United States Patent

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[72] Inventors **Hermanus Petrus Johannes Gillissen Vlijmen;**
Lucas Gerardus Christinus Teurlings, 's-Hertogenbosch, both of, Netherlands

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[73] Assignee **AMP Incorporated Harrisburg, Pa.**
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[31] **6716581**

[54] **PRINTED CIRCUIT EDGE CONNECTOR**
3 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **339/217,** 339/17, 339/176
[51] **Int. Cl.** **H01r 13/50**
[50] **Field of Search** 339/176, 217, 17, 206, 210

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Primary Examiner—Marvin A. Champion
Assistant Examiner—Robert A. Hafer
Attorneys—Curtis, Morris and Safford, Marshall M. Holcombe, William Hintze, William J. Keating, Frederick W. Raring, John R. Hopkins, Adrian J. La Rue and Jay L. Seitchik

ABSTRACT: A printed circuit edge connector comprises contact springs having contact surfaces substantially parallel to the direction of insertion of a printed circuit board, each contact spring being loaded between three laterally spaced surfaces along a contact-receiving cavity of a housing so that the contact pressure is substantially constant over the whole area of the contact surfaces so that excessive wear against specific regions of the contact surfaces containing precious metal plating is thereby avoided.

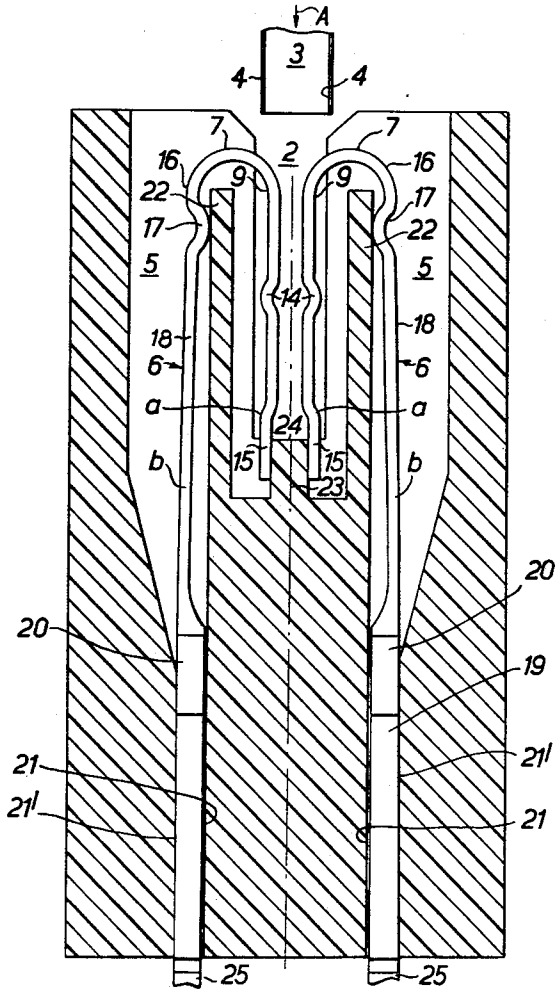

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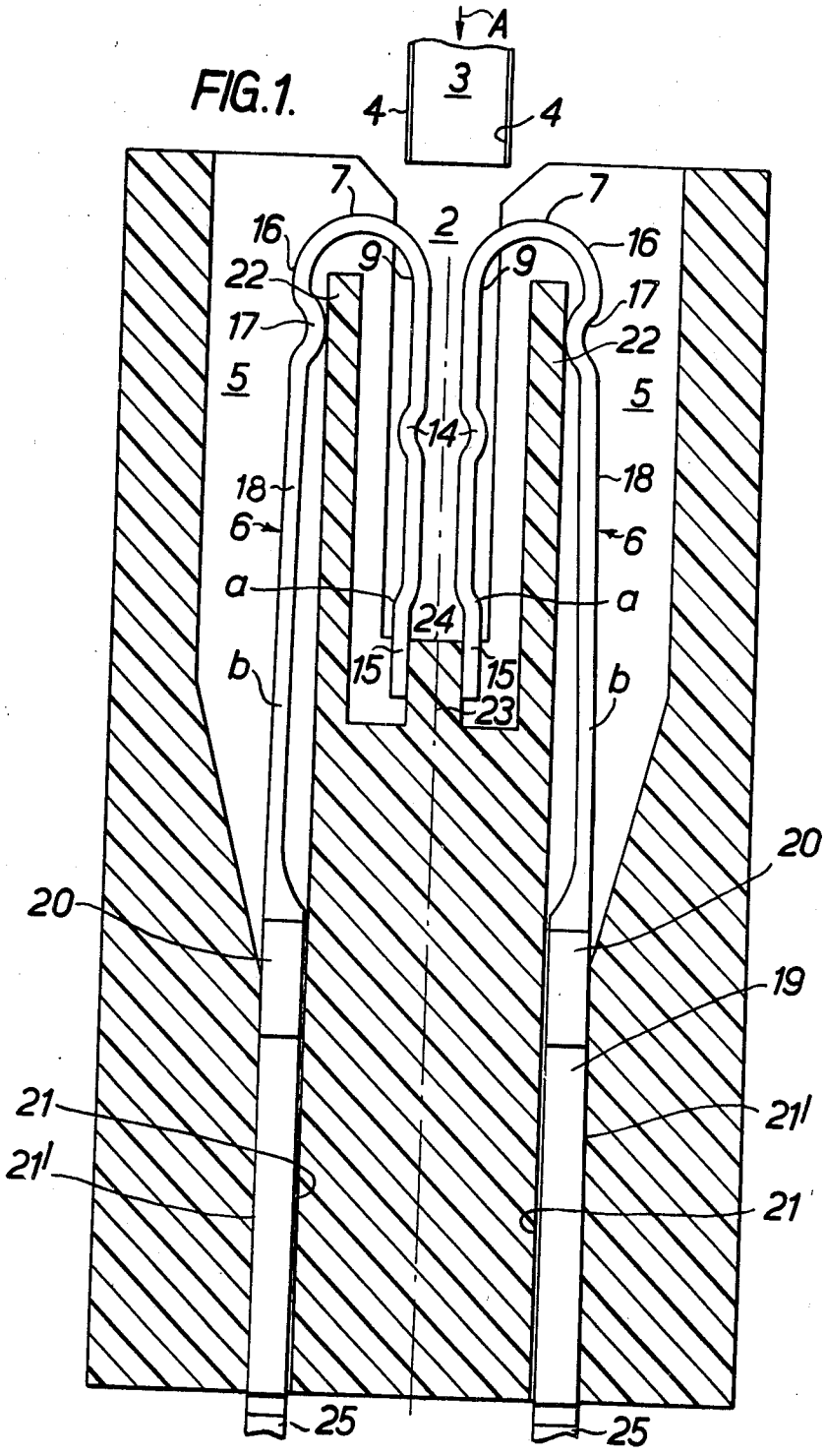
FIG. 1.



INVENTOR
HERMANUS PETRUS JOHANNES GILISSEN
LUCAS GERARDUS CHRISTINUS TEURLINGS
BY Adrian J. LaRue

FIG. 2.

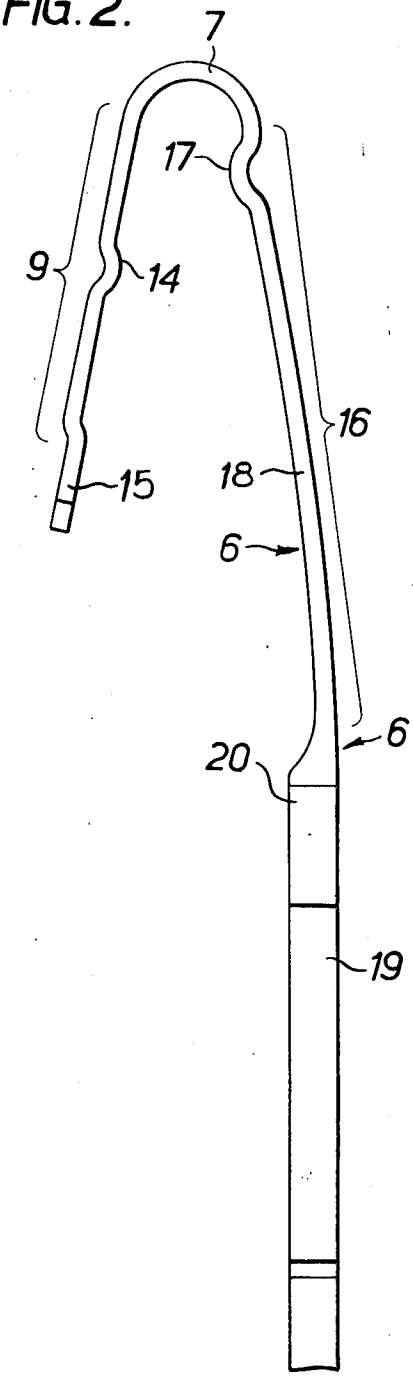
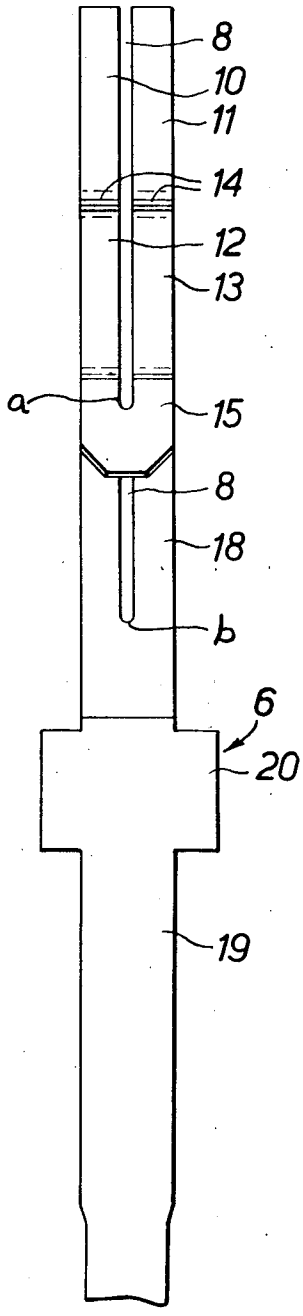


FIG. 3.



INVENTOR

HERMANUS PETRUS JOHANNES GILISSEN

LUCAS GERARDUS CHRISTINUS TEURLINGS

BY Adrian J. LaRue

PRINTED CIRCUIT EDGE CONNECTOR

This invention relates to electrical connectors and more specifically to printed circuit edge connectors having preloaded contact springs.

An electrical connector assembly for connecting an electrical lead to a printed conductor on a printed circuit panel may comprise an insulating housing defining a channel for receiving an edge of the printed circuit panel and a spring metal contact element disposed in the housing and having a contact spring portion having a contact surface or contact surfaces for engaging the panel when inserted into the channel, the contact spring portion being formed as a loop which is stressed between abutment surfaces of the housing to preload the contact surface or contact surfaces.

A disadvantage of known electrical connector assemblies of the kind described above, is that the contact surface or contact surfaces are unevenly loaded so that the total contact force between the contact surface or contact surfaces and the printed conductor are likewise uneven. This leads to undue wear on the more heavily loaded areas of the contact surface or contact surfaces, which are usually gold-plated, as a result of insertion and withdrawal of the printed circuit panel or of vibration to which the assembly, when mated with the panel, may be subjected.

An object of the invention is to provide a printed circuit edge connector which is preloaded at three spaced locations within a contact-receiving area of a dielectric housing.

Another object is the provision of a printed circuit edge connector having contact surfaces extending substantially parallel to an insertion axis thereof.

A further object is to provide a printed circuit edge connector having axially spaced contact surfaces along spring contact sections of contact elements.

An additional object is the provision of a printed circuit edge connector wherein the total contact force-to-contact surface deflection curve of the contact element rises sharply upon initial insertion of a printed circuit board into the board-receiving channel and thereafter remains substantially constant even where the board varies in thickness.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there is shown and described an illustrative embodiment of the invention; it is to be understood, however, that this embodiment is not intended to be exhaustive nor limiting of the invention but is given for purpose of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

According to the invention, an electrical connector assembly for connecting an electrical lead to a printed conductor on a printed circuit panel comprises an insulating housing defining a channel for receiving an edge of the printed circuit panel and a spring metal contact element disposed in the housing and having a loop-shaped contact spring portion having a contact surface or contact surfaces for engaging the panel when inserted into the channel, the contact surfaces extending substantially parallel to the direction of insertion of the panel into the channel and the contact spring portion being stressed between first, second and third abutment surfaces of the housing so that the contact surface or contact surfaces of the contact portion are substantially constantly loaded over the whole area of the contact surface or contact surfaces.

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

FIG. 1 is a cross-sectional view of an electrical connector assembly comprising electrical contact elements disposed in a housing;

FIG. 2 is a side view of one of the contact elements prior to being mounted in the housing; and

FIG. 3 is a view looking from the left of the contact element of FIG. 2.

The assembly shown in FIG. 1 comprises an elongate electrically insulating housing 1 defining a channel 2 for receiving in the direction of the arrow A in FIG. 1 the edge 3 of a printed circuit panel or board having thereon printed conductors 4. The housing 1 defines pockets 5 (only two of which are shown) each containing a spring metal contact element 6.

Each element 6 comprises a contact spring portion formed as a loop, the bight 7 of which is directed upwardly (as seen in FIG. 1) of the pocket 5 in which the element 6 is disposed. Each element 6 is longitudinally divided by a slot 8 (FIG. 3) between points *a* and *b* in FIG. 1 into two parts of equal width to provide bifurcated contact spring portions. One arm 9 of each loop, which arm lies in the channel 2 and extends longitudinally thereof has, as shown in FIG. 3, four discrete contact surface portions 10 to 13 defined by the slot 8 and by bights 14 bowed laterally or inwardly of the insertion axis of channel 2. Each arm 9 also has a free end portion 15 which is offset from the contact surface portions 12 and 13 of the arm 9. The other arm 16 of the loop has a bight or bowed portion defining a projection 17 bowed towards the channel 2 and from which extends a portion 18 diverging from the arm 9 downwardly (as seen in FIG. 1) and having formed integrally therewith an electrical connecting post 19 having transverse lugs 20 in the vicinity of its junction with the portion 18.

The housing 1 has openings 21 each debouching into the base of one of the pockets 5 at one end and into the lower (as seen in FIG. 1) surface of the housing 1 at the other end. Each pocket 5 has a wall 22 extending parallel to the channel 2 on one side thereof. A wall 23 extending parallel to the wall 22 and centrally of the channel 2 has an upper (as seen in FIG. 1) surface 24 forming a stop surface for the panel 3.

The posts 19 which are received in the openings 21 have portions 25 extending from the lower (as seen in FIG. 1) wall of the housing 1 for connection to electrical leads (not shown), e.g. by metallic clips or by wrapping the leads about the portions 25. In the present example, the posts 19 are of slightly oversized cross section with respect to the openings 21.

FIGS. 2 and 3 show one of the contact elements 6 prior to insertion in its pocket 5. To insert each element 6 into the housing 1, the post 19 of the element 6 is force-fitted into one of the openings 21 by engaging the lugs 20 of the element 6 with a tool (not shown) to drive the post 19 into the opening 21 until the lugs 20 of the element 6 engage a shoulder (not shown) in the opening 21 thus preventing further advance of the post 19. As the post 19 is advanced into the opening 21, the loop of the element 6 is pressed laterally away from the channel 2 so that the portion 18 of the element 6 clears the adjacent wall 22 and the portion 15 of the contact element engages the wall 23 as the post 19 is being driven home, the crest of the bowed portion or projection 17 engaging the side of the wall 22 remote from the channel 2. The element 6 is thus under stress between the walls 22 and 23 and the laterally outer side 21' of the wall of the opening 21. The contact surface portions 10 and 11 are preloaded by the arm 16, the contact surface portions 12 and 13 being preloaded by both the arms 9 and 16, each contact surface portion 10 to 13 being preloaded substantially to a constant extent over the whole of its area. Thus when the panel 3 has been inserted into the channel 2 to engage the surface 24, the contact forces exerted by the contact surface portions 10 to 13 against the panel 3 are substantially equal. The radiused loops of elements 6 define guide means to guide panel 3 between arms 9. The fact that the contact surface portions 10 to 13 extend essentially parallel to the insertion direction of the panel 3 and the fact that they are substantially equally preloaded reduces wear on

the plating of the contact surface portions where these portions are plated, as will usually be the case, with an electrically conductive corrosion resistant coating for example gold, since the contact pressure exerted by the contact surface portions **10** to **13** against the panel **3** is substantially constant over the contact areas. The even engagement between the contact surface portions **10** to **13** and the panel **3** resulting from this even contact pressure ensures that even if the assembly is vibrated at its resonant frequency there will be little damage to the plating, if present, on the contact surface portions. Shifting of the panel **3** with respect to the housing as a result, for example, of vibration causes little relative movement between the contact surface portions **10** to **13** and the panel **3** in view of the parallelism between these surface portions and the panel.

The preloading described above enables each arm **9** to be spaced from the center of the channel **2** by a distance small enough to ensure that the deflection of the contact surface portions **10** to **13** upon the insertion of the panel **3** into the channel **2** is small relative to the static contact force exerted by the contact surface portions **10** to **13** against the panel **3** in its fully inserted position.

The total contact force-to-contact surface deflection curve of the contact element rises sharply upon initial insertion of the panel **3** into the channel **2** and thereafter remains substantially constant even where the panel varies in thickness.

The preloading of the contact surface portions as well as the shape of the curve, mentioned above, can be varied by altering the relative lengths and positioning of the arms **9** and **16** with respect to the post **19**.

The posts may be secured to the housing by means other than force fitting as described above.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

The invention is claimed in accordance with the following:

1. An electrical connector comprising a dielectric housing having a channel and a pocket in communication with said channel, said pocket having an opening in communication therewith and a wall extending substantially parallel to said channel, another wall at an inner end of said channel and extending substantially parallel to said pocket wall, a contact element having a section disposed in said opening and a spring contact section including a portion extending along an inner surface of said pocket wall, a loop spaced adjacent to and extending along an outer end of said pocket wall and contact surface means extending along said channel and being substantially parallel to an insertion axis of said channel, a free end of said spring contact section disposed in engagement with said another wall, and projection means provided by said portion in engagement with said inner surface of said pocket wall, said section in said opening, said projection means in engagement with said inner pocket wall surface and said free end in engagement with said another wall providing preloaded contact surface means substantially constantly loaded over the whole area of said contact surface means.

2. An electrical connector assembly for connecting an electrical lead to a printed conductor on printed circuit panel, the assembly comprising an insulating housing defining a channel for receiving an edge of the printed circuit panel and a spring metal contact element disposed in the housing and including a loop-shaped contact spring portion having contact surface means for engaging the panel when inserted into the channel, the contact surface means extending substantially parallel to the direction of insertion of the panel into the channel and the contact spring portion being stressed between first, second and third abutment surfaces of the housing so that the contact surface means of the contact portion is substantially constantly loaded over the whole area of the contact surface means, the contact spring portion having a free end part on one side of the loop formed by the contact spring portion, this one side of the loop providing the contact surface means the free end part of the loop engaging the first abutment surface, the other side of the loop having a projection engaging the second abutment surface which extends between the two sides of the loop and being stressed between the third abutment surface and the projection.

3. An electrical connector assembly for connecting an electrical lead to a printed conductor on a printed circuit panel, the assembly comprising an insulating housing defining a channel having a mouth for receiving an edge of a printed circuit panel to be inserted into the channel and a spring metal contact element disposed in the housing and having a contact spring portion formed in the shape of a loop one side of which has a flat contact surface or flat contact surfaces for engaging the panel when inserted into the channel, such surface of surfaces extending substantially parallel to the direction of insertion of the panel into the channel, the loop-shaped contact spring portion being stressed by engagement of the contact element with first, second and third abutment surfaces of the housing, in such a way that the contact surface or contact surfaces are substantially uniformly preloaded over the whole area of the contact surface or contact surfaces, the first abutment surface being remote from the mouth of the channel and engaging a free end portion of the one side of the loop-shaped contact spring portion, the second abutment surface engaging the other side of the loop-shaped contact spring portion and cooperating with the third abutment surface to stress the other side of the loop-shaped contact spring portion, in which the first abutment surface is formed by a first wall of the housing, disposed centrally of the channel and extending in the insertion direction of the panel, the second abutment surface being formed by a second wall of the housing, which wall is parallel to the first wall, the said contact surface or contact surfaces extending parallel to the second wall to the side of that wall facing the channel, the portion or portions of the said contact surface or surfaces nearest the mouth of the channel being preloaded by that side of the loop-shaped contact spring portion which is disposed on the opposite side of the second wall to the contact surface or surfaces, and the portion or portions of the contact surfaces nearest the base of the channel being preloaded by both sides of the loop-shaped contact spring portion, in which the first and second abutment surfaces are spaced from one another in the direction of insertion of the panel, the first abutment surface lying between the second and third abutment surfaces in the direction of insertion of the panel, in which the other side of the loop-shaped contact spring portion has a projection engaging the second abutment surface which lies between the two sides of the looped-shaped contact spring portion.