

[54] **LOW INSERTION FORCE CONNECTOR
FOR MODULAR CIRCUIT PACKAGES**

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[51] Int. Cl. H01r 13/54
[58] Field of Search 339/75, 174, 17 C, 17 CF,
339/217 S

[56] **References Cited**
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3,683,317	8/1972	Walkup	339/17 C
3,693,131	9/1972	Klehm	339/17 CF
3,750,085	7/1973	Cooper	339/75 M

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Rathburn & Wyss

[57] **ABSTRACT**

Connector for modular circuit packages including several male leads, such as large scale integrated circuit packages. The connector has a housing including a base with a carriage movable in a cavity in the base between outer and inner positions. The carriage is prevented from moving out of the cavity beyond its outer position so that the parts are maintained in assembled relation for convenient use. The modular circuit package is placed on a support surface on the carriage, and its leads enter recesses in the housing with no insertion force. A number of terminals are carried by the housing, and each includes a spring contact normally positioned to permit free entry of a lead into its recess. After the modular circuit package is placed on the carriage with its leads in the recesses, the package and the carriage are pressed to move the carriage from the outer to the inner position and cam means on the carriage engage the terminals to force the spring contacts against the package leads within the lead receiving recesses. Resilient tabs releasably latch the carriage in its inner position while permitting convenient release of the carriage for replacing the package.

13 Claims, 8 Drawing Figures

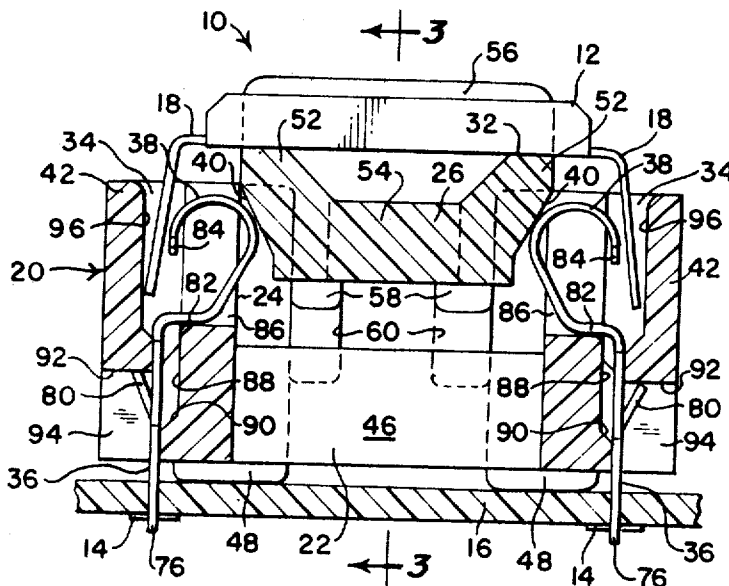


FIG. 1

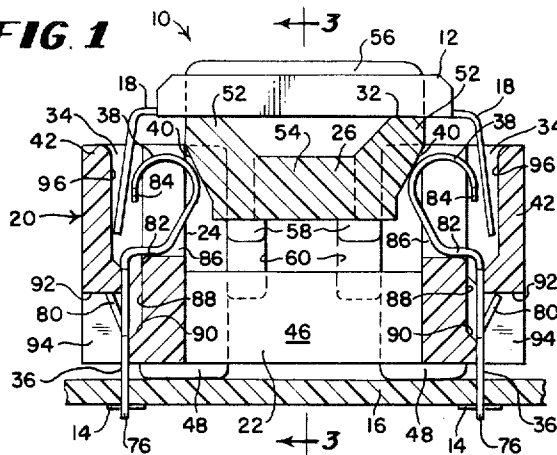


FIG. 2

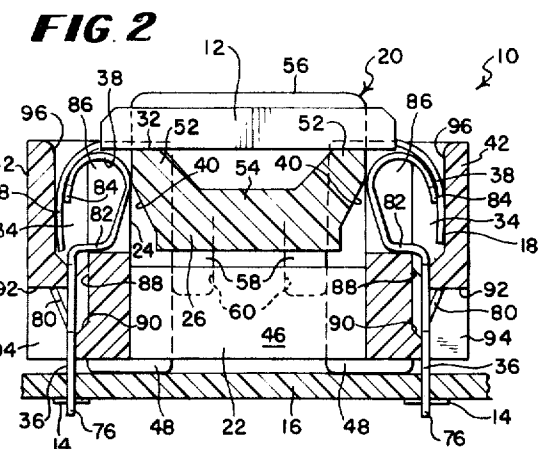


FIG. 3

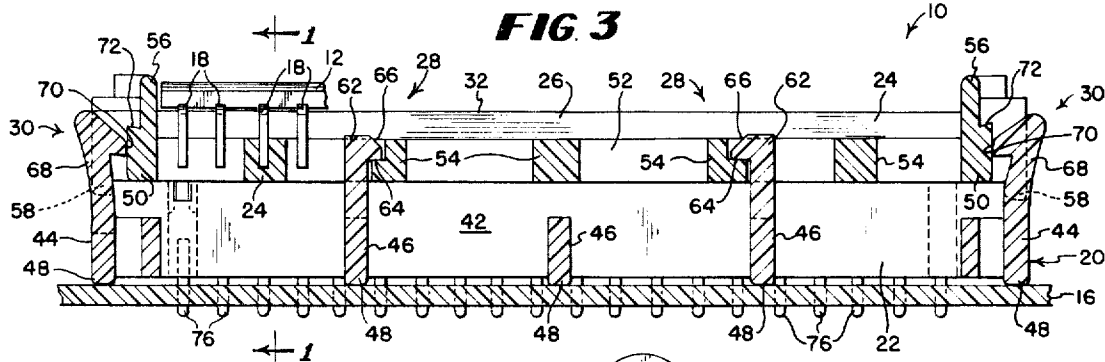


FIG. 4

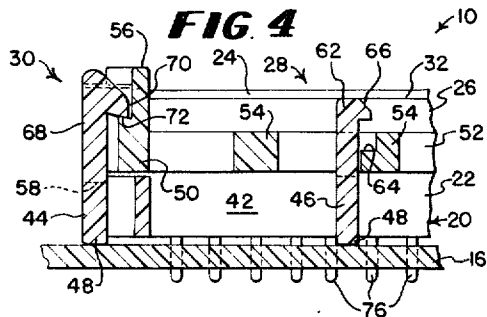


FIG. 5

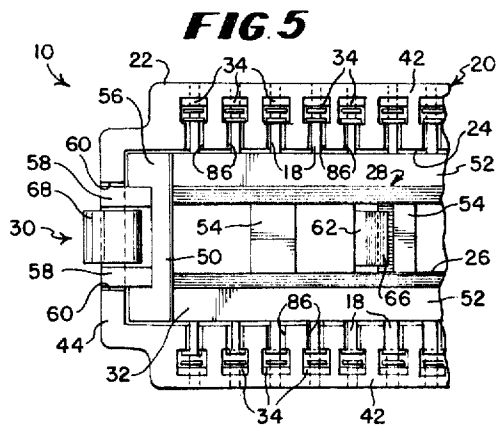


FIG. 7

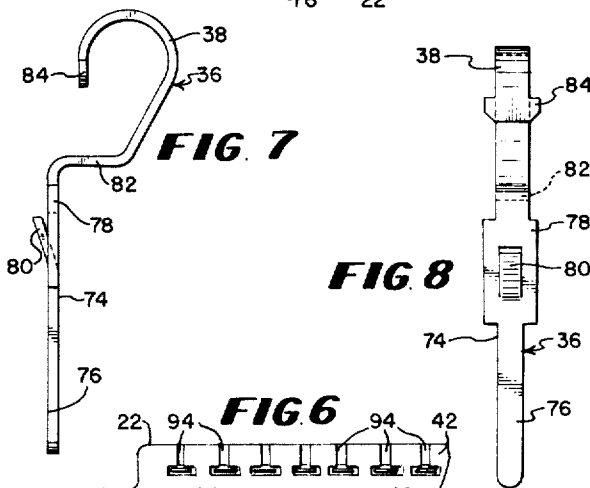
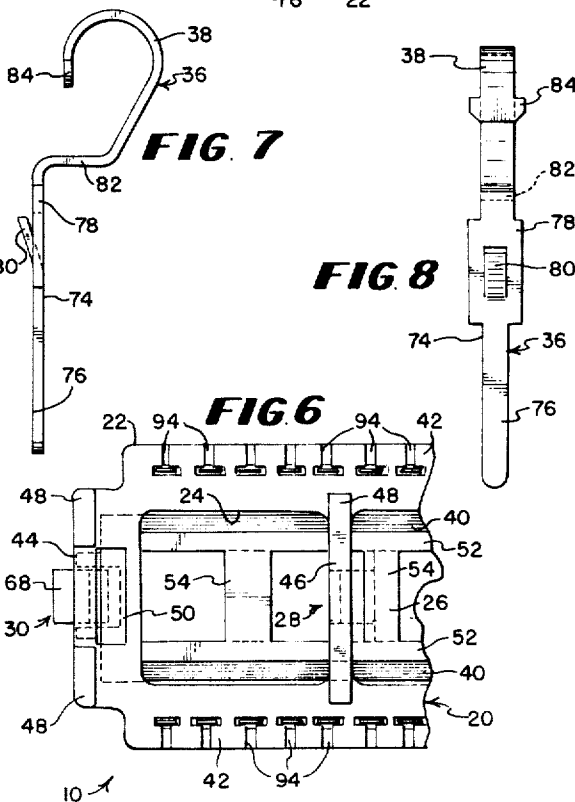


FIG. 8



LOW INSERTION FORCE CONNECTOR FOR MODULAR CIRCUIT PACKAGES

The present invention relates to connectors for modular circuit packages, and more particularly to connectors of the type referred to as low or zero insertion force sockets.

The term "modular circuit package" as used herein is intended to encompass devices such as large scale integrated circuit packages (known as LSI's), dual-in-line packages and other packages or devices having plural male leads.

The traditional method of mounting circuit components to printed circuit boards is to solder the extending leads to conductive areas of the board. Disadvantages of this method are the expense of carrying out the soldering operation and the difficulty in replacing previously soldered components. These difficulties become quite serious with sophisticated modern modular circuit packages such as dual-in-line packages having, for example, eight or fourteen leads, and LSI's having, for example, forty leads.

In order to overcome the problems encountered with soldering components to external circuitry, various types of socket connectors having been developed. Examples of such connectors utilized for transistor devices and dual-in-line packages respectively are disclosed in U.S. Pats. Nos. 3,516,044 - Barnes et al. and 3,673,543 - Garner. Although the connectors illustrated in these patents do overcome the problem of difficulty in replacement of circuit components, nevertheless they are subject to other disadvantages. A primary difficulty is that in order to mount the circuit component in the socket, it is necessary to apply a force to the male leads.

Devices such as LSI's not only include many leads, but also the leads are quite fragile and delicate. In the use of a connector of the type requiring insertion forces to be applied to leads, the total force required is substantial when many leads are involved. In addition, due to the fragile nature of the leads, the leads may be unable to accommodate insertion forces without bending or otherwise becoming damaged.

Devices known in the art as zero or low insertion force sockets have been developed for the releasable mounting of modular circuit packages. An example of such a device is disclosed in U.S. Pat. No. 3,683,317 - Walkup. Known structures of this character are subject to disadvantages including the lack of support for the modular circuit package, the force required to bring about connection to the package leads after mounting of the package, difficulty in mounting of a package due to the fact that the connector includes separate and unattached housing parts, and difficulty in releasing the package for replacement after initial mounting in the connector.

Among the important objects of the present invention are to provide an improved low insertion force connector for modular circuit packages which is simple to use, reliable in operation, and inexpensive to manufacture, and to overcome the disadvantages encountered in known arrangements. Further objects are to provide a connector including relatively movable housing parts that are maintained in assembled relationship prior to use; to provide a connector wherein a package mounted on the connector is adequately supported; to provide a connector having novel structure for estab-

lishing electrical connections to inserted package leads; and to provide a connector wherein release of a package after initial mounting can readily be effected.

Briefly, in accordance with the above and other objects and advantages of the present invention, there is provided a connector for a modular circuit package of the type including several male leads. The connector includes a housing having two parts - a base with a cavity defined therein, and a carriage mounted in the cavity for movement between outer and inner positions. A retaining structure maintains the carriage and the base in assembled condition and prevents the carriage from moving out of the cavity beyond its outer position. The carriage includes an externally facing support surface against which a modular circuit package is supported. Recesses are provided in the housing for receiving the leads of the package when the package is placed on the support surface. Several terminals are mounted in the housing, and each includes a spring contact normally positioned adjacent the lead receiving recess so that an unobstructed path is provided for free entry of the leads. When the carriage is moved from its outer to its inner position, cam surfaces on the carriage engage the terminals to force the spring contacts into firm engagement with the leads of the package. Resilient latching tabs on the base engage the carriage in the inner position in order to hold the carriage in place and to permit convenient release and replacement of the package.

The invention and its objects and advantages may be more fully understood from consideration of the following detailed description of the embodiment of the invention illustrated in the accompanying drawings, wherein:

FIG. 1 is a sectional view of a connector constructed in accordance with the principles of the invention, taken along the line 1—1 of FIG. 3, and illustrating the connector mounted on a printed circuit board and during mounting of a modular circuit package;

FIG. 2 is a view similar to FIG. 1 illustrating the connector after mounting of the modular circuit package;

FIG. 3 is a sectional view of the connector of FIG. 1 taken along the line 3—3 of FIG. 1, with certain structure omitted for clarity;

FIG. 4 is a fragmentary view similar to part of FIG. 3 illustrating the connector after mounting of the modular circuit package;

FIG. 5 is a fragmentary top view of the connector of FIG. 1;

FIG. 6 is a fragmentary bottom view of the connector of FIG. 1;

FIG. 7 is an enlarged elevational side view of a terminal of the connector of FIG. 1; and

FIG. 8 is another side view of the terminal of FIG. 7.

With reference now to the drawings, there is illustrated a connector designated as a whole by the reference numeral 10 and constructed in accordance with the principles of the present invention. The connector 10 serves to establish releasable electrical connections with and to support a modular circuit package 12 and to electrically interconnect the package 12 with conductive regions 14 of a printed circuit board 16. The package 12 in the illustrated arrangement comprises a large scale integrated circuit package, or LSI, having an array of forty male leads 18 in a standard double row configuration. The principles of the invention may be applied to connectors for many types of modular circuit packages including dual-in-line packages, semi-

conductor components, and others. Similarly, although the connector 10 of the present invention is designed for mounting upon and connection to conductive areas 14 of the printed circuit board 16, connectors of the present invention may be adapted for interconnection with external circuitry of many types.

In general, the connector 10 includes a housing generally designated as 20 comprised of a base member 22 having a cavity 24 therein and a carriage 26 supported for movement in the cavity 24. In FIGS. 1, 3, 5 and 6 the carriage 26 is illustrated in an outer position relative to the base member, and a retaining structure generally designated as 28 (FIGS. 3 and 4) is provided to prevent withdrawal of the carriage 26 from the cavity 24 beyond the outer position. In FIGS. 2 and 4 the carriage is illustrated in an inner position, and a latching structure generally designated as 30 (FIGS. 3 and 4) is provided to hold the carriage 26 in place with respect to the base 22 when it is pushed to its inner position.

In order to support the modular circuit package 12 in position on the connector 10, the carriage 26 is provided with a support surface 32 facing outwardly of the connector 10 and against which the base of the package 12 may be placed. Base 22 is provided with a number of lead receiving recesses 34 flanking the mouth of cavity 24 and corresponding to the array of leads 14 of the modular circuit package 12. When the package 12 is placed upon the support surface 32 as illustrated in FIG. 1, the leads 14 enter the recesses 34.

Electrical connection is made to the leads 18 by means of a plurality of terminals 36 corresponding in number to the leads 18 and recesses 34. Each terminal 36 includes a spring contact portion 38 which, in the normal or relaxed condition of the terminal 36, is disposed for free and unobstructed entry of the corresponding lead 18 into the corresponding recess 34. When the modular circuit package 12 together with the carriage 26 is pushed from the outer position of FIG. 1 to the inner position of FIG. 2, cam surfaces 40 of the carriage 26 engage the terminals 36 to force the spring contacts 38 firmly into engagement with the leads 18 thereby to establish reliable electrical connection to the leads and to hold the package 12 firmly in position.

Proceeding now to a more detailed description of the illustrated embodiment of the invention, the base 22 is generally rectangular or box-like in shape, and has a configuration complementary to that of the modular circuit package 12. The base 22 includes a peripheral generally continuous outer wall made up of opposed side walls 42 and opposed end walls 44. As best seen in FIG. 5, the cavity 24 for receiving the carriage 26 is defined centrally of the walls 42 and 44. Side walls 42 are spanned at spaced locations by a series of struts or ribs 46, and the uppermost edges of the struts 46 define the innermost extent of cavity 24. The bottom of the base 22 is spaced slightly from the printed circuit board 16 by means of a number of protrusions 48 in order to permit the flow of heat and/or gasses which may occur during mounting of the base 22 to the board 16 by soldering of terminals 36, and also to provide for ventilation of the modular circuit package 12.

Carriage 26 is complementary in shape to and somewhat smaller than base 22, and fits snugly into cavity 24. The carriage 26 includes spaced end walls 50 and side walls 52. In order to provide for rigidity of the carriage 26, and to permit ventilation of the package 12, the side walls 52 are interconnected at spaced points by

a series of struts or ribs 54. The outermost portions of the side walls 52 form the support surface 32 for the modular circuit package 12, and the end walls 50 are extended outwardly to provide protective walls or guards 56 flanking the ends of the package 12. Cam surfaces 40 are formed on the sides of walls 52.

As indicated above, the carriage 26 may be moved inwardly and outwardly of the base 22 between the outer position illustrated in FIGS. 1, 3, 5 and 6 and the inner position illustrated in FIGS. 2 and 4. In the illustrated arrangement, the base 22 and carriage 26 are fabricated as separate parts and thus are not integrally joined with one another. After fabrication, the carriage 26 is aligned over cavity 24 of base 22 and pushed inwardly. The carriage is guided to the proper position and is thereafter guided in movement between the inner and outer positions by means of a pair of guide projections 58 associated with the end walls 50 of the carriage 26 movable in guide slots 60 formed in the end walls 44 of the base 22.

When the carriage 26 is initially assembled with the base 22, the retaining structure 28 permits assembly of the parts and thereafter maintains the parts in assembled arrangement for convenience in use of the connector 10. As best seen in FIGS. 3 and 4, the retaining structure 28 includes a pair of generally hook-shaped fingers 62 formed as resilient integral extensions of a pair of the struts 46 of base 22. Fingers 62 are engageable with shoulders 64 formed on a pair of struts 54 of the carriage 26. When the carriage is initially guided into cavity 24, cam surfaces 66 on the fingers 62 cause the fingers to be deflected around the corresponding struts 54, and as the carriage 26 reaches the outer position, the fingers resiliently snap inwardly to overlie the shoulders 64 and prevent subsequent movement of the carriage 26 from the cavity 24.

It is contemplated that the assembled connector 10 may be left in the condition illustrated in FIG. 1 with the carriage 26 in its outer position until the connector 10 is used to mount a modular circuit package. When a package 12 is mounted, the carriage 26 is moved to its inner position, and the latching structure 30 thereafter holds the carriage in the inner position. Latching structure 30 comprises a pair of resilient latching tabs 68 formed integrally with the end walls 44 of the base 22. Each tab 68 is somewhat hook-shaped in configuration and includes an end or nose surface 70 which rides over the outer surface of the end wall 50 of the carriage 26. As best seen in FIG. 3, the tabs 68 are bent resiliently outwardly by contact of the end surfaces 70 with the walls 50 and this results in a frictional detaining force being applied to the carriage 26 so that it is frictionally detained in its outer position pending use.

When the carriage 26 is moved from its outer position to its inner position by pushing against the frictional force applied by the tabs 68 to the walls 50, inadvertent withdrawal of the carriage is prevented by engagement of the tabs 68 with locking shoulders 72 provided on the walls 50. However, it should be noted that the extremities of the tabs 68 are smooth and rounded so that they may easily be grasped and displaced outwardly by hand in order to provide for release of the carriage 26 from the inner position. In addition, release is facilitated by the fact that the tabs 68 are readily accessible at the outer ends of the base 22.

One terminal 36 of the connector 10 is illustrated in detail in FIGS. 7 and 8. Each terminal includes a gener-

ally straight shank portion 74 terminating in a pin contact portion 76 extending from base 22 of connector 10. Pin contact 76 can be connected to external circuitry such as conductive areas 14 of the printed circuit board 16 by any conventional soldering process. Near the opposite end of the shank portion 74, the terminal 36 is provided with a widened region 78 from the central area of which there is outwardly struck a resilient locking tang 80.

Spring contact portion 38 of the terminal 36 is formed by a generally U-shaped segment of the terminal. The spring contact 38 is displaced to the side of the plane of the shank portion 74 by means of a transversely extending segment 82. The extremity of spring contact 38 is provided with an enlarged or widened head portion 84.

Conveniently, in assembly of the connector 10 the terminals 36 are simply inserted into the base 22 and are retained in place by means of the locking tangs 80 and transverse segments 82. More specifically, and as can best be seen in FIG. 5, each lead receiving recess 34 is generally square in cross section and extends from the top wall of the base 22. The recesses 34 correspond in number and position to the leads 18 of the modular circuit package 12, and are of ample size to permit free and unobstructed entry of the leads into recesses. Each recess 34 communicates with the cavity 24 by means of a slot or channel 86 of narrower width than the recess 34.

As a terminal 36 is inserted into the base 22, the pin contact portion 76 is directed downwardly into the lead receiving recess 34. The widened area 78 maintains the terminal in the desired position within recess 34 as downward movement of the terminal continues. The leading end or pin contact portion 76 enters a channel 88 extending downwardly from the recess 34 and strikes a sloped guiding surface 90 to guide the pin contact 76 downwardly out of the base 22. As the locking tang 80 reaches the bottom of the lead receiving recess 34, it is resiliently compressed inwardly toward the shank portion 74, and when the terminal 36 is fully inserted, the tang 80 snaps outwardly to engage a shoulder 92 and prevent inadvertent withdrawal of the terminal from the base 22. Access openings 94 are provided so that the tangs 80 may be depressed for withdrawal of terminals 36 if desired. Upon full insertion of each terminal 36, the transverse segment 82 abuts against the bottom of the corresponding slot 86 in order to prevent overinsertion of the terminal.

Because the leads 18 of the modular circuit package 12 may be large in number and may be quite fragile and delicate due to their small size, it is desired that the force applied to the leads in mounting of the package 12 be as little as possible. For this reason, the terminals 36 are arranged so that movement of the leads 18 into the recesses 34 is completely unobstructed. As can best be seen in FIG. 1, in the relaxed position of the terminals 36 the spring contacts 38 lie for the most part in the slots 86 and in the cavity 24. Only the widened head portion 84 of the spring contacts 38 are retained within the recesses 34 so that the leads 18 are easily inserted between the spring contacts 38 and walls 96 of the recesses 34 opposite the contacts 38.

After placing the modular circuit package 12 on the support surface 32 with the leads 18 positioned within the recesses 34 as shown in FIG. 1, the package 12 and the carriage 26 are pushed easily by hand into the cav-

ity 24 from the outer position to the inner position. The side walls 52 of the carriage 26 are provided with the cam surfaces 40 of sufficient extent to overlie all of the terminals 36. During inward movement of the carriage, the cam surfaces 40 engage the portions of the spring contacts 38 lying within the cavity 24 and force the spring contacts 38 into the recesses 34. Consequently, as best seen in FIG. 2, the spring contacts 38 are pushed transversely against the leads 18 and firmly and resiliently capture the leads 18 between the spring contacts 38 and walls 96. Excessive force is not required due to the mechanical advantage afforded by the cam surfaces 40 acting against spring contacts 38. A reliable electrical connection is made to each lead 18 by its corresponding terminal 36 and by firm engagement of the leads 18 the modular circuit package 12 is held in position supported against the support surface 32 of the carriage 26.

Subsequent to initial mounting of the modular circuit package 12 in the connector 10, replacement of the package 12 may be required. In this event, it is possible to release the carriage 26 from its inner position simply by outward movement of the latching tabs 68. Due to the resilient nature of the spring contacts 38 and their engagement with the cam surfaces 40, the carriage 26 together with the package 12 snaps or pops outwardly from the inner position of FIG. 2 to the outer position of FIG. 1 upon release of the latching structure 30. At this point the modular circuit package 12 can easily be lifted from the connector 10 and replaced with a new package 12 to be mounted.

Although the invention has been described with reference to details of the illustrated embodiment, such details are not intended to limit the invention as defined in the following claims.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A connector for a modular circuit package including plural male leads, said connector comprising:

a housing including a base and having base wall means defining a cavity therein and a carriage mounted in said cavity for movement between outer and inner positions;

retaining means on said base and carriage for preventing movement of said carriage from said cavity beyond said outer position;

an externally directed support surface on said carriage adapted to receive the circuit package;

recess means in said base wall means housing defining a plurality of lead receiving paths for receiving the leads of a circuit package disposed on said support surface;

a plurality of terminals mounted in said housing, each including a spring contact normally positioned partly within said cavity adjacent one said lead receiving path and permitting unobstructed entry of a lead into said path; and

means on said carriage slidably engaging said terminals upon movement of the carriage from the outer position to the inner position and camming said spring contacts transversely into said lead receiving paths and against the inserted leads.

2. The connector of claim 1, further comprising releasable latch means on said base and carriage for retaining said carriage in said inner position.

3. The connector of claim 2, said carriage including carriage wall means telescoped within said base wall

means, said releasable latch means including resilient tab means formed integrally with one said wall means and latch shoulder means on the other said wall means.

4. The connector of claim 3, two sets of said tab and shoulder means disposed at opposite points on the outer periphery of said housing.

5. The connector of claim 1, said base wall means including opposed side walls and opposed end walls surrounding said cavity, said recess means comprising two rows of recesses, one row in each of said side walls flanking said cavity.

6. The connector of claim 5, a slot extending between each said recess and said cavity, each spring contact being disposed partly in said cavity and partly in said slot in the outer position of said carriage, and said camming means including cam surfaces on the carriage engaging each said spring contact in said cavity to move said contacts through said slots toward said recesses upon movement of said carriage to its inner position.

7. The connector of claim 6, each said spring contact including an enlarged portion received in said recess for retaining said enlarged portion outside of said slot.

8. The connector of claim 5, channel means extending from each said recess to the exterior of said base, and each terminal including an additional contact structure extending into said channel means.

9. The connector of claim 8, said additional contact structure comprising a pin contact.

10. The connector of claim 8, resilient tang means on said terminals and shoulder means in said base for retaining said terminals in said base.

11. The connector of claim 1, said carriage including guard walls flanking said support surface and extending outwardly from the support surface a distance larger than the height of the package.

12. A connector for a modular circuit package including plural male leads, said connector comprising;

a housing including a base having a cavity defined in part between a pair of opposed side walls;
a carriage mounted in said cavity for movement between outer and inner positions;

an externally directed support surface on said carriage adapted to receive the circuit package;

recess means in said housing defining a plurality of lead receiving paths for receiving the leads of a circuit package disposed on said support surface, said recess means comprising two rows of recesses, one row in each of said opposed side walls flanking said cavity, each recess including a portion open to said cavity;

a terminal mounted in said housing adjacent each recess, each including a first terminal portion held by said housing and an otherwise unsupported spring contact extending from said first portion and normally positioned adjacent one said lead receiving path and permitting unobstructed entry of a lead into said path, each spring contact in its normal position including a first segment disposed in said recess and a second segment extending into said cavity from the corresponding one of said side wall; and

a pair of opposed cam surfaces on said carriage engageable with said second segments of said terminals upon movement of the carriage from the outer position to the inner position for forcing said spring contacts transversely outwardly into said lead receiving paths and against the inserted leads.

13. A connector as claimed in claim 12 each said portions of said recesses open to said cavity comprising a slot of reduced width, said first segment of said spring contact of each terminal including a head portion wider than said slot.

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