

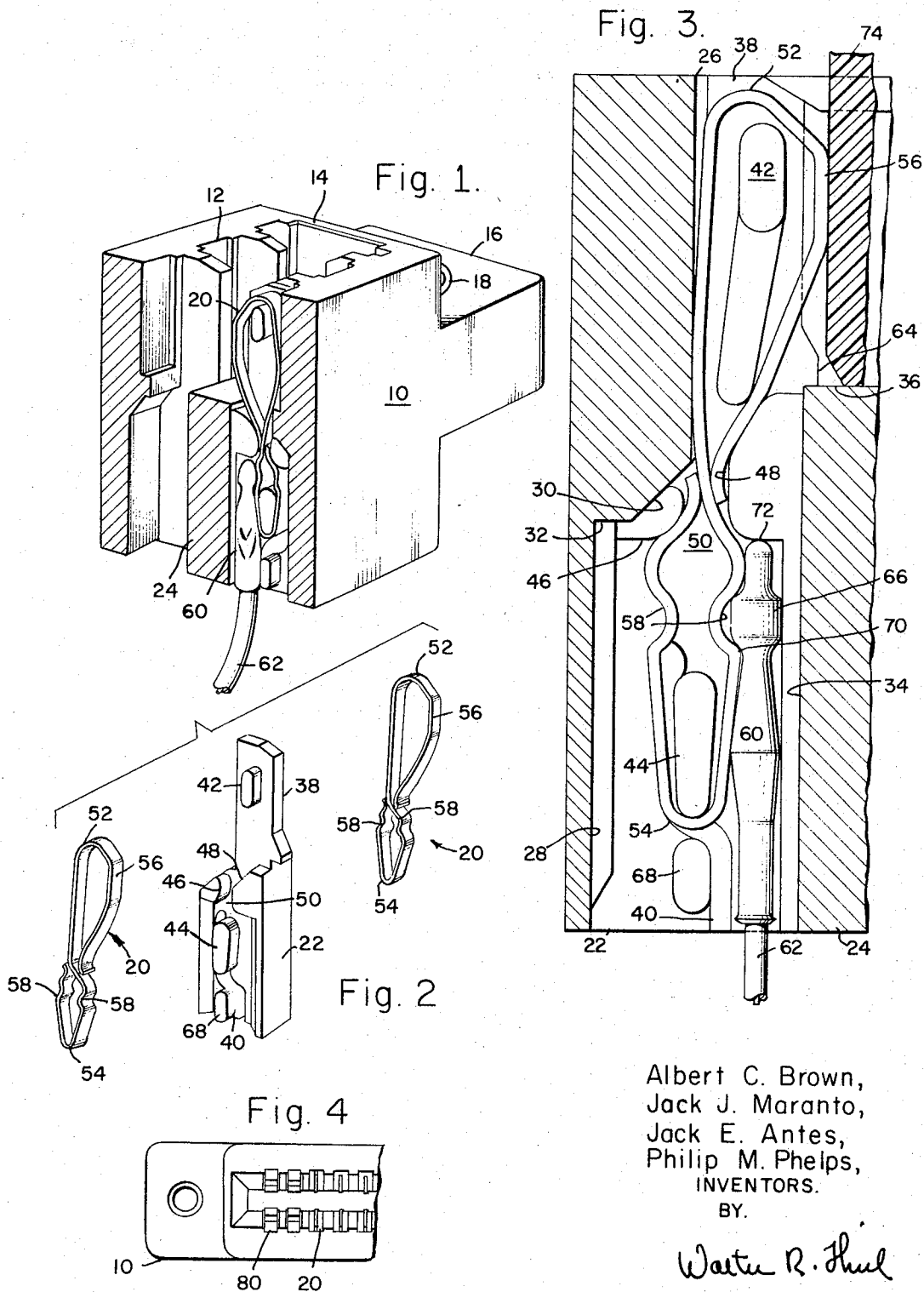
Dec. 26, 1967

A. C. BROWN ET AL

3,360,767

ELECTRICAL CONNECTOR

Filed Aug. 24, 1965



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ELECTRICAL CONNECTOR

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Filed Aug. 24, 1965, Ser. No. 482,081

4 Claims. (Cl. 339-176)

ABSTRACT OF THE DISCLOSURE

This is an electrical connector for coupling a conventional conductor such as a round wire to a circuit board. The connector includes a pair of deflectable loops in an insulating plug which are held by a restriction near the center of the plug to permit each of the loops to independently deflect as they are engaged by a conductor termination device or the conductor terminations on a printed circuit board.

This invention relates to an electrical connector and more particularly to an electrical connector for connecting small conductors to closely spaced terminations of electrical circuits on printed circuit boards or other mateable contact elements.

The miniaturization of electronic systems and sub-systems having hundreds and often thousands of conductors has necessitated the development of terminal blocks and connectors to which a large number of the terminations of these conductors may be removably connected. Heretofore, multiconnector terminal blocks have been available for the termination of conductors on printed circuit boards which are spaced at certain intervals along the edge of the board such as at .100 inch centers. However, for computer applications such previously used spacings are excessive and it has been found more desirable to space such terminations at reduced distances such as at .050 inch centers. In multiconnector terminal blocks, such spacing may be used for most connectors since in computer applications large currents are not carried by conductors. However, some connectors must be spaced on centers having greater distances of separation because of the necessity of connecting high electric current equipment such as a power supply to the printed circuit board.

Therefore, it is an object of the present invention to provide an improved connector for a mating element such as a printed circuit board.

It is another object of the improved electrical connector of the present invention to provide a multicontact connector for making electrical contact to printed circuit board conductor terminations spaced on centers of different distances.

It is a further object of the present invention to provide an improved electrical connector for a printed circuit board having a spring loaded contact element adapted to simultaneously and removably contact more than one electrical conductor.

Briefly, the improved electrical connector of the present invention comprises a receptacle block having a plurality of cavities for receiving single electrical conductors and a longitudinal groove for positioning a printed circuit board or other mating electrical element. An insulating plug member supporting one or more spring contact elements is retained in each cavity so that a conductor termination on a printed circuit board makes contact with one part of the contact element, and one or more electrical conductors makes contact with another part of the contact element. The contact elements are spring loaded into a precise configuration in the insulating plug element prior

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to insertion into the cavity by a plurality of bosses formed in the plug to define the configuration of the contact element.

Other advantages of the invention will hereinafter become more fully apparent from the following description of the drawings which illustrate a preferred embodiment thereof and in which:

FIGURE 1 is a perspective view shown in section of a receptacle block showing the positioning of the plug and spring contact element of the present invention;

FIG. 2 is an exploded perspective view showing the insulating plug and a pair of spring contact elements;

FIG. 3 is an enlarged sectional view of a portion of the receptacle block and printed circuit board showing in more detail the insulating plug, spring contact element and conductor terminating device; and

FIG. 4 is a top elevational view of a portion of the terminal block of the present invention illustrating the positioning of contact elements of different size in the block.

Referring now to FIGS. 1 and 2, a connector block or insulating body 10 of a plastic material such as diallyl phthalate has been formed with a plurality of transverse chambers or cavities 12 and a longitudinal recess 14. Typically, the block includes a flange 16 at each end having a bore or aperture 18 therein for mounting the block to a support structure by bolts or screws (not shown). A pair of contact members or elements 20 typically formed from a continuous, one-piece metal flat strip or wire such as high conductivity copper alloy, nickel alloy or beryllium copper alloy and having a unique shape is locked into contact with an insulating plug 22 which is inserted into and retained within each of the chambers 12.

While in FIGS. 1 and 2 there is shown and hereinafter described a connector block 10 with opposing chambers or cavities 12 and a pair of contact elements 20 cooperating with the insulating plug 22 to adapt each of the cavities 12 for the termination of independent electrical conductors, it should be understood that without varying from the scope of the present invention, one of the rows of the plugs 22 and the pair of contact members 20 or one of the contact members 20 may be eliminated if desired to make contact with only one side of a printed circuit board or to make contact with conductor terminations spaced at greater distances respectively.

In addition to FIGS. 1 and 2, referring now to FIG. 3, each of the cavities 12 extends transversely of the insulating body 10 from top to bottom as pictured in the figures and contains a barrier or divider 24 which divides it into two parts for a portion of its length starting at the bottom and running slightly beyond a center point thereof. The side of the cavity 12 is of uneven shape with first and second flat portions or surfaces 26, 28 of different widths and an inclined surface 30 and a shoulder 32 between the flat portions, while the divider 24 is of generally rectangular shape as shown in cross section with flat sides and a top surface 34, 36 respectively.

The insulating plug 22 has a generally elongated shape having a finger portion 38, a slot or groove 40, an upper and lower spring positioning bosses 42, 44, and a pair of spring gripping bosses 46, 48 defining a restriction 50. The contact member or element 20 is folded or upset into a double loop configuration with a right hand upper loop 52 and a left hand lower loop 54. The upper loop 52 is of slightly larger size than the lower loop 54 and has a flat portion 56 adapted for contact with the printed circuit board, while the lower loop 54 includes a pair of detents or recesses 58 for engaging and retaining an electrical conductor termination device 60 to which an electrical conductor 62 is affixed by conventional means such as crimping the device to the conductor 62 after stripping the insulation.

To facilitate a better understanding of the unique connector of the invention, the following is a detailed description of its assembly and operation. Referring first to FIG. 2, each of the spring contact elements 20 is assembled into contact with opposite sides of the plug 22 by inserting them into contact with the upper and lower bosses 42, 44 and the retaining bosses 46, 48. By such assembly, a pre-load is put on the curved leg of the upper loop 52, as well as both of the legs of the lower loop 54, and the contact member 20 is brought into electrically shorting relationship by folding both of the ends of contact member 20 into contact with itself at substantially opposing points. The retention of ends of the upper and lower loops 52 and 54 between the retaining bosses 46 and 48 in the restriction 50 provides independent fulcrum or pivot points for both the loops when they are deflected by engagement with the mating electrical element and the conductor terminating device respectively. Thus, one loop may deflect about the pivot point without affecting the other loop. The assembled plug 22 and contact member 20 are assembled into a cavity by inserting them into the bottom of the cavity 12 in engagement with the side thereof. The surface of the plug 22 remains in contact with the side of the cavity as the upper portion of the plug passes through the restriction 50 until a locking step 64 on the plug snaps into engagement with the upper surface 36 of the barrier 24. Further movement of the plug 22 into the cavity 12 is prevented by the engagement of one surface of the plug with the shoulder 32 on the cavity wall. The plug is prevented from falling out of the cavity by the spring force of the upper loop holding the step 64 in contact with the surface 36.

While a specific type of conductor terminating device is shown and will hereinafter be described, this has been done for illustration only since other contact terminating devices may be used without varying from the scope of the present invention. The conductor terminating device 60 of FIG. 3 is generally an elongated pin-like configuration having a cylindrical contact locking portion 66 which is shaped to engage and be locked in position by the locking shoulder of the detent 58 in the lower loop. As the pin 60 is inserted into the bottom of the cavity, it is either guided to the right or left side of the contact member by a guide boss 68 and the corresponding adjacent divider surface 34 or the cavity surface 28.

As the pin 60 is inserted into the terminal block as shown in FIG. 3, the contact locking portion 66 engages a knee 70 of the detent 58 causing the lower leg to deflect inwardly allowing the locking portion 66 under further advance to enter the detent. When a tip 72 of the pin engages the lower surface of the restrictive boss 48, acting as a stop, the depressed spring knee 70 returns to its locking position thereby retaining the locking portion 66.

When a printed circuit board 74 or other mating electrical element is inserted into the longitudinal groove 14 in receptacle block 10, the upper loop 52 is deflected inwardly by the edge of printed circuit board 74. This causes the legs of the upper loop to be deflected towards the wall of the cavity and engage the printed circuit board with a substantially constant spring force normal to the surface of the circuit board because the upper loop 52 has been deflected sufficiently to bring the contact surface 56 into substantially parallel relationship with the surface of the circuit board.

The electrical current path of the improved connector of the present invention is from the electrical conductor 62 and termination device 60 to the lower loop 70 of the contact member where it is divided at the point of contact of the two loops into a path around both of the legs of the upper loop to the contact surface 56 engaging the printed circuit board. If desired, a second electrical conductor and termination device (not shown) may be in-

serted into engagement with the other detent to couple in a second circuit, ground connection or a redundant connector point.

The upper edge of the plug locking stop 64 is chamfered or beveled to produce a smooth assembly of the plug 22 into the block 10 and to facilitate the entry of a removal tool (not shown) into the longitudinal groove for unlatching the stop and removal of the plug and contact springs by a downward force from the tool.

As shown in FIG. 4, when it is desired to make contact to printed circuit board conductor terminations spaced on different center distances, the plug 22 and spring contact elements 20 in a terminal block 10 may be replaced by a larger contact element 80 such as that described in co-pending patent application Ser. No. 338,805 filed Jan. 20, 1964, now Patent 3,273,109, and assigned to the same assignee as the present application. By such modification, those cavities containing the plug and contact elements of the present invention will make contact with the conductor terminations spaced on one center distance while those cavities containing the larger contact element 80 will make contact with conductor terminations spaced on a different or larger center distance. This enables high current drawing equipment to be coupled to the same receptacle as electrical components having lesser current requirements.

While one embodiment of this invention has been herein illustrated, it should be appreciated by those skilled in the art that variations of the disclosed arrangement both as to its details and the operation of such details may be made without departing from the skill and scope thereof. Accordingly, it is intended that the foregoing disclosure and the showings made in the drawings may be considered as illustrative of this invention and not construed in a limited sense.

What is claimed is:

1. An electrical connector comprising: an electrical conductor; a receptacle block having a plurality of cavities each adapted to receive a mating electrical contact element; an electrical insulating plug member supporting at least one flexible electrical contact element in at least one of said cavities, each said flexible electrical contact element including a pair of deflectable loop portions pivotally retained by said plug member, one of said loop portions being adapted to be deflected into engagement with said mating electrical contact element and the other of said loop portions being adapted to be independently deflected into engagement with said electrical conductor, said loop portions being formed in the opposite ends of an elongated metal strip with the ends thereof looped into engagement with said strip in an opposing relationship at a point substantially adjacent the end of each loop portion; and said plug member including a restriction adapted to retain the looped ends of said strip to provide an independent pivot for each of said loop portions.

2. The electrical connector of claim 1 wherein the receptacle block includes a longitudinal groove for receiving a printed circuit board as the mating electrical contact element.

3. The electrical connector of claim 1 wherein said electrical conductor includes a termination device and said other loop portion includes a pair of detents in opposite legs thereof for engaging and retaining more than one termination device.

4. The electrical connector of claim 1 wherein one loop portion is a left hand loop and the other loop portion is a right hand loop and both of said loops are folded into electrically shorted relationship by engaging opposite sides of said elongated strip.

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