ABSTRACT: An electrical connector assembly having a low insertion force upon mating of a first connector member and a second connector member. Each of the connector members contains contacts mounted in bores formed therein. The contacts of one of the connector members extends forwardly from the bore. A split insulator member in one of the connector members forms a pair of actuating plates with centrally mounted drive for moving the actuating plates in opposite directions. The actuating plates move the contacts of the connector in which it is mounted so as to mate the contact surfaces of the connector members. The centrally mounted drive may comprise a shaft member having an actuating cam mounted on it which, upon rotation of the shaft, causes a cam bearing to be displaced. Further, the shaft member may have a polarizing device mounted thereon coaxial with the shaft for engagement with a polarizing device on the other connector.
LOW INSERTION FORCE CONNECTOR ASSEMBLY

The invention relates, in general, to an improved low insertion force connector assembly and, more particularly, to a very high density connector assembly having a minimum force transmitted to connector member components when the connector assembly is actuated.

BACKGROUND OF THE INVENTION

In U.S. Pat. application Ser. No. 770,513, filed on Oct. 25, 1968, entitled, "Low Insertion Force Connector Assembly," and assigned to the assignee of the present application, there is described a high-density connector assembly wherein no contact mating forces are encountered during engagement of the connector assembly. A sliding plate is provided in one of the connectors to move the contacts so that the contact surfaces of the contact engage the contact surface of the contacts in the mating connector. A plastic insert which houses the contacts contains a cam shaft at one end. Rotation of the cam shaft causes the contacts to move the contact portions in the plastic insert, thus, allowing the contacting surfaces to be electrically interconnected. One drawback to the aforementioned connector assembly has been that the resultant forces of the actuator plate against the cam shaft were quite high, with peak loads on the actuator bearing requiring high-strength materials to be used. One result was that the number of contacts contained in the connector were limited because of such forces being present.

In order to overcome the attendant disadvantages of prior art zero-force connector assemblies, the present invention provides a zero-force connector assembly wherein extremely large numbers of contacts may be utilized in the invention, yet the resultant forces produced by the connector when the contacts are actuated to minimize, the resultant forces of the actuator plate against the cam bearing are partially cancelled which results in lower forces being transmitted to the cam bearing and the connector housing. Peak loads on the cam bearing surfaces are reduced in half which, in turn, reduces the sliding friction between the actuating cam and the cam bearing. Loading on the actuator plate is always compressive which is desirable when sustained loads are applied to plastic material. Moreover, central polarization means may be provided which are mounted surrounding the cam shaft.

The advantages of this invention, both as to its construction and mode of operation, will be readily appreciated as the same becomes better understood by reference to the following detailed description, when considered in connection with the accompanying drawings in which like reference numerals designate like parts throughout the figures.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which are to be regarded as merely illustrative:

FIG. 1 shows a perspective view of the preferred embodiment of the connector assembly prior to mating of the plug connector and receptacle connector;

FIG. 2 depicts a side view, partly in section, of the connector assembly of FIG. 1 with the plug connector and receptacle connector coupled together with the contacts of the connectors unmated;

FIG. 3 illustrates the connector assembly of FIG. 2 with the contacts mated and;

FIG. 4 shows an exploded view of the polarization and locking means of the connector.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is depicted an improved zero-force connector assembly 12 in accordance with the invention. The connector assembly comprises a plug connector 14 and a receptacle connector 16. The plug connector 14 comprises an outer metal shell housing 22 having mounting flanges 24 at opposite ends thereof with openings 26 therein for insertion of bolts or other locking means to secure the plug connector 14 to a panel. The plug connector 14 further comprises an insulator member 28 which is mounted within the housing shell 22 and which has its front portion extending forwardly therefrom. The plug connector further comprises a plurality of contact or contacts 32 which extend through the insulator member 28 and which have contacts mounted therein, each of which are secured to one of the wires 34. A plug polarizing device 36 is mounted in a central opening 38 in the insulator 28 of the plug connector.

The receptacle connector 16 comprises a rectangular metal shell member 42 having flanges 44 at either end thereof with openings 46 so as to enable the receptacle connector to be secured to a panel. Receptacle contacts 52 which are connected to wires 54 are mounted within the shell 42. A receptacle-polarizing device 56 and locking means 58 secured adjacent to the polarizing device 56 are mounted within the central front portion of the receptacle connector and will be described in greater detail hereinafter. The locking means 58 is made integral with a shaft 62 having a hexagonally shaped portion 64 at the rear end thereof which passes through the rear end of the receptacle connector 16 and which may be rotated by means of a conventional wrench 66.

Referring now to FIG. 2, there is shown a sectional view of the plug connector and receptacle connector mated with the contacts thereof in a noncontacting position. The plug connector contact boxes 32 contain lip portion 72 having a forward-facing shoulder 74 and a rearward-facing shoulder 76. Mounted within the bore 32 is the plug connector contact 82 having a beam portion 84 mounted at the forward end of the bore 32. At the forward end of the beam portion 84, there is a contacting surface 86 of somewhat elliptical shape. Extending from the back portion of the beam portion 84 is a locking tongue 88 which rests against the forward-facing shoulder 74 and can be depressed so as to remove the contact 82 from the bore of the insulator, should it be necessary. Secured to the rear end of the beam portion 84 is a crimp pot 92 whose forward end is adjacent the rearward-facing shoulder 76. The crimp pot 92 is integral with a wire strain relief 94 into which the wires 34 are inserted. The insulator members 96 are split in two parts along a center seam 96. A reduced diameter bore 98 is extended forwardly from the center thereof. Further, an enlarged diameter forward bore 102 is formed at the front of the insulator. Inserted in the center of the block adjacent a forward-facing shoulder 104 formed by the bores 98 and 102 is a locking plate 106. The locking plate 106 which is shown in greater detail in FIG. 4, comprises a somewhat circular disc having opposed flat sides 108 along a portion thereof and a central opening 112. Extending into the central opening is a locking key 114. The locking plate 106 has mounted along the front periphery thereof, a plug shell portion 116 which secures the locking plate 106 to the insulator 28. Further secured to the front side of the locking plate 106 is the plug polarizing device 36. The plug polarizing device 36 is shown in greater detail in FIG. 4 and comprises a rear base member 122 having extending forwardly therefrom, three post members 124 which are spaced from each other so as to produce the desired polarizing effect as will be explained hereinafter.

A receptacle connector 16 contains the front insulator 126 which forms a pair of actuator plates, as well as rear insulator 132, which are split along a central seam in a similar manner as insulator 28. The insulators 126 and 132 each contain bores 134 and 136, respectively, which are axially aligned when the plug contacts 82 and receptacle contacts 52 are in a nonmating position as shown in FIG. 2. The bore 134 contains an outwardly extending central lip 138. Further, the bore 136 contains an inwardly extending portion 142 forming a forward-facing shoulder 144 and a rearward-facing shoulder 146. Mounted within the bores 134 and 136 are the contacts 52. The contacts 52 comprise a beam portion 152 having a contacting surface 154 mounted on the front portion of the beam 152 which extends forwardly of the front end of the front insu-
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1. A locking tine 156 extends from the rear portion of the beam 152 and abuts the forward-facing shoulder 144 in a manner similar to the contact 82 of the plug connector. Further, the contact 52 and 82 are separated from each other. Thus, as can be readily seen, during coupling and uncoupling of the plug connector 14 and receptacle connector 16 to be separated from each other. Moreover, upon mating of the contacting surfaces of the contacts, the peak loads on the cam bearing surfaces are reduced by utilization of the split insulator 126, thus, reducing sliding friction between the actuating cam and the cam bearing. Because the two parts of the insulator 126 are driven away from the cam 206, loading on the insulator 126 is always compressive, which is desirable for plastic insulator materials.

What I claim is:

1. An electrical connector assembly comprising:
   a first connector member having a plurality of contacts, each contact having a contacting surface and being secured in individual bores in said first connector member;
   a second connector member having a plurality of contacts, each of said second connector member contacts being secured in individual bores in said second connector member and having a contacting surface extending from said bores;
   means for moving said plurality of contacts in one of said connectors in tandem causing said first connector member contacting surfaces to mate with said second connector member contacting surfaces after said first connector member is secured to said second connector member comprising a split insulator member forming a pair of contacting plates and driving means for moving said contacting plates in opposite directions, said driving means being rotatably mounted on one of said connector members.

2. An electrical connector assembly in accordance with claim 1, wherein said driving means comprises a rotatable shaft member having an actuating cam member secured to each of said actuating plates where rotation of said shaft causes said actuating cam to displace said cam bearing.

3. An electrical connector assembly in accordance with claim 1, wherein said driving means comprises a centrally located shaft member having an actuating cam mounted thereon.

4. An electrical connector assembly in accordance with claim 3, wherein said shaft member has a polarizing post member mounted coaxial with said shaft member for engagement with a polarizing post member on the other of said connector members.

5. An electrical connector assembly in accordance with claim 3, wherein said shaft member has positioned on the front end thereof key means for interengagement with a key member on the other connector member, rotation of said shaft member after said connector members are secured together allowing said keying means to lock said connectors together.