, wherein the grooves are provided with means for press fitting the connection pins (9) at least locally.

8. Connector according to claim 7, wherein at least one wall of the grooves (17) near the exit point of the free legs (12) of the connection pins (9) has a thickened part running at right angles to the bottom of the grooves (17).

9. Connector according to one of claims 1-6, wherein in the bent position the free leg of the connection pins grips behind at least one wall thickened part of the corresponding groove.

10. Connector according to one of the preceding claims, wherein the bore (16) of the positioning element (14) for accomodating the respective connection pin (9) tappers at the insert side.

11. Connector according to one of the preceding claims, wherein the face of the bore (16) opposite of the bending face (18) of the anvil is constituted by a chamfer (28).

12. Connector according to one of the preceding claims, wherein the face of the positioning element (14) facing the connection pin output side (13) is provided with flanges (20) which extend at right angles to said element face and grip over the corresponding side faces of the connector housing (2).

13. Bending mandrel (29) for interacting with the bending anvil to bend the connection pins of the connector according to one of the

preceding claims, wherein the curved bending face (18) of the bending anvil and the bending face (35) of the mandrel interacting therewith complement each other in shape.

14. Bending mandrel according to claim 13, wherein the bending
5 face of the mandrel is provided with ribs (30, 31) standing up perpendicular to the bending face (35), the thickness of which ribs corresponds to the width of the grooves (17) of the bending anvil, and wherein the rib consists of a first part (32, 33) with an edge running parallel to the bending face (34) of the mandrel and a second part
10 (35, 36) connecting thereto having a curved edge in which the radius of curvature corresponds to that of the curved bending face of the bending anvil.

15. Bending mandrel according to claim 14, wherein the curved part of the rib ends in a peak-shaped part (37, 38), and at the side of the bending anvil lying opposite the curved groove part, the bore (16) in the positioning element (14) and bending anvil for passing through the connection pins widens out at an angle corresponding to the angle of the outside of the peak (37, 38).

16. Positioning element and anvil intended for assembling a
20 connector according to one of the preceding claims and bending the connection pins.