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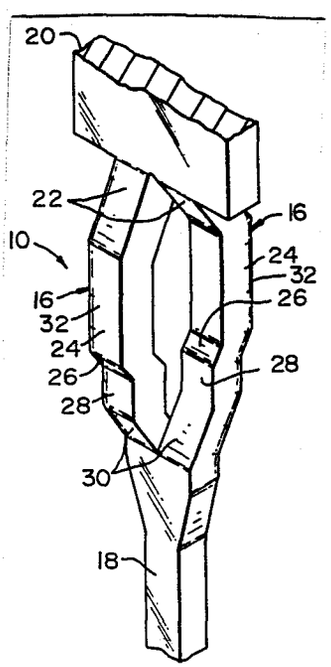
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(54) An improved compliant section for circuit board contact elements.

(57) The present invention relates to compliant sections (10) utilized on contact elements which are mounted in plated-through holes (12) in printed circuit boards (14), generally in conjunction with card edge and other electrical connectors. More particularly, the invention disclosed includes two elongated spring members (16) having generally centrally located, load-receiving segments (24) so that forces exerted against the spring members (16) are more uniformly distributed along the lengths thereof.



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AN IMPROVED COMPLIANT SECTION FOR CIRCUIT BOARD CONTACT ELEMENTS

U.S. Patent 3, 634,819 discloses a contact element having a compliant section which may be inserted in a plated-through hole in a circuit board. The compliant section includes two resilient or spring members, located intermediate the ends, having an arcuate configuration, forming a shape similar to an eye of a needle. The periphery of the compliant section is greater than the plated-through hole which receives it so that the section is compressed upon being inserted thereinto. The spring members will maintain the contact element in position and further will also provide an excellent electrical connection.

The present invention is intended to provide a contact element of the above kind which is substantially improved to yield better retention and electrical connection.

A contact element as defined in the first paragraph of this specification is, according to the present invention therefore, characterized in that the compliant section is provided with a pair of spaced apart, spring members with each member having two vertical segments, one spaced below and inwardly of the other, and joined to each other and to the upper and lower sections of the contact element by obliquely extending segments.

For a better understanding of the invention, reference will now be made, by way of example, to the accompanying drawings, in which:

FIGURE 1 is an isometric view of the compliant section of a contact element incorporating the features of the present invention;

FIGURE 2 is a view of the compliant section of Figure 1 positioned fully in a plated-through hole in a circuit board;

FIGURE 3 is a view of the compliant section of Figure 1 positioned partially in a plated-through hole having a minimum diameter;

FIGURE 4 is a view taken along line 4-4 of Figure 2; and

FIGURE 5 is a view taken along line 5-5 of Figure 3.

Compliant section 10, shown in the several drawings, may be included into any one of several different contact elements or pins which are mounted in plated-through holes 12 (Figures 2-5) in printed circuit board 14 or the like. The compliant section is that part of an element or pin which is driven into the plated-through hole and retained therein by the resilient characteristics of the section. Two most important aspects of a compliant section is the force required to insert it into the hole and the force required to withdraw it from the hole. Although the two are related through a given range for a particular design and metal used, the relation may not hold at the higher extremes. For example, it was found that one design required such a high insertion force that the resilient or spring members were deformed and the resulting configuration resulted in giving the section a taper pin effect; i.e., the contact element could be withdrawn without effort after only a slight dislodging motion.

Other problems noted included the finding that certain designs had no compliancy because the spring members could not bend or flex as the section was being driven into the hole. Contra, highly resilient spring members flexed so readily that the contact element, mounted in the board, could be moved or rocked back and forth quite easily thereby causing electrical discontinuities.

The compliant section of the present invention overcomes the above and other problems. The major structural features of

compliant section 10 includes two spring members 16, positioned between a tail section 18 (note, however, that the compliant section could be the lowest part of the contact element) and an upper contact section 20. As these sections can be of any shape and are not directly important to the present invention, they are not shown.

As the drawing indicates, the members are identically shaped and include five segments. The uppermost segments, indicated by reference numeral 22, are attached to section 20 and extend downwardly (towards tail section 18) and obliquely outwardly therefrom. Elongated segments 24 extend straight axially downwardly from their attachment to the first segments 22. Third segments 26, extending downwardly and obliquely inwardly; i.e., towards each other, connect the elongated second segments 24 with a second but shorter axially extending segments 28. Segments 26 position segments 28 inwardly relative to segments 24. The fifth and last segments 30 extend downwardly and obliquely inwardly to their attachment with tail section 18.

The outwardly facing surfaces 32 of the spring members are preferably non-symmetrically curved from side to side; i.e., traverse to the axis of the contact element. The cross-sectional drawings in Figures 4 and 5 show this curvature.

The overall configuration of the two spring members 16 are such as to define an angular bowed compliant section with a disruption therein occasioned by the second and shorter vertical segments 28.

Figure 2 is a cross-sectional view showing compliant section 10 fully inserted into plated-through hole 12 in board 14. The outwardly facing surfaces 32 on segments 24 are abutting the wall defining the hole. The spring members are in compression, having been inserted into a hole of less diameter than the distance between surfaces 32 on opposing segments 24. Accordingly, there is excellent electrical contact therebetween.

Figure 4 is a cross-sectional view taken along line 4-4 in Figure 2. This view shows second segments 24 pressing against the wall of plated-through hole 12.

The insertion of compliant section 10 is in effect a two stage operation. Figure 3 shows the first stage which is inserting the section up to the third segment 26. Figure 5 is a cross-sectional view taken along line 5-5 in Figure 3.

The significance of the two stage insertion operation is that it permits beam loading nearer to the axial center of each spring member. Accordingly, the spring members, which are beams secured at each end, are able to enjoy maximum resiliency because the stresses imparted to them from the loading are more evenly distributed along their length. Central loading occurs whether the plated-through hole is of maximum, minimum or intermediate diameter. In a maximum diameter condition, the two lower segments 28 and 30 will enter the hole under substantially no insertion force. Loading, i.e., pressure exerted by the wall, begins against the oblique surfaces on segments 26 as they engage the wall of hole 12. In a minimum diameter hole, loading still begins with segments 26 but some very little insertion force may be required to drive the compliant section in that far, particularly if manufacturing tolerances are too loose.

Another advantage gained through the novel compliant section structure disclosed herein is that kinking of the spring members are avoided such as may occur when the loading point is adjacent one secured end.

Yet another benefit is gained under the two stage insertion operation. The compliant section is fairly well into the plated-through hole before the insertion forces become substantial. Thus the first stage insertion provides partial seating in the proper alignment and registration and after final insertion, the contact element will be correctly mounted on the board.

Maximum resiliency is achieved from central loading as noted above. Further, resiliency is maximized by the long, overall

length of the spring members. Such length, however, does not distract from the ability of the compliant section to have high retention in the hole. The oblique segments 22 and 30 provide a stiffness to the members required for such retention without degrading the aforementioned resiliency.

In addition to the advantages noted above, the compliant section of the present invention exerts a strong force against the wall so that with the high retention characteristics, the contact element cannot be easily rocked laterally by a force directed against the sections of the element extending above or below the board.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as some modifications will be obvious to those skilled in the art.

CLAIMS

1. A compliant section (10) for circuit board contact elements and the like, comprising two spring members (16), attached at their ends to upper and lower sections (20, 18) of the contact element and being formed to generally bow outwardly in opposite directions, characterized in that the spring members (16) are provided with a downwardly and inwardly extending, load receiving oblique segments (26) attached to and positioned immediately below elongated, axially extending segments (24).

2. The compliant section (10) according to claim 1 characterized in that the spring members (16) are further provided with upwardly and inwardly extending oblique segments (22) attached to and positioned above the axially extending segments (24).

3. The compliant section (10) according to claim 2 characterized in that the spring members (16) are further provided with second, axially extending segments (30) attached to and positioned below the load-receiving oblique segments (26).

4. The compliant section (10) according to claim 3 characterized in that the spring members (16) are further provided with downwardly and inwardly extending segments (30) attached to and positioned below the second axially extending segments (28).

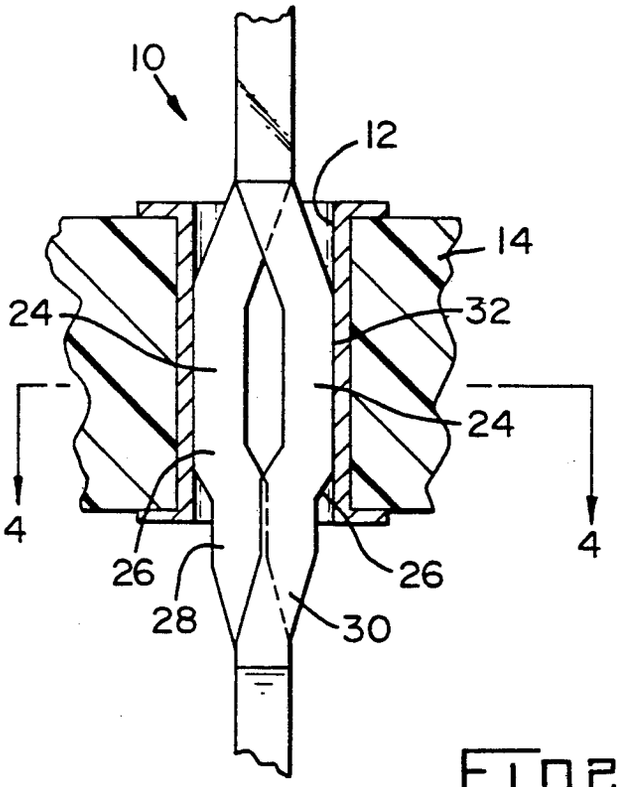


FIG.2

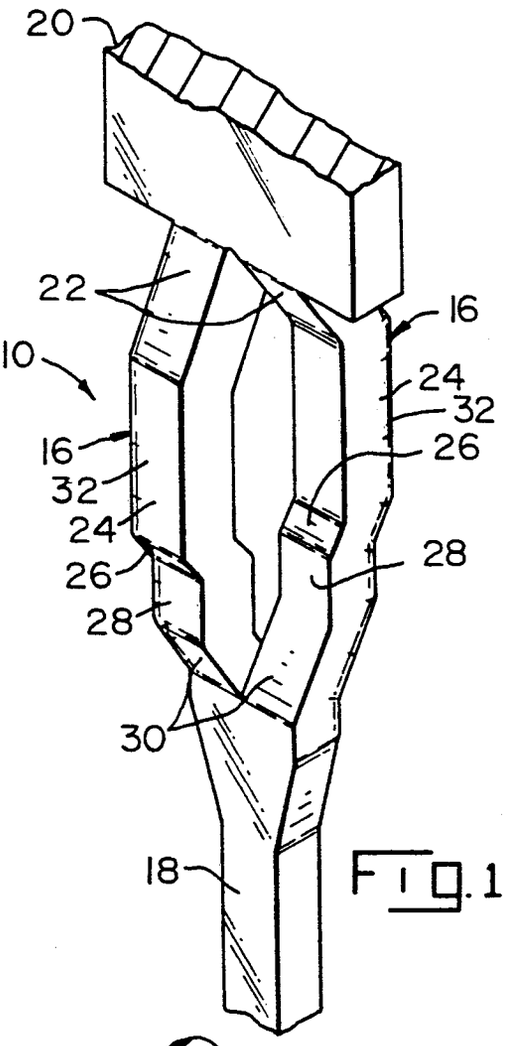


FIG.1

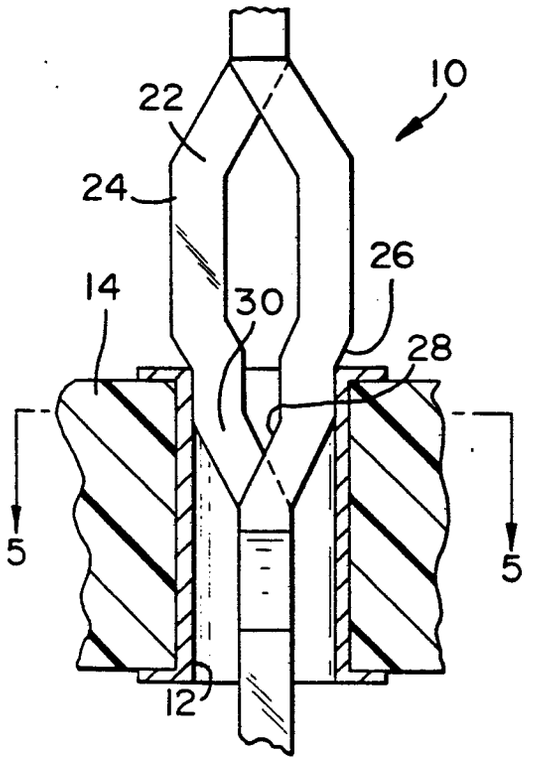


FIG.3

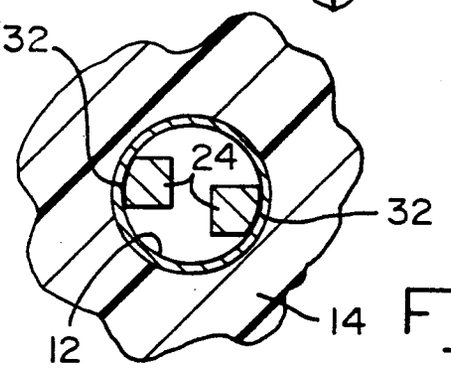


FIG.4

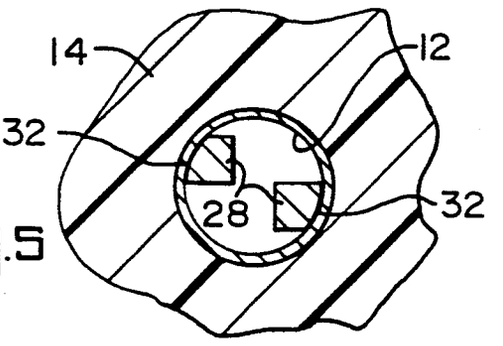


FIG.5

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EUROPEAN SEARCH REPORT

0134094
Application number

EP 84 30 4942

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DESIGN ENGINEERING, Oktober 1977, Seite 111; Morgan-Grampion Ltd., London, GB; "Product in perspective - Electrical connectors" * Figure 2 *	1-4	H 01 R 9/09
X	ELEKTRONIK, vol. 30, no. 9, September 1981, pages 69-70, München, DE; K. WEBER: "Elastische Einpressstifte für Leiterplatten" * Figure 2 *	1-4	
A	US-A-4 186 982 (F. COBAUGH) * Figures 1,3,4 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 01 R 9/09

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-11-1984	000087121

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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