

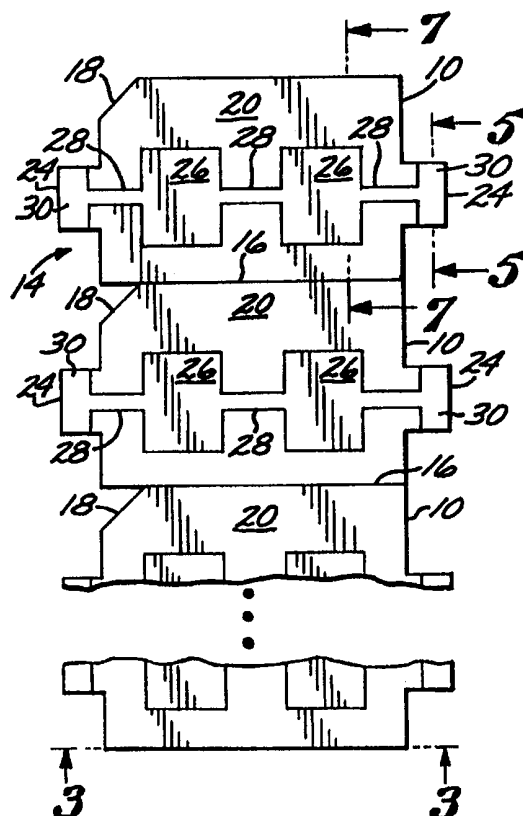
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: SUBSTRATE-BASED FEMALE CONNECTOR COMPONENT

**(57) Abstract**

A planar female electrical connector component (10) is formed on a substrate (12). The connector component includes at least one planar conductive contact element (26) formed on a major surface of the substrate, and a conductive termination (30) integral with the substrate and electrically connected to the contactelement (26). In a preferred embodiment, the substrate has substantially parallel top (20) and a bottom (22) surface, and the conductive termination is formed on a substrate projection (24) having an end surface (30d), a top surface (30a), and a bottom surface. The projection top surface (30) and the projection bottom surface (30b) are substantially coplanar with the substrate top (20) and bottom (22) surfaces, respectively. The termination is formed as a contiguous metallization on the top, bottom and end surfaces of the projection (24) and is electrically connected to the contact element (26) by a conductive trace (28) formed on a major surface of the substrate.



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1           SUBSTRATE-BASED FEMALE CONNECTOR COMPONENT

3           CROSS-REFERENCE TO RELATED APPLICATION

4           This Application claims priority under 35 U.S.C. §119(e) from U.S.  
5           Provisional Patent Application Serial No. 60/064,246; filed November 4,  
6           1998.

8           FEDERALLY-FUNDED RESEARCH OR DEVELOPMENT

9                           Not Applicable

11           BACKGROUND OF THE INVENTION

12           The present invention relates to the field of electrical connectors,  
13           and more specifically to the class of electrical connectors that employ  
14           male and female components. In particular, the present invention  
15           relates to a female connector component for use with a compliant male  
16           connector component, such as a spring-loaded male connector  
17           component.

18           Compliant electrical connectors are used in a wide variety of  
19           products that employ electronic components and circuit boards that are  
20           removable or that must be installed with a surface-to-surface contact  
21           only. Such connectors are used, for example, as battery connectors and  
22           board-to-board connectors in cellular telephones, and as connectors in  
23           removable computer peripherals.

24           Prior art connectors of this type frequently employ solid metal  
25           parts that are often supplied on a lead frame. An insulative (plastic)  
26           part or housing then holds or forms the metal part in its operational  
27           position. This structure does not easily permit the integration of other  
28           components or circuitry without significantly increasing the costs of  
29           production.

30           It would therefore be advantageous to provide a female connector  
31           component, for use with a compliant male connector component, that

1 easily permits the integration of other components. Further, it would be  
2 advantageous to provide such a female connector component that can  
3 be economically manufactured, that exhibits goods qualities of durability  
4 and reliability, that is readily adaptable for surface mounting by  
5 conventional methods on printed wiring boards, and that is compatible  
6 with conventional automation equipment and packaging.

### 8 SUMMARY OF THE INVENTION

9 Broadly, the present invention is an electrical connector  
10 component formed on a substrate, comprising at least one planar  
11 conductive contact element formed on a major surface of the substrate,  
12 and a conductive termination integral with the substrate and electrically  
13 connected to the contact element. In a preferred embodiment, the  
14 substrate has substantially parallel top and bottom surfaces, and the  
15 conductive termination is formed on a substrate projection having an  
16 end surface, a top surface, and a bottom surface. The projection top  
17 surface and the projection bottom surface are substantially coplanar  
18 with the substrate top and bottom surfaces, respectively. The  
19 termination is formed as a contiguous metallization on the top, bottom  
20 and end surfaces of the projection, and it is electrically connected to the  
21 contact element by a conductive trace formed on a major surface of the  
22 substrate.

### 24 BRIEF DESCRIPTION OF THE DRAWINGS

25 Figure 1 is a top plan view of a strip comprising a plurality of  
26 substrate-based female connector components, in accordance with the  
27 present invention, prior to separation into separate, individual  
28 components;

29 Figure 2 is an end elevational view of a single female connector  
30 component, taken from the right side of Figure 1;

1           Figure 3 is a side elevational view of a single female connector  
2 component, taken along line 3 - 3 of Figure 1;

3           Figure 4 is a bottom plan view of a single female connector  
4 component;

5           Figure 5 is cross-sectional view taken along line 5 - 5 of Figure 1;

6           Figure 6 is a cross-sectional view taken along line 6 - 6 of Figure  
7 2; and

8           Figure 7 is a cross-sectional view taken along line 7 - 7 of Figure  
9 1.

10

#### 11           DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

12           Referring now to the drawings, a substrate-based female  
13 connector component 10, in accordance with a preferred embodiment of  
14 the invention is shown. The connector component 10 comprises a  
15 substrate 12 which is preferably an insulative material, such as a ceramic  
16 or a plastic, with ceramic being most preferred. A metallic substrate 12  
17 may also be used. If the substrate 12 is metallic, however, the  
18 conductive components to be described below must be insulated from it.  
19 A plurality of the substrates 12 may be formed as a continuous strip 14,  
20 as shown in Figure 1, with adjacent pairs of substrates 12 being  
21 delineated by score lines 16, as is well known in the art. The connector  
22 components 10 can be fabricated while the substrates 12 are connected  
23 together in the strip 14, and then separated (singulated) into individual  
24 components 10 along the score lines 16. Proper orientation of the strip  
25 14 during the fabrication process, and of the substrates 12 during the  
26 end user's assembly procedures, is assured by the provision of an  
27 orientation notch 18 adjacent each score line 16.

28           Each substrate 12 has a pair of substantially parallel major  
29 surfaces, i.e., an upper surface 20 and a lower surface 22. The specific  
30 dimensions and shape (in plan view) of the substrate 12 may be varied

1 to suit any number of applications. Each substrate 12 has an integral  
2 tab or projection 24 extending from at least one end, or, preferably,  
3 from each of two opposite ends, as shown in the drawings. The upper  
4 surface 20 is provided with one or more conductive contacts 26, and  
5 with a desired number of conductive traces 28. Formed on each of the  
6 projections 24 is a conductive termination 30. The traces 28 are located  
7 so as to provide electrical interconnections between the contacts 26, and  
8 to provide electrical connections between the contacts 26 and each of  
9 the conductive terminations 30.

10 The contacts 26 and the traces 28 may be applied to the upper  
11 surface 20 of the substrate 12 by any of a number of methods well  
12 known in the art. For example, the contacts 26 and the traces 28 may  
13 be formed by electroplating a conductive metal, or by thick film  
14 deposition of a conductive ink, or by a combination of these techniques,  
15 among others. While the contacts 26 and the traces 28 are shown in the  
16 illustrated embodiment as being formed only on the upper surface 20,  
17 they may also be formed on the lower surface 22, if desired.

18 The terminations 30 may be formed by the same techniques used  
19 to form the contacts 26 and the traces 28, except that the terminations  
20 30 must be formed on at least three contiguous surfaces. Specifically,  
21 each of the tabs 24 has a top surface (coplanar with the top surface 20  
22 of the substrate 12), a bottom surface (coplanar with the bottom surface  
23 22 of the substrate 12), an end edge surface, and a pair of side edge  
24 surfaces. Of these surfaces, the terminations 30 must be formed on at  
25 least the top surface, the bottom surface, and the end edge surface, as  
26 shown in Figure 6, to form, respectively, a top termination portion 30a,  
27 a bottom termination portion 30b, and an end edge termination portion  
28 30c. Advantageously, the terminations 30 may also be formed on the  
29 side edge surfaces, as shown in Figure 5, to form a pair of side edge  
30 termination portions 30d.

1       The terminations 30 are used to connect the connector  
2 component 10, both electrically and mechanically, to a printed wiring  
3 board (not shown) by means of solder or conductive epoxy. Typically,  
4 the connection is made at the bottom termination portion 30b, but the  
5 other termination portions 30a, 30c, 30d may also be used in specific  
6 applications.

7       The particular pattern of contacts 26 and traces 28 shown in the  
8 drawings is exemplary only. The number and arrangement of these  
9 elements can be varied to suit a wide variety of applications.  
10 Furthermore, the pattern and arrangement of the contacts 26 and traces  
11 28 can be adapted to accommodate one or more surface mount  
12 components (not shown) on the top substrate surface 20 and/or the  
13 bottom substrate surface 22.

14       From the foregoing, it can be seen that the present invention  
15 provides a female connector component that easily permits the  
16 integration of other components, that can be economically  
17 manufactured, that exhibits good qualities of durability and reliability,  
18 that is readily adaptable for surface mounting by conventional methods  
19 on printed wiring boards, and that is compatible with conventional  
20 automation equipment and packaging.

21       While a preferred embodiment has been described above, it will  
22 be appreciated that a number of variations and modifications will  
23 suggest themselves to those skilled in the pertinent arts. Many such  
24 modifications and variations have been discussed or suggested above.  
25 Such modifications and variations are considered to be within the spirit  
26 and scope of the invention, as described in the claims that follow.

1 WHAT IS CLAIMED IS:

2 1. An electrical connector component formed on a substrate,  
3 comprising:

4 a planar conductive contact element formed on a major  
5 surface of the substrate; and

6 a conductive termination integral with the substrate and  
7 electrically connected to the contact element.

8

9 2. The electrical connector component of Claim 1, wherein the  
10 substrate includes a projection that is substantially coplanar with the  
11 major surface, and wherein the termination is formed on the substrate  
12 projection.

13

14 3. The electrical connector component of Claim 2, wherein the  
15 projection has an end surface, a top surface, and a bottom surface, and  
16 wherein the termination comprises a contiguous metallization on the top  
17 projection surface, the bottom projection surface, and the end  
18 projection surface.

19

20 4. The electrical connector component of Claim 3, wherein the  
21 projection has a pair of opposed side surfaces, and wherein the  
22 termination comprises a contiguous metallization on the projection top  
23 surface, the projection bottom surface, the projection end surface, and  
24 the projection side surfaces.

25

26 5. The electrical connector component of Claims 1, 2, 3, or 4,  
27 wherein the contact element is electrically connected to the termination  
28 by a conductive trace on the major surface.

29

30



1           6. The electrical connector component of Claims 1, 2, 3, or 4,  
2 wherein the contact element is formed of electroplated metal.

3

4           7. The electrical connector component of Claims 1, 2, 3, or 4,  
5 wherein the contact element is formed of a thick film conductive ink.

6

7           8. An electrical connector component, comprising:

8               a substrate having substantially parallel top and bottom  
9 surfaces and first and second opposed ends;

10              a projection extending from at least one of the substrate  
11 ends and having top and bottom surfaces that are substantially  
12 coplanar with the top and bottom surfaces, respectively, of the  
13 substrate;

14              a planar conductive contact element disposed on at least  
15 one of the top and bottom surfaces of the substrate; and

16              a conductive termination on the projection and electrically  
17 connected to the contact element.

18

19           9. The electrical connector component of Claim 8, wherein the  
20 projection has an end surface, and wherein the termination comprises a  
21 metallization comprises a contiguous metallization on the top projection  
22 surface, the bottom projection surface, and the end projection surface.

23

24           10. The electrical connector component of Claim 9, wherein the  
25 projection has a pair of opposed side surfaces, and wherein the  
26 termination comprises a contiguous metallization on the projection top  
27 surface, the projection bottom surface, the projection end surface, and  
28 the projection side surfaces.

29

30

1           11. The electrical connector component of Claims 7, 8, 9, or 10,  
2 wherein the contact element is electrically connected to the termination  
3 by a conductive trace on the major surface.

4

5

6           12. The electrical connector component of Claims 7, 8, 9, or 10,  
7 wherein the contact element is formed of electroplated metal.

8

9           13. The electrical connector component of Claims 7, 8, 9, or 10,  
10 wherein the contact element is formed of a thick film conductive ink.

## AMENDED CLAIMS

[received by the International Bureau on 22 March 1999 (22.03.99);  
original claims 2,3 and 9 cancelled; original claims 1,4-8,10,  
11-13 amended; (3 pages)]

1. (Amended) An electrical connector component formed on a substrate that includes a major surface and a projection that is substantially coplanar with the major surface, the projection having an end surface, a top surface, and a bottom surface, the component comprising:

a planar conductive contact element formed on the major surface of the substrate; and

a conductive termination formed on the substrate projection and electrically connected to the contact element, wherein the termination comprises a contiguous metallization on the top projection surface, the bottom projection surface, and the end projection surface.

2. (Canceled)

3. (Canceled)

4. (Amended) The electrical connector component of Claim 1, wherein the projection has a pair of opposed side surfaces, and wherein the termination comprises a contiguous metallization on the projection top surface, the projection bottom surface, the projection end surface, and the projection side surfaces.

5. (Amended) The electrical connector component of Claims 1 or 4, wherein the contact element is electrically connected to the termination by a conductive trace on the major surface.

1           6. (Amended) The electrical connector component of Claims 1 or 4,  
2 wherein the contact element is formed of electroplated metal.

3  
4           7. (Amended) The electrical connector component of Claims 1 or 4,  
5 wherein the contact element is formed of a thick film conductive ink.

6  
7           8. (Amended) An electrical connector component, comprising:  
8           a substrate having substantially parallel top and bottom surfaces and first  
9 and second opposed ends;

10           a projection extending from at least one of the substrate ends and  
11 including top and bottom surfaces that are substantially coplanar with the top  
12 and bottom surfaces, respectively, of the substrate, the projection further  
13 including an end surface;

14           a planar conductive contact element disposed on at least one of the top  
15 and bottom surfaces of the substrate; and

16           a conductive termination on the projection and electrically connected to  
17 the contact element, wherein the termination comprises a contiguous  
18 metallization on the top projection surface, the bottom projection surface, and  
19 the end projection surface.

20

21           9. (Canceled)

22

23           10. (Amended) The electrical connector component of Claim 8, wherein  
24 the projection has a pair of opposed side surfaces, and wherein the termination  
25 comprises a contiguous metallization on the projection top surface, the  
26 projection bottom surface, the projection end surface, and the pair of opposed  
27 projection side surfaces.

1           11. (Amended) The electrical connector component of Claims 8 or 10,  
2       wherein the contact element is electrically connected to the termination by a  
3       conductive trace on the major surface.

4

5           12. (Amended) The electrical connector component of Claims 8 or 10,  
6       wherein the contact element is formed of electroplated metal.

7

8           13. (Amended) The electrical connector component of Claims 8 or 10,  
9       wherein the contact element is formed of a thick film conductive ink.

STATEMENT UNDER ARTICLE 19

The replacement sheets submitted herewith include pages 1 and 6-8.

Page 1 has been changed to correct a typographical error in the priority date set forth at lines 5-6. The correct date of November 4, 1997 is now stated.

The claims on pages 6-8 have been amended as follows:

Page 6: Claim 1 has been amended to include the subject matter of claims 2 and 3, which have been canceled. Claim 4 has been amended to depend from claim 1, and claim 5 has been amended to depend from claims 1 or 4.

Page 7: Claims 6 and 7 have been amended to depend from claims 1 or 4. Claim 8 has been amended to include the subject matter of claim 9; which has been canceled. Claim 10 has been amended to depend from claim 8.

Page 8: Claims 11-13 have been amended to depend from claims 8 or

1/1

FIG. 1

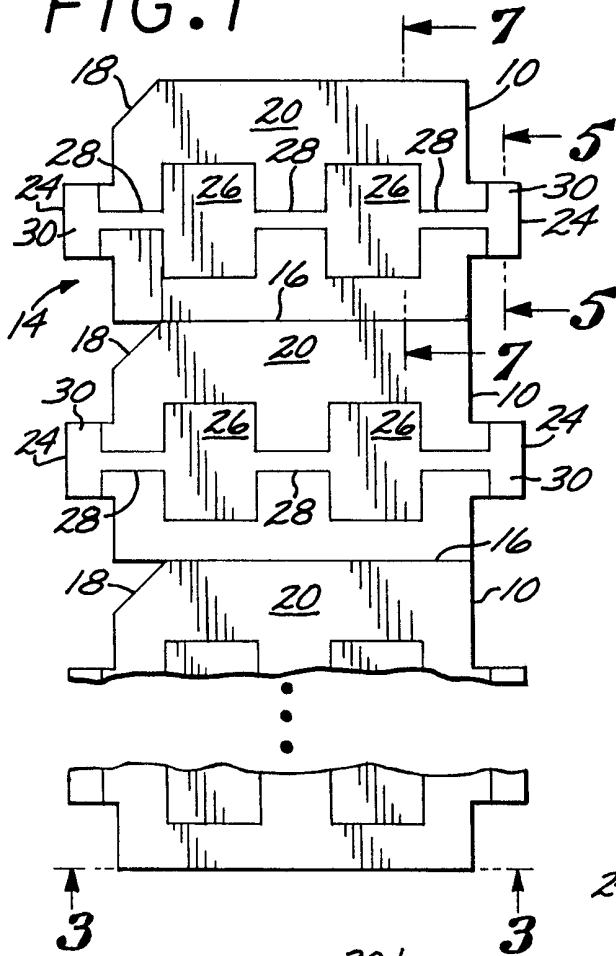


FIG. 2

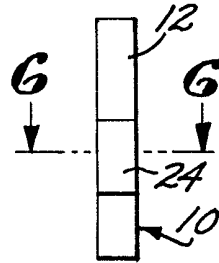


FIG. 3

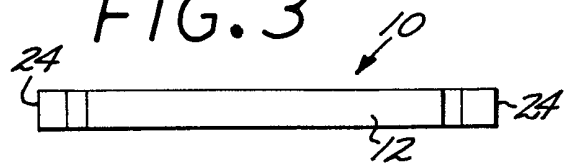


FIG. 4

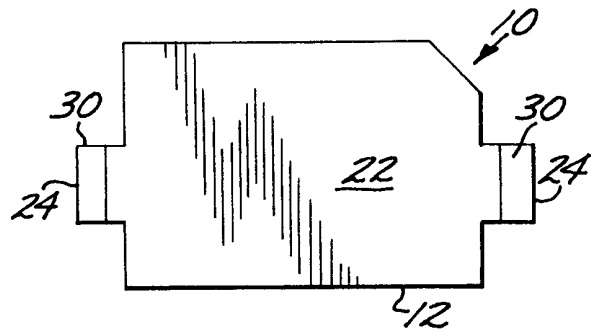


FIG. 6

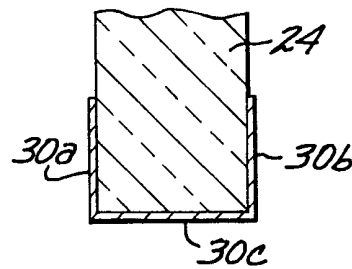


FIG. 5

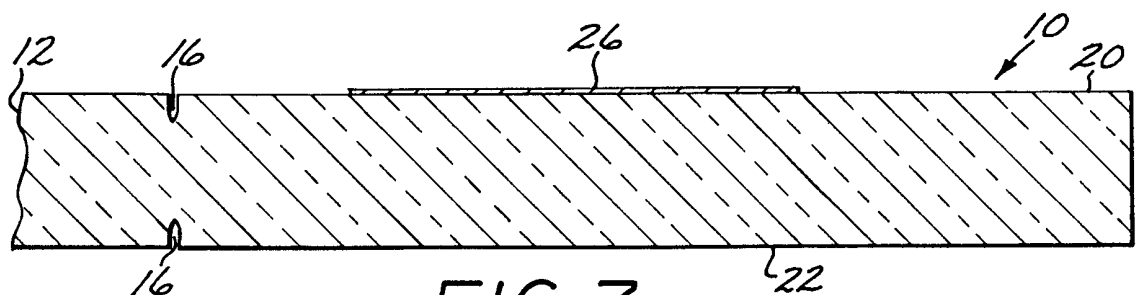
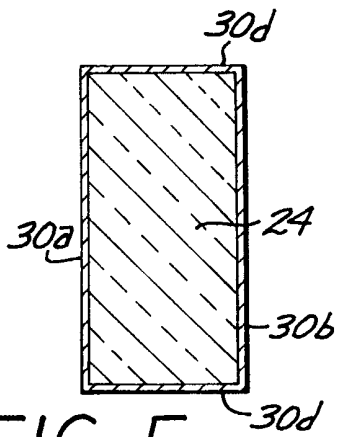


FIG. 7

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/23145

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : H01R 9/09

US CL : 439/55

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 439/55, 76.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
none

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,044,963 A [KUKKONEN ET AL.] 03 SEPTEMBER 1991(03/09/91), SEE FIGURES 2 AND 4.	1, 2, 8
X	US 4,018,495 A [FREITAG] 19 APRIL 1977(19/04/77), SEE ENTIRE DOCUMENT	1-6, 8-12
X	US 4,770,645 A [ANTES] 13 SEPTEMBER 1988(13/09/88), SEE COLUMN 4, LINES 38-42 AND 66-68.	1, 2, 7, 8, 13

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

23 DECEMBER 1998

Date of mailing of the international search report

26 JAN 1999

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