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(72) Inventors JAMES RAY COLLIER

ROBERT FRANKLIN COBAUGH



(54) ELECTRICAL CONNECTOR

(71) We, AMP INCORPORATED, a corporation organised and existing under the laws of the State of New Jersey, United States of America, of Eisenhower Boulevard, Harrisburg, State of Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to an electrical connector capable of self-aligning its contacts with the complementary contacts of a mating housing.

The present invention is an electrical connector comprising a housing of insulating plastics material having a plurality of apertures each receiving an individual one of a plurality of contacts each of which has a first portion for connection to external circuitry and a second portion extending out of the respective aperture at a mating surface of the housing for mating with a complementary contact, each aperture being dimensioned such that its walls intimately engage the received contact at a location inwardly of the mating surface, the width of the aperture in one plane being increased between the inward location and the mating surface of the housing to permit flexure of the second portion of the received contact in the one plane about the inward location, and the width of each aperture in a plane perpendicular to the one plane between the inward location and the mating surface of the housing being such that it prevents movement of the second portion of the received contact in the perpendicular plane, whereby each second portion is capable of flexure in only said one plane, with all the second portions being flexible in the same or parallel planes.

An embodiment of the present invention will now be described, by way of example,

with reference to the drawings, in which:—

Figure 1 is an exploded perspective view partially in section, of an interconnection assembly incorporating a connector according to the present invention;

Figure 2 is a view taken on the line 2-2 of Figure 1 subsequent to interconnection of a connector according to the invention with a further connector;

Figure 3 is a fragmentary cross-sectional view taken on the line 3-3 of Figure 2;

Figure 4 is a partial view of Figure 3 showing a detail of the invention; and

Figure 5 is a view similar to Figure 2 but drawn to a larger scale and demonstrating the operation of the present invention.

Connectors according to the invention comprise housings 10 receiving contact members 12, which connectors are matable with further connectors (which form no part of the present invention) comprising housings 14 and contact members 16. The housing 10 is substantially rectangular in shape and moulded from a plastics material. The contacts 12 may be made by stamping from sheet metal and comprise, respectively, a contact blade portion 18 and a terminal portion 20. The contact members are initially formed as a serial array interconnected as seen in Figure 1 by a carrier strip 22 integrally connected to the ends of the blade portions 18. The blade portions 18 are wider than the terminal portions 20 and are interconnected respectively by bevelled portions 21 (Figure 3).

The housing 10 is provided with two parallel rows of equally-spaced parallel through apertures 26 which form receptacles for the contacts 12, each of the apertures 26 within one row being aligned with a corresponding aperture 28 within the other row. In addition, the housing comprises housing portions 30, 32, and 34 defining the apertures 26 and 28 therebetween, respectively, which are of progressively shorter

height, and consequently, the housing 10 has a step-like configuration in cross-section, as particularly seen in Figure 2, whereby the apertures 26 are seen to extend substantially the entire height of the housing while the apertures 28 extend only approximately one-half the height of the housing. In this manner, subsequent to insertion of the contacts 12 within the housing apertures 26 and 28, the housing portions 32 and 34 serve as anvils about which the terminal portions 20 of contacts 12 may be bent so as to extend in co-planar fashion laterally of the housing 10, whereupon such portions 20 may subsequently be secured within holes in a printed circuit board 36 by any conventional means, such as for example, solder 37. An upstanding integral lug 39 is provided at each end of the housing 10 through which suitable fasteners (not shown) may be passed in order to secure firmly the printed circuit board 36 to housing 10. To support board 36 relative to the housing 10, the housing portion 34 is integrally provided with a laterally extending flange 41 having an upper support surface on which the board 36 is supported.

The apertures 26 and 28, are respectively provided with pairs of relatively convergent side wall portions 38 and parallel side wall portions 40, when viewed perpendicular to a plane transverse to the longitudinal axis of the housing, as seen in Figure 2. The width in that transverse plane of the terminal portion 20 of the contact 12 is slightly less than that of aperture 26 defined between the wall portions 40, while the distance between the wall portions 38 is greater than the width in that transverse plane of blade portions 18 of contacts 12.

The apertures 26 and 28, when viewed perpendicular to a plane which extends longitudinally of the housing 10, include parallel side wall portions 42 and 44 respectively, which are slightly further apart than the width in that longitudinal plane of blade portions 18 and the terminal portions 20, respectively, of contacts 12. A bevelled portion 46 interposed between portions 42 and 44 corresponds to the bevelled portion 21 of contacts 12, as seen in Figure 3. Side walls 44 extend the entire height of housing 10 so as to define transversely extending slots 47 (see Figures 1 and 2) which serve to guide the laterally extending portions of terminals 20 and maintain the same in co-planar alignment so as to facilitate proper interconnection with printed circuit board 36.

Consequently, upon insertion of the contacts 12 within the housing 10, the contact blades 18 will be firmly seated and restrained from any lateral movement in a longitudinal plane within housing 10 due

to the inter-engagement between bevelled portion 21 of contacts 12 and bevelled seating portion 46 of housing 10 as well as between the blade 18 and wall portions 42, while concomitantly therewith, lateral flexural movement of the contact blade portions 18 within a transverse plane is permitted due to the location of wall portions 38 relative to the blades, as seen in Figure 4. Flexure of the contact blade portions is enhanced by providing a reduced width (measured in the transverse plane) portion at the junction of each portion 18 with the corresponding portion 20. The terminal portions 20 are restrained from any lateral movement due to the presence of wall portions 40 and 44. The contacts are also restrained from any longitudinal movement relative to housing 10 due to the inter-engagement between bevelled portion 21 of contacts 12 and bevelled seating portion 46 of housing 10, as well as the interengagement between terminal portions 20 of contacts 12 and the upper planar surfaces 48 and 50 of housing portions 32 and 34, respectively, subsequent to the bending of terminals 20.

With reference now to Figures 1, 2 and 5 the significance of the lateral flexural movement of the contact blades 18 within the housing 10 will now be explained. In order to ensure that the mating contact members 12 and 16 within the housings 10 and 14 will be relatively properly aligned, a pair of dependent aligning pins 52 disposed along the longitudinal axis of the housing 10, project downwardly from each end of housing 10, and corresponding apertures 54 are provided within the end portions 56 of housing 14, whereupon insertion of pins 52 within apertures 54 serves to align housings 10 and 14 initially relative to one another. In addition, housing 10 is provided with a dependent skirt 58 integrally formed with housing portions 30 and 34 the lateral extent between the skirt portions being greater than the lateral dimension of the central recessed section 60 of substantially I-shaped housing 14, to permit some play between the housings 10 and 14 as seen in Figure 5 at 61. It will be noted that the skirt 58 does not extend the entire length of housing 10 although in other embodiments it could. End portions 62 of the housing 10 may be supported upon end sections 56 of housing 14. The depth to which skirt 58 extends is slightly greater than that to which contact members 12 extend when firmly seated within housing 10 whereby skirt 58 additionally serves to protect the contact blades 18, which extend out of the apertures 26, 28 at a mating surface of the housing 10, from damage.

Although the housings 10 and 14 may

consequently be properly supported and aligned relative to one another, as noted heretofore, throughout the service life of a particular piece of electronic equipment, the circuit boards housed therein may be exchanged an unaccountable number of times wherein misaligned contact members within the connector housings is a common occurrence. However, as particularly seen in Figure 5, upon mating of the housings 10 and 14, if the contact blades 18 should be out of alignment with the corresponding apertures 64 and contact receptacles formed by contact members 16 of housing 14, the upper bevelled portions 66 associated with apertures 64 will tend to deflect the contact blades 18 so as to in fact become axially aligned within the contact receptacles formed by contact members 16. Correspondingly, since contact blades 18 are in effect mounted within housing 10 in a cantilever fashion and are permitted to flex within a lateral plane, within predetermined limits defined by wall portions 38, the blades are able to be aligned with the mating contact members 16 without undergoing any structural damage.

WHAT WE CLAIM IS:—

1. An electrical connector comprising a housing of insulating plastics material having a plurality of apertures each receiving an individual one of a plurality of contacts each of which has a first portion for connection to external circuitry and a second portion extending out of the respective aperture at a mating surface of the housing for mating with a complementary contact, each aperture being dimensioned such that its walls intimately engage the received contact at a location inwardly of the mating

surface, the width of the aperture in one plane being increased between the inward location and the mating surface of the housing to permit flexure of the second portion of the received contact in the one plane about the inward location, and the width of each aperture in a plane perpendicular to the one plane between the inward location and the mating surface of the housing being such that it prevents movement of the second portion of the received contact in the perpendicular plane, whereby each second portion is capable of flexure in only said one plane, with all the second portions being flexible in the same or parallel planes.

2. An electrical connector as claimed in Claim 1, in which the second portion of each contact is reduced in width in said one plane at a position adjacent the inward location.

3. An electrical connector as claimed in Claim 1 or Claim 2, in which the first portion of each contact extends perpendicularly with respect to the second portion, and externally of the housing.

4. An electrical connector as claimed in any preceding claim, in which the mating surface of the housing is provided with a skirt at least partially surrounding the mating surface and projecting in a direction parallel to and further than the second contact portions.

5. A connector substantially as described with reference to and as shown in the drawings.

For the Applicants:
R. G. STUART-PRINCE,
Chartered Patent Agent.

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