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Carter

[11] **3,871,736**

[45] **Mar. 18, 1975**

[54] **CONNECTORS PROVIDING INTERCONNECTION BETWEEN CLOSELY SPACED CONDUCTORS AND WIDELY SPACED TERMINALS**

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[73] Assignee: **AMP Incorporated,** Harrisburg, Pa.

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[21] Appl. No.: **399,240**

[52] **U.S. Cl.**..... **339/221 R,** 339/17 CF, 339/217 R, 339/256 R

[51] **Int. Cl.**..... **H01r 9/08,** H01r 13/54

[58] **Field of Search**..... 339/17, 19, 47–49, 339/154, 156, 174, 176, 217, 221, 252, 256, 258

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Primary Examiner—James T. McCall
Assistant Examiner—Terrell P. Lewis

[57] **ABSTRACT**

Connectors are disclosed for making contact between an electronic circuit module and a plurality of terminal pins mounted in a frame and adapted to receive further electrical connections. Each of the connectors is mounted in a respective slot in a housing and includes a first portion projecting from one side of the housing to engage a conductor of the electronic circuit module, a second portion projecting from another side of the housing to allow test access to the connector, and a third portion forming or being in contact with the terminal.

3 Claims, 16 Drawing Figures

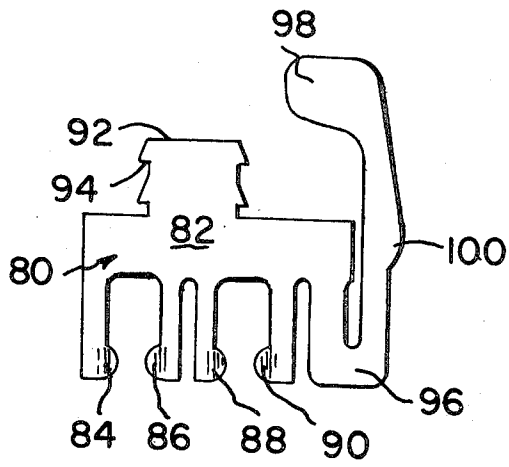


FIG. 1

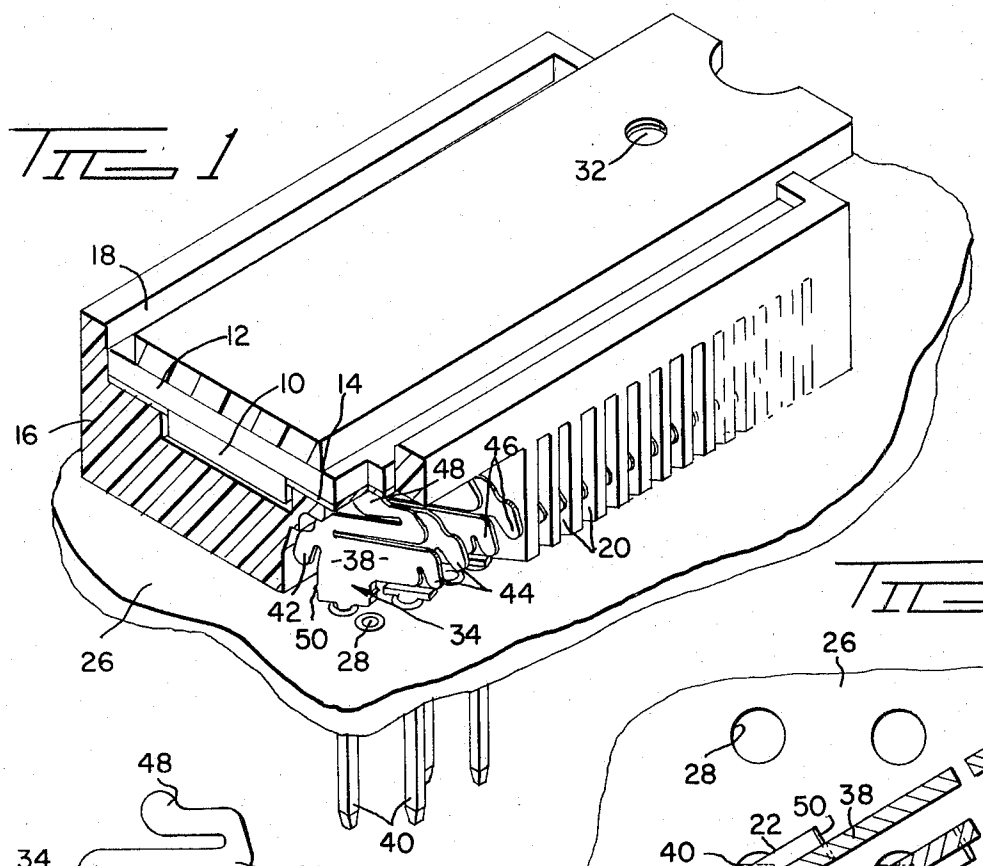
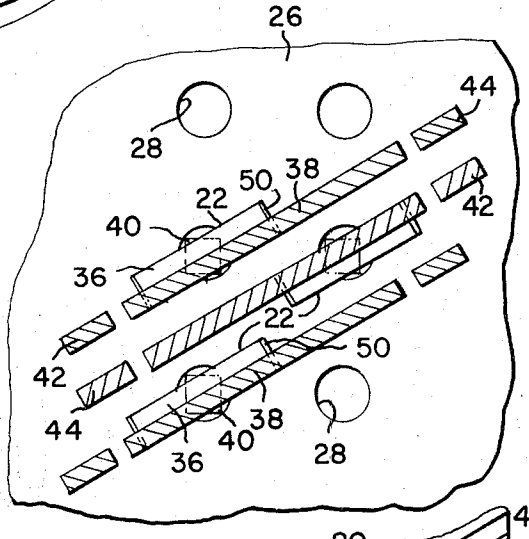


FIG. 4



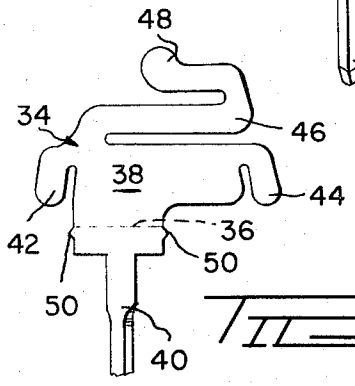
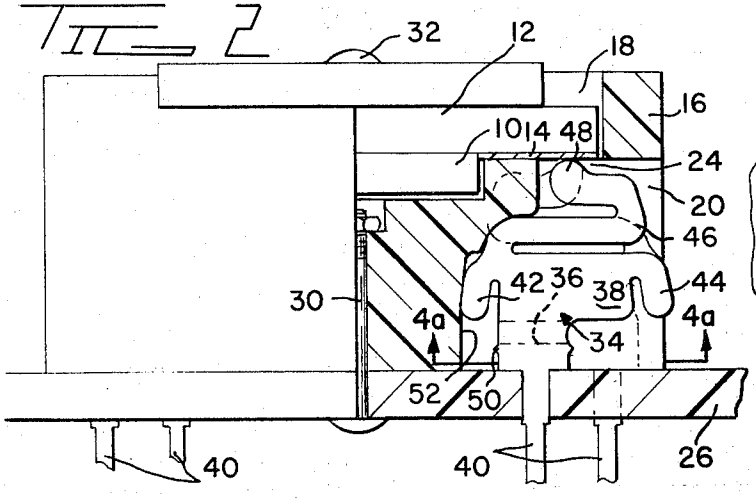


FIG. 3

FIG. 2



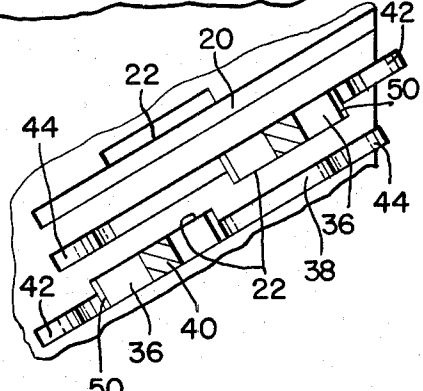
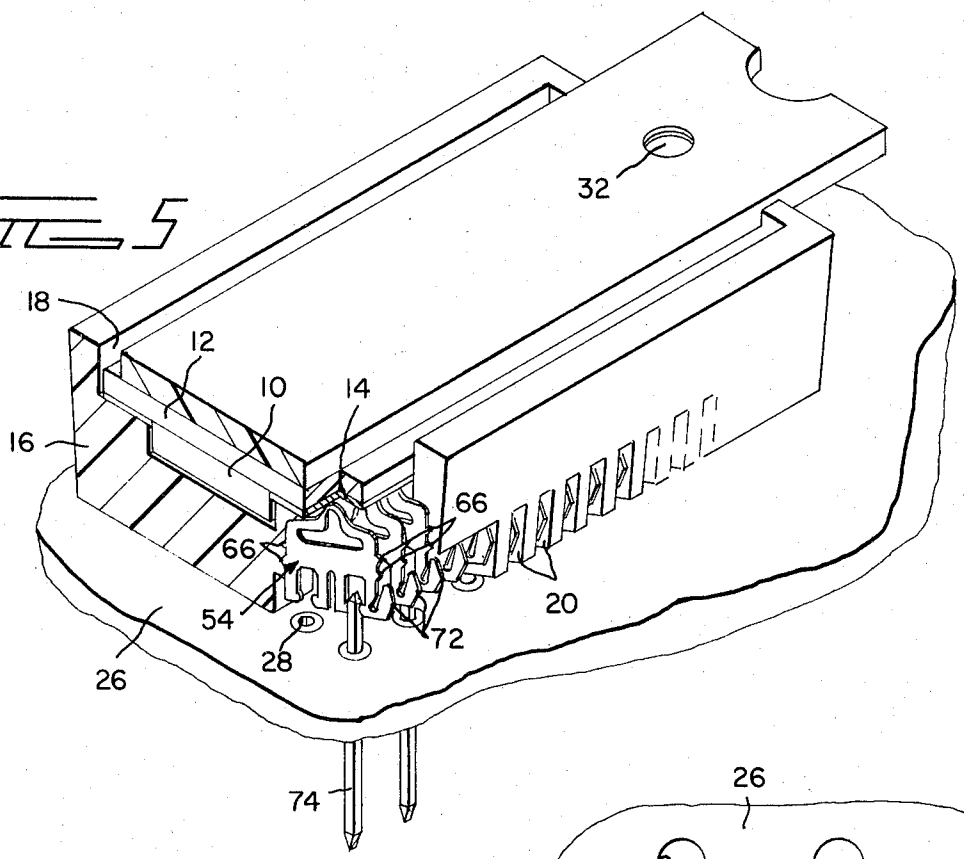


FIG. 4a

FIG 5



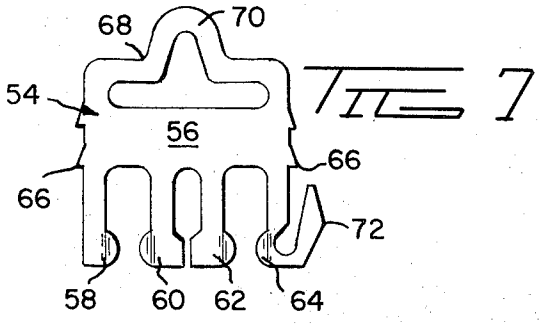


FIG 7

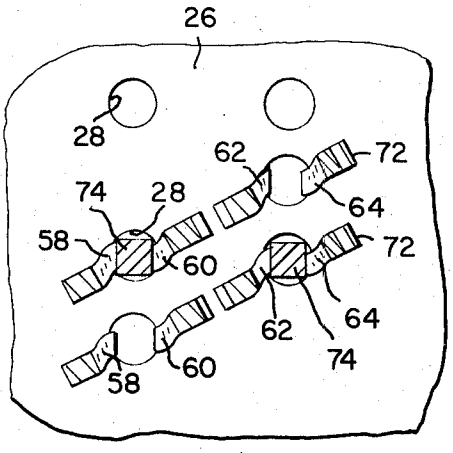


FIG 8

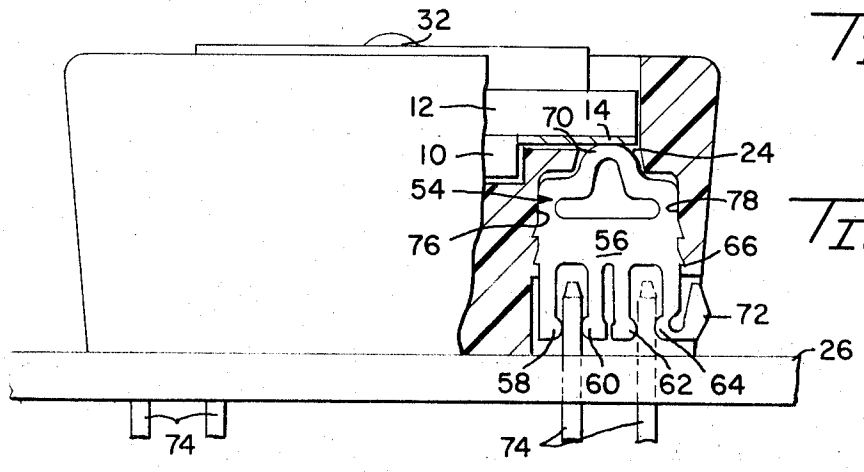


FIG 6

FIG 9

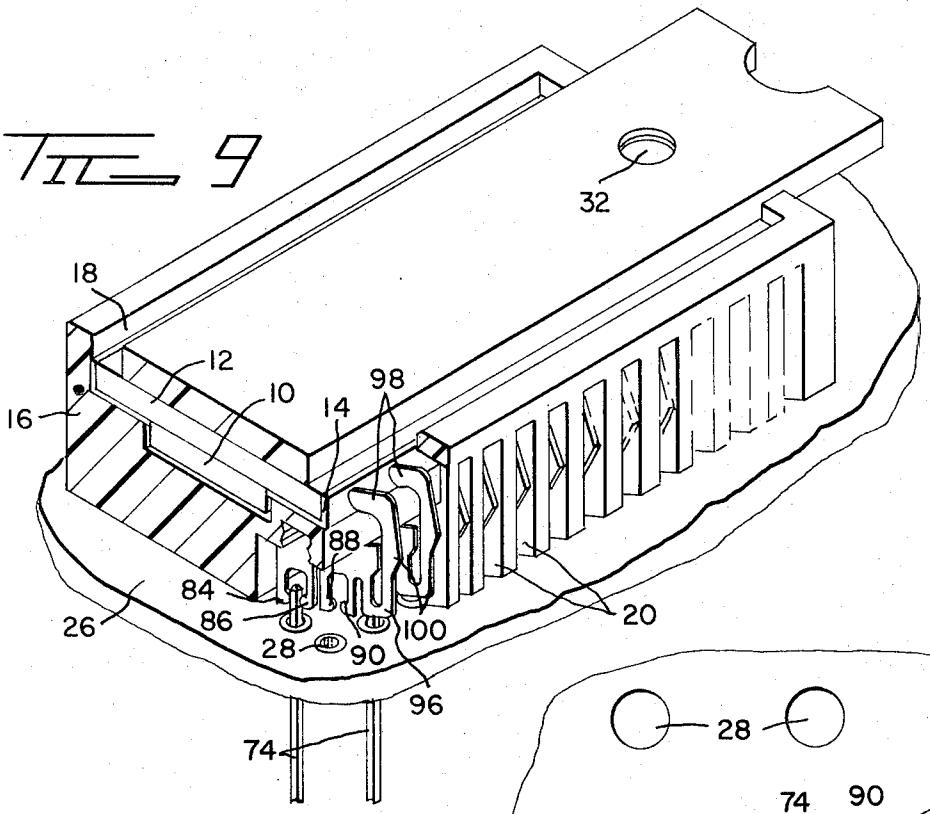
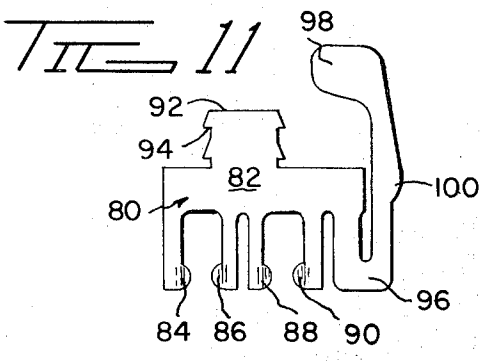


FIG 11



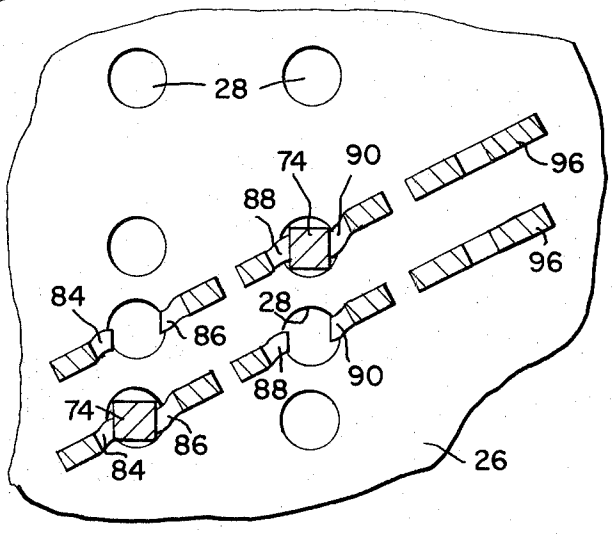


FIG 12

FIG 10

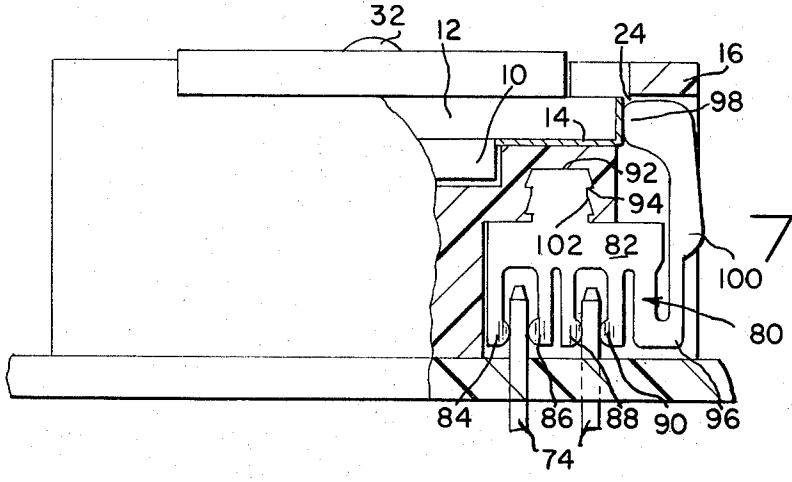


FIG 13

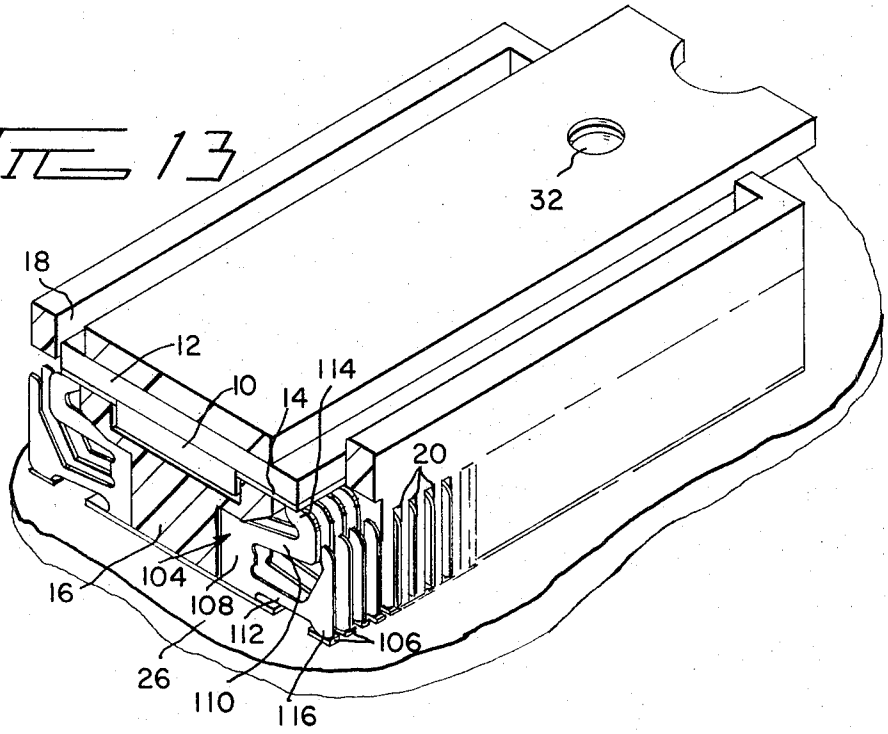


FIG 15

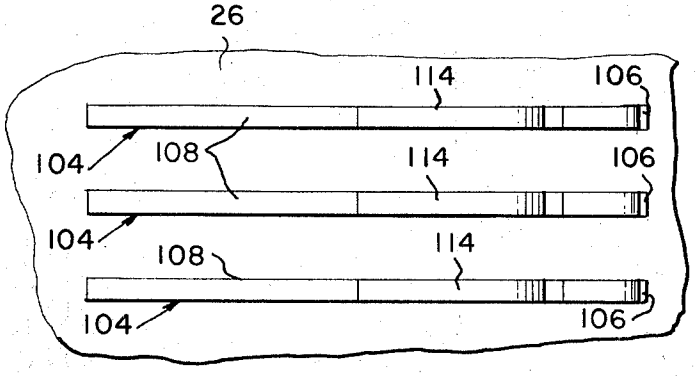
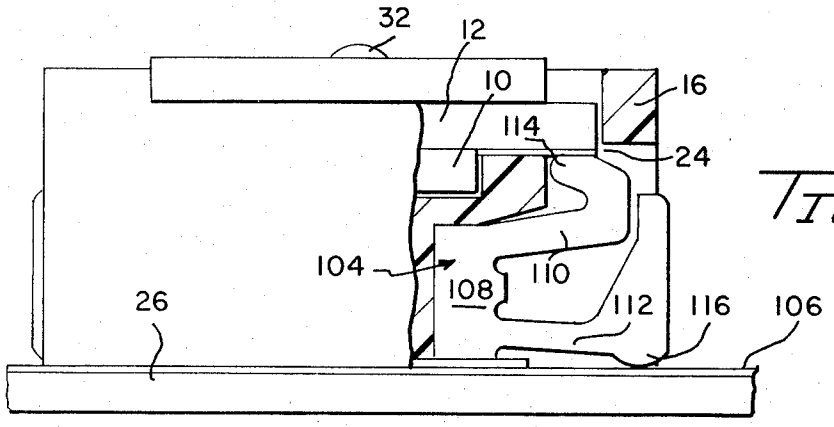


FIG 14



CONNECTORS PROVIDING INTERCONNECTION BETWEEN CLOSELY SPACED CONDUCTORS AND WIDELY SPACED TERMINALS

BACKGROUND OF THE INVENTION

1. The Field Of The Invention

The present invention relates to improved connectors for making side or edge contact with conductor pads of circuit boards including electronic modules and in particular to connectors adapted to make side or edge engagement with circuit boards contact pads while providing ready access test access for the contact point.

2. The Prior Art

Electronic circuit modules are produced in many shapes and forms and are fabricated in a variety of sizes, weights and thicknesses. Each module is provided with a circuit or circuits which perform certain desired functions, for example, amplifiers, counters, registers, memory storage, etc. Most of the circuits used are in the miniature and subminiature size range and are therefor difficult to handle. For this reason many of these circuits, which are also called "chips" and/or "flat-packs," are mounted on flat boards with one or more conductive lead extending from the circuit to the edge of the boards for interconnection to a utilization device and/or to a source of electrical energizing potential.

There are known connectors for making connection between an electronic circuit and a source and/or utilization device. For example, U.S. Pat. No. 3,107,319 teaches a modular component to printed circuit connector with a cantilever leg providing a resilient contact with a printed circuit board. Another leg is used for solder contact with circuit components and is not suitable for making edge or surface contact with a circuit module. U.S. Pat. No. 3,622,950 shows a connector assembly having integral terminal posts. Conductors from a circuit module are tightly received between biased arms to make connection with the terminal contact. This connector requires an additional member to achieve the biasing.

SUMMARY OF THE INVENTION

The present invention is an electrical connector for electrically and mechanically interconnecting spaced terminal pins with more closely spaced edge or surface contact pads on a circuit board carrying an electronic module. The connector includes a body, a resilient contacting arm lying in the plane of the body and adopted to engage contact pads of the circuit board, a terminal pin extending from the body for further electrical interconnection, and test access means extending from the body to project from a housing to provide a constant test point. The housing includes a circuit board and electronic module receiving portion and a plurality of connector receiving grooves formed along at least part of the periphery of the housing.

It is therefore an object of the present invention to construct a new and improved electrical connector which will provide sufficiently high contact forces to form a gas tight seal at the electrical junction between a contact arm of the connector and the associated circuitry module contact pad.

It is another object of the present invention to produce electrical connectors capable of making either edge or surface engagement with contact pads of a circuit module.

It is yet another object of the present invention to construct electrical connectors which can mate with terminal posts or have integral terminal posts.

It is still another object of the present invention to produce an electrical connector which, when mounted in an associated housing, will have a portion thereof projecting from the housing and serving for test access to the contact.

The foregoing and other objects of the present invention will become apparent to those skilled in the art from the following detailed description taken with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view, partly in section, of a housing having the first embodiment of the subject connector mounted therein;

FIG. **2** is a partial transverse vertical section through the housing of FIG. **1**;

FIG. **3** is a side elevation of the first embodiment of the subject connector;

FIG. **4** is a schematic top plan view showing the orientation of the first embodiment connector in the housing;

FIG. **4***a* is a bottom plan view of a fragment of the housing showing two loaded and one empty cavities;

FIG. **5** is a perspective view, partially in section, of a housing having a second embodiment of the subject connector mounted therein;

FIG. **6** is a partial transverse vertical section through the housing of FIG. **5**;

FIG. **7** is a side elevation of the second embodiment of the subject connector;

FIG. **8** is a schematic top plan view showing the alignment of the second embodiment connector in the housing;

FIG. **9** is a perspective view, partly in section, of a housing having a third embodiment of the subject connector mounted therein;

FIG. **10** is a partial transverse vertical section view through the housing of FIG. **9**;

FIG. **11** is a side elevation of the third embodiment of the subject connector;

FIG. **12** is a schematic top plan view showing the mounting of the third embodiment connector in the housing;

FIG. **13** is a perspective view, partially in section, of a housing having a fourth embodiment of the subject connector mounted therein;

FIG. **14** is a partial transverse vertical section through the housing of FIG. **13**; and

FIG. **15** is a schematic top plan view showing the orientation of the fourth embodiment connector devices in the housing.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The several embodiments of the present connector are described making interconnection with packaged electronic modules, such as may be found in computers and the like. In such cases the electronic modules **10** are mounted on a rigid circuitry boards **12** having electrical leads **14** printed thereon extending radially outwardly to an edge portion of the board where a contact pad is formed on either the edge or surface of the

board. Since the modules are of extremely small size, the leads must be made to radiate therefrom in order to provide sufficient spacing at the sides of the board for making contact with the related circuitry, such as either a source of potential or a utilization device. The present connectors serve to make good electrical and mechanical interconnection between pads having a first grid spacing and terminal pins having a second larger grid spacing.

Turning now to the first embodiment of the subject connector, see FIGS. **1** to **4**, a housing **16** has a stepped central recess **18** extending substantially its entire longitudinal length. A plurality of spaced, parallel connector cavities **20** are formed along at least one wall of the housing. Each cavity **20** includes a notch or recess **22**, see FIG. **4***a*, and communicates with recess **18** via longitudinal slot **24**. The housing **16** is mounted on a chassis or support frame **26** in close proximity to a plurality of apertures **28** and is fixed in position by conventional mounting means **30**, such as nuts and bolts or screws. The circuit board **12** is fixedly mounted in the housing **16** by conventional mounting means **32** and a single mounting means can be used to mount both the board on the housing and the housing on the chassis if so desired.

The first embodiment of the subject connector **34** is formed from premilled flat stock and has a transverse step **36** (see FIG. **4**) extending through body portion **38**. An integral terminal pin **40** of square section depends from the thicker bottom side of the body portion **38**. The terminal pin **40** is rotated about its own axis to be angularly positioned with respect to the plane of the connector. Resilient arms **42, 44** extend in cantilever fashion from opposite sides of body portion **38** and a folded cantilever arm **46** extends from the top of the body portion. A contact projection **48** is on the free end of the arm **46**. Retention projections **50** extend from opposite sides of the thicker lower part of the body portion **38**.

The first embodiment connector **34** is mounted in the cavities **20** from the bottom of the housing **16** in an alternating reversed configuration (see FIG. **4**) so that the contacts **48** are spaced close enough to engage pads **14** on the circuit board **12** while the terminal pins **40** are spaced somewhat further apart enabling other connections to be made therewith. It should be noted that the apertures **28** are formed in two spaced, parallel rows and that the terminal pins **40** are inserted in alternate apertures to achieve the desired spacing.

The connectors **34** are inserted from the bottom of the housing **10** into slots **20** with one resilient arm, in this case **42**, engaging the rear wall **52** of the slot to bias the connector so that the opposite retention projection **50** engages in the notch **22** to firmly hold the connector in position. The other resilient arm **44** extends from the side of the housing and serves as the test point. The end contact **48** engages the surface pad **14** of the circuit board **12** while terminal pin **40** depends through an aperture **28** of chassis **26** for appropriate engagement with plugs, wire wrapping, soldered and other available connections.

It should be here noted that all four embodiments of the subject connector are stamped from flat stock and used in edge wise orientation which gives maximum stiffness for a given material thickness. Only the first embodiment, as noted above, is stamped from premilled stock in order to have sufficient thickness to form the terminal pin.

The second embodiment of the subject connector **54**, see FIGS. **5** to **8**, is symmetrical and therefor is mounted in the housing **10** aligned in a single direction. The connector **54** includes a body portion **56**, a plurality of legs **58, 60, 62** and **64** depending from the bottom of the body portion, retention projections **66** extending from opposite sides of the body **56**, and contact arm **68** extending upwardly from the body and carrying a contact portion **70** thereon. A flat spring arm **72** extends from leg **64** to project out of the housing **16** and serve as a test point. Retention of the connector in the housing is accomplished by projections **66** on each side of the connector body **56** engaging the opposing walls **76, 78** of the housing **16**.

Separate terminal posts **74** are fixedly mounted in alternate apertures **28** of the chassis **26**. The face portions of the legs **58, 60, 62, 64** contacting the terminal posts **74** have coined edges to assure flat to flat mating between terminal posts and connector legs even though the connector **54** is obliquely positioned in the housing as shown in FIG. **8**. The legs which engage the terminal post behave as cantilever springs while the contact arm **68** engaging the electronic module pad **14** functions as a simple beam with fixed ends. In this manner forces consistent with the use of non-noble plating may be obtained in compact form.

The connector slots **20** in the molded plastic housing assure proper orientation of all of the interengaging elements. Since the slots are positioned on an angle with respect to the major axis of the housing, the legs of the contacts are positioned so that one pair will engage the associated terminal pin.

The third embodiment **80** of the present invention is similar to the second embodiment in that it is intended for use with terminal pins **74** fixed in the chassis **26**. This embodiment includes a contact body **82** having at least two pairs of depending legs **84, 86, 88, 90** and an oppositely directed stud **92** having laterally extending retention projections **94**. A folded cantilever beam **96** depends from one end of the connector body **82** in the manner of arm **46** of the first embodiment. This beam extends upwardly and inwardly with respect to the housing so that a contact projection **98** on the free end thereof engages a pad **14** on the side edge of the circuit board **12**. The cantilever beam **96** also has an edge portion **100** which projects through the side wall of the housing to provide a test access point.

The faces of the legs **84, 86, 88** and **90** which contact the terminal posts **74** have coined edges to assure flat mating between post and connector even though the connector is obliquely positioned in its housing, as shown in FIG. **12**. The members which engage the terminal post behave as conventional cantilever springs while the beam engaging the edge pad functions as a heavy recurved cantilever fixed to the main body of the connector. In this manner forces consistent with the use of non-noble platings may be obtained in compact form. The connector is mounted in the housing by inserting stud **92** into a corresponding recess **102** in the housing **16**. The molded plastic housing assures proper orientation of all of the interconnecting elements even with the contact cavities positioned on an angle with respect to the major axis of the housing.

The fourth embodiment **104** of the subject connector is designed for making surface to surface connection

between the circuit board **12** and a printed circuit **106** on chassis **26.** This connector is formed from flat stock and has a body portion **108** with a pair of cantilever arms **110, 112** extending therefrom. Each arm has a folded configuration with a contact portion **114, 116,** respectively engaging the associated circuitry. The arm **112** has an extension **118** which will project from a side of the housing to provide test access. This surface to surface connector uses a flat blank contact to resiliently connect between two opposite parallel pads of an electronic element and printed circuit substrate. Thus the modified cantilever springs of this contact can furnish forces which would be consistent with non-noble surface coatings used in electrical applications.

The present invention is subject to many modifications and variations without departing from the spirit or essential characteristics thereof. The above described embodiments are therefore to be considered in all respects as being illustrative and not restrictive of the scope of the invention.

What is claimed is:

1. An electrical connector mounted in a housing to make good electrical and mechanical interconnection between a circuit board attached to one side of the housing and a terminal adjacent the opposite side of the housing, comprising:

a connector body having at least one retention projection extending from each of two opposite sides of said body;

a resilient circuit board contacting arm comprising a simple beam extending from said body and having a contact projection on the free end thereof;

at least one pair of resilient, parallel, spaced apart legs depending from said body and adapted to resiliently grip said terminal therebetween; and

a resilient test access arm integral with one of said legs and adapted to extend therefrom in cantilever fashion to project from said housing thereby providing constant test access to said connector.

2. An electrical connector mounted in a housing to make good electrical and mechanical interconnection between a circuit board attached to one side of the housing and a terminal adjacent the other side of the housing, comprising:

a connector body having at least one retention projection extending from each of two opposite sides of said body;

a resilient circuit board contacting arm extending from said body, said arm comprising a loaded beam both ends of which are attached to the body and having a contact projection intermediate the ends thereof;

at least one pair of resilient, parallel, spaced apart legs depending from said body and adapted to resiliently grip said terminal therebetween; and

a resilient test access arm integral with one of said legs and adapted to extend therefrom in cantilever fashion to project from said housing thereby providing constant test access to said connector.

3. An electrical connector mounted in a housing to make good electrical and mechanical interconnection between a circuit board attached to one side of the housing and a terminal adjacent the opposite side of the housing, comprising:

a connector body having at least one housing engaging projection extending from one side of said body;

at least one resilient arm extending from a side of said body opposite said projection, said arm adapted to bias said projection into engagement with said housing;

a cantilever circuit board contacting arm extending from another side of said body, said contacting arm comprising a beam folded upon itself and having a contact projection on the free end thereof; and

an integral terminal depending from the side of said body opposite said contacting arm, said terminal having a rectangular section greater thickness than the body of said connector and being rotated about its own axis from the plane of said body.

* * * * *