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Keitel

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[54] **EDGE MOUNT CONNECTOR TERMINAL**

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[52] **U.S. Cl.** ..... **339/95 R,** 339/17 L, 339/176 MP

[51] **Int. Cl.** **H01r 9/12**

[58] **Field of Search** 339/17, 95, 176

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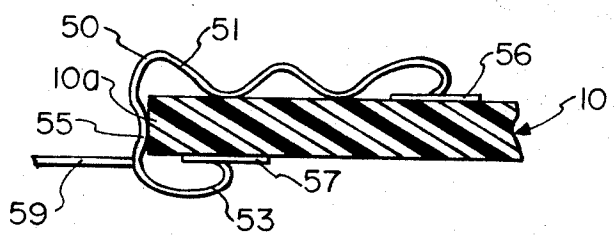
[57] **ABSTRACT**

An edge mount connector terminal connectible to the edge portions of board-like substrates and engageable with edge mounted terminal pads. The connector terminal is comprised of a pair of oppositely disposed elongated jaw members commonly depending from a bight portion and insertable onto the edge portion of the substrate. One of the jaw members is generally greater in length than the other jaw member and has its free end portion serrated for anti-slippage contact with the terminal pad. The end portion is biased onto the terminal pad and has improved mechanical construction to permit improved solder attachment techniques. The one jaw member also engages the substrate other than at its free end portion in a location generally opposite from the area of engagement of the other jaw member with the substrate for providing stabilization of the connector terminal with respect to the substrate and the terminal pad.

9 Claims, 9 Drawing Figures



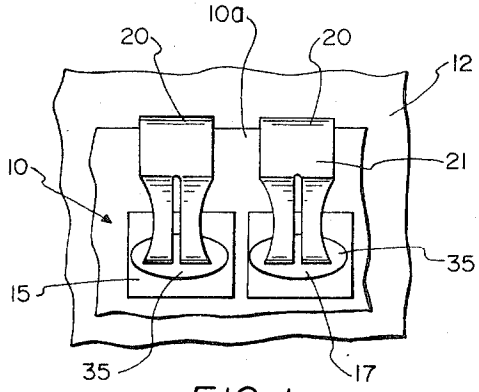


FIG. 1

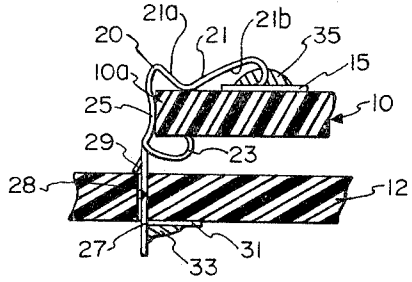


FIG. 2

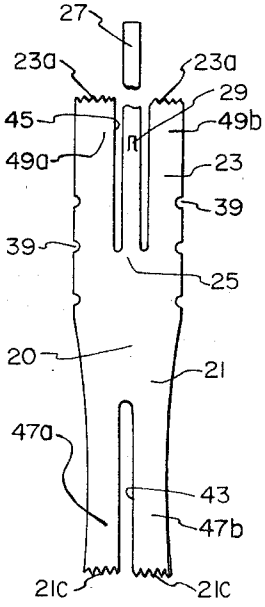


FIG. 3

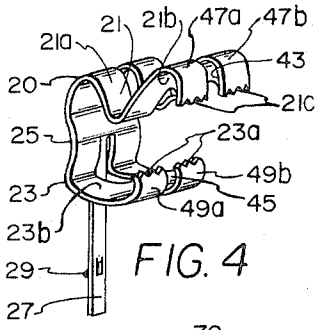


FIG. 4

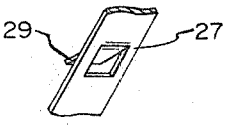


FIG. 4A

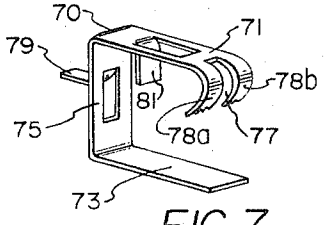


FIG. 7

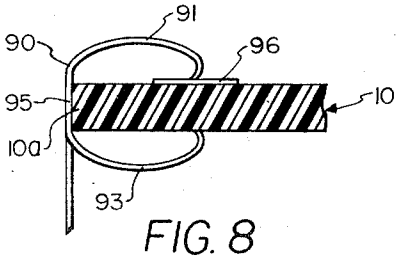


FIG. 8

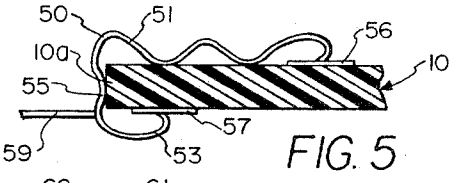


FIG. 5

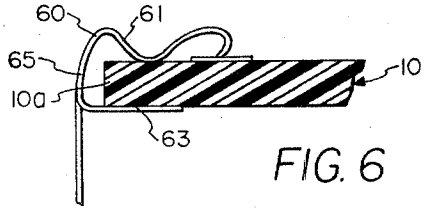


FIG. 6

EDGE MOUNT CONNECTOR TERMINAL

BACKGROUND

This invention relates generally to connector terminals, and more particularly, relates to connector terminals designed for edge mount application to relatively thin board-like substrates such as are suitable for the mounting of hybrid circuits.

The widespread use of hybrid circuits of both thick and thin film configurations have precipitated several configurations for connector terminals suitable for mounting to the edge portions of the board-like substrates. Conventionally, the edge mount connector terminals engage terminal pads located adjacent the edge portions of the substrates and are used to interface between electrical connections supported on the substrates and circuit means exterior to the substrates. Existing edge mount connector terminals suffer from one or more of several disadvantages, to wit: (1) some connector terminals lack support against lateral movement and tend to rotate about an axis perpendicular to the terminal pads; (2) the area of contact with the terminal pad is not secure from slippage; (3) the contact end portions of the connector terminals are often too large in comparison to the contact surface area of the terminal pad for accepting a proper soldered connection to the terminal pad; (4) the contact end portions of the connector terminals have poor mechanical relationship to the terminal pads often causing rupture of mechanical bonding between the terminal pads and the substrates; (5) the connector terminals do not have sufficient adjustment capability to permit a single configuration of connector terminal to be used by a variety of substrate thicknesses and differing degrees of offset of the terminal pads from the edges of the substrate; (6) the leads from the connector terminals are often too inflexible so that they act as lever arms to apply undesirable mechanical forces directly to the substrate and the terminal pads during the application of mechanical forces and shifts caused by movement of the hybrid circuits with respect to the printed wiring board substrates upon which the hybrid circuits are often mounted.

SUMMARY

It is therefore an object of the present invention to provide a novel configuration for edge mount connector terminals which is secured against movement with respect to the terminal pad; it is another object of the invention to provide an improved mechanical relationship for the lead wires of the connector terminals and also for the contact end portions of the connector terminals; it is still another object to provide an improved configuration for the contact end portions of the connector terminals which permits improved solder attachment techniques for joining the contact end portions to the terminal pads.

An edge mount connector terminal is connectible to the edge portion of board-like substrates such as are suitable for the mounting of hybrid circuits. The connector terminal is engageable with a terminal pad mounted on a surface of the substrate substantially adjacent the edge portion thereof. In one practice of the invention, the edge mount connector terminal includes a pair of oppositely disposed elongated jaw members commonly depending from a bight portion and having free end portions spaced apart by substantially the thickness dimension of the substrate. A terminating

lead is depended from the bight portion for providing attachment means for connecting a connector terminal to circuit means exterior to the substrate. The connector terminal is connectible to the substrate through insertional movement of the edge portion of the substrate between the jaw members until the movement is halted through engagement with the bight portion of the connector terminal. One of the jaw members, preferably the one to engage the terminal pad, is generally of a greater length than the other jaw member and contains an inwardly offset length portion for engaging the substrate to stabilize the connector terminal. An outwardly offset length portion is provided for supplying an inward directional spring-like bias to the free end portion of the one jaw member onto said terminal pad. The contact end portion is provided with serrated means for frictionally engaging the terminal pad and the extreme free end portion is curved slightly inward with respect to the space between the jaw members for yielding to the insertional movement of the substrate and for opposing the withdrawal movement of the substrate. The other jaw member preferably embraces the substrate at a location generally opposite of the area of engagement of the inwardly offset length portion for further stabilizing the connector terminal and producing an independent mechanical effect for the free end portion of the jaw member.

Other objects and advantages of the invention will naturally occur to those skilled in the pertinent art as the invention is described in connection with the accompanying drawing in which:

THE DRAWING

FIG. **1** is a partial top plan view of a pair of edge mount connector terminals in accordance with the present invention, each joined by solder fillets to a terminal pad of a hybrid circuit substrate and showing a printed wiring board on which to mount the hybrid circuit substrate;

FIG. **2** is a sectional side view of FIG. **1** and showing a depending terminating lead for the connector terminals;

FIG. **3** is a top plan view of an unfolded planar section of a connector terminal;

FIG. **4** is a frontal perspective view of an individual connector terminal constructed in accordance with the present invention;

FIG. **4A** is a fractional perspective view of a portion of the terminating lead of the connector terminal of FIG. **4**;

FIG. **5** is a partial sectional side view of an alternative embodiment for the connector terminal;

FIG. **6** is a partial sectional side view of another alternative embodiment of the connector terminal;

FIG. **7** is a perspective view of still another alternate embodiment of the connector terminal; and

FIG. **8** is a partial sectional view of a further alternative embodiment of the connector terminal.

DETAILED DESCRIPTION

Now referring to the drawing, FIG. **1** shows the top plan view of a fragmentary section of a substrate **10** upon which to support a variety of electrical components and circuit paths such as would comprise a hybrid circuit. The hybrid circuit substrate **10** could typically be of either a thin film or thick film configuration and itself be mounted upon some suitable substrate such as

a printed wiring board, a fragmentary section thereof being shown at **12** in FIGS. **1** and **2.** The hybrid circuit substrate **10** is provided with at least a pair of terminal pads **15** and **17** positioned adjacent the edge portion **10***a* of the hybrid circuit substrate **10.** As commonly understood the terminal pads are utilized to make connections with the components and circuit paths which are supported on the hybrid circuit substrate **10** and may vary in their placement with respect to the adjacent edge portion **10***a* and with respect to each other. A typical terminal pad would be comprised of a deposition of conductive materials such as alloys of gold, silver or copper and have a thickness dimension of some two to four mils. Typical spacing of the center of the terminal pad from the extreme edge portion of the hybrid circuit substrate **10** would be from 50 to 140 mils and the spacing between adjacent terminal pads as measured from center to center would be in the order of some 100 mils.

FIGS. **1** through **4** show a first embodiment of an edge mount connector terminal **20** constructed in accordance with the principles of the present invention. While FIG. **1** shows two of the connector terminals **20,** the pair of connector terminals is shown for the purpose of illustrating their spacing when mounted to the adjacent terminal pads **15** and **17** and only one of the connector terminals **20** will be described in detail. The connector terminal **20** is comprised of a single generally U-shaped member having two spaced jaw members or leg portions **21** and **23** oppositely disposed and commonly extending from a bight portion **25.** The connector terminal **20** includes a terminating lead **27** extending preferably outwardly from the bight portion **25** and being extended through a suitable aperture **28** in the printed wiring board substrate **12.** The receiving aperture **28** comprises socket means within the printed wiring board **12** within which to mount the hybrid circuit substrate **10** with respect to the printed wiring board **12.** The terminating lead **27** includes protruding shoulder means **29** intermediately of its length dimension for engaging the upper surface of the printed wiring board **12** as viewed in FIG. **2** to limit the extent of the insertion of the terminating lead **27** within the aperture **28.** On the bottom surface of the printed wiring board **12,** there is provided a connecting terminal pad **31** to which the terminating lead **27** may be firmly connected as by a solder pad **33.**

As can be appreciated from a consideration of the drawing, the connector terminal **20** is pluggable in its mounting pattern and is inserted over the edge portion **10***a* of the hybrid circuit substrate **10.** Preferably, the edge portion **10***a* is received into the space between the jaw member **21** and **23** to the extent that the extreme edge portion thereof engages the bight portion **25** of the connector terminal **20.** The engagement of the bight portion **25** with the extreme edge portion of the connector terminal **20** serves to prevent a lateral shift of the connector terminal **20** with respect to the terminal pad **15,** thus serving to stabilize the connector terminal **20** with respect to the hybrid circuit substrate **10** and the terminal pad **15.** Connector terminals without this stabilization tend to rotate about an axis perpendicular to the terminal pad and subject the terminal pad to added mechanical stresses. The connector terminal **20** is comprised of relatively thin blade-like metal stock, FIG. **3,** and is configured to be generally spring-like in its reception of the edge portion **10***a* of the hybrid circuit substrate **10.** This is readily accomplished by providing a space between the jaw members **21** and **23** at, at least, the free end portions thereof which is substantially the same or slightly less than the thickness dimension of the insertable substrate **10.** Many suitable materials exist with which to construct the connector terminal **20** such as nickel-chrome and nickel-iron alloys, copper nickel 725 alloy, phosphor bronze, tinned brass, stainless and cold roll steel. A wide variety of relative thicknesses and widths of the connector terminals obviously can be provided to meet a particular design requirement. It is also possible to construct the connector terminal **20** from wire stock having a general circular or oval cross-section but the blade configuration is preferred. It is desirable that the contacting jaw member which is engageable with a terminal pad, such as the jaw member **21** that is engageable with terminal pad **15** in FIG. **2,** be no wider than approximately three-fourths of the width of the terminal pad **15** so as to permit a proper mechanical attachment of the free end portion thereof to the terminal pad as by means of a solder pad **35.**

FIG. **3** shows a generally flat unfolded specimen of the connector terminal **20** showing the width of the leg portions **21** and **23** and the bight portion **25.** Suitable notches **39** can be provided in the edge areas of the bight portion **25** to facilitate the bending of the connector terminal **20** into its special contoured shape. In the embodiment shown in FIGS. **1** through **4** as well as for the alternative embodiment shown in FIGS. **5** and **6,** the upper leg portion (such as leg portion **21**) of the connector terminal **20** is made longer in its length extension than is the lower leg portion (such as leg portion **23**) so as to produce somewhat of an independent mechanical effect for the free end portion of the longer leg portion. This is accomplished by providing an inwardly offset length portion **21***a* intermediately of the upper leg portion **21,** FIG. **4,** which preferably engages the upper surface of the hybrid circuit substrate **10** at a point intermediately of the terminal pad **15** and the extreme edge portion **10***a*. Thereafter, the effect is completed by providing for the shorter lower leg portion **23** to engage the lower surface of the hybrid circuit substrate **10** at a point substantially immediately opposite of the point of engagement of the inwardly offset length portion **21***a*. It should be noted as well that the clamping effect of the inwardly offset length portion **21***a* combined with the lower leg portion **23** prevents the application of a torque force which would be applied to the hybrid circuit substrate **10** if the longitudinally separated free end portions of the leg portions **21** and **23** were permitted to be the only areas of contact with the substrate **10.** In addition to providing the independent mechanical effect for the free end portion of the leg portion **21,** the surface engagement of the inwardly offset length portion **21***a* provides lateral stability to the connector terminal **20** with respect to the terminal pad **15** and the hybrid circuit substrate **10.** This lateral stability is sufficient in its effect to permit the engagement of the bight portion **25** with the substrate edge portion **10***a* to be omitted, if desired.

The upper leg portion **21** further includes an outwardly offset length portion **21***b*, FIG. **2,** which is provided for imparting an inward directional bias to the free end portion of the leg portion **21** onto the terminal pad **15.** The contact end portion **21***c* of the leg portion **21** includes a saw-tooth configuration for comprising

serrated means to provide an anti-slippage firm contact with the terminal pad **15.** The serrated means serve to clamp into the terminal pad for preventing linear and rotational movements of the contact end portion **21***c* with respect to the terminal pad **15.** It is shown in the drawing that the serrated means such as saw-tooth edges **23***a* are advantageously provided for the lower leg portion **23** to improve its gripping contact as well but it is to be considered optional. Also, an inwardly concave curvature **23**b, FIG. **4,** is provided for the lower leg portion **23** to further impart a gripping contact with the hybrid circuit substrate **10.** Another feature of the invention is to provide the extreme free end portions of the leg portions **21** and **23** with somewhat of a reversed curvature where the blunt saw-tooth edges are directed slightly inward into the space between the leg portions **21** and **23.** Obviously, the inward directed curvature will cause the free end portions of the leg portions **21** and **23** to yield to the insertional movement of the substrate edge portion **10***a* and to oppose the opposite withdrawal movement of the substrate edge portion **10***a*. As shown most clearly in FIGS. **3** and **4,** the leg portions **21** and **23** are provided with generally central lengthwise slot-like openings **43** and **45,** respectively, which slots define pairs of independently acting members **47***a* and **47***b* and **49***a* and **49***b*, respectively. This configuration provides the advantage of independent and redundant action to the members **47***a*–**47***b* and **49***a*–**49***b* but primarily is useful in permitting a greater area of the terminal pad **15** to be available for the soldered connections such as the connection **35.** Heretofore, it has been difficult to provide such a soldered connection which has a high mechanical and electrical integrity because the free end portions tend to cover the major portion of the terminal pads and the configurations of the free end portions have prevented ready access to the underside areas of the free end portions and the adjacent areas of the terminal pads. The openings **43** and **45** improve the capillarity effects of the soldered connections to the independent members **47***a*–**47***b* and **49***a*–**49***b*.

The terminating lead **27** is conveniently provided to depend from the bight portion **25** of the connector terminal **20.** The shoulder portion **29** has been conveniently formed from material removed from the interior width of the terminating lead **27** as clearly shown in FIG. **4**A. The terminating lead **27** is made to be relatively flexible so as to decrease the tendency for movements and shifts of the printed wiring board substrate **12** with respect to the hybrid circuit substrate **10** to be transported to the hybrid circuit substrate **10** through the connector terminal **10.** The terminating lead **27** is relatively incompressible however so as to mount the hybrid circuit substrate **10** in a standoff position from the surface of the printed wiring substrate **12.** Hence, mechanical forces are transmitted to the connector terminal **20** and to the terminal pad **15.** An improved mechanical relationship between the free end portions of the connector terminals **20** and the terminal pads such as the terminal pad **15** has already been described in many aspects. An additional aspect of the improved mechanical relationship relates to the inability of these mechanical forces to be transmitted through the connector terminal **20** to the independent members **47***a*–**47***b* and **49***a*–**49***b* onto the terminal pad **15** because of one or both of the areas of engagement between the contact terminal **20** and the hybrid circuit substrate **10** as provided by the inwardly offset length portion **21***a* and the bight portion **25.** It is apparent that such transmitted mechanical forces could possibly rupture the mechanical attachment of the terminal pad **15** to the hybrid circuit substrate **10** and/or the mechanical contact of the solder pad **35** to the free end portions of the leg portions **21** and **23.**

Some alternative configurations for the connector terminal **20** are shown in FIGS. **5** through **8.** FIG. **5** shows an alternative embodiment **50** for the connector terminal having an upper leg portion **51** and a lower leg portion **53** commonly depending from a bight portion **55.** The longer upper leg portion **51** includes a plurality of continuous inward and outward offset length portions generally intermediately thereof for providing multiple areas of engagement with the hybrid circuit substrate **10** wherein the stabilization effect is enhanced. The free end portion of the upper leg portion **51** is biased onto a terminal pad **56,** is turned inward with respect to the space between the leg portions **51** and **53** and may be provided with serrated means on the immediate contact end portion thereof in the same manner as described for the primary embodiment. A terminal pad **57** is provided on the lower surface of the hybrid circuit substrate **10** and is positioned closer to the extreme edge portion **10***a* than is the terminal pad **56** in order to permit the engagement of the lower leg portion **53** therewith. A terminating lead **59** is shown to illustrate that the terminating leads for the connector terminals may be varied in their positions. FIG. **6** shows still an alternative embodiment **60** for the connector terminal having an upper leg portion **61** and a lower leg portion **63** inserted over the edge portion **10***a* of the hybrid circuit substrate **10.** It is to be noted in this embodiment that the bight portion **65** of the connector terminal **60** does not engage the extreme area of the substrate edge portion **10***a* and the lower leg portion **63** is provided as a flat extension engaging the lower surface of the hybrid circuit substrate **10.** FIG. **7** shows still a further embodiment of the connector terminal **20** in the form of a connector terminal **70** generally configured as a U-shaped clamp member having two spaced leg portions **71** and **73** commonly depending from a bight portion **75.** The leg portion **71** has its free end portion separated by a lengthwise slot-like opening **77** to define a pair of independently acting members **78***a* and **78***b* similar to the members **47***a*–**47***b*. A short terminating lead **79** is provided with material removed from the bight portion **75,** and an inwardly depending tab **81** is provided for engaging the surface of the hybrid circuit substrate **10** similar to the inwardly offset length portion **21***a*. FIG. **8** shows still a further embodiment of the connector terminal in the form of the connector terminal **90.** The connector terminal **90** is a simple construction which has upper and lower leg portions **91** and **93** shaped to be inwardly concave. The bight portion **95** is meant to engage the extreme area of the substrate edge portion **10***a* for providing stabilization. It is to be noted that the additional stabilization structure of the inwardly offset length portion for engaging the substrate **10** has not been provided. Hence, it is necessary to elongate the lower leg portion **93** to permit the free end portion thereof to engage the substrate **10** generally opposite the engagement of the leg portion **91** with its associated terminal pad **96.**

While the present invention has been shown and described with reference to the preferred embodiments

thereof, the invention is not limited to the precise forms set forth herein, and various modifications and changes may be made withot departing from the spirit and scope thereof.

What is claimed is:

1. An edge mount connector terminal for connecting to board-like substrates having terminal pads mounted on the surface of said substrates substantially adjacent an edge portion thereof, said connector terminal comprising a pair of oppositely disposed elongated jaw members commonly depending from a bight portion and having free end portions spaced apart by substantially the thickness dimension of said substrate for accepting the insertion of said edge portion therebetween and engaging opposite surfaces of said substrate, said free end portion of at least of one said jaw members providing a contact end portion for engaging said terminal pad and the intermediate length of said one jaw member includes firstly an inwardly offset length portion engageable with said substrate to provide a first contact area therewith for stabilizing said connector terminal with respect to said substrate in both the planar dimension of said substrate and transverse to said planar dimension, said first contact area being disposed on the edge portion of said substrate intermediately of said terminal pad and the extreme edge of said substrate, and secondly an outwardly offset length portion for imparting an inward bias to said contact end portion in a direction onto said terminal pad, and a terminating lead depending from said bight portion for providing an electrical connection to circuit means exterior to said substrate.

2. An edge mount connector terminal as claimed in claim 1 wherein said one jaw member includes a plurality of continuous pairs of said inwardly offset length portions and said outwardly offset length portions, each of said inwardly offset length portions engaging said substrate to provide contact areas therewith, respectively, for decreasing movement of said connector terminal with respect to said substrate and each of said outwardly offset length portions providing an inward bias to the immediately following length portion of said one jaw member.

3. An edge mount connector terminal as claimed in claim 1 wherein said contact end portion of said one jaw member includes serrated means thereon for engaging said terminal pad for providing increased frictional engagement between said contact end portion of said one jaw member and said terminal pad.

4. An edge mount connector terminal as claimed in claim 3 wherein the other jaw member is configured to be generally concave toward the adjacent surface of said substrate and said free end portion thereof includes a reverse curvature in a direction slightly inward with respect to the space between jaw members for yielding to the insertional movement of the substrate in a first direction into said space and for opposing the withdrawal movement of a substrate in a second direction from said space.

5. An edge mount connector terminal as claimed in claim 4 wherein the other jaw member is provided with a contact end portion for engaging said substrate surface and includes serrated means thereon for engaging said substrate surface with increased frictional engagement.

6. An edge mount connector terminal as claimed in claim 2 wherein said one jaw member includes a generally central slot-like opening extending lengthwise thereof for defining a pair of free end portions, each of free end portions having contact end portions for engaging said terminal pad, said contact end portions including serrated means thereon for providing increased frictional engagement with said terminal pad, and said free end portions including a reverse curvature in a direction slightly inward with respect to the space between said jaw members for yielding to the insertional movement of the substrate in a first direction into said space and for opposing the withdrawal movement of the substrate in a second direction from said space.

7. An edge mount connector terminal as claimed in claim 6 wherein the other jaw member includes a generally central slot-like opening extending lengthwise thereof for defining a pair of free end portions having contact end portions thereon including serrated means for engaging said terminal pad and providing increased frictional engagement therewith.

8. An edge mount connector terminal for push-on mounting to edge portions of board-like substrates having terminal pads connecting to circuit paths supported on said substrate, said edge mount connector terminal comprising a single U-shaped member having two leg portions depending from a common bight portion for engaging opposite surfaces of said substrate and being spaced apart at the free end portions thereof by slightly less than the thickness dimension of said substrate for imparting an inward bias to said leg portions with said substrate inserted into said space, one of said leg portions being aligned for engagement with said terminal pad and including in its extreme free end portion a generally central lengthwise opening defining a pair of separate contact tines, said contact tines being inclined in a direction slightly inward of said space for facilitating the insertion of said substrate and for opposing the withdrawal of said substrate from said space, a terminating lead depending from said bight portion for providing means for connecting said circuit paths to exterior circuit means and said U-shaped member providing at least one contact area with said substrate disposed on a surface common to said terminal pad intermediately of said terminal pad and the extreme edge portion of said substrate for isolating said free end portion in contact with said terminal pad from mechanical forces resulting from movements of said terminating lead.

9. An edge mount connector terminal for push-on mounting to edge portions of board-like substrates having terminal pads connecting to circuit paths supported on said substrate, said edge mount connector terminal comprising a single U-shaped member having two leg portions depending from a common bight portion for engaging opposite surfaces of said substrate and being spaced apart at the free end portions thereof by slightly less than the thickness dimension of said substrate for imparting an inward bias to said leg portions with said substrate inserted into said space, at least one of said leg portions having a free end portion thereof allowing for engagement with said terminal pad and including a reverse curvature in a direction slightly inward with respect to the space between said leg portions for yielding to the insertional movement of the substrate in a first direction into said space and for opposing the withdrawal movement of the substrate in a second direction from said space and including serrated means thereon for engaging said terminal pads for providing increased

firctional engagement between said free end portion of said one leg portion and said terminal pad, connecting means depending from said bight portion for providing electrical connections from said circuit paths on said substrate to exterior circuit means and said U-shaped member providing at least one contact area with said substrate disposed intermediate of said two free end portions for isolating said free end portions in contact with said terminal pads from mechanical forces resulting from movements of said connecting means.

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