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[54] CIRCUIT BOARD CONNECTORS
5 Claims, 13 Drawing Figs.

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176, 221, 258 |

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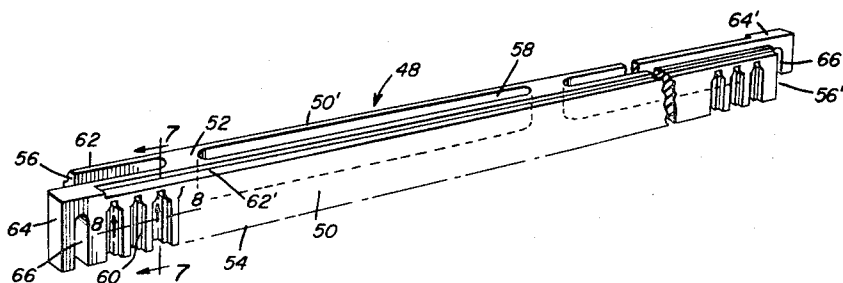
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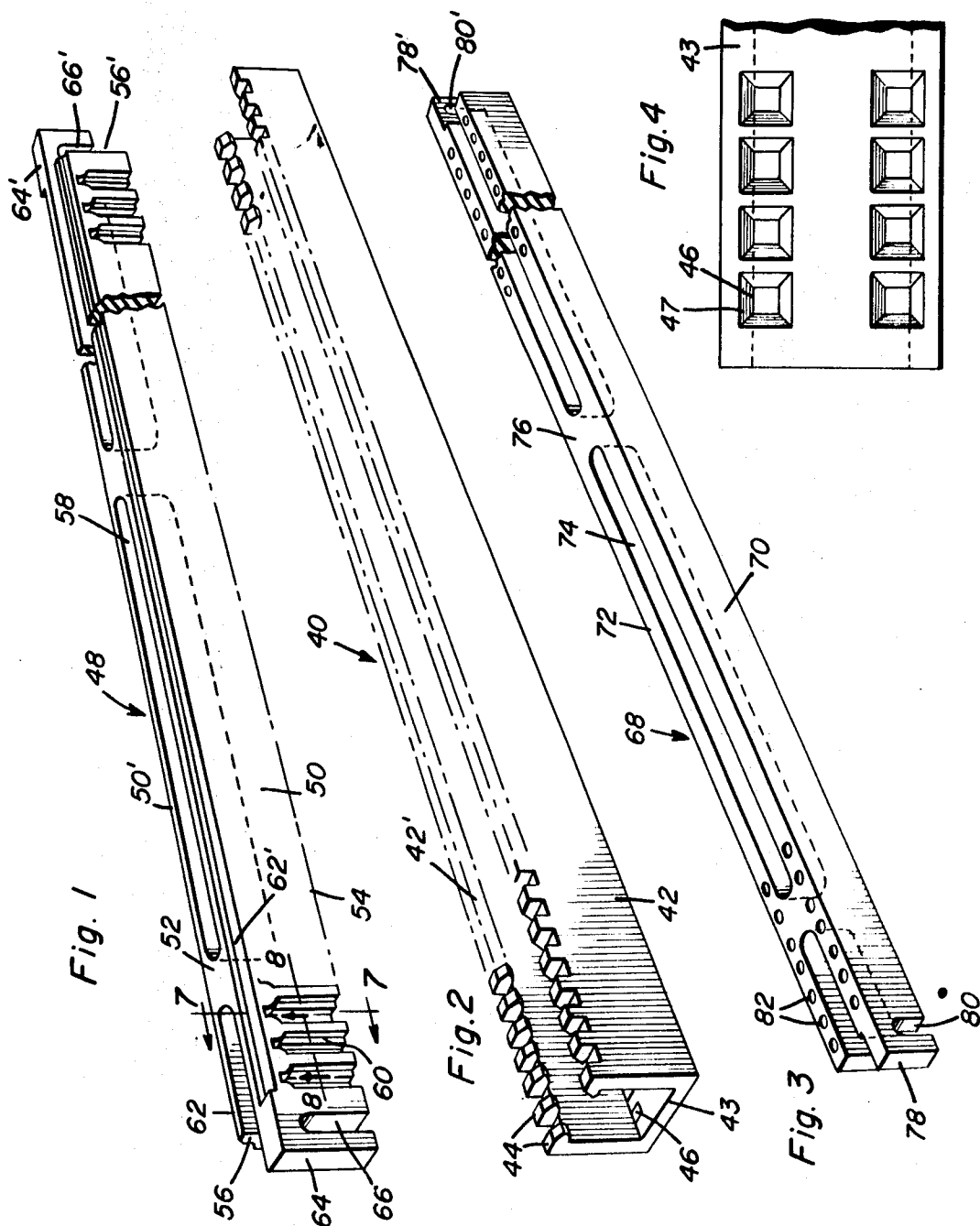
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ABSTRACT: A two-part connector assembly including a female connector having asymmetrical contact elements which prevent simultaneous mechanical resonance of the elements. A mating male connector includes barbed pin contacts securely embedded within a block.





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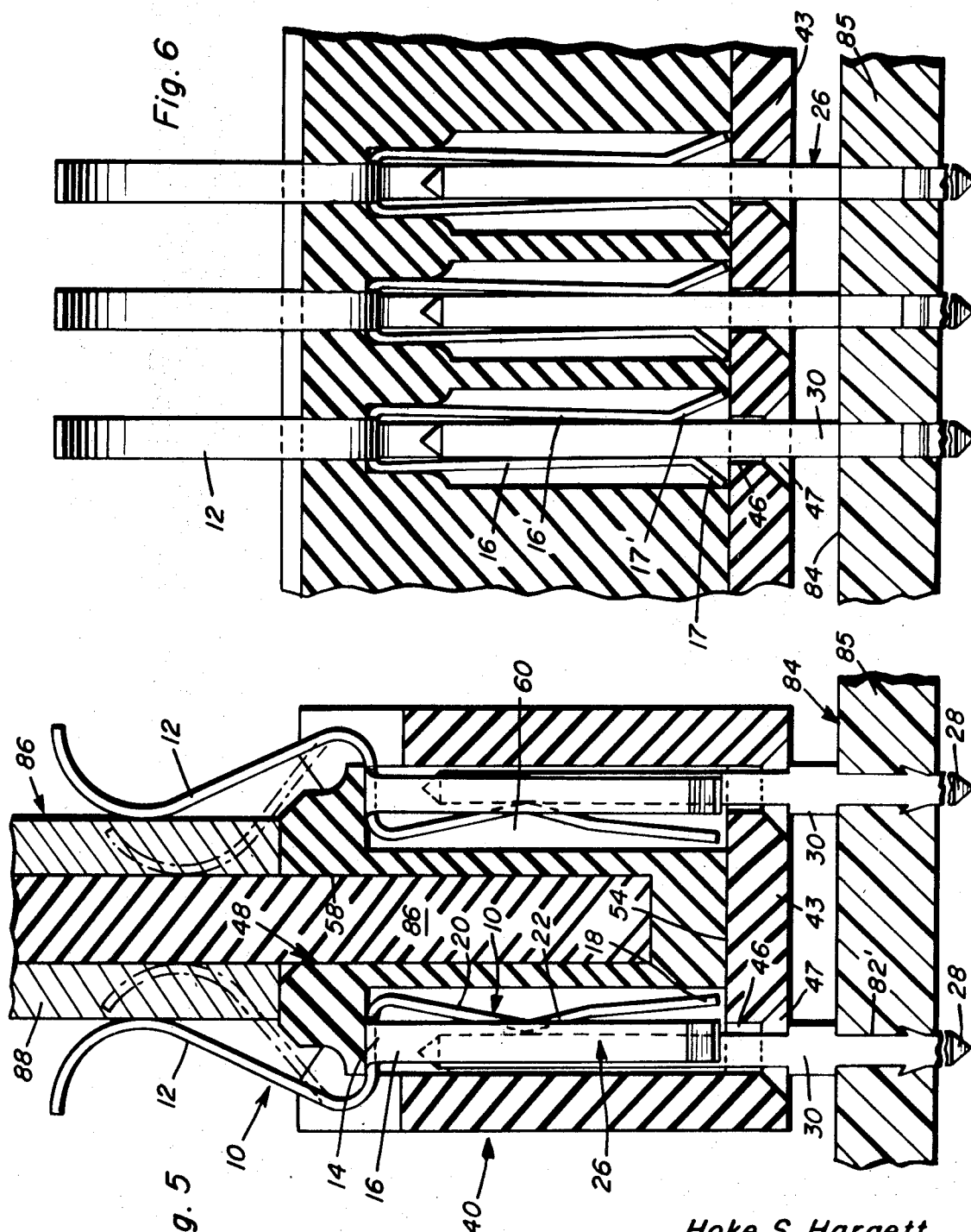
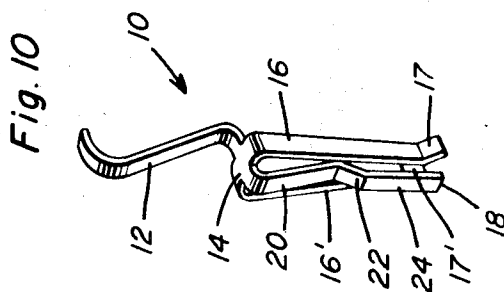
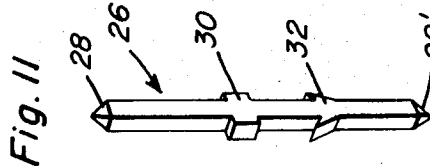
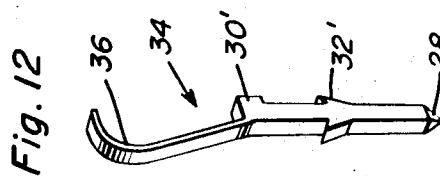
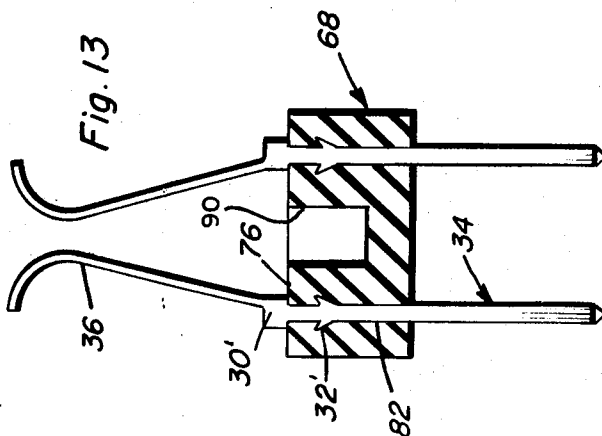
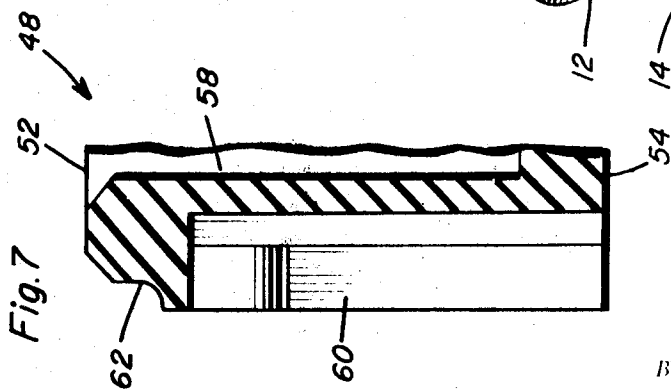
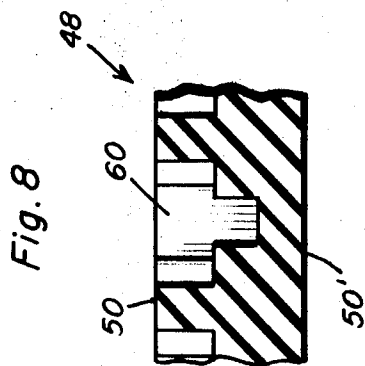
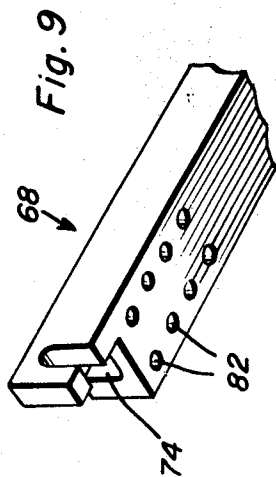


Fig. 6

Fig. 5

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CIRCUIT BOARD CONNECTORS

The present invention relates to printed circuit board connectors.

Electronic circuitry embodying a modular component concept generally requires a moth board having connector elements which engage mating connectors extending outwardly from a printed circuit board. One such construction includes pinlike connectors received within a mother board, the pins having outwardly extending ends. One of these ends provides means for connecting the pin to suitable electronic circuitry. The opposite end of the pin is caused to engage a female contact retained along an edge of a printed circuit card. Thus, when a printed circuit card is connected or "plugged into" the mother board, electrical signal continuity between the printed circuit board and other electronic circuitry is achieved. As the electronic state of the art progresses, electronic equipment operates at higher frequencies which tend to induce mechanical resonance in the female connector elements. As a result, mechanical vibration in these connectors cause transient loss of electrical contact which in turn causes erratic operation of an associated electronic system. Also, a large number of conventional connectors are designed so that the female contacts are exposed thereby rendering them vulnerable to damage and misalignment when male connectors are introduced therein. Still another problem with prior art devices concerns the amount of force required for inserting into and extracting a printed circuit board from a mating connector. It is desirable to reduce these forces so that damage of the same and wear thereupon is reduced to a minimum. Still further, several prior devices have been conceived which include contact members embedded within a base or block. In the event that a male connector becomes broken, it is necessary to replace the entire connector assembly. As will be appreciated, this may require a needless appropriation of many man-hours, during which time the equipment remains inoperative.

The present invention includes two principal embodiments. The first embodiment comprises a two-part assembly having slots therein for receiving printed circuit boards. The assembly includes provision for mounting asymmetrical female connectors which serve to virtually eliminate simultaneous mechanical resonance of contact elements during high frequency equipment operation. The assembly is so constructed so as to retain the female connectors in a recessed position thereby preventing the exposure of the same to harmful forces. The female connector integrally connects an elastically yieldable contact element for contacting suitable portions of a printed circuit board. The female connector is designed to reduce insertion and extraction forces necessary to manipulate a male connector with respect to the female connector. The male connectors utilized in the present invention are pinlike members having barbs attached thereto which are embedded within a block or base and upon the setting of the base material around a pin member, it becomes securely embedded within the base. A shoulder portion of the pin member limits inward displacement of the pin member into the base member. However, should the male pin member become broken it is easily replaced by cutting the shoulder portion therefrom and pushing the pin connector through the base member thereby permitting replacement with another pin member.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view of a core portion associated with a two-part assembly of a first embodiment.

FIG. 2 is a perspective view illustrating a housing portion for receiving the core shown in FIG. 1.

FIG. 3 is a perspective view illustrating a base member for receiving male contacts.

FIG. 4 is a partial bottom plan view of the base member shown in FIG. 3.

FIG. 5 is a transverse sectional view of the two-part assembly of the first embodiment shown in relation with a mating male pin connector assembly.

FIG. 6 is a partial longitudinal sectional view of the assembly shown in FIG. 5.

FIG. 7 is a partial sectional view taken along a plane passing through section line 7—7 of FIG. 1.

FIG. 8 is a partial sectional view taken along a section line 8—8 of FIG. 1.

FIG. 9 is a partial perspective view illustrating a base member for a second embodiment of the present invention.

FIG. 10 is a perspective view of a female connector member.

FIG. 11 is a perspective view of a male contact element.

FIG. 12 is a perspective view of a second type male contact element.

FIG. 13 is an end sectional view illustrating the relationship between the base member shown in FIG. 9 and two confrontingly disposed male contact elements shown in FIG. 12.

For purposes of simplifying the description of the present invention, reference is initially made to FIG. 10 which illustrates a basic female contact member denoted by reference numeral 10 which includes a substantially S-shaped, elastically yieldable contact 12 which functions as a double spring. The lower portion of this element is integrally attached to a rectangular flange portion 14 which integrally mounts a female receptacle. Two oppositely disposed and confrontingly converging cantilevered finger elements 16 and 16' extend longitudinally from flange portion 14 in a direction opposite to the S-shaped contact 12. The lowermost portion of the finger elements 16 and 16' include angularly offset portions 17 and 17'. The line of intersection between portions 16 and 17 as well as 16' and 17' provides an inwardly projecting bend for engaging a male contact. A third fingerlike element 18 is disposed in generally parallel relation to the aforementioned finger elements 16 and 16', element 18 being perpendicularly oriented to both elements 16 and 16'. Element 18 is also connected in a cantilevered fashion at one end thereof to flange portion 14 and includes a first inwardly directed portion 20 appending to an angularly offset portion 22 which is in turn integrally attached to a third linearly offset portion 24. The intersection between portions 20 and 22 forms a bend for contacting a male connector. In order to virtually eliminate simultaneous mechanical resonance in the elements of female contact member 10 due to the influence of high frequency electrical signals conducted therethrough, the aforementioned lines of intersection or bends which engage the male contact inserted within the receptacle are longitudinally spaced from each other.

Referring to FIG. 11, a male contact denoted by reference numeral 26 is in the form of an elongated pin member having a square or noncircular cross section with flat sides. Contact member 26 is adapted to be inserted within female connector 10 previously described. The particular structure of contact member 26 includes pyramidal ends 28 and 28'. Further, an intermediate portion of the pin includes shoulder projections 30 protruding from two oppositely disposed edges of the pin body. Barb elements 32 project outwardly from these edges, the barbs being utilized to anchor the male contact member within a base block.

A second form of male contact element is shown in FIG. 12 and denoted by reference numeral 34. This contact element includes a lower pyramidal end 28 and barb elements 32' identical with barb elements 36 of the contact element 26 aforementioned. Contact element 34 further includes a single shoulder projection 30' projecting from one edge of the element. The oppositely disposed edge integrally mounts an inwardly curving elastically yieldable element 36 extending upwardly in an opposite direction from the main body portion of the pin connector. The yieldable element 36 is employed to contact suitable portions of the printed circuit card placed adjacent thereto in much the same manner as previously discussed in connection with element 12 of the female connector 10 shown in FIG. 10.

Attention is directed to FIGS. 1 and 2 which illustrate a two-part assembly for retaining a plurality of female contacts 10 as shown in FIG. 10. FIG. 2 illustrates an elongated channel-shaped housing 40 formed by lateral wall portions 42 and 42' interconnected by base portion 43. The outward edge of walls 42 and 42' are denticulated to include inwardly directed toothlike projections 44. Square-shaped apertures 46 are formed in base portion 43, adjacent lateral walls 42 and 42' in alignment with the spaces between adjacent toothlike projections 44. As seen in FIGS. 4, 5 and 6, these apertures extend outwardly through tapering frustoconical recesses 47 to guide entry of a pin member as explained hereinafter.

FIG. 1 illustrates an elongated core member 48 having oppositely disposed lateral sides 50 and 50' interconnected by top edge 52 and bottom edge 54. The end edges of the core member are denoted by 56 and 56'. A number of longitudinally spaced elongated slots or recesses 58 are formed inwardly from top edge 52 to accommodate a printed circuit board therein.

Laterally opening recesses or cavities 60 are formed inwardly of sides 50 and 50' for receiving female contacts 10 as shown in FIG. 5. These recesses extend transversely between lower edge 54 to a point adjacent top edge 52. The cross-sectional shape of each recess 60 may be clearly seen in FIGS. 7 and 8. The upper edge 52 of the elongated core member 48 includes laterally disposed elongated chamfer formations 62 and 62' which serve to mate with projections 44 of channel member 40 to retain core 48 within housing 40 by detent action. The core and housing are fabricated from a suitable elastomeric insulating material permitting "snapping" insertion of the core into the housing. In order to remove the core from the housing, lateral walls 42 and 42' of the housing are spread apart to release the formations 62 and 62' and permit withdrawal of the core. Tabular mounting projections 64 and 64' are respectively connected to the end edges 56 and 56' of core 48. Each of these extensions includes a generally U-shaped slot 66 therein to receive a fastener when it is desired to mount the core on a surface. The completed structure and assembly of the two-part assembly including core 48 and housing 40 is clearly shown in FIGS. 5 and 6.

Construction of a male connector begins with a suitable base member such as is shown in FIG. 3 and denoted by reference numeral 68 made of an elastomer material. The base member includes parallel spaced lateral sides 70 and 72. Base member 68 further includes an upper edge 76 within which are formed elongated slots or recesses 74 similar to the slots 58 of the core 48 shown in FIG. 1. The upper and lower edges of base member 68 are planar and do not include a chamfered surface. The end edges of the base member include tabular extensions 78 and 78' for facilitating the mounting of the base member on a surface. Generally U-shaped slots 80 and 80' are respectively formed within extensions 78 and 78' to receive suitable fasteners. A series of closely spaced cross-sectionally circular apertures 82 are formed between the upper and lower edges of the base member 68 as shown in FIGS. 3 and 9 to accommodate male contact elements denoted by 34 shown in FIG. 12. The completed structure is illustrated in FIG. 13 wherein cross-sectionally, noncircular male contact elements 34 have been press fitted through the circular apertures 82 so that barb elements 32 pierce the base element 68 until the shoulder portion 30' of the contact element rests in abutment with the upper surface 76 of the base element 68. A recess 90 is formed downwardly through the upper surface 76 and serves to receive a printed circuit board edge therein.

Referring to FIGS. 5 and 6, a male connector is denoted by

reference numeral 84 and is seen to include a base member 85 similar to the base member 68 but lacking the slots 74. Base member 85 is adapted to receive the pin members 26 shown in FIG. 11. The insertion of these pin members into base member 85 is identical with the procedure previously discussed in connection with male contact members 34. As will be noted from FIGS. 5 and 6, each male contact 26 engages a female contact 10. The opposite end portion 28 of the male contact member provides means for connecting electrical wires thereto such as by means of soldering, wire wrapping, or the like. It will be further noted that shoulder elements 30 provide a means of spacing base portion 43 of housing 40 from the male connector base member 85. In operation of the device, a printed circuit board 86 is slipped between flexibly yieldable contact elements 12 and is received within slot 58 formed in core 48. As previously mentioned, contact elements 12 are adapted to engage the surface of conductor strips 88 on the printed circuit board 86. Thus, electrical continuity is completed between the end 28 of male contact element 26 and the conductor strips 88 on printed circuit board 86.

Should any of the male contact members 26 break, a replacement may be inserted after cutting the contact member below shoulder 30 so that the barbed portion of the male contact may be pushed through its associated base member 85 thereby clearing aperture 82' as a new contact member is being inserted.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. An electrical connector comprising a core member having at least one recess therein, a female contact inserted in the recess, a housing fastened to the core member for securing the contact in its recess, the female contact having a first trifurcated portion adapted to receive a male contact, the trifurcated portion including three fingers with respective offset points for engaging the male contact in a nonsymmetrical manner, the fingers being designed to exhibit nonharmonic response with respect to each other thereby obviating simultaneous intermittent disengagement between any two fingers and the male contact, the female contact having a second portion for engaging a printed circuit board to complete an electrical path between the male contact and the board.

2. The structure set forth in claim 1 wherein the core and housing include detent means for removably fastening the core member to the housing.

3. The structure of claim 2 wherein the detent means comprises doglike projections along edges of the housing, and chamfer formations along edges of the core members for receiving respective projections.

4. The structure of claim 3 wherein an opening is formed in the housing in registry with the male contact, the opening serving to shelter the fingers from direct exposure.

5. A female contact comprising a first trifurcated portion adapted to receive a male contact, and an S-shaped portion extending from the trifurcated portion adapted to engage the circuit board, the trifurcated portion including three fingers extending in the same general direction, the fingers having mutually offset bends therein to engage a received male contact along spaced points thereon, the points being designed to prevent mutual harmonic oscillation of any two fingers.