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MULTIPLE ELECTRICAL CONNECTOR AND METHOD OF CONSTRUCTING SAID CONNECTOR

Filed May 8, 1961

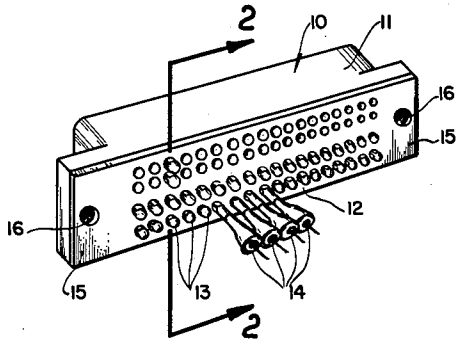



FIG. 1

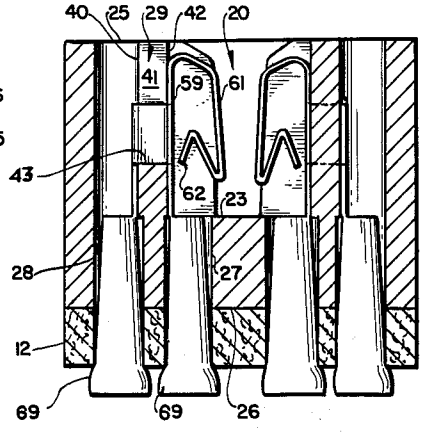



FIG. 2

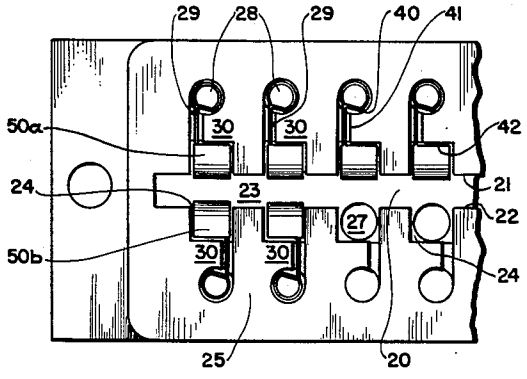



FIG. 3

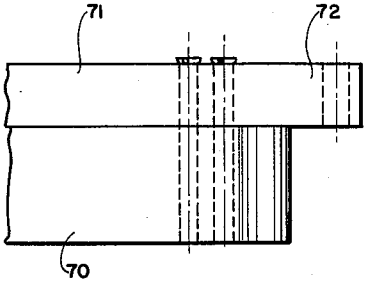



FIG. 4

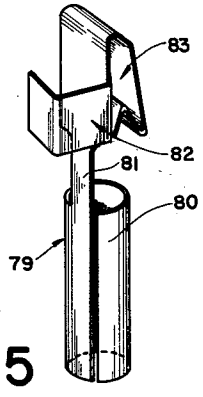



FIG. 5

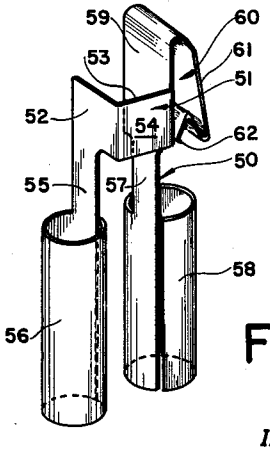



FIG. 6

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# MULTIPLE ELECTRICAL CONNECTOR AND METHOD OF CONSTRUCTING SAID CONNECTOR

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The present invention relates generally to an improved multiple electrical connector and, more particularly, to a miniature multiple connector adapted for interconnecting a printed circuit board with a plurality of electrical conductors.

Prime requisites for a commercially acceptable multiple electrical connector are that it be moderately priced and that it provide an excellent electrical connection between a plurality of miniature electrical conductors. In order to fulfill these goals, the connector should be easily and inexpensively constructed. For various reasons, contemporary connectors do not meet these requirement. One problem, for example, for which the prior art fails to teach an inexpensive and successful solution is that of retaining a plurality of electrically conductive contact elements within a unitary insulated block. The above problem is particularly acute in the case of connectors supplied for military use at high temperatures.

Accordingly, it is an object of the present invention to provide an improved multiple electrical connector which may be easily and economically constructed while providing an excellent electrical connection between a plurality of miniature electrical conductors.

Another object of the present invention is to provide an improved structure and method for retaining a plurality of electrically conductive contact elements within a unitary insulated block.

Still another object of the present invention is to provide an improved miniature multiple connector adapted for interconnecting a printed circuit board with a plurality of miniature taper-pin type conductors.

A still further object of this invention is to provide a miniature multiple connector which is suitable for high temperature use and meets the requirements prescribed by the United States armed forces.

Other and further objects, features and advantages of the invention will become apparent in the detailed description of the invention in conjunction with the attached drawings wherein:

FIG. 1 is a perspective view of a multiple electrical connector constructed in accordance with the present invention;

FIG. 2 is an enlarged partial cross-section taken along the line 2—2 of FIG. 1;

FIG. 3 is a top view of a multiple electrical connector constructed in accordance with the present invention;

FIG. 4 is a side view of another embodiment of a multiple electrical connector constructed in accordance with the present invention;

FIG. 5 is a perspective view of one embodiment of a conductive contact element adapted for use in multiple electrical connectors constructed in accordance with the present invention; and

FIG. 6 is a perspective view of another embodiment of a conductive contact element adapted for use in multiple electrical connectors constructed in accordance with the present invention.

In use, the connectors of the general type herein described are quite often installed in banks in a console cabinet with the longitudinal axis of the connector body being vertical, whereby the printed circuit boards may be



inserted from the front or rear of the console as needed. However, in order to establish a frame of reference for the description below, and facilitate the understanding of the preferred embodiments of the invention, they will be described in an orientation with the connector side which receives thhe printed circuit board on top, i.e., as seen in FIGURE 2.

Briefly, in accordance with a preferred form of the present invention, there is provided a molded base member provided with a longitudinal groove in the top face thereof. Along each side of this groove are formed a plurality of spaced recesses. In each of these recesses there is provided an opening, or bore, extending between the bottom of the groove and the bottom face of the base. An additional opening, or bore, respectively adjacent each recess cooperates with a narrow slot extending therebetween to form a plurality of shoulders defined by sides perpendicular to the bottom face of the base. This slot only extends from the top of the body vertically part way through the body.

Cooperating with each recess and pair of adjacent openings is a contact element. Each contact element, preferably formed from a unitary sheet of conductive resilient material, includes a substantially U-shaped portion, first and second contact cylinders and a contact spring. These contact elements are located within the base element so that the first and second contact cylinders extend through adjacent openings of the base and depend below the base, the lower edge of the U-shaped portion engages the bottom of the slot, and the exposed sides of the shoulder adjacent the openings so as to prevent downward, longitudinal or lateral movement of the contact relative to the base. In such position, the contact spring is located in the recess proximate the respective pair of openings.

For reasons developed below, there is a sheet of high strength material contiguous with the bottom face of the base and containing openings through which extend each of the contact cylinders. After the contact cylinders have been inserted therein their end portions are flared so as to engage the high strength material and anchor the contact elements against upward vertical movement relative to the base member.

Referring now to the drawings in more particular, the embodiments of the invention illustrated are for high temperature military applications. In such cases, an electrical connector 10 comprises a base 11 preferably constructed of a molded insulated plastic of such as of diallyl phthalate type. Diallyl phthalate plastics will function at the high temperature and may be economically molded in the complex shape illustrated to receive a plurality of metal contact elements 13. However such plastics are brittle and weak. Therefore, it was found that when, for anchoring purposes, the metal contact elements are flared as mentioned above and described below, the plastic could often fracture.

To overcome this deficiency an insulative sheet, or layer, 12 of high strength material, having properly disposed openings through which the contact elements 13 extend, is located contiguous to the bottom face of the base 11. Because of the unique construction of the connector, the layer 12 has a simple rectangular shape with a series of holes drilled in it. Therefore, the layer 12 can be formed from a tough, high strength material such as epoxy laminated fibre glass as required by military standards without necessitating high production costs.

The sheet or layer 12 also could be formed of a material such as nylon or polychlorotrifluoroethylene. However, usually, if the requirements of the intended uses are moderate enoughe to use such materials for the layer

12, the body 11 and the layer can be made as one piece out of such materials.

As is conventional with miniature multiple connectors the electrical connector 10 also includes extending lugs 15 each provided with a mounting hole 16.

The construction of the multiple electrical connector of FIG. 1 is shown in detail in the enlarged cross-sectional view of FIG. 2 and the enlarged top view of FIG. 3. As shown therein, the molded base section 11 is provided with a central longitudinal groove 20 defined by sides 21 and 22 and bottom 23, for receiving the terminal end of a printed circuit board (not shown). Along both of the sides of the longitudinal groove are formed a plurality of spaced recesses 24 each of which extend between the groove bottom 23 and the top face 25 of the base 11. In each of these recesses there is provided an opening, or bore, 27 between the bottom 23 of groove 20 and the opposite, or bottom, face 26 of the base 11. Additional openings, or bores, 28 are provided adjacent each of the openings 27 and in the embodiment shown in FIGS. 2 and 3, these openings extend entirely through the base element 11 between the top and bottom faces thereof.

A plurality of narrow slots 29 perpendicular to both the top and bottom base faces 25 and 26 and longitudinal groove 20 interconnect each recess 24 with its associated adjacent opening 28, thereby forming a plurality of shoulders 30 defined by faces 40, 41 and 42, each of which are perpendicular to the top and bottom base faces. Each of these slots 29 only extend part way through the body 11 and terminate in an upwardly facing bottom 43.

A unitary conductive contact element 50 adapted for use with the base 11 is illustrated in FIG. 6. This contact is preferably constructed from a unitary sheet of conductive resilient sheet stock and formed as shown, to include a substantially U-shaped portion 51 having sides 52, 53 joined by a web 54. Integral with side 52 is shank 55 which forms a portion of the wall of a first contact cylinder 56. Integral with side 53 is shank 57 which forms a portion of a second contact cylinder 58. The side 53 also forms the outer member 59 of a contact spring 60 which also includes inner member 61 and V-shaped spring 62. The outward movement of inner member 61 relative to the outer member 59 is limited by the end of the spring 62 engaging either the outer member 59 or shank 57, or both.

A complete multiple electrical connector constructed in accordance with the present invention is formed by inserting the first contact cylinder 56 through the base opening 28 and the second contact cylinder 58 through the base opening 27. As shown in FIG. 3, when the lower edge of the U-shaped portion 51 abuts the slot bottom 43, the U-shaped member surrounds the associated shoulder 30; side 52 of the portion 51 engaging the face 40 of shoulder 30, side 53 of the portion 51 engaging the face 42 of the shoulder 30, and web 54 of the portion 51 engaging the face 41 of the shoulder 30, thereby anchoring contact element 50 against lateral, lonitudinal, or downward movement relative to the base 11.

The contact element is permanently installed within the base 11 by extending the first and second contact cylinders 56 and 58 through mating openings in the high strength sheet 12 and flaring the end portions of one or both of the contact cylinders as shown at 69 so as to grip the sheet 12.

The high strength material does not have to be attached to the bottom face 26 of base 11 since the flared contact cylinders serve to permanently retain the sheet 12 in the position shown. Furthermore, the use of sheet 12 obviates subjecting base element 11 to the stresses of the flaring operation, whereas the base would otherwise be subjected to possible chipping and cracking—particularly if the base is constructed from a material such as diallyl phthalate plastic.

As shown in FIGS. 2 and 3, the contact element 50 is of the appropriate size so that a substantial portion of the integral contact spring 60 lies within the recess 24, i.e., outside the groove 20. Inner member 61 lies outside the recess, however, within the longitudinal groove 20.

In like manner, each of a plurality of contact elements inserted into respective pairs of openings 27, 28 are anchored in position by respective shoulders 30 and flared cylindrical portions 69. Oppositely positioned contact elements such as elements 50*a* and 50*b* ordinarily define a complete contact unit which engages with a mating contact of a printed circuit board (not shown) extended within the longitudinal groove 20.

Installing the contact elements within the base member in the manner described above has several advantages over structures and methods shown in the prior art, in addition to more rapid manufacture. The U-shaped portions 51 of the contact element engaging the shoulder 30 defined by sides perpendicular to the front base face 25 positively prevents lateral movement of the contact element relative to the base 11. Accordingly, a printed circuit board extended into the longitudinal groove 20 moves only the inner member 61 of the contact spring 60 to provide a secure and positive electrical contact.

In addition, flaring of the bottoms of the cylinders not only provide a permanent retention of the contact elements, but facilitates entrance of the taper pin type of electrical connector. Further, as noted above, the construction shown does not require that the material used for the complex portion of the connector base have high strength. This permits the use of easily molded material for high temperature connectors.

An alternative embodiment of a multiple electrical connector constructed in accordance with the present invention shown in FIGURE 4 utilizes a somewhat thinner base element 70 and a thicker high strength element 71 whereby the extending lug 72 is defined entirely by the member 71. As a result, the base element 70 is somewhat simpler to form since it need only the constructed in a rectangular block form without extended lugs being formed integral therewith.

In the embodiment of the invention shown in FIGS. 1 and 2, each contact element 50 has included a pair of contact cylinders 56, 58. Although both of these cylinders may be utilized to provide a continuous circuit with integral contact spring 60, the double cylinder assembly also facilitates electrically checking each circuit since normally only a single taper pin will be required in conjunction with each contact spring 60, the other contact cylinder then being used for test purposes.

If, however, the dual contact cylinder is unnecessary, a simplified multiple electrical connector may be constructed in accordance with the present invention by utilizing a contact element 79 shown in FIG. 5 which comprises the unitary contact cylinder 80, shank 81, U-shaped member 82, and contact spring 83. This contact element is identical with the member shown in FIG. 6 except that one contact cylinder and associated shank have been deleted. As a result, the portion of the opening 28 between the bottom 23 of longitudinal slot 20 and the bottom face 26 of base 11 may also be deleted if desired. Otherwise, the assembly of the contact element 79 in the base element 11 is identical with the embodiment shown and described hereinabove, i.e. U-shaped portion 82 encloses shoulder 30 of base 11 and contact cylinder 80 is flared to engage the sheet 12 thereby anchoring contact element 79 against both lateral and vertical movement.

Although exemplary embodiments of the invention have been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiments disclosed may be subjected to vari-

ous changes, modifications and substitutions without necessarily departing from the spirit of the invention.

We claim:

1. A multiple electrical connector comprising:

a base member constructed of an insulative material and having a longitudinal groove in the top face thereof, a plurality of spaced recesses along both sides of said groove, a plurality of first openings respectively between the bottom of each of said recesses and the bottom face of said base, a plurality of second openings respectively adjacent said first openings and extending between the top and bottom faces of said base member, and a plurality of narrow slots perpendicular to said longitudinal groove respectively joining adjacent ones of said recesses and second openings thereby forming a plurality of shoulders defined by sides each of which are perpendicular to said top face, each slot extending from said top face part way through said base member;

a plurality of contact elements each constructed from a unitary sheet of conductive resilient material and having a substantially U-shaped portion, a first contact cylinder integral with one of the sides of said U-shaped portion, a second contact cylinder and contact spring integral with the other side of said U-shaped portion;

each of said contact elements being located within said base

element through said top side so that said first contact cylinder extends through one of said second openings, said second contact cylinder extends through the first opening adjacent said second opening, said U-shaped portion engages the exposed sides of the shoulder adjacent said openings so as to prevent lateral movement of said contact element relative to said base, and said contact spring is located in the recess proximate said first opening.

2. The multiple electrical connector defined in claim 1 wherein a sheet of high strength material is contiguous with the bottom face of said base member, said sheet containing openings in said sheet through which extend each of said contact cylinders, said cylinders being flared so as to engage said high strength material and thereby anchor said contact elements against upward movement relative to said base member.

3. The multiple electrical connector defined in claim 1 wherein the contact spring of said contact element includes an outer member integral with said second contact cylinder and retained in said base adjacent said shoulder, an inner member integral with said outer member and extending out of said recess into said longitudinal groove, and a substantially V-shaped spring integral with said outer member for limiting outward movement of said inner member relative to said outer member.

4. An electrical connector comprising:

a base member constructed of an insulative material and having a longitudinal groove in the top face thereof;

a generally vertical recess in one side of said groove;

a first opening between the bottom of said recess and the bottom face of said base, a cavity adjacent said first opening and extending downward from the top face, a narrow slot perpendicular to said groove joining said recess and said cavity thereby forming a shoulder defined by sides each of which are perpendicular to said front face;

a contact element constructed from a unitary sheet of conductive resilient material and having a substantially U-shaped portion, a contact cylinder and a contact spring;

said contact element being located within said base element so that said contact cylinder extends through said opening, the sides of said U-shaped portion engage respective exposed sides of said shoulder so as to prevent lateral movement of said contact element relative to said base, and said contact spring is located in said recess.

5. The electrical connector defined in claim 4 wherein a layer of high strength material is contiguous with the bottom face of said base member, said sheet containing an opening through which extends said contact cylinder, said cylinder being flared so as to engage said layer and thereby anchor said contact element against upward movement relative to said base member.

6. The electrical connector defined in claim 4 wherein the contact spring of said contact element includes an outer member integral with said contact cylinder and retained in said base adjacent said shoulder, an inner member integral with said outer member and extending out of said recess into said longitudinal slot, and a substantially V-shaped spring integral with said inner member for limiting outward movement of said inner member relative to said outer member.

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