



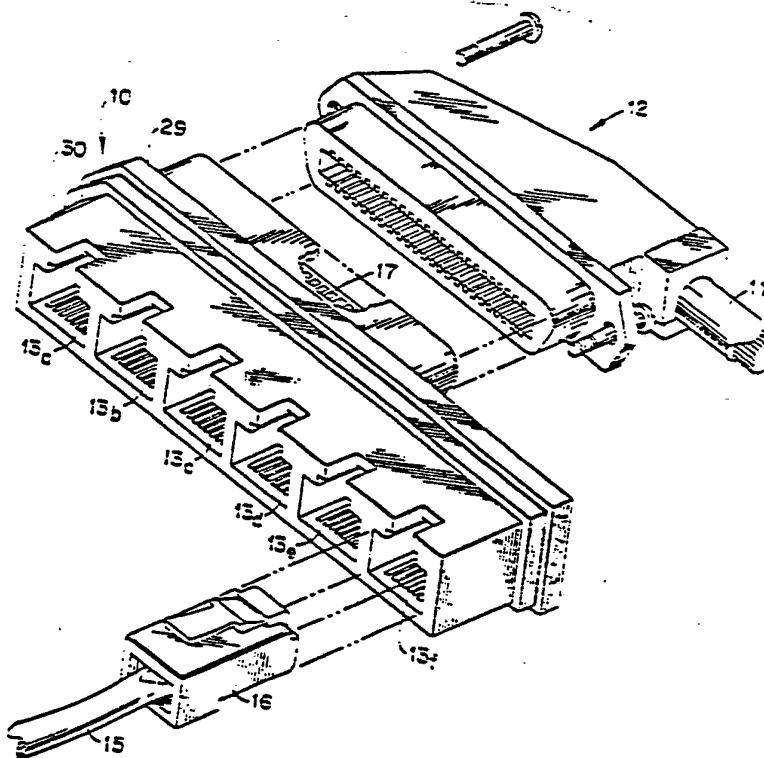
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US83/00456 (22) International Filing Date: 1 April 1983 (01.04.83) (31) Priority Application Numbers: 365,855 365,856 (32) Priority Dates: 5 April 1982 (05.04.82) 5 April 1982 (05.04.82) (33) Priority Country: US (71) Applicant: AKZONA INCORPORATED [US/US]; P.O. Box 2930, Asheville, NC 28802 (US). (72) Inventors: JOHNSTON, James, J. ; 14 Anchorage Lane, Old Saybrook, CT 06475 (US). VADEN, James, L. ; Route 3, Box 358, Weaverville, NC 28787 (US). (74) Agent: CARTER, David, M.; Akzona Incorporated, P.O. Box 2930, Asheville, NC 28802 (US).</p>		<p>(81) Designated States: DE (European patent), FR (European patent), GB (European patent), JP.  <b>Published</b> <i>With international search report.</i></p>

(54) Title: INTERFACE CONNECTOR

(57) Abstract

A novel interface connector for electrically interconnecting input (15) and output (11) cables which are terminated with multiple contact element, separable electrical connectors (12 and 16). The interface finds particular use where the input (15) and output (11) cables are terminated with dissimilar or nonmating connectors. The novel interface of the invention employs internal printed circuitry (20), rather than hard wiring. A separable electrical connector which has at least one resilient electrical contact (22') having a generally bowed or arched portion (54) intermediate its two ends (55 and 56) is also included. The two ends (55 and 56) of the contact element (22') are retained against a backer surface in the connector housing so that the contact functions as a doubly supported beam structure. A forward end of the contact is protected from mechanical damage by a shroud (58).



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INTERFACE CONNECTORBACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates to interface connectors for electrically connecting selected conductors of at least one input cable to selected conductors of at least one output cable, wherein said input and output cables are terminated with multiple contact element, separable electrical connectors. The invention finds particular use in telephone distribution wiring where there is commonly a need to interconnect various cables which are terminated with dissimilar, i.e., non-mating, connectors. The specifically disclosed embodiment of the invention is designed, in particular, to interconnect a 25 pair, band marked distribution (BMD) cable, which is terminated with a female ribbon connector, with several telephone instruments, which each have cables terminated with modular plugs.

This invention further relates to electrical connectors and, more particularly, to an electrical connector having doubly supported, bow-shaped contact elements which are each protected by a shroud.

## 2. Description of the Prior Art

It is common practice in the telephone industry to use 25 conductor pair, band marked distribution (BMD) cable in commercial installations where it is necessary to connect a large number of telephone devices to a central distribution box and where selective access must be had by each telephone device to a relatively large number of incoming telephone lines. Typically, BMD cable is terminated with a so-called female ribbon connector, such as, the "Champ" manufactured by AMP, Inc. or the "Blue Ribbon" manufactured by Amphenol Company.



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Until recently, it had also been a standard practice to terminate the cable of each telephone instrument, or keyset, with a mating, male ribbon connector with the instrument cable being connected  
5 only to those contact elements in the connector needed to pick up the desired telephone lines.

For a variety of reasons, most prominently the need to curtail the rising cost of skilled labor, but also in order to reduce the actual cost of the  
10 connectors themselves, most telephone companies are today endeavoring to equip substantially all new telephone instruments, including multiple line keysets, with so-called modular plugs rather than the connectors used in the past. The production of keyset telephone  
15 instruments having modular plugs presents an obvious problem where installation is required in a building which is wired with BMD cable terminated with ribbon connectors; the two connector types are non-mating.

The use of modular plugs has, accordingly,  
20 spawned the need for interface connectors which are able to mate both with the ribbon connectors used to terminate BMD cable and with the modular plugs used on the telephone instruments. All such devices will, of necessity, comprise at least one male ribbon connector  
25 of the known per se variety and at least one modular receptacle, also of the known per se variety. Means, of one sort or another, must also be provided within the interface connector for electrically connecting selected contact elements of the ribbon connectors to  
30 selected contact elements of the modular receptacles.

It is in this last regard that most, if not all, prior art interface connectors have exhibited a rather severe shortcoming; that is, discrete wire conductors have been used to make the required internal  
35 connections within the interface. The use of such internal hard wiring in a connector is undesirable for



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several reasons. First, connector assembly where hard wiring is involved is labor intensive and connectors so produced must be priced accordingly. In addition, the use of manual assembly, which is almost certainly  
5 required to produce a hard wired connector, introduces the possibility of assembler error. And, finally, hard wired interface connectors cannot achieve the degree of compactness which is often desired.

From the above discussion, it should be evident that there exists a great need for an improved  
10 interface connector which does not make use of internal hard wiring. The present invention fulfills this need.

A number of known per se separable electrical  
15 connectors utilize spring loaded contact elements which have a generally bowed or arched configuration and which are retained in a connector housing so as to function as doubly supported beam structures. Such contact elements may be found in either plug or recep-  
20 tacle connector housings and are adapted for sliding or wiping electrical engagement with corresponding contact elements in complementary connector housings. The contact elements found in most so-called "ribbon" connectors are exemplary of the type referred to.

25 Experience with connectors of the above-described variety has, to some extent, proven unsatisfactory, because the contact elements of many designs are susceptible to mechanical damage. Such damage to the contact elements may occur, for example, through  
30 the improper mating of connector parts or through the improper insertion of tools and the like into the connector. A bent or otherwise damaged contact element will, of course, render the connector useless.



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OBJECTS OF THE INVENTION

Accordingly, it is one object of this invention to provide an improved interface connector which overcomes the above disadvantages.

5 It is another object of this invention to provide an electrical connector having doubly supported, bow-shaped contact elements which are protected from mechanical damage.

10 It is a further object of the invention to provide an electrical connector having protected contact elements wherein the means for protecting said contact elements do not alter the desirable mechanical properties thereof.

15 And it is a further object of the invention to provide a connector having such contact protection means which is, nonetheless, compatible and able to mate with known per se connectors.

SUMMARY OF THE INVENTION

20 In accordance with one form of the present invention, there is provided an interface connector which comprises at least one connector means for making separable electrical connection to a female ribbon connector and at least one connector means for making separable electrical connection to a modular plug. The  
25 contact elements of these connector means are directly connected, as by soldering, to a common printed circuit board. Conductive paths on the board are provided for making the desired interconnections between contact elements in the two types of connector means. An in-  
30 sulating housing contains the printed circuit board and preferably also incorporates both types of connector means as integral portions thereof.

In accordance with another form of the invention, there is provided a separable electrical connector which includes at least one resilient electrical  
35 contact element having a generally bowed or arched



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portion intermediate its two ends. The two ends of the contact element are retained against a backer surface in the connector housing so that the contact functions as a doubly supported beam structure. A forward end of the contact is protected from mechanical damage by a shroud which is molded into the connector housing.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a drawing depicting the interface connector of the invention in the environment of its intended use, connected, at its input side, to a BMD cable terminated with a ribbon connector and, at its output side, to a telephone instrument equipped with a modular plug.

Figure 2 is an exploded, isometric view of the interface connector according to the invention.

Figure 3 is front, plan view of the interface connector according to one form of the invention.

Figure 3' is front, plan view of the interface connector according to another form of the invention.

Figure 4 is a rear, plan view of the interface connector according to one form of the invention.

Figure 4' is a rear, plan view of the interface connector according to another form of the invention.

Figure 5 is a partial view, from one end, of the interface connector according to one form of the invention.

Figure 5' is a partial view, from one end, of the interface connector according to another form of the invention.

Figures 6, 7 and 8 depict a novel contact element used in the interface connector.



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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning first to Figure 1, the interface connector 10 provided by the invention is depicted in its intended environment of use. An input, 25 conductor pair, BMD cable 11, coming from a central distribution box, not shown, is terminated with a female ribbon connector 12 of the known per se variety. An output cable 15, having eight conductors, leads to a telephone instrument, not shown, which is to be connected into the system. Cable 15 is terminated with a modular plug 16 of the known per se variety. The interface 10 is provided on one side with a male ribbon connector 17, which mates with the female 12, and on the other side with six modular receptacles 13a-13f, each of which is adapted to receive a plug such as 16. It will be noted that, when assembled as shown, the combination of ribbon connector, interface and modular plug possesses an in-line or 180° configuration.

Figures 2 through 5 illustrate the construction of interface 10. The connector comprises a printed circuit board 20 to which there is affixed, on one side, an input array 21 which includes forty-eight to fifty electrical contact elements 22. Each contact element 22 is retained by the board by press fit insertion of a tail portion thereof into a plated through hole 23 in the board followed by heating to reflow the solder, in a manner well known in the art. The contact elements 22 in the input array 21 are suitably arranged for making electrical contact with corresponding contact elements of the female ribbon connector 12 which terminates the input cable 11.

To the other side of the printed circuit board 20, there are affixed six output arrays, 24a through 24f, of wire spring electrical contact elements 25. Each of the contact elements 25 is also retained by the board by press fit insertion of a tail portion thereof into a plated through hole 26 in the board



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followed by heating to reflow the solder. The contact elements 25 in each of the arrays 25a through 25f are suitably arranged for making electrical contact with corresponding contact elements of a modular plug, such as 16, terminating an output cable, such as 15.

A plurality of plated, conductive paths 27 (only a few of which are shown) are provided on both sides of the printed circuit board 20 for electrically interconnecting preselected contact elements 22 in the input array 21 to preselected contact elements 25 in the output arrays 24a through 24f.

The precise interconnections to be thus made by the conductive paths 27 will, of course, be a matter of design choice. For example, in an interface wherein each output array comprises eight contact elements, as in the embodiment shown, it might be desired to connect the eight contact elements in output array 24a to a first group of eight contact elements in the input array 21, the eight contact elements in output array 24b to a second group of eight contact elements in the input array, and so on. In this way, each of the arrays 24a through 24b will provide access to different groups of telephone lines. As an alternative, the contact elements in all six output arrays may be be connected to a single group of contact elements in the input array. This scheme would permit the connection of six telephone instruments to the same group of telephone lines.

An insulating housing contains the printed circuit board 20, together with the electrical contact elements 22 and 25 which are affixed thereto. Preferably, the housing comprises two housing portions 29 and 30 which are adapted to fit together, as shown, to form the whole.

As depicted in Figure 3, the housing portion 29 includes exterior embossments 31a and 31b which



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together constitute an embossment which is a mating surface for a female ribbon connector. The electrical contact elements 22 extend through openings 40 in housing portion 29 and are positioned upon the embossment 31b in a standard male ribbon connector array.

As shown in Figure 4, the housing portion 30 comprises the six modular receptacles, 13a through 13f, each of which is an aperture appropriately dimensioned to receive a modular plug, such as the plug 16. As shown in Figure 5, each of the receptacles 13a through 13f has a first end 34 located at the face 33 and a second end 35 opposite thereto which is located within the interface interior. An internal floor member 36 runs between the ends 34 and 35 of each receptacle.

In the assembled interface, the printed circuit board 20 forms a rear wall of each of the plug receiving receptacles, 13a through 13f, located at the second ends 35 thereof. The electrical contact elements 25 in each of the output arrays, 24a through 24f, extend from the printed circuit board 20 into the respective receptacles 13a through 13f, running from the second ends 35 of the apertures toward the first ends 34. In each receptacle, the wire spring contacts 25 are positioned upon the internal floor member 36 and are maintained in a spaced-apart, side-by-side relationship by a comb 37 on the floor member. An arched portion 38 intermediate the two ends of each of the contacts 25 is provided for making electrical contact with a corresponding contact element of a modular plug.

As will be readily appreciated by those skilled in the connector art, the two housing portions 29 and 30 may be securely assembled by any of a variety of means, including gluing or ultrasonic welding.



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The present invention is regarded to be, most broadly, an interface for connecting selected conductors of at least one input cable to selected conductors of at least one output cable wherein said  
5 input and output cables are each terminated with a multiple contact element, separable electrical connector and wherein the interface relies on an internal printed circuitry rather than hard wiring.

While the interface of the disclosed embodiment is adapted to connect together input and output  
10 cables which are terminated with ribbon connectors and modular plugs, respectively, the use of such termination in the disclosed embodiment should not be construed as limiting. Obviously, an interface according  
15 to the invention may be constructed for use with input and output cables which are terminated with other connector types.

Similarly, while a printed circuit board is utilized in the disclosed embodiment, printed circuitry,  
20 including flexible printed circuitry, may in general be used.

Figures 3', 4' and 5' illustrate an alternative construction of interface 10. The connector comprises a printed circuit board 20 to which there is  
25 affixed, on one side, an input array 21 which includes, more or less, fifty resilient electrical contact elements 22'. Each contact element 22' is retained by the board by press fit insertion of a tail portion thereof into a plated through hole 23 in the board  
30 followed by heating to reflow the solder, in a manner well known in the art. If the contact elements 22' are fabricated of sheet metal stock, however, it is preferred to use the novel press fit configuration depicted in Figures 6, 7 and 8. In this novel configuration,  
35 the tail 70 of the contact 22' is stamped so that it has generally "V" shaped cross section wherein the



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legs 71 and 72 of the V are initially spread so as to be slightly wider than the diameter of the plated through hole 23. The contact tail has a bevel 73 which facilitates insertion of the tail into the hole. As the tail is so inserted, the V configuration resiliently folds together slightly so that the edges 74 and 75 are urged to bite into the plating 76 lining the hole. The contact elements 22' in the input array 21 are suitably arranged for making electrical contact with corresponding contact elements of the female ribbon connector 12 which terminates the input cable 11.

To the other side of the printed circuit board 20, there are affixed six output arrays, 24a through 24f, of resilient electrical contact elements 25'. Each of the contact elements 25' is also retained by the board by press fit insertion of a tail portion thereof into a plated through hole 26 in the board followed by heating to reflow the solder. The contact elements 25' in each of the arrays 25a through 25f are suitably arranged for making electrical contact with corresponding contact elements of a modular plug, such as 16, terminating an output cable, such as 15.

A plurality of plated, conductive paths 27 (only a few of which are shown) are provided on both sides of the printed circuit board 20 for electrically interconnecting preselected contact elements 22' in the input array 21 to preselected contact elements 25' in the output arrays 24a through 24f.

An insulating housing contains the printed circuit board 20, together with the electrical contact elements 22' and 25' which are affixed thereto. Preferably, the housing comprises two housing portions 29 and 30 which are adapted to fit together, as shown, to form the whole.

As depicted in Figure 3, the housing portion 29 includes exterior embossments 31a' through 31b'



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which together constitute an embossment which is a mating surface for a female ribbon connector. The electrical contact elements 22' extend through openings 40 in housing portion 29 and are positioned upon the embossment 31b' in a standard male ribbon connector array.

As shown in Figure 4, the housing portion 30 comprises the six modular receptacles, 13a through 13f, each of which is an aperture appropriately dimensioned to receive a modular plug, such as the plug 16. As shown in Figure 5, each of the receptacles 13a through 13f has a first end 34 located at the face 33 and a second end 35 opposite thereto which is located within the interface interior. An internal backer surface 36 runs between the ends 34 and 35 of each receptacle.

In the assembled interface, the printed circuit board 20 forms a rear wall of each of the plug receiving receptacles, 13a through 13f, located at the second ends 35 thereof. The electrical contact elements 25' in each of the output arrays, 24a through 24f, extend from the printed circuit board 20 into the respective receptacles 13a through 13f, running from the second ends 35 of the apertures toward the first ends 34. In each receptacle, the resilient contacts 25' are positioned upon the internal backer surface 36 and are maintained in a spaced-apart, side-by-side relationship by a comb 37 on the floor member. An arched portion 38 intermediate the two ends of each of the contacts 25' is provided for making sliding or wiping electrical contact with a corresponding contact element of a modular plug and for lending resilience to the contact element. Because each contact is supported at both of its two ends, 50 and 51, by the backer surface 36, the contacts function as doubly supported beam structures and are, consequently, fairly rigid.



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An overhang 52 is provided for enshrouding the end 50 of the contact element 25'. Overhang 52 protects the contact element 25' from mechanical damage by not allowing the end 50 to be lifted and bent back by an object entering the connector (for example, another connector or a tool). At the same time, however, it will be noted that the overhang 52 permits entry of the plug 16 into the receptacle.

It will be further noted that a clearance space 53 is provided under the overhang. The space 53 permits expansion of the contact 25' in the direction  $X_1$  when the contact in plug 16 exerts a mating force  $F_1$ .

On the ribbon connector side of the interface, it will be noted that resilient contact element 22' also comprises an arched or bowed portion 54 intermediate its two ends 55 and 56. The arched portion is adapted to slidably or wipingly engage a corresponding contact element in the female ribbon connector 12 and, also, provides resilience for the contact element 22'. A backer surface 57 of the embossment 31 (b)' supports the ends 55 and 56 of the contact element 22 so that the element functions as a relatively rigid doubly supported beam structure.

Overhangs 58 are provided on the end of the male embossment 31b' to shroud and protect the ends of the contact elements 22', in the same way that the overhang 52 protects the contact element 25'. Once again, clearance spaces 59 are provided under the overhangs 58 to allow expansion of the contact elements 22' in the direction  $X_2$  in response to the mating force  $F_2$ . It will be noted that the overhangs 58 do not interfere with the mating of the male and female ribbon connectors.

From the foregoing description of the embodiments of the invention, it will be apparent that



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changes and modifications in construction obvious to those skilled in the art which do not depart from the scope of the invention are intended by the appended claims to be covered.



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I CLAIM:

1. An interface connector, having an in-line configuration, for electrically connecting selected conductors of an input cable to selected conductors of an output cable wherein said input cable is terminated with a female ribbon connector of the known per se variety and wherein said output cable is terminated with a modular plug of the known per se variety, wherein said interface comprises:
- 10 (a) a printed circuit board having first and second sides;
- (b) an input array of electrical contact elements affixed to said first side of said printed circuit board, the various contact elements in said array being suitably arranged for making electrical contact with corresponding contact elements of a female ribbon connector terminating said input cable;
- 15 (c) an output array of electrical contact elements affixed to said second side of said printed circuit board, the various elements in said array being suitably arranged for making electrical contact with corresponding contact elements of a modular plug terminating said output cable;
- 20 (d) a plurality of conductive paths on said printed circuit board electrically connecting preselected contact elements in said input array to preselected contact elements in said output array; and,
- 25 (e) an insulating housing within which said printed circuit board is contained, said housing having a first and a second face on an opposite side thereof, said printed circuit board residing therebetween, an appropriately dimensioned male ribbon connector embossment being provided on said first face of said housing to join with said female ribbon connector
- 30
- 35



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to permit the mating of contact elements of said ribbon connector with corresponding contact elements in said input array on said circuit board, and an appropriately dimensioned aperture being provided in said second face of said housing to receive said modular plug to permit the mating of contact elements of said modular plug with corresponding contact elements in said output array on said printed circuit board.

2. An interface according to Claim 1 wherein said male ribbon connector embossment projects from said first face, an input array of electrical contact elements extending from said printed circuit board and through said first face, in a standard male ribbon connector contact array, upon said embossment, and further, wherein said modular plug receiving aperture extends from and through said second face into said housing, said aperture having a first end located at said second face, a second end opposite thereto and an internal floor member running between said first and second ends, wherein said printed circuit board is positioned so as to form, at least partially, a rear wall of said plug receiving aperture at the second end thereof, and, wherein said electrical contact elements in said output array extend from said printed circuit board into said plug receiving aperture and toward said first end thereof, said contact elements being positioned so as to lie upon said internal floor member of said plug receiving aperture.

3. An interface according to Claim 1 for connecting one input cable terminated with one female ribbon connector to six output cables each terminated with a modular plug.

4. An interface according to Claim 1 wherein said insulated housing is comprised of first and second housing portions which are adapted to be joined together to form said housing, wherein said first



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housing face is included in said first housing portion and wherein said second housing face is included in said second housing portion.

5 5. A modular receptacle for receiving a modular plug of the known per se variety, said receptacle comprising:

an insulating housing;

10 an aperture which extends from and through a face of said housing into the interior thereof, said aperture being appropriately dimensioned to receive a modular plug therein and having a first end located at said housing face, a second end opposite thereto and an internal floor member running between said first and second ends;

15 said receptacle further comprising a plurality of wire spring electrical contact elements which lie upon said internal floor member in a spaced-apart, side-by-side array wherein each contact element extends substantially from said first end to said second end of said aperture.

20 6. The receptacle of Claim 5 wherein each of said wire spring electrical contact elements comprises an arched portion intermediate to its two ends.

25 7. The receptacle of Claim 5 wherein said internal floor member comprises comb means for maintaining said wire spring electrical contact elements in said spaced-apart, side-by-side array.

30 8. The receptacle of Claim 5 further comprising a rear wall member at the second end of said plug receiving aperture wherein said wire spring electrical contact elements extend from said rear wall into said aperture.

9. A separable electrical connector comprising:



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an insulating separable connector housing configured to slidably mate with a complementary separable connector housing;

a backer surface in said housing;

5 at least one resilient electrical contact element having first and second ends and an arched portion intermediate thereto, said first end being fixedly secured to said housing and said first and second ends being supported by said backer surface so  
10 that said contact element functions as a doubly supported beam structure, said contact element being configured to slidably engage a corresponding element in said complementary housing when said two housings are mated; and,

15 an overhang on said backer surface enshrouding said second end of said contact element so as to protect the same from damage.

10. The connector of Claim 9 wherein a clearance space is included under said overhang for  
20 allowing said contact element to expand in response to the force of engaging said corresponding contact element.

11. The connector of Claim 9 wherein said overhang allows the mating of said two housings.

25 12. The connector of Claim 9 wherein said connector is a male adapted to mate with a female.

13. The connector of Claim 9 wherein said first end of said electrical contact element is fixedly secured to a printed circuit board retained in said  
30 housing.

14. The connector of Claim 13 wherein said electrical contact element comprises a tail which is adapted to be press fit into a plated through hole in said printed circuit board, said tail having a  
35 generally V-shaped cross section wherein the legs of



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the V are initially spread so as to be slightly wider than the diameter of said plated through hole.

15       15. The connector of Claim 9 wherein said housing comprises an appropriately dimensioned male ribbon connector embossment, which embossment comprises said backer surface.

10       16. The connector of Claim 9 wherein said housing comprises an aperture which extends from and through a face of said housing into the interior thereof, said aperture being appropriately dimensioned to receive a modular plug therein and having a first end located at said housing face and a second end opposite thereto, wherein said back surface comprises a member running between said first and second ends.

15       17. An electrical contact element designed for press fit insertion into a plated through hole of a printed circuit board, said contact element comprising a tail portion having a generally V-shaped cross section wherein the legs of the V are initially spread  
20       so as to be slightly wider than the diameter of said plated through hole.

18. The electrical contact element of Claim 17 wherein said tail portion is beveled to facilitate insertion thereof into said plated through hole.



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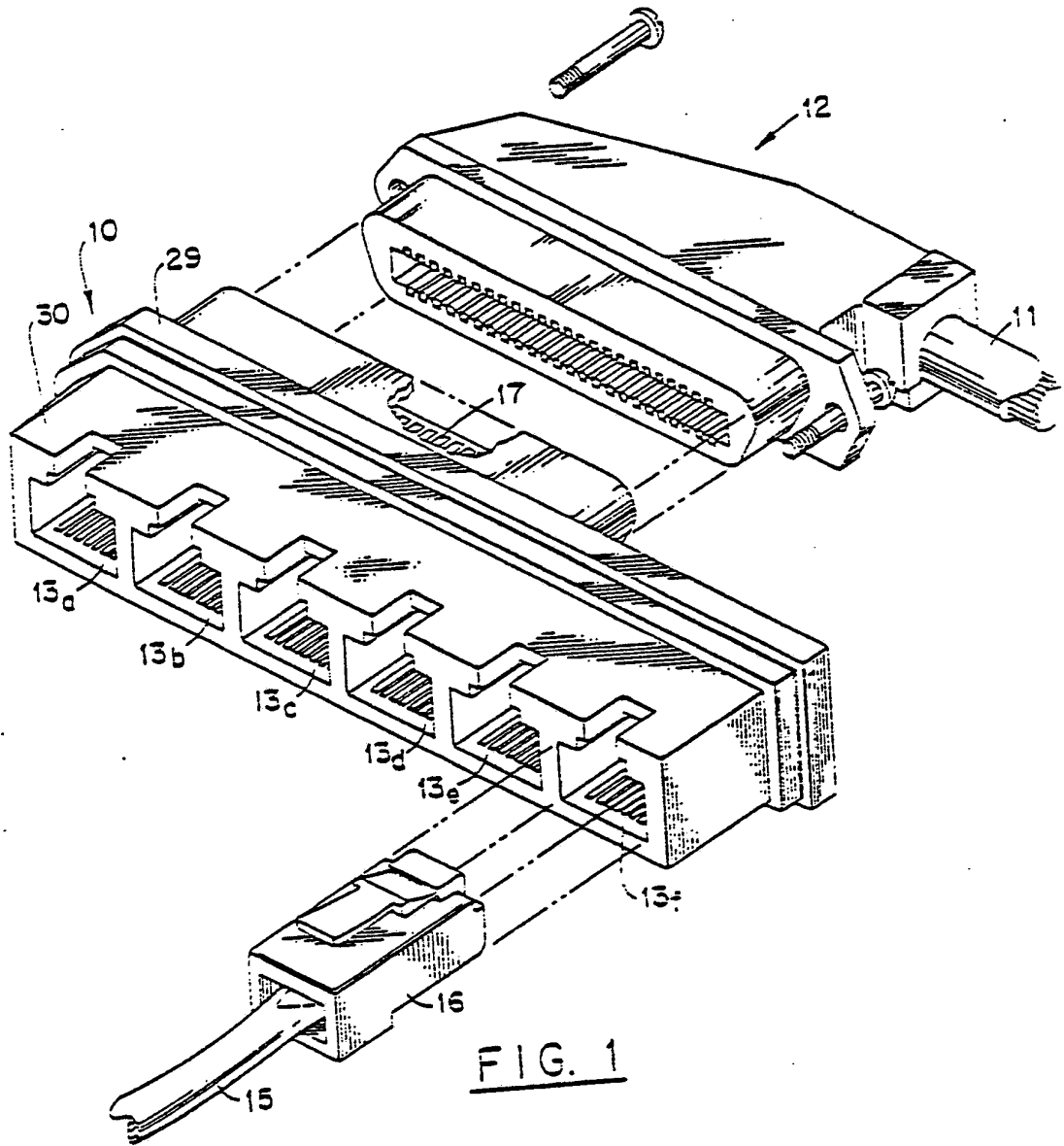


FIG. 1

SUBSTITUTE SHEET



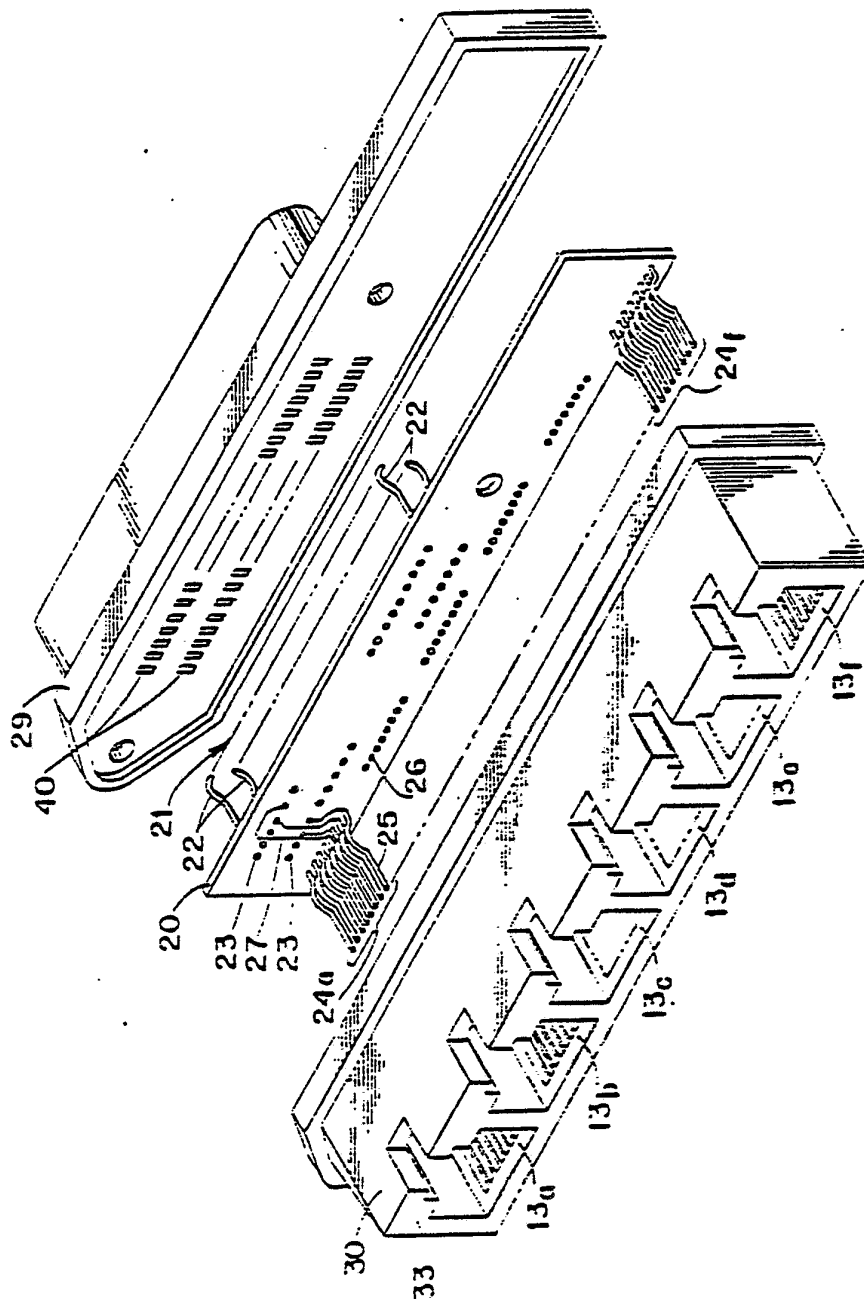


FIG. 2



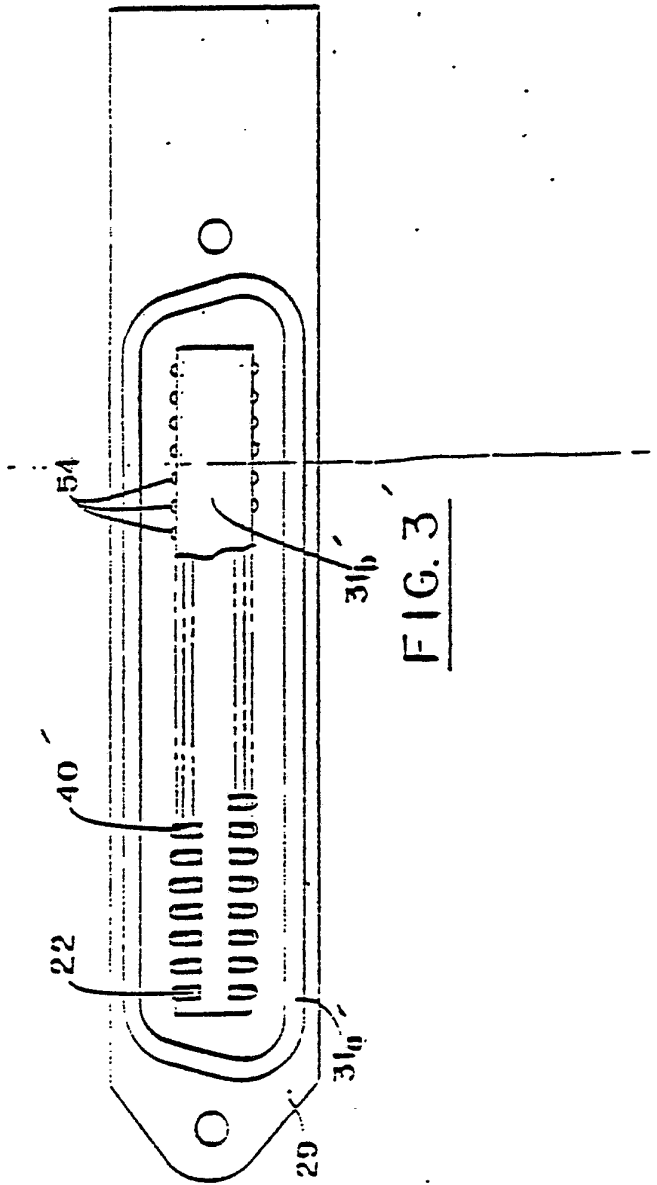


FIG. 3

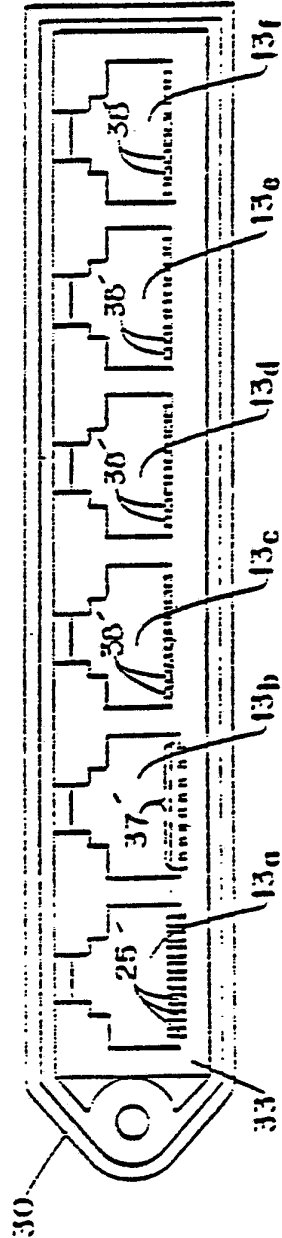


FIG. 4



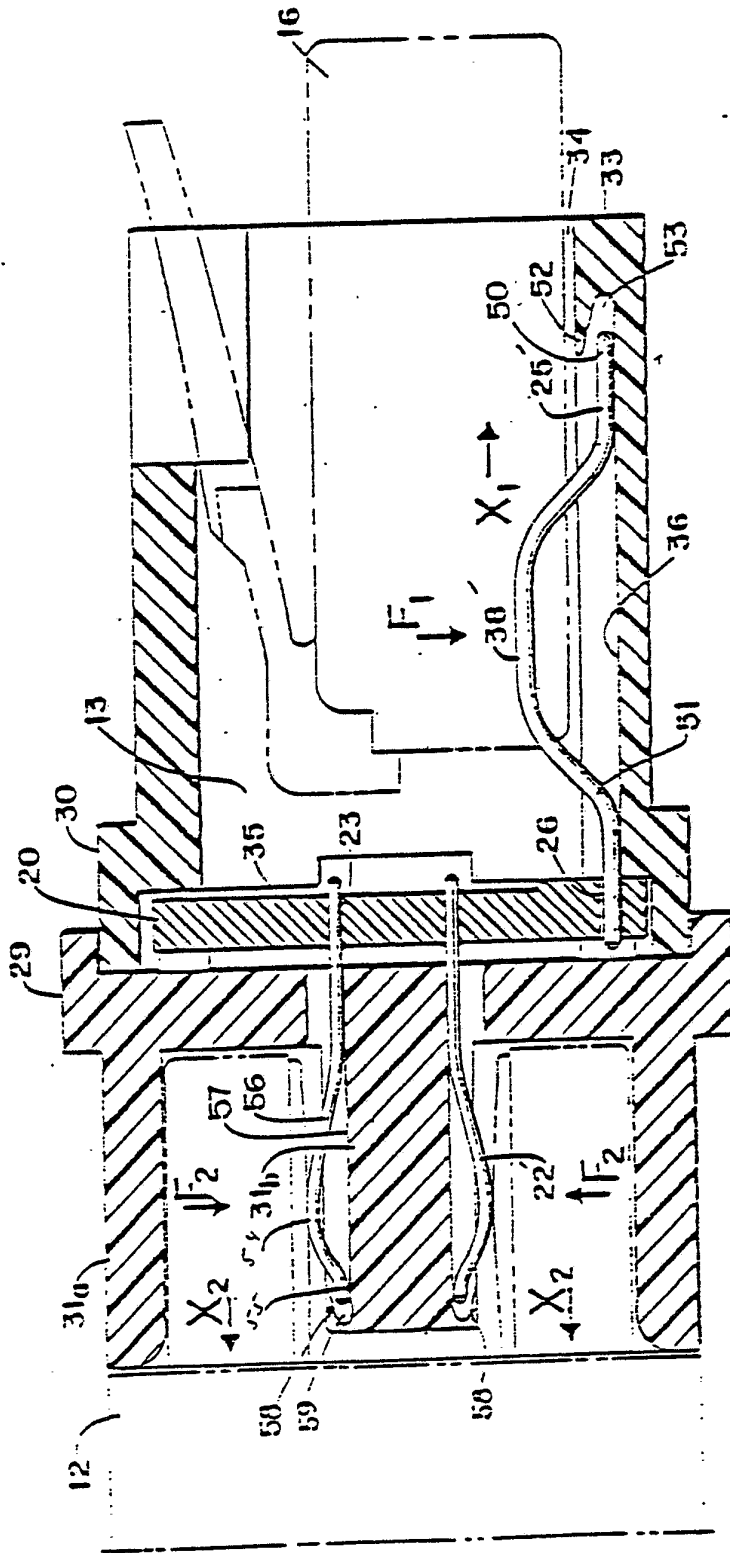


FIG. 5



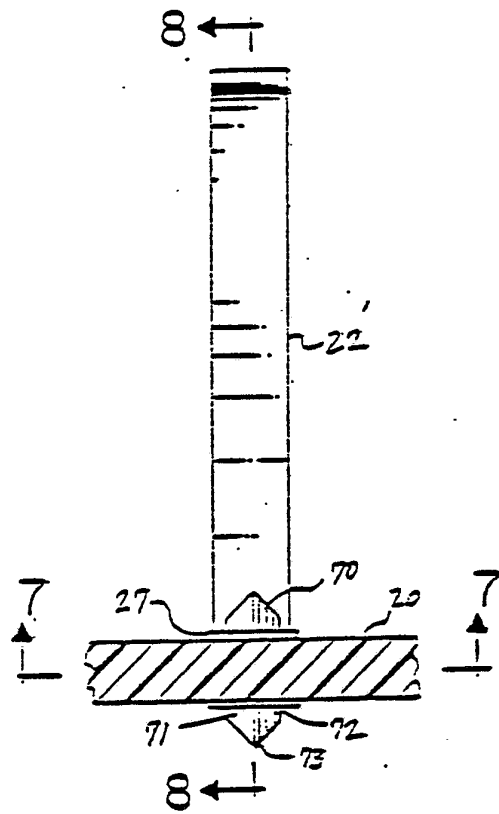


FIG. 6

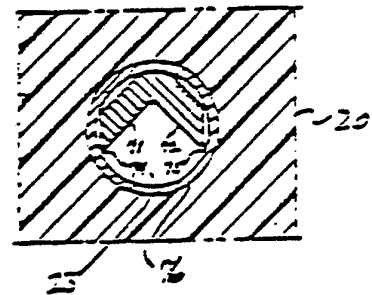


FIG. 7

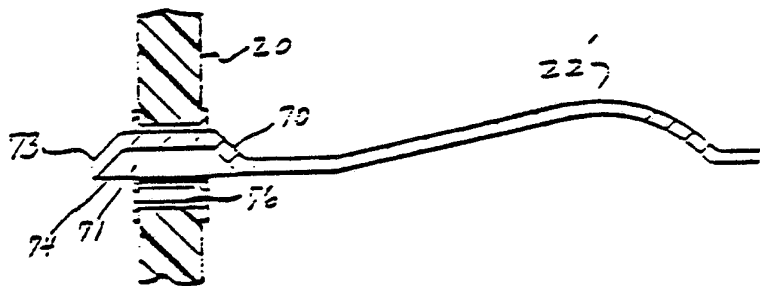


FIG. 8



# INTERNATIONAL SEARCH REPORT

International Application No PCT/US83/00456

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>3</sup>				
According to International Patent Classification (IPC) or to both National Classification and IPC				
INT CL3 H01R 9/09, 27/02 US 339/17.C, 156.R				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched <sup>4</sup>				
Classification System	Classification Symbols			
US	339/17.R, C, LC, 156.R			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>				
Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>		
Y	US, A, 4,286,835 (Adams et al) 01 Sept 1981	1-4		
Y	US, A, 3,551,874 (Volinskie) 29 Dec. 1970	1-4		
Y,E	US, A, 4,385,791 (Lovrenich) 31 May 1983	1-4		
Y	N, Telephone Engineer and Management, issued 15 Jan. 1981, advertisement for Multi- Jack Adapters	1-4		
X	US, A, 3,101,231, (Klostermann) 20 Aug. 1963	5-16		
X	N, IBM Technical Disclosure  Bulletin, Volume 5, No.5, issued Oct 1962, H.C. Schick, Component Mounting And Wire Wrapping Contact, page 10	17,18		
<p><sup>15</sup> Special categories of cited documents:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </td> <td style="width: 50%; border: none;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or 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</p> <p>"X" document of particular relevance</p> </td> </tr> </table>			<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or 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</p> <p>"X" document of particular relevance</p>
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<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search <sup>3</sup>	Date of Mailing of this International Search Report <sup>2</sup>			
07 July 1983	<b>21 JUL 1983</b>			
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>			
ISA/US	<i>Neil Abrams</i>			