United States Patent

Gluntz

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[54] POST CONNECTOR AND ASSEMBLY

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[52] **U.S. Cl.** .....**339/17 CF,** 317/101 CP, 339/176 MP, 339/217 R

[51] **Int. Cl.** **H05k 1/02**

[58] **Field of Search** 317/101; 174/68.5; 339/17, 339/217, 221, 176, 258, 256, 192, 220

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[57] **ABSTRACT**

An electrical connector assembly for demountably connecting electrical components. Typically at least two post-type connectors are staked to a baseboard which may have printed circuitry thereon with the post connectors advantageously having point-to-point wire termination extending from one side of the baseboard and from the other side having an elongated spring contact lanced out from the middle of each of said posts with the free ends of said spring contacts being formed near the ends of said posts and curved back towards said posts. A carrier board, having similar holes, carries an electrical component positioned adjacent said holes advantageously with its leads loosely clinched through said holes. The carrier board being demountably positioned on said posts by pressing the carrier board down onto said posts with the free ends of respective posts passing into the corresponding holes until a spring contact engages a respective individual lead of the electrical component passing through the particular hole.

14 Claims, 5 Drawing Figures

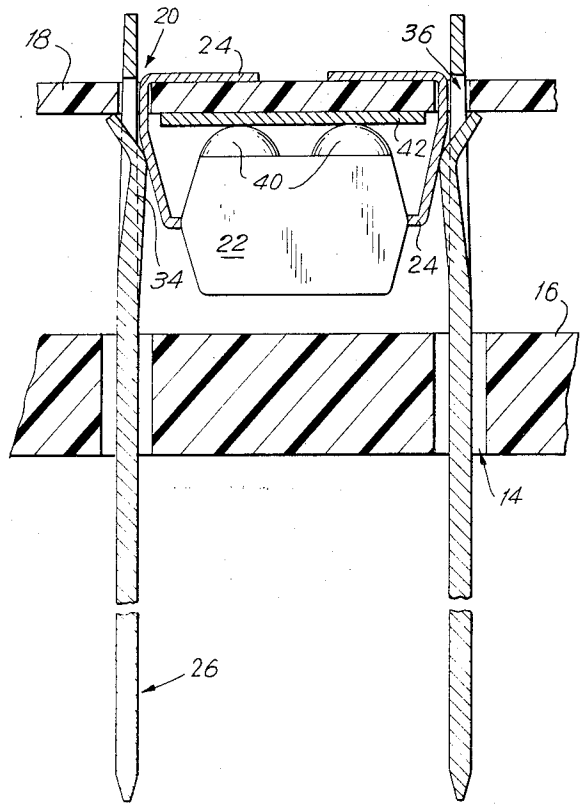
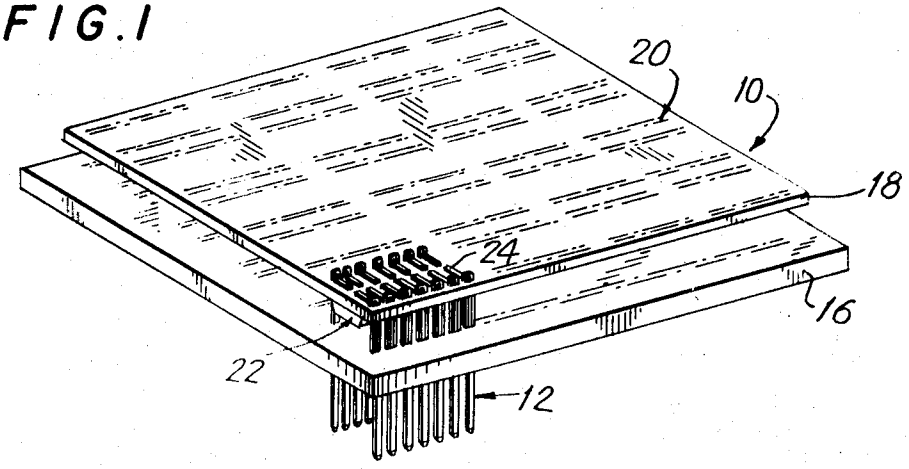


FIG. 1



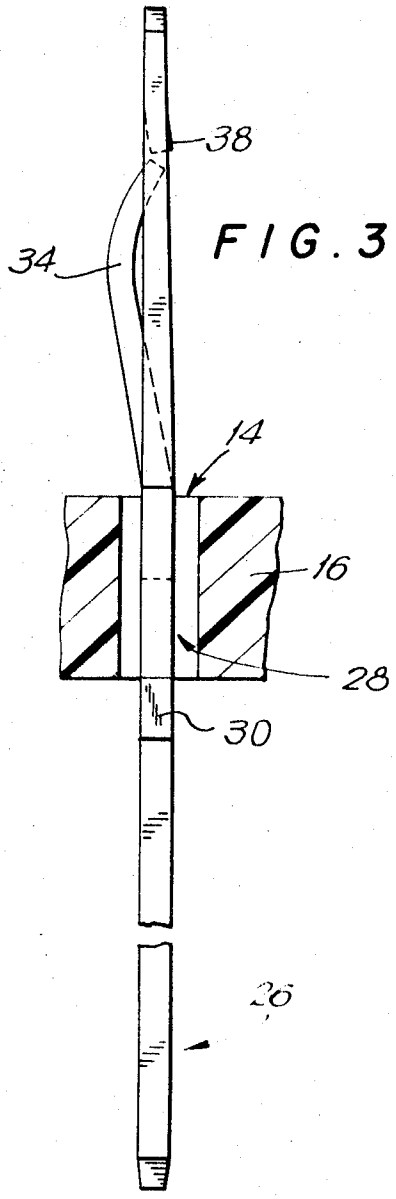


FIG. 3

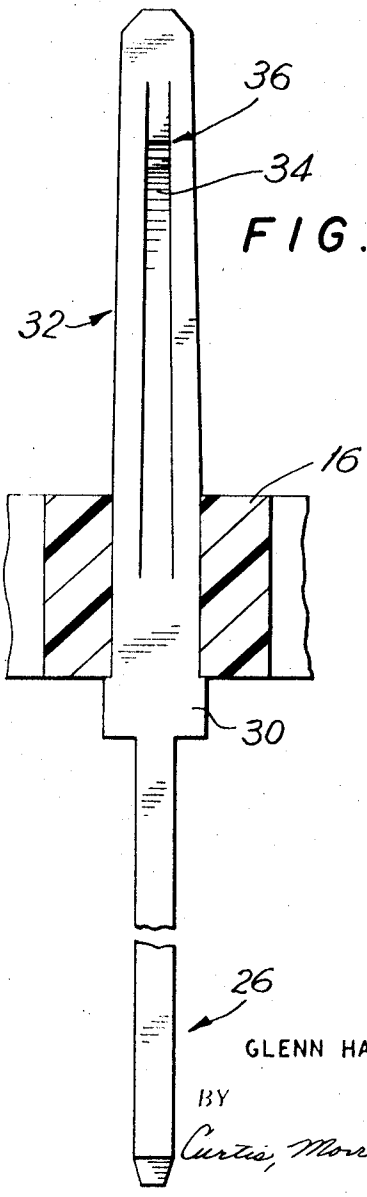
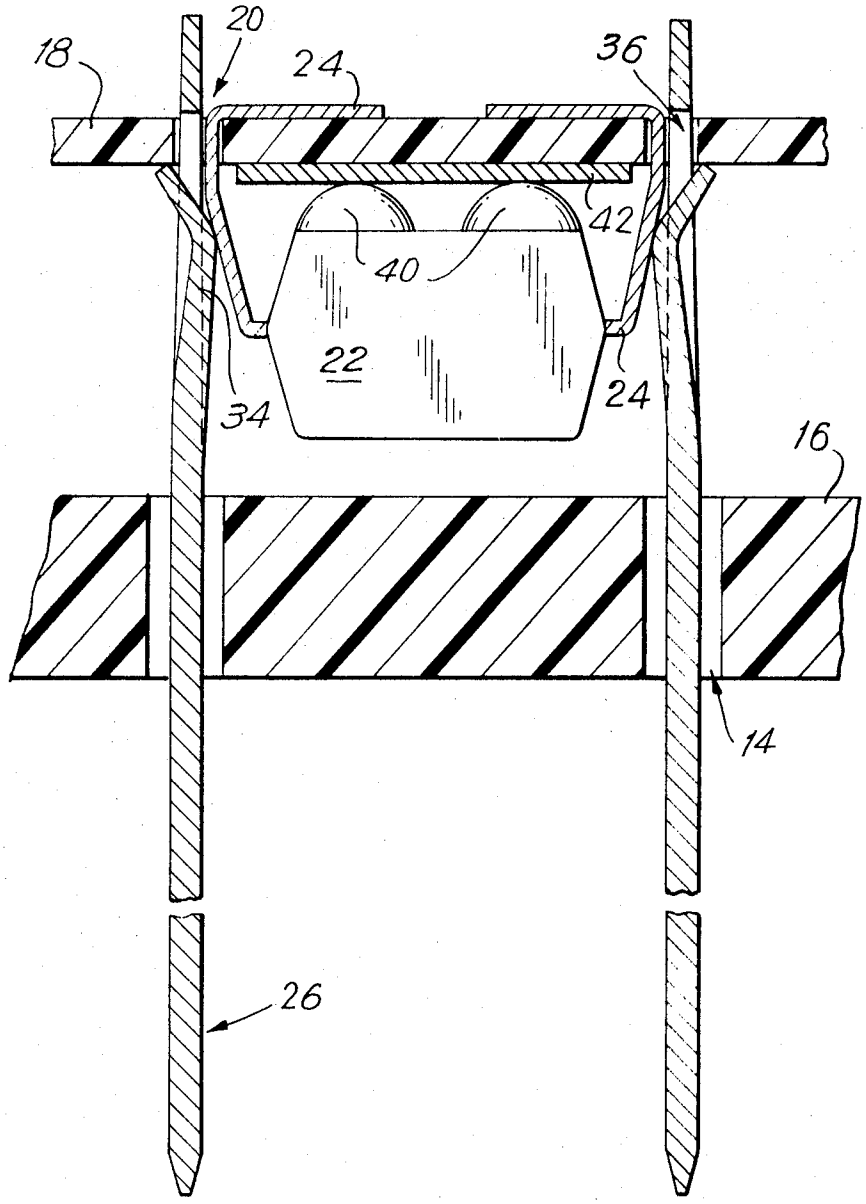


FIG. 4

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FIG. 2



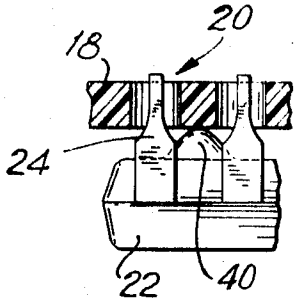


FIG. 5

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POST CONNECTOR AND ASSEMBLY

This invention relates to electrical connectors and assemblies and more particularly to such devices for use in demountably connecting electrical components.

In recent years considerable technology has been developed for mounting electrical components, particularly of the more complex variety such as diodes, transistors, integrated circuits and the like, in electrical circuits. As these electrical components become more miniaturized and more complex, they also become more fragile and difficult to connect into the circuitry. Adequate soldering techniques become particularly difficult because of the irreparable damage which the heat can cause to the particular electrical component, as well as to adjacent components in typical densely packed electronic equipment. These problems are particularly compounded when there is added the requirement that the component be readily demountable from the circuitry. The incorporation of many such electrical components has in the past required manual techniques for incorporation into the circuitry. Also, the prior art solderless connectors required to incorporate the electrical components into the circuitry are often sufficiently large to be inefficiently bulky and heavy and undesirable in applications requiring such electrical components in large numbers. Because of the increasing complexity of the integrated circuit modules the cost for each such small unit can be considerable so that it would be desirable to be able to replace such individual modules in densely packed electronic equipment without having to replace whole sub-assemblies in which such individual modules have typically in the past been permanently wired together with other similar modules and other inexpensive electronic equipment.

It is an object of the present invention to provide an electrical connector and a connector assembly for overcoming the problems discussed herein.

It is a further object of the present invention to provide electrical connectors which are capable of pluggably engaging a plurality of electrical components for connection with further circuitry.

It is a further object of the present invention to provide a connector assembly for electrical components having increased ability to dissipate heat at low cost.

Broadly, the connector and assembly of the present invention achieve these objects in a preferred embodiment by a staked post connector having one end adapted to make conventional connection to further circuitry and having the other end formed with a spring contact lanced out from said post and being bent to extend slightly away from the surface of the post and then back towards said post. With preferably an array of such connectors staked into holes in a baseboard, a pluggable carrier board having one or more electrical components mounted thereon preferably has a corresponding array of holes to accommodate the free ends of each of said connectors. This carrier board is sometimes referred to as a mother board or a header. The electrical components are positioned on the carrier board so that each lead of the electrical component will engage the spring contact of a respective connector and make electrical connection therewith as the carrier board is plugged onto the free ends of the upstanding posts of each respective connector. Advantageously, each lead extends up through a respective hole in the carrier board to make a possible redundant contact with its respective connector post and also to serve to loosely clinch the component in place.

In this specification and the accompanying drawings we have shown and described a preferred embodiment of our invention and have suggested various alternatives and modifications thereof; but it is to be understood that these are not intended to be exhaustive and that many other changes and modifications can be made within the scope of the invention. These suggestions herein are selected and included for purposes of illustration in order that others skilled in the art will more fully understand the invention and the principles thereof and will thus be enabled to modify it and embody it in a variety of forms, each as may be best suited to the conditions of a particular use.

In the accompanying drawings:

FIG. 1 is a partially diagrammatic isometric view of an assembly of a preferred embodiment according to the present invention showing a carrier board plugged onto contacts staked in a parallel baseboard which contacts each engage respective leads of an integrated circuit packet mounted on said carrier board;

FIG. 2 is an enlarged vertical cross section through a basic pair of staked connectors with a carrier board having an electrical component mounted thereon positioned on said connectors with the leads of the electrical component in engagement with the spring contacts of the connectors;

FIG. 3 is a vertical side elevation of a slightly modified electrical connector according to the present invention showing it staked and positioned on a cross section of a fragment of the baseboard;

FIG. 4 is a front elevation of the connector in FIG. 3; and

FIG. 5 is a partial side elevation of an integrated circuit package on carrier board.

In the illustrated embodiment, the connector assembly **10** is formed of connectors **12** staked into circular holes **14** in the baseboard **16** by an interference fit. A carrier board **18** has an array of holes **20** corresponding to the array of staked connectors **12**. Advantageously, the electrical components **22** are mounted on the underside of the carrier board **18** with their electrical leads **24** extending through respective holes **20** to loosely clinch the components in place.

The individual connector **12** is basically a rectangular male post, one end **26** of which is a terminating means which may be of an acceptable design for accomplishing connection with other portions of an electrical circuit. As illustrated herein, this end **26** is a continuation of the rectangular post of the connector adaptable for point-to-point wiring by wire wrap or clip termination. It is within the scope of this invention that the baseboard **16** have printed circuitry thereon. The terminating means portion **26** of this connector **12** could make direct contact with such printed circuitry.

As illustrated in FIGS. **3** and **4**, the connector **12** has a central portion **28** which serves as the mounting means for effectively staking this connector **12** into position on the baseboard **16**. In the usual manner this central portion **28** is formed of a size relative to a hole **14** whereby as the connector **12** is staked into position, the corners of the central portion **28** wedge into the walls of the hole **14** resulting in a strong interference fit directly positioned by the stop projections **30**.

To aid in the staking of the connector **12**, but even more importantly to aid in the proper location in a respective hole **20** on the carrier board **18**, the contact end **32** of the connector **12** is preferably tapered on both its width and its depth. This tapering is advantageous in reducing the tolerance requirements for accurate staking and additionally permitting slight misalignment of the staked connector **12** resulting from an accidental collision which would otherwise prevent the carrier board **18** from plugging onto the array of connectors **12**. For similar reasons, the corners of the contact end **32** of the connector **12** are broken, all for easy entry into the apertures **20**. The post **32** of the contact end is a curved projecting contact **34** lanced out longitudinally, preferably from the center of said post **32**. This spring contact **34** projects out away from the post **32** sufficient to ensure good spring contact against a lead **24** positioned adjacent the respective hole **20**. The free end of the contact **34** curves back towards the post **32** and, preferably, is positioned within the central slot **36** in the at rest position. This latter position prevents the end of the contact **34** from snagging on the lead **24** or alternatively from extending too far on the other side of the post **32** so as to be subject to distortion by accidentally catching on something or even shorting against adjacent electrical equipment when in the flexed position. In order to permit free flexing of the contact **34** in the slot **36**, the sides of the post **32** bounding the slot **36** are slightly bowed outwardly, but not so much as to unduly destroy the taper.

In the illustrated embodiment the array of holes are arranged as they might be for use in conjunction with a number of integrated circuit packets **22**. Only one such packet is illustrated in FIGS. **1** and **2**. This is commonly referred to in the industry as a "dip pack" (sometimes translated as a dual in-line integrated circuit package). As can be seen from the drawings, this particular component **22** is an integrated circuit package having seven legs **24** extending from either side. The dip-pack **22** is loosely positioned on the carrier board **18** by passing each set of legs **24** through respective holes **20** arranged in spaced parallel rows and then folding the legs **24** across the top of the carrier board **18** as shown in FIG. **2**. When all of the electrical components **22** are positioned on the carrier board **18** the latter is slipped over the posts **32** and pressed down. This causes the contacts **34** to engage the leads **24** making a good electrical wipe connection under pressure as the contact **34** is sprung toward the post **32**.

In addition, the curved projecting contacts **34** provide a stopping means of a cradle-type configuration to limit the downward path of the carrier board **18**. See FIG. **2** where the free end of contact **34** catches on the under side of the board **18**.

Note that since the free end of the post **32** is rectangularly shaped and tapered, it is self centering in the hole **20** as the carrier board is positioned down over it. This can result in a wedging action of the post **32** against the lead **24** in the hole **20**, resulting in a redundant contact which serves to enhance the reliability and quality of the electrical connection made by this type of assembly. It is for this reason that the post **32** retains the tab **38** (shown in FIGS. **3** and **4**), rather than having it stamped out (as shown in the form of connector **12** illustrated in FIG. **2**).

Although the electrical component illustrated in FIG. **2** has long legs **24**, it is within the scope of this invention that the leads **24** take the form of a conductive button or other functionally equivalent configuration with the electrical component **22** fastened onto the carrier **18** in a position to make an effective connection with the contact **34** when the carrier board **18** is plugged into place.

The integrated circuit package **22** illustrated is typically manufactured with spacer buttons **40**, which are presumably intended to permit circulation of air past the package **22** to aid in the dissipation of heat. These buttons **40** can be supplemented or even supplanted by a spacer **42** which aids in positioning the electrical components **22** sufficiently far away from the carrier board **18** so that the leads **24** are correctly positioned relative to the contacts **34**. This spacer can also be made of a heat conductive metal such as aluminum to aid in the problem of heat dissipation.

The dip-pack can have from just a few leads **24** to as many as 20 to 40. The distance between the centers of adjacent leads are 0.01 inches. The distance between the parallel rows of holes **20** can be 0.35 inches. As can be seen in FIG. **5**, the lead **24** of a dip-pack **22** typically narrows down, for example from a 0.15 inch width to a 0.05 inch width. The height of the contact **32** can be in the order of one-third of an inch. As can be seen in FIG. **4** the blanking of the contact **34** extends down into the central portion **28** of the connector **12**. This prevents undue flexing at the point of projection of the contact **34** from the contact end **32**. The free end of the contact **34** can have a radius of one-tenth of an inch with its end making an angle of approximately 30° to the post **32**.

From the foregoing it can be seen that the connector of the present invention has the advantage over most of the prior art in making direct contact to the leads of the electrical component without requiring an intermediate connecting device attached to the lead of the electrical component, thereby giving the simplicity which saves on both space and expense. By using this connector with the carrier board the latter is readily demountable (i.e., unpluggable) and the electrical components can be readily replaced. Furthermore, this connector eliminates the difficult soldering techniques which the use of such heat causes, particularly with regard to integrated circuit leads. This connector assembly is readily adaptable to loading by automation, contrary to prior techniques which often required manual mounting. With automatic loading as many as two thousand parts an hour could easily be assembled. An additional feature of the present invention is utilizing an aluminum strip heat spacer **42** which has been epoxied to the carrier board. This aids in taking full advantage of the increased density made possible by this type of assembly. Note that the top of the connector post **32** in addition to providing a possible redundant contact also acts as a locator to assure post **32** is properly aligned relative to the lead **24** of the electrical component **22** so that the spring contact **34** of the post **32** is properly aligned relative to the component's lead **24** and does not short between two adjacent leads or the like.

I claim:

1. An electrical connector comprising mounting means for positioning said connector, terminating means for fixing a wire lead to said connector, a post formed with said mounting and terminating means, an elongated spring contact lanced out from and connected to said post, said spring contact being bent slightly out from said post with its free end being angled back toward said post, said post being tapered adjacent to the length of said spring contact and provided with a tapered free end portion on said post adjacent to said angled back free end of said spring contact, said free end of said spring contact terminating adjacent to said free end portion of said post.

2. The structure as recited in claim **1**, and further including: a tab on the free end portion of said post and in adjacent opposed relationship to said free end of said spring contact.

3. An electrical connector assembly comprising a baseboard having a hole therein, a connector as claimed in claim **1** staked in said hole, a carrier board bearing at least one electrical component and having a hole therein for accommodating a free end of said post, an electrical component mounted on said carrier board and having a bare electrical lead adjacent said hole to make positive electrical connection with the spring contact of said connector, said carrier board being positioned on said connector substantially parallel to said baseboard with said connector extending through said carrier board hole and said spring contact engaging said lead of said component.

4. An assembly as claimed in claim **3** wherein the free end of said contact is sufficiently long relative to its respective hole in said carrier board so as to catch on the underside of said carrier board.

5. An electrical connector comprising: mounting means for positioning said connector, terminating means for fixing a wire lead to said connector, a rectangular cross section post formed with said mounting and terminating means, an elongated spring contact connected to said post and being lanced out near the free end of said post, said spring contact being bent slightly out from said post with its free end being angled back toward a very slightly widened U-shaped configuration of said free end of said post to assure unencumbered flexing of the spring contact, said mounting means and terminating means being formed at the other end of said post, and said post being tapered toward said free end on both the broad and narrow sides.

6. A connector as claimed in claim **5** wherein said mounting means is formed on said post adjacent to where said spring contact joins said post and is shaped as an extension of said post having a substantially constant rectangular cross section terminating in a stop projection opposite from said first end of said post wherein said post can be mounted by interference fit in a cylindrical hole.

7. A connector as claimed in claim **6** wherein said terminating means is formed at said other end in the form of a rectangular post for point-to-point wiring.

8. A connector as claimed in claim **5** wherein said spring contact being lanced out along the length of said post is bent outwardly from said post at a small angle sufficient to make positive electrical spring engagement with a conductive surface positioned adjacent the surface of said post from which said spring contact extends and further wherein the free end of

said spring contact comprising a minor portion thereof is bent in a smooth radius back to said post at a slightly greater angle.

9. A connector as claimed in claim 8 wherein the free end of said spring contact will make an angle with said post on the order of approximately 150°.

10. An electrical connector assembly comprising a baseboard having a hole therein, a connector as claimed in claim 5 staked in said hole, a carrier board bearing at least one electrical component and having a hole therein for accommodating the first end of said post, an electrical component mounted on said carrier board adjacent said hole and having a bare electrical lead, said carrier board being positioned on said connector substantially parallel to said baseboard with said connector extending through said carrier board hole and said spring contact engaging said lead of said component.

11. An assembly as claimed in claim 10 further comprising a second similar connector staked in said baseboard spaced from said first connector by an amount sufficient to accommodate said electrical component and with its respective spring contact facing that of said first connector, said carrier board having a second hole accommodating the first end of said second connector's post, said component having a second bare electrical lead standing up away from said header and extending down clinched through said second hole in the carrier board with said spring contact of said second connector engaging said second lead.

12. An assembly as claimed in claim 10 further comprising a spacer between said carrier board and said electrical component for causing said leads to extend sufficiently far from said carrier board to engage effectively said spring contacts.

13. An assembly as claimed in claim 12 wherein said spring contacts are so formed that their free ends extend beyond the posts from which they are lanced when in engagement with said leads to an extent sufficient to engage said carrier board beyond the holes therethrough and prevent its insertion along said posts beyond the free ends of said spring contacts.

14. An assembly as claimed in claim 12 wherein said spacer is made of a thermally conductive material to serve as a heat sink.

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