United States Patent [19]

Crane et al.

[11] **3,727,169**

[45] **Apr. 10, 1973**

[54] **CONNECTOR FOR PRINTED CIRCUIT BOARDS**

[75] Inventors: **Merlin L. Crane; Michael J. Howett,** both of Banning, Calif.

[73] Assignee: **The Deutsch Company Electronic Components Division,** Banning, Calif.

[22] Filed: **Nov. 12, 1970**

[21] Appl. No.: **88,600**

[52] **U.S. Cl.** .....**339/17 L,** 339/66 M, 339/94 M, 339/184 M, 339/217 R

[51] **Int. Cl.**.....**H01r 7/02,** H01r 13/70, H05k 1/04

[58] **Field of Search**.....339/17 R, 17 L, 17 LC, 339/17 M, 17 C, 18 R, 18 C, 65, 66, 59, 60, 61, 176 MP, 176 MF, 94 R, 94 M, 184 R, 184 M, 218, 45

[56] **References Cited**

UNITED STATES PATENTS

3,493,916	2/1970	Hansen	339/17 LC
3,568,131	3/1971	Kennedy	339/45 M
2,944,240	7/1960	Barber	339/66 M X
3,336,569	8/1967	Nava	339/94 M X
3,477,061	11/1969	Stephenson	334/94 M X
3,129,044	4/1964	Lyman, Jr. et al.	339/66 M X
3,491,330	1/1970	Barnhart et al.	339/184 M
3,007,131	10/1961	Dahlgren et al.	339/17 F X
2,967,284	1/1961	Bailey et al.	339/17 LC
3,264,599	8/1966	Kinkaid	339/17 LC
2,993,189	7/1961	Schelke	339/184 RX

OTHER PUBLICATIONS

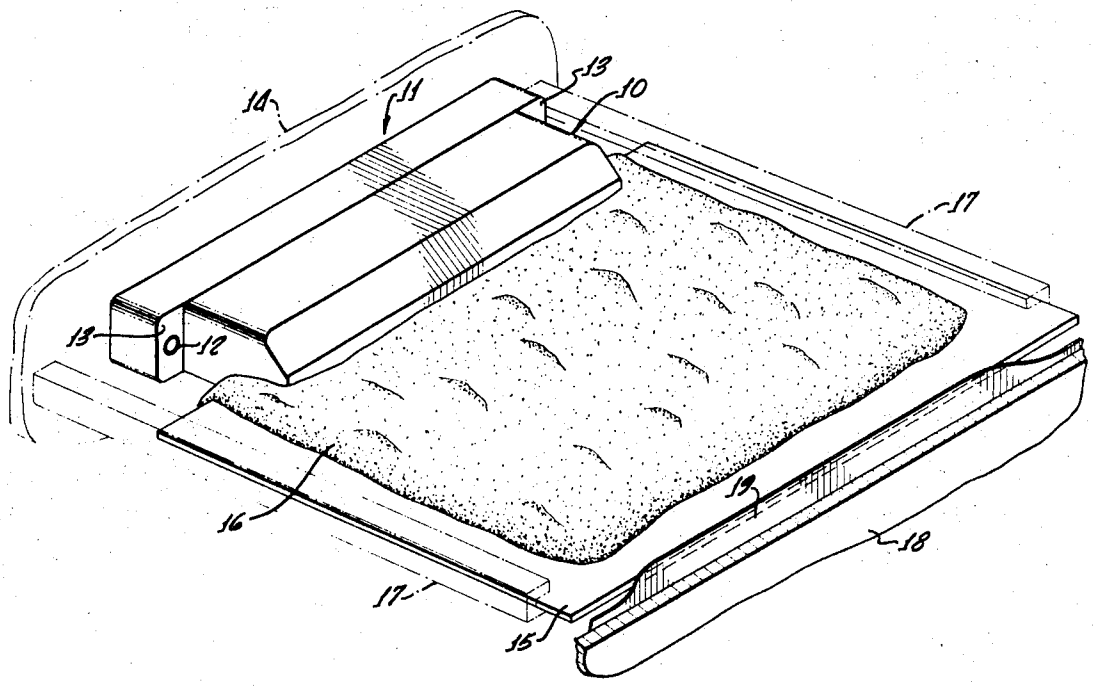
H. H. Buggie, Inc. Catalog, April 1958, Printed Circuit Connectors, Page 13, "Right Angle Contact Strip."

Primary Examiner—Marvin A. Champion
Assistant Examiner—Terrell P. Lewis
Attorney—Gausewitz, Carr & Rothenberg

[57] **ABSTRACT**

An electrical connector for a printed circuit board in which a plug has right-angled pins with first end portions extending to one end of the printed circuit board, with a space being provided between the body of the plug and the circuit board to allow inspection, after which the surfaces are covered with potting material. Posts on the plug enter openings in the circuit board to align the board and transmit loads. The opposite ends of the pins extend through a sealing gasket which is compressed by the forward end of the receptacle and has protrusions around the pins that enter corresponding recesses in the receptacle body in forming a seal. A peripheral O-ring seal also is provided between the plug are contained in the receptacle, held by rear-release retainer clips. Several openings in the forward face of the plug selectively can receive keying pins to enter corresponding openings in the receptacle, with stop pins being positionable in the receptacle openings to preclude mismating of the plug and receptacle. The keying pins and stop pins are held by releasable retainer clips similar to those used in retaining the socket contacts.

10 Claims, 13 Drawing Figures



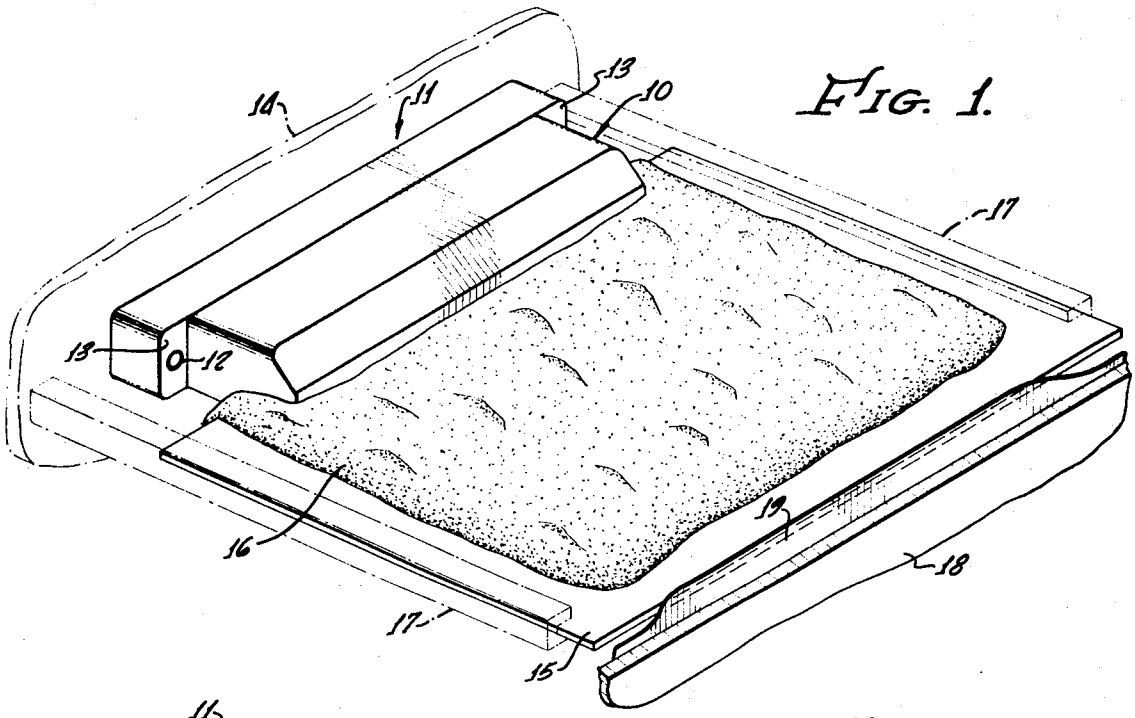


FIG. 1.

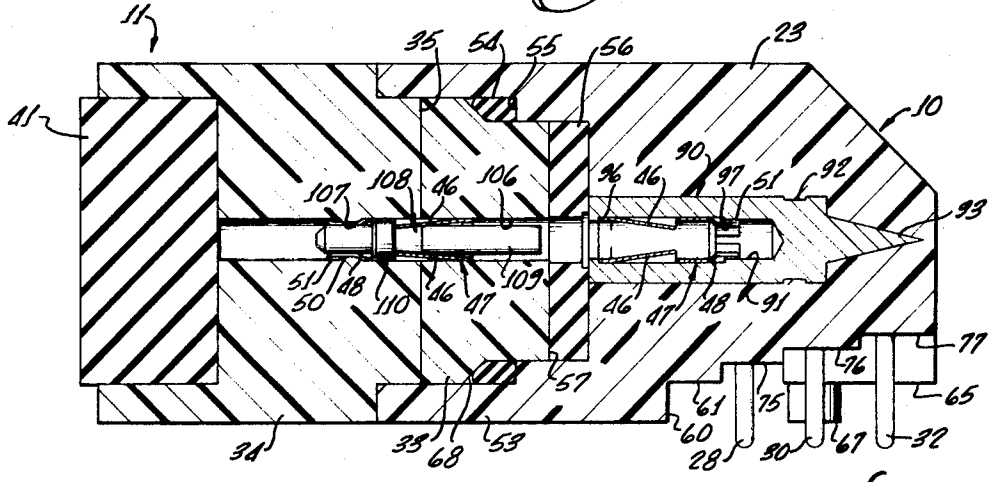


FIG. 8.

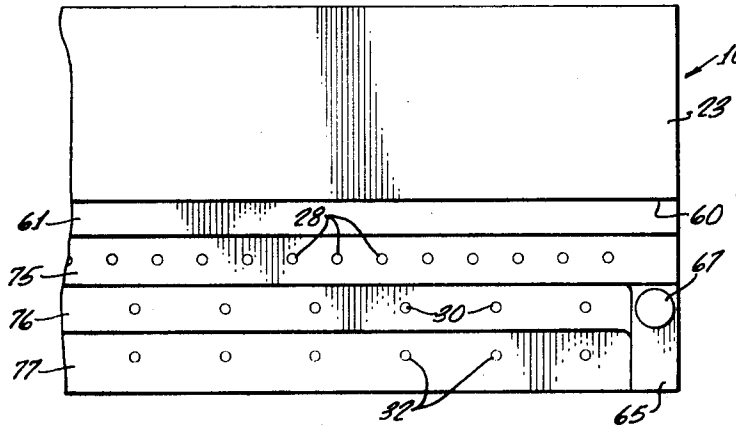


FIG. 13.

INVENTORS.
MERLIN L. CRANE
MICHAEL J. HOWETT
BY Dawson, Carr & Ostlenberg
ATTORNEYS.

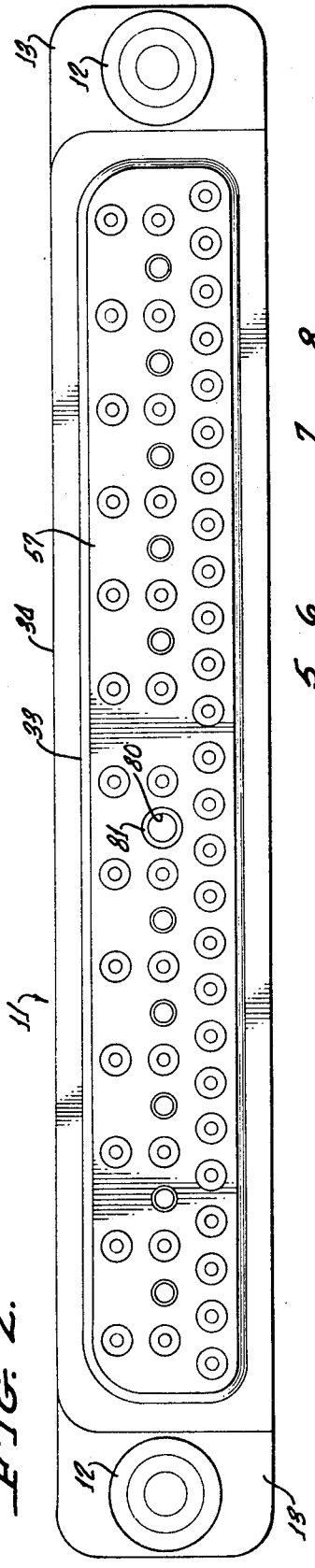


FIG. 2.

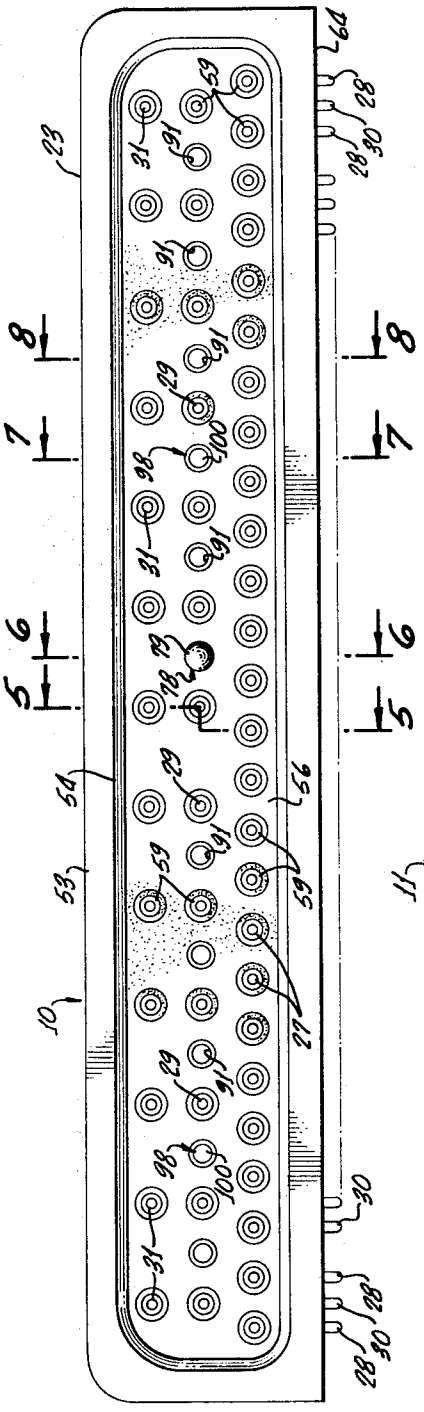


FIG. 3.

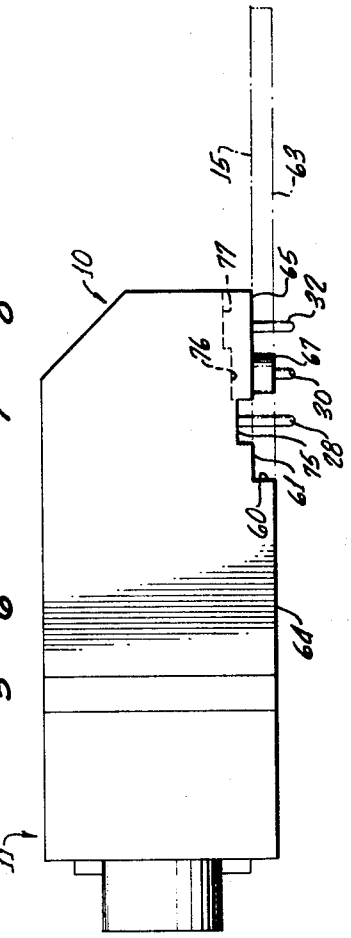


FIG. 4.

INVENTORS.
MERLIN L. CRANE
MICHAEL J. HOWETT
BY
Lawrence, Carr & Rothenberg
ATTORNEYS.

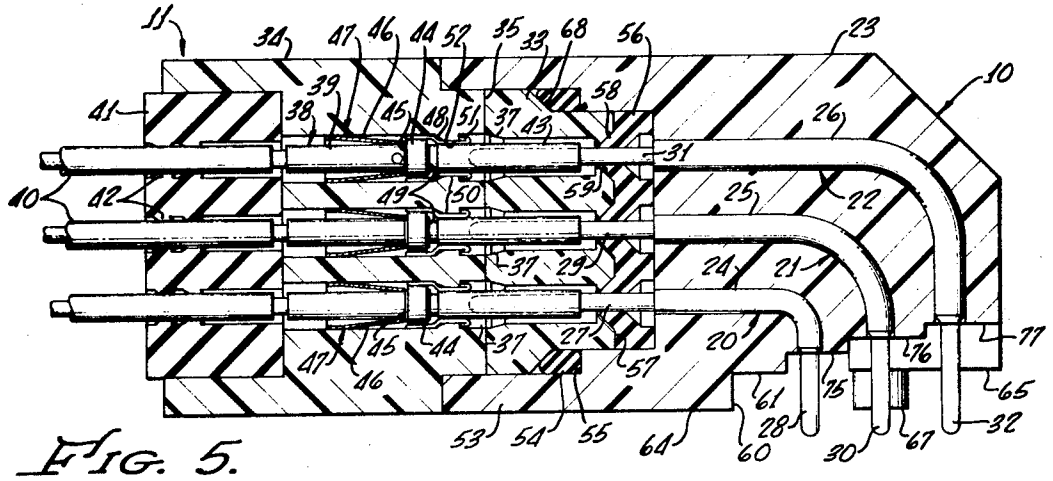


FIG. 5.

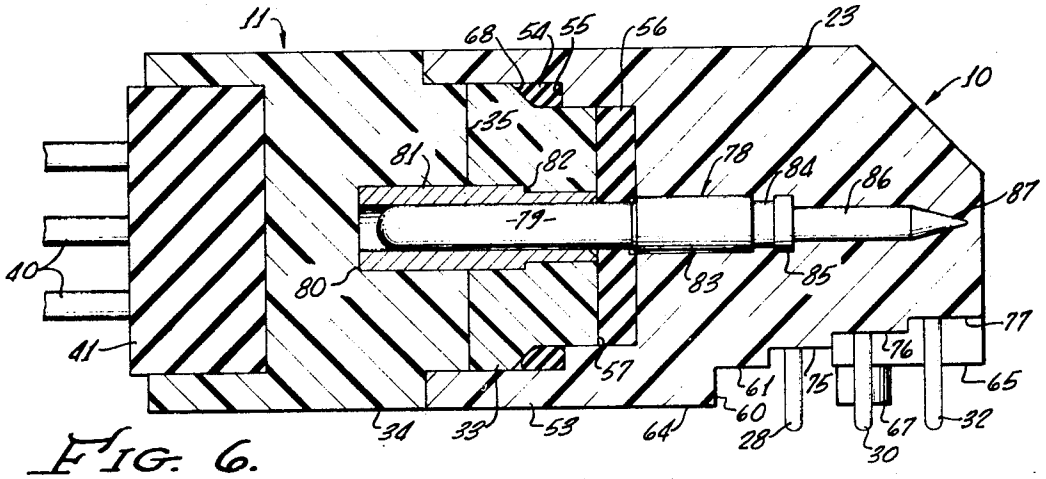


FIG. 6.

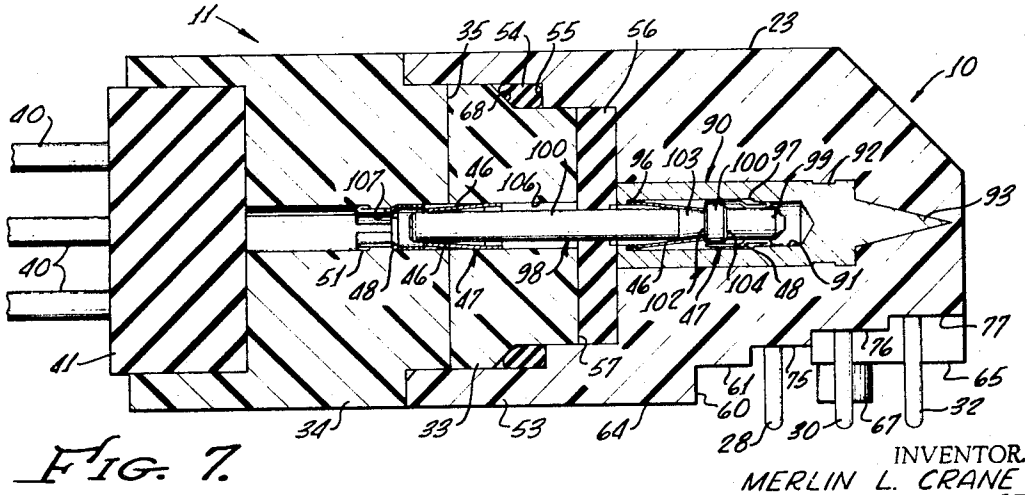


FIG. 7.

INVENTORS.
MERLIN L. CRANE
MICHAEL J. HOWETT
BY Jansen, Carr & Rothenberg
ATTORNEYS.

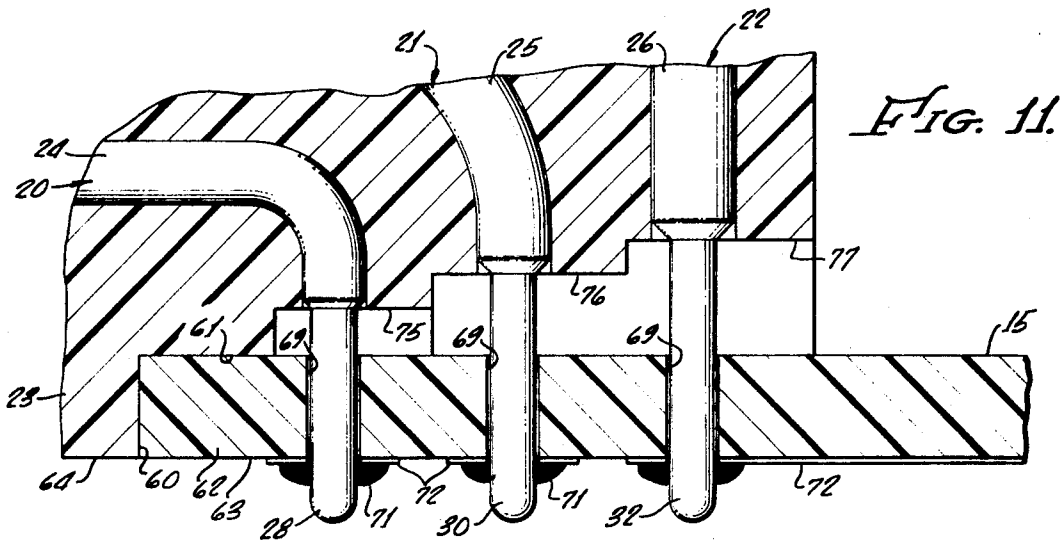


FIG. 11.

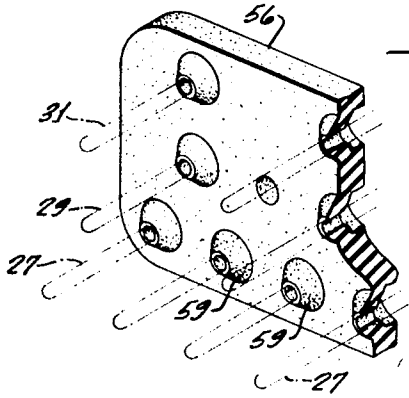
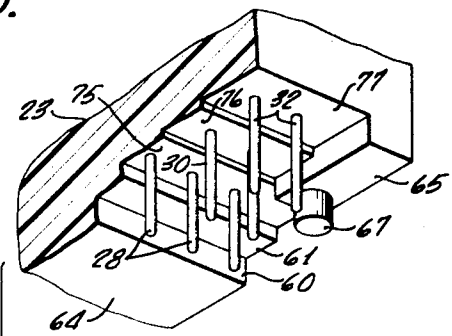


FIG. 10.



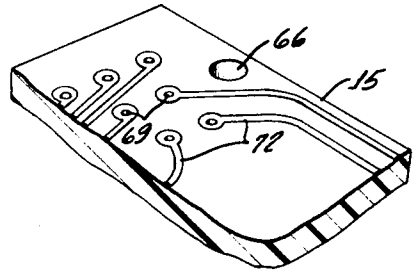


FIG. 12.

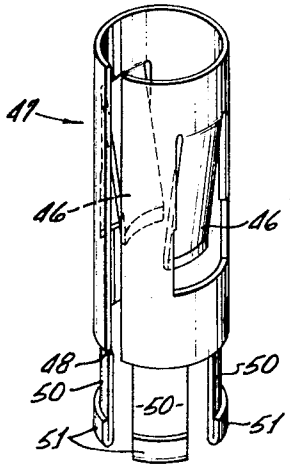


FIG. 9.

INVENTORS.
MERLIN L. CRANE
MICHAEL J. HOWETT
BY Gauvreau, Corr & Rothenberg
ATTORNEYS.

CONNECTOR FOR PRINTED CIRCUIT BOARDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to electrical connectors.

2. Description of Prior Art

In aircraft and associated ground support equipment, electrical connectors are needed for joining together printed circuit boards and wires. In these electrical systems, a plug of a connector is associated with the circuit board, while a receptacle is stationary and engageable by the plug when the connector is mated. The circuit boards are mounted in tracks that allow linear movement to a position in which the plug and receptacle are mated for completing the circuits. The circuits are interrupted by pulling the circuit boards away from the receptacles. A number of circuit boards may be included, each of which is to be engageable with a particular receptacle, while the plugs and receptacles should never be mismated.

In connectors for this purpose, proper environmental seals are needed in order to protect against moisture and contamination. Another problem involves the connection of the plug to the circuit board where excess solder or foreign matter can be present but undetected. With the end of the plug engaging one surface of the circuit board, it has been possible to inspect visually only on the opposite side of the printed circuit board after the soldering operation is complete. In some instances, there may be unseen portions of solder, chips or other foreign material that bridge across the pins or circuit elements to form short circuits. In these systems, there is a need also for a versatile keying arrangement to make certain that only the preselected plugs and receptacles are mated. In other words, it should not be possible to move a plug and receptacle to the mated position unless it is intended that their circuits be interconnected. They keying arrangement should accommodate a large number of plugs and receptacles, while in all instances precluding improper mating.

SUMMARY OF THE INVENTION

The present invention provides an improved electrical connector arrangement particularly adapted for solving the problems noted above as well as providing other advantages. It is a lightweight but durable connector, environmentally sealed and resistant to shock and vibration. It allows complete inspection of the connections between the plug pins and the printed circuit board. Both the socket contacts and keying pins are held by rear-release retainer clips, facilitating the use and maintenance of the connector.

In this connector, there are pins permanently molded in the dielectric body of the plug, projecting outwardly from two surfaces of the plug. The pins are curved within the body of the plug so that the projecting end portions of the pins are at 90° to each other. One set of pin ends mates with socket contacts in the receptacle, while the other is connected to one end of a printed circuit board. Integral posts extend from the plug body and enter corresponding openings in the circuit board, which helps position the circuit board properly, and also transmits loads between the plug and the circuit board as the connector is used. Spacers are provided at the plug surface adjacent the printed circuit board, so that only the tip portions of the pins are engaged at the

circuit board, and there is a gap between the circuit board and the surfaces from which the pins extend. This means that, after the pins are soldered to the circuit board, both sides of the board may be readily inspected to ascertain whether any extra solder or foreign matter has entered the area between the circuit board and the plug body. After the inspection, the circuit board and plug end are potted, covering over all exposed circuit components as well as the exposed portions of the pins. This provides an environmental seal.

The pin ends to mate with the receptacle contacts extend outwardly through a resilient rubber insert and within a recessed forward portion of the plug body. The receptacle body fits within the recessed portion of the plug body when the connector is in the mated position. Conventional socket contacts in the receptacle body then receive the ends of the pins to complete the electrical circuits. These socket contacts are held in the receptacle body by rear-release retainer clips. The resilient rubber insert is compressed by the end of the receptacle body when the connector is mated, providing an effective interfacial seal. Conical protrusions on the resilient insert around the pin ends wedge into recesses in the forward face of the receptacle to further seal at each pin. In addition, there is an annular sealing member within the recessed portion of the plug body, which also is engaged by the receptacle to form a seal around the periphery of the joint. Thus, there is an environmental seal at the interface of the connector as well as at the circuit board area. Seals also are provided around the wires that enter the receptacle for connection to the socket contacts.

The plug and receptacle bodies include several aligned openings which are used in a keying arrangement to allow only a preselected plug and receptacle to be mated. In each of these openings is a retainer clip of the type used in holding the socket contacts. Normally, only one or two of these openings in the plug will receive a keying pin which is held by the retainer clip and projects outwardly from the forward end of the plug. The projecting end of the keying pin may enter the corresponding aligned opening in the receptacle. In all other keying openings in the receptacle, stop pins are inserted. These are similar to the keying pins but are shorter and do not extend beyond the outer ends of the openings in the receptacle. These stop pins prevent any plug from mating with a receptacle other than the one having the keying pins projecting outwardly at the openings left vacant. By including several openings in the plug and receptacle, a very large number of keying combinations are possible, so that there may be many circuit boards on hand, but only one can mate with a selected receptacle. Both the keying pins and the stop pins are removable from the retainer clips by a conventional contact removal tool.

There also is a guide pin for assisting in the alignment and mating of the plug and receptacle. This may be a relatively large pin at the central portion of the plug, one end of which is permanently molded into the plug body, while the other end projects outwardly from the plug. This pin can enter the bore of a metal sleeve received in the receptacle body. The guide pin and its opening are offset from the center of the connector and so prevent 180° mismating of the plug and receptacle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the connector of this invention with its associated circuit board, with the plug and receptacle in the mated position;

FIG. 2 is an elevational view of the forward end of the receptacle;

FIG. 3 is an elevational view of the forward end of the plug;

FIG. 4 is a side elevational view of the plug and receptacle in the mated position;

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 3, but with the plug shown mated with the receptacle, illustrating the arrangement of the pins and sockets in the connector;

FIG. 6 is a transverse sectional view similar to FIG. 5, taken along line 6—6 of FIG. 3, showing the guide pin arrangement;

FIG. 7 is a transverse sectional view similar to FIG. 5, taken along line 7—7 of FIG. 3, illustrating the keying provision;

FIG. 8 is a transverse sectional view similar to FIG. 5, taken along line 8—8 of FIG. 3, showing the arrangement of the stop pins in the receptacle to prevent mismating;

FIG. 9 is a perspective view of a retainer clip which is used in holding the socket contacts, the keying pins and the stop pins;

FIG. 10 is a fragmentary perspective view of the sealing gasket at the forward face of the plug;

FIG. 11 is an enlarged fragmentary sectional view showing the connection of the pins to the printed circuit board;

FIG. 12 is an exploded fragmentary perspective view of the plug and printed circuit board; and

FIG. 13 is a fragmentary bottom plan view of the plug.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The connector of this invention, as illustrated in FIG. 1, includes an elongated generally rectangular plug **10** adapted to mate with a similarly shaped receptacle **11**. Screws extend into tapped inserts **12** in laterally projected flanges **13** of the receptacle to hold it to a fixed structure **14**, which may be located aboard an aircraft. Wires extend to the receptacle **11** where they are connected to contacts within the receptacle, as will be explained below. The plug **10** is connected to a circuit board **15**, and both surfaces of the circuit board and the area around the plug are sealed with a potting material **16**. The edges of the circuit board **15** fit within tracks **17** that allow rectilinear movement of the assembled plug **10** and circuit board **15**. Therefore, by sliding the circuit board **15** in the tracks **17** toward the receptacle **11**, the plug and receptacle may be mated for completing the electrical circuits between the circuit board **15** and the wires entering the receptacle. A closure member **18** carries a leaf spring **19** which engages the rearward end of the circuit board **15** to hold the connector in the mated position. The connector is separated by removing the member **18** and its spring **19**, and then sliding the circuit board **15** and the plug **10** away from the receptacle **11**.

The plug **10** provides a right angle connection to the terminals on the circuit board **15**. This is accomplished by means of three sizes of pin contacts **20**, **21** and **22** that are molded within the housing **23** of the plug, as best seen in FIG. 5. The latter member is of a suitable dielectric material, such as rigid plastic. The contacts **20**, **21** and **22** include enlarged intermediate portions **24**, **25** and **26**, respectively. The smaller contact **20** includes projecting ends **27** and **28** of reduced diameter which are used in making the connections to the receptacle **11** and circuit board **15**, respectively. Similar ends **29** and **30** are included on the intermediate size contact **21**, while the larger contact **22** includes such end portions **31** and **32**. With the housing **23** of the plug being an elongated generally rectangular member, this arrangement of the contacts places their ends in three parallel rows. The ends of the contacts are proportioned so that they all extend outwardly to a common plane at the tips of the contacts.

The housing for the receptacle **11** also is of rigid dielectric material, including a forward portion **33** bonded to a rearward portion **34** along a flat transverse bond line **35**. Within the receptacle housing are parallel rows of openings **37** that receive socket contacts **38** of conventional construction. The rearward barrel ends **39** of the socket contacts **38** receive the ends of wires **40** from which the insulation has been stripped, and are crimped to the wires to form connections therewith. The wires **40** enter the receptacle through a resilient rubber sealing grommet **41** at the rearward end of the receptacle. Annular beads **42** in the openings through the member **41** engage the wire surfaces to form a seal with each wire. In the mated position of the connector, the pin ends **27**, **29** and **31** enter the forward socket ends **43** of the contacts **38**. This forms electrical circuits between the wires **40** and the pin contacts.

The socket contacts **38** include enlarged central portions **44** which provide rearward shoulders **45** that are engageable by resilient spring fingers **46** of retainer clips **47**. The latter members are of the type described in U.S. Pat. No. 3,475,720, also shown in FIG. 9, being longitudinally split cylindrical sleeves which include inwardly deflected portions **48** forwardly of the spring fingers **46**. The inwardly deflected portions **48** provide annular shoulders on the retainer clips, which are adjacent the forward shoulders **49** of the contact enlargements **44**. The spring fingers **46** and the retainer clip shoulders **48** hold the contacts **38** against axial movement. The contacts **38** are removable from the rear by deflecting the spring fingers **46** outwardly past the contact shoulders **45** by the use of a suitable conventional tool, such as that shown in U.S. Pat. No. 3,110,093.

The forward portions of the retainer clips **47** have additional longitudinal cuts to define four resilient segments **50** the ends of which are bent outwardly to provide doubled-over portions **51**. Between the shoulders **48** and the doubled-over end portions **51**, the retainer clips extend through short sections **52** of the openings **37** that are of reduced diameter. These parts of the openings **37** provide annular shoulders that cooperate with the retainer clip shoulders **48** and end parts **51** to hold the retainer clips in the openings.

The plug housing **23** includes a forward open portion **53** that forms a rectangular recess dimensioned to receive the forward part of the receptacle **11** when the

connector is in the mated position. There is a sealing member **54** in the forward portion of the plug housing **23** adjacent a shoulder **55** which helps seal the interior of the mated connector. This may be an O-ring given the rectangular shape of the forward portion **53** of the plug housing **23** and bonded in position to be engaged by a shoulder **68** on the receptacle. An additional sealing effect is realized from a resilient rubber gasket **56** that extends around the pin ends **27, 29** and **31** and engages the forward end **57** of the receptacle when the connector is mated. The gasket **56** is compressed at that time so as to produce an effective interfacial seal. Forward frustoconical protuberances **58** on the gasket **56** around each pin (see FIG. **10**) enter frustoconical recesses **59** in the receptacle face **57**, the recesses **59** having a greater included angle than the protuberances **58** so that the latter elements are compressed inwardly around the pins to further seal.

In making the connections to the other ends of the pins **20, 21** and **22**, the circuit board **15** is positioned beneath the rearward portion of the plug **10**. The undersurface of the rearward portion of the plug is contoured to define an inwardly directed shoulder **60** and an adjacent longitudinally extending surface **61** that is at right angles to the axes of the pin ends **28, 30** and **32**. These are engaged by the edge portions **62** of the circuit board **15**, which locates the bottom surface **63** of the circuit board flush with the undersurface **64** of the plug housing **23** in the example shown in FIG. **11**. There are also short sidewalls **65** at the opposite ends of the housing **23** which are transverse to the surface **61** and have outer surfaces in the same plane as the surface **61** and also engaged by the edges of the circuit board. The printed circuit board has openings **66**, as seen in FIG. **12**, which complementarily receive downwardly extending cylindrical posts **67** at the lower edges of the sidewalls **65** of the plug housing **23**, to further assist in aligning and anchoring the circuit board. The posts **67** also transmit forces between the circuit board **15** and the plug **10** as the connector is mated and unmated, relieving the contacts of these loads. When the circuit board is positioned as shown in FIG. **11**, the ends **28, 30** and **32** of the pins **20, 21** and **22**, respectively, fit through openings **69** in the circuit board. The tips of the pins project past the circuit board surface **63** and by solder **71** are connected to the circuit elements **72**. The circuit board **15** is bonded to the surfaces **60, 61** and **65** of the plug housing **23** before the connections are made to the pin contacts.

The lower surface of the plug housing **23** is stepped inwardly progressively at locations **75, 76** and **77** adjacent the pin ends **28, 30** and **32**, respectively. Thus, the surface **61** and the walls **65** of the plug housing **23** space the circuit board **15** outwardly, and there is a gap between the circuit board and the locations where the pins project from the housing. This affords complete visibility of the areas where the pins enter the circuit board **15**. From this, it can be ascertained whether or not any solder, metal chips or other foreign matter has found its way into the area between the pins and the circuit board. If so, the extraneous material can be suitably removed to assure that the pins are completely clear and that nothing will cause a short circuit.

After the soldering has been completed, the potting material **16** is applied to both surfaces of the printed circuit board **15** and around the area where the plug is connected to it. This produces a complete environmental seal preventing any moisture from entering the zone where the pins and the circuit board are joined. Additional environmental seals are provided at the interface of the plug and receptacle, as discussed above, in view of the compression of the resilient gasket **56**, the gasket protrusions **58** wedged in the recesses **59**, and the O-ring **54**. Also, a seal is accomplished around each of the wires **40** at the resilient rubber insert **42** at the rearward end of the receptacle **11**. Consequently, in all areas of the connector the electrical components are isolated and are fully protected from moisture.

In order to facilitate the mating of the connector and to simplify the moving of the plug and receptacle into the properly aligned position, there is a guide pin **78** on the plug **10**, which has an outer end **79** that projects forwardly and is adapted to enter a socket opening **80** in the receptacle (see FIGS. **2, 3** and **6**). The socket opening **80** is a cylindrical aperture in a metal sleeve **81**, locked in position by an external annular shoulder **82** when the two sections **33** and **34** of the receptacle housing are bonded together. The inner end portion of the guide pin **78** includes an enlarged cylindrical part **83**, adjacent which is a smaller diameter portion **84**, beyond which is an annular enlargement **85**. From this, there is a smaller cylindrical extension **86** that terminates in a generally conical end part **87**. The guide pin **78** is effectively retained by the plug housing **23** in the molding process as the material of the housing fills the spaces between the enlarged portions of the guide pin and locks against the pin shoulders. The guide pin **78** and sleeve **81** are offset from the center of the plug and receptacle, which prevents mating the connector with the plug and receptacle relatively rotated 180° out of position.

A keying position is included in the connector to assure that, while a particular plug and receptacle can be mated, it is impossible to assemble plugs and receptacles that are not intended for interconnection. A wide variety of keying combinations is possible with this invention, so that the basic plug and receptacle configuration will permit the arrangement of many sets of uniquely mating plugs and receptacles. In accomplishing this result, the plug is provided with a plurality of inserts **90** having bores **91** which extend to the forward end of the plug. In the example shown, there are ten of the inserts **90** arranged in a row along the central portion of the plug. Each insert **90** includes an annular section **92** of reduced outside diameter, thereby providing a pair of shoulders to assist in locking the insert in place when the plug housing **23** is molded, as may be seen in FIG. **7**. The rearward ends **93** of the inserts **90** are conical.

Each bore **91** is provided with an inwardly directed shoulder **96** adjacent its forward end and another shoulder **97** at the inner portion of the bore. A retainer clip **47** is positioned in each bore **91**, with one end of the retainer clip being adjacent the shoulder **96**, and the inwardly bent shoulder portion **48** of the clip next to the shoulder **97**, which thereby holds the retainer clip within the bore.

A pin **98** is adapted to fit within the bore **91** of the insert **90** and project outwardly from the forward end of the plug. The pin **98** includes a short cylindrical portion

99 in the inner part of the retainer clip 47, connecting to an annular enlargement 100. The elongated portion 101 of the pin extends beyond the annular enlargement 100 in the opposite direction. Adjacent the shoulder 102 defined by the annular enlargement 100 is a frustoconical portion 103 of the pin 98 which, by tapering inwardly, increases the radial dimension of the shoulder. The retention fingers 46 are positioned adjacent the shoulder 102, while the inwardly bent shoulder 48 of the retainer clip 47 is engageable with the other shoulder 104 of the annular enlargement 100. The pin 98 is installed readily by merely pushing it in to a position where the spring fingers 46 snap inwardly adjacent the shoulder 102 defined by the annular enlargement 100. The pin 98 is removable from the insert 90 by a conventional contact removal tool of the type referred to above, which will deflect the spring fingers 46 outwardly pass the surface of the shoulder 102 so that the pin 98 may be pulled from the opening 91.

At locations opposite the bores 91, the receptacle is provided with corresponding cylindrical openings 106. In the inner portions of the openings 106 are additional retainer clips 47. Each bore 106 is provided with a short section 107 of reduced diameter which receives the forward portion of the retainer clip 47 adjacent the inwardly bent shoulder 48 and the doubled-over end portions 51 of the retainer clip. These parts of the retainer clip 47 cooperate with the shoulders at the ends of the reduced diameter portion 107 to hold the retainer clip 47 in the opening 106.

With the openings 106 being aligned with the bores 91, a pin 98 projecting from the plug 10 is in a position to enter the corresponding opening 106 in the receptacle. Although the end portion 101 of the pin when in an opening 106 will be engaged by the inwardly inclined spring fingers 46 of the retainer clip 47, there is no shoulder on this outer portion of the pin so that it will not be held by that retainer clip. Therefore, the pin end 101 may enter the opening 106 when the connector is mated and freely leave it when the plug and receptacle are separated.

As the keying arrangement is utilized, normally there are one or two keying pins 98 installed in selected bores 91 in the plug 10. The corresponding openings 106 in the receptacle are left vacant. However, in all of the other openings 106 in the receptacle, there are installed stop pins 108, as shown in FIG. 8. The latter members are similar to the keying pins 98, but are shorter so that their outer ends 109 are close to, but slightly inwardly of, the forward end of the receptacle housing member 33. The stop pins 108 include annular enlargements 110 the forward ends of which are engageable by the resilient spring fingers 46 and the rearward ends of which are adjacent the inwardly bent shoulder portions 48 of the retainer clips. This holds the stop pins 108 in position. They are readily installed in this manner by merely being pushed inwardly from the forward end of the receptacle housing. As this is done, the annular enlargement 110 deflects the spring fingers 46 outwardly until they are free to snap inwardly in front of it, at which point the stop pin 108 is held in place in the bore 106. However, the stop pin 108 can be removed by the previously mentioned standard contact removal tool.

The stop pins 108 will block the keying pins 98 of any mismated plug, so that such a plug cannot be moved to a position where the contacts are in engagement. This means that the stop pins will prevent the mating of the receptacle with any plug which does not have keying pins positioned to allow interconnection, which prevents mismating of the connector sections. Through the use of ten openings and two keying pins, a wide variety of combinations may be obtained to permit many plugs and receptacles to be included in a group, while still preventing mismating of any two. More than two keying pins may be used if an even greater number of possible keying combinations is needed.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

What is claimed is:

1. An electrical connector comprising

a first connector section including a first body of dielectric material,

a plurality of first contacts carried by said first body,

a second connector section including a second body of dielectric material,

a plurality of second contacts carried by said second body,

said first and second connector sections being movable to a mated position in which said first and second contacts are in interengagement for completing electrical circuits therebetween, and being separable for disengaging said first and second contacts and interrupting said circuits,

and keying means for preventing mismating with a different connector section,

said keying means including a plurality of first opening means in said first body, and a plurality of second opening means in said second body,

said first and second opening means being in alignment when said connector sections are in said mated position,

first gripping means in said first opening means, second gripping means in said second opening means,

at least one pin means engaging one of said first gripping means in one of said first opening means and projecting outwardly from said first body for entry into the second opening means in said second body aligned with said one of said first opening means,

and stop means in all of said second opening means except said second opening means aligned with said one of said first opening means,

each of said stop means being engageable by an additional pin means aligned therewith and projecting outwardly from said first body for preventing entry of said additional pin means into the second opening means occupied by said stop means,

whereby said stop means prevent a different connector section from moving to a mated position with said second connector section.

2. A device as recited in claim 1 in which said first and second gripping means are releasable for permitting variations in said keying means.

3. A device as recited in claim 1 in which the number of said stop means exceeds the number of said pin means.

4. A device as recited in claim 1 in which said stop means comprises an additional pin in each of said second opening means aligned with said one of said first opening means, said additional pins forming abutment means for preventing substantial entry of said pin means into said second opening means irrespective of the relative rotational positions of said pin means and said additional pins.

5. An electrical connector comprising
a first connector section including a first body of dielectric material,
a plurality of first contacts carried by said first body,
a second connector section including a second body of dielectric material,
a plurality of second contacts carried by said second body,
said first and second connector sections being movable to a mated position in which said first and second contacts are in interengagement for completing electrical circuits therebetween, and being separable for disengaging said first and second contacts and interrupting said circuits,
and keying means for preventing mismating with a different connector section,
said keying means including a plurality of first opening means in said first body, and a plurality of second opening means in said second body,
said first and second opening means being in alignment when said connector sections are in said mated position,
first gripping means in said first opening means, second gripping means in said second opening means,
at least one pin means engaging one of said first gripping means in one of said first opening means and projecting outwardly from said first body for entry into the second opening means in said second body aligned with said one of said first opening means,
said first gripping means including
a shoulder in each of said first opening means,
and spring finger means spaced outwardly from said shoulder,
said pin means including a duality of shoulders positionable between said spring finger means and said shoulder in said first opening means for thereby retaining said pin means therein,
said spring finger means being deflectable for releasing said pin means.

6. An electrical connector comprising
a first connector section including a first body of dielectric material,
a plurality of first contacts carried by said first body,
a second connector section including a second body of dielectric material,
a plurality of second contacts carried by said second body,
said first and second connector sections being movable to a mated position in which said first and second contacts are in interengagement for completing electrical circuits therebetween, and being separable for disengaging said first and second contacts and interrupting said circuits,
and keying means for preventing mismating with a different connector section,
said keying means including a plurality of first opening means in said first body,
and a plurality of second opening means in said second body,
said first and second opening means being in alignment when said connector sections are in said mated position,
first gripping means in said first opening means, second gripping means in said second opening means,
at least one pin means engaging one of said first gripping means in one of said first opening means and projecting outwardly from said first body for entry into the second opening means in said second body aligned with said one of said first opening means,
and stop means in all of said second opening means except said second opening means aligned with said one of said first opening means,
whereby said stop means prevent a different connector section from moving to a mated position with said second connector section,
said second gripping means including
a shoulder in each of said second opening means,
and spring finger means spaced outwardly from said shoulder
said stop means including a duality of shoulders positionable between said spring finger means and said shoulder in said second opening means for thereby retaining said stop means therein,
said spring finger means being deflectable for releasing said stop means.

7. An electrical connector comprising
a first body of dielectric material,
a plurality of first contact means in said first body of dielectric material,
said first contact means being adapted for connection to wires,
a second body of dielectric material,
a plurality of second contact means carried by said second body of dielectric material,
said first and second bodies being relatively movable between a position of relative adjacency and a position of relative remoteness,
said second contact means being engageable with said first contact means for forming electrical circuits therewith when said first and second bodies are in said position of relative adjacency, and being separated from said first contact means when said first and second bodies are in said position of relative remoteness,
said second contact means including a plurality of pins projecting outwardly from a first surface of said second body,
and a printed circuit board having a principal surface having a plurality of openings therein receiving

said pins, and an edge surface connected to said principal surface,

including a second surface adjacent said first surface and substantially parallel thereto, and a third surface connected to said second surface substantially at right angles relative thereto,

said edge surface of said printed circuit board engaging said third surface,

said principal surface of said printed circuit board engaging said second surface adjacent said third surface, and being spaced from said first surface inwardly herefrom.

8. A device as recited in claim 7 in which

said pins project from said first surface in rows substantially parallel to said third surface,

said first surface being stepped to provide a discrete portion substantially parallel to said third surface for each of said rows,

said discrete portions being progressively closer to said principal surface as they approach said third surface.

9. A device as recited in claim 8 including in addition a wall adjacent either end of said second surface,

said walls being transverse relative to said second surface and having outer edges engaging said principal surface of said printed circuit board.

10. A device as recited in claim 9 including in addition

an integral post projecting outwardly from the outer edge of each of said walls,

said printed circuit board having an opening substantially complementarily receiving each of said posts.

* * * * *