



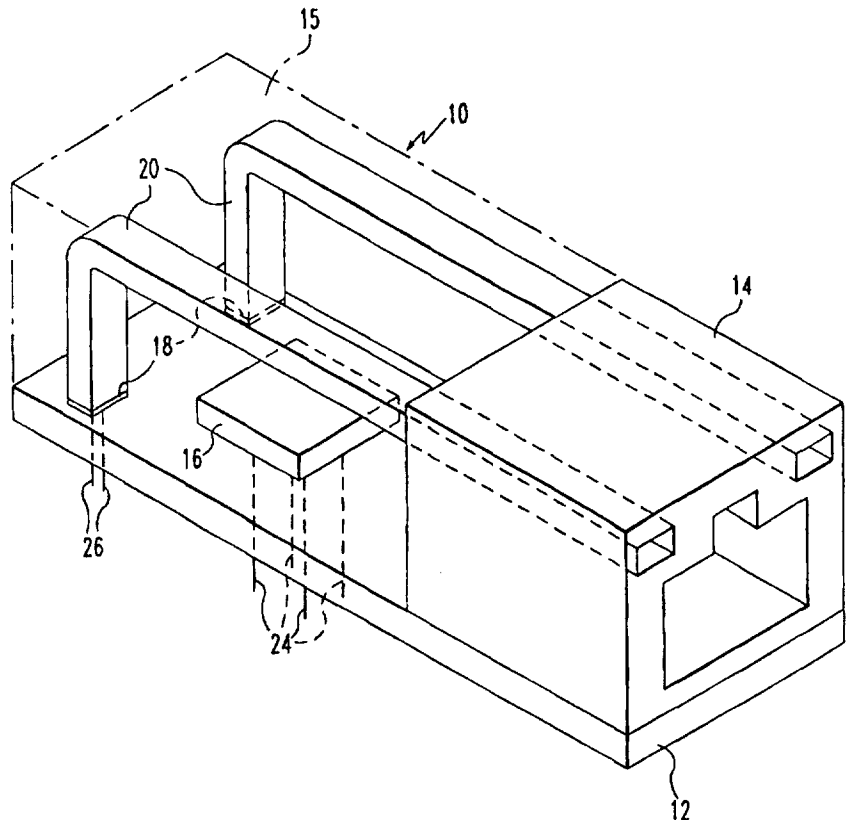
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/US97/12205</p> <p>(22) International Filing Date: 24 July 1997 (24.07.97)</p> <p>(30) Priority Data: 60/022,973 2 August 1996 (02.08.96) US 08/846,699 30 April 1997 (30.04.97) US</p> <p>(71) Applicant: BERG TECHNOLOGY, INC. [US/US]; One East First Street, Reno, NV 89501 (US).</p> <p>(72) Inventors: BELOPOLSKY, Yakov; 2407 West Bayberry Drive, Harrisburg, PA 17112 (US). OLEYNICK, Gary, J.; 1452 Valleda Lane, Encinitas, CA 92024 (US). SOMERVILLE, James, A.; 215 Dogwood Drive, Hershey, PA 17033 (US).</p> <p>(74) Agents: LONG, Daniel, J. et al.; 825 Old Trail Road, Etters, PA 17319 (US).</p>		<p>(81) Designated States: CN, JP, KR, SG, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published <i>With international search report.</i></p>

(54) Title: CONNECTOR WITH CIRCUIT DEVICES AND INDICATORS

(57) Abstract

A console including an electrical connector adapted to be mounted on a printed circuit board (PCB) comprising a base member (12) mounted on the PCB, an insert member (14a) mounted on the base member, a jack member (14b) engaging said insert member and a component member (16) positioned on the base member remotely from said insert member and said jack member.



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CONNECTOR WITH CIRCUIT DEVICES AND INDICATORS**Background of the Invention**

1. **Field of the Invention:** This invention relates to electrical connectors and particularly to connector modules incorporating diverse elements including signal conditioning components and/or visual indicators. The invention has particular adaptability to modular jacks.
2. **Brief Description of Prior Developments:** At present, connectors such as modular jacks are usually mounted onto a circuit board forming a part of the electronic device for which the modular jack is an input/output connection. The terminals of the jack are usually electrically connected to surface traces on the circuit board by through-hole or surface mount soldering techniques. The circuit traces in turn lead to discrete signal processing elements such as low pass filters, common mode chokes, isolation transformers and other inductors to process electronic signals provided to or from the jack. Such signal conditioning elements are necessary to accommodate ever increasing signal rates achieved in telecommunications and data transmission networks.

Developers of network systems and the like have expressed a desire to have the line status of an array of such modular jacks independently indicated for each jack. The usual way of accomplishing this is to provide a series of LEDs on the circuit board, with light transmitting elements for carrying light from the LED to a portion of the face plate of the device in

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which the array of jacks is mounted. Because the LEDs are considered relatively electrically noisy, they are usually mounted on an electrically isolated, separately grounded portion of the circuit board. In turn, this results in the visual indicators being separated from the jacks. This separation causes the determination of line status for an array of jacks to be made more difficult.

Summary of the Invention

The present invention comprises a console including an electrical connector adapted to be mounted on a printed circuit board (PCB) comprising a base member mounted on the PCB, an insert member mounted on the base member, a jack member engaging said insert member and a component member positioned on the base member remotely from said insert member and said jack member.

Brief Description of the Drawings

The present invention is further defined by the accompanying drawings in which:

Fig. 1 is an isometric view of one embodiment of the connector module of the present invention;

Fig. 2 is an exploded view of a connector module;

Fig. 3 is an exploded view of another embodiment of a connector module according to the invention;

Fig. 4 is an elevational view of an element of the module shown in Fig. 3;

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Fig. 5 is a side view of another embodiment of the connector module of the present invention including visual indicators.

Fig. 6 is a front view of the modular jack used in the connector module shown in Fig. 5;

5 Fig. 7 is an embodiment of the module shown in Fig. 5 with a shield applied;

Fig. 8 is a side view of a modified version of the module illustrated in Fig. 3; and

Fig. 9 is a front elevation of the insert shown in Fig. 8.

10 **Detailed Description of the Preferred Embodiments**

Some effort has been made to make the LEDs integral with the housing of the modular jack, but this is considered undesirable because of electrical noise considerations. To avoid compromising the signals, the LEDs are separately mounted from the signal conditioning elements.

15 Fig. 1 shows an isometric view of a connector module according to the invention. The module 10 includes a base member 12, which can comprise a printed circuit board, a lead frame or other mounting substrate. A connector 14 is mounted on the printed circuit board 12 and can comprise a modular jack, such as an RJ 45 jack. The housing of the
20 jack 14 has a cavity for receiving a plug and has contact terminals disposed within the cavity for mating with terminals on the plug. Tail ends of the terminals are electrically connected, as by soldering, to traces (not shown) on the printed circuit board 12.

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In order to electrically quiet or otherwise condition signals provided to or received from the jack 14, suitable electrical components, represented by the component 16, are mounted on the printed circuit board. Such elements commonly comprise filters, common mode chokes, isolation transformers, etc.

One or more light sources, such as LEDs 18, are mounted on the printed circuit board 12 in a manner electrically isolated from the components 16. Light from the LEDs is transmitted to the front face of the jack 14 by suitable light conductors, such as plastic fibers 20. The fibers 20 extend from the LEDs, through the housing of the jack 14, to the front face of the jack. In this fashion, a visual indication of desired information, such as line status, can be indicated directly on the front face of each jack.

As added protection to the components mounted on the printed circuit board 12 behind the connector 14, an overmolded material or encapsulate 15 or a metal shield can be applied to the printed circuit board 12. This results in a one-piece connector module that can be mounted on a printed circuit board (not shown), through an appropriate I/O pin arrangement 24 that separates noise bearing lines from quiet lines and provides for connection to quiet and noisy ground planes. Suitable pins 26 are provided for LEDs 18. Thus, a single connector module 10 can be provided that easily and quickly mounts onto a base circuit board without the need for mounting separate electrical components and/or visual signal elements;

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Fig. 2 illustrates the construction of a connector module, without a visual indicator, and utilizing an available type of modular jack. In this arrangement, the jack 14 comprises an inverted L-shaped insert 14a that carries the jack terminals 15. The terminal tails 15a are through-hole
5 mounted on the printed circuit board 12. The insert 14a is slidably received in the housing 14b of the jack. Desired electrical components 16 are mounted on the printed circuit board 12 and are encapsulated or shielded so that the board 12, jack 14 and encapsulant form a single module. Electrical signals are passed to and from the module by signal
10 pins 17 that are received in the printed circuit board (not shown) on which the module is mounted;

Fig. 3 shows the elements of a connector module with which space requirements are minimized. In this embodiment, the modular jack includes a housing 14b in which is received a terminal insert 14c
15 comprising an insulative carrier 14d and the terminals 15. In this embodiment, the terminal tails 15d extend directly beyond the carrier 14d. The carrier 14d is designed to be mounted by sliding into suitable grooves within the housing 14b. For this module, a small circuit board 28 formed of a suitable circuit board material, such as FR-4, is sized to fit
20 within the rear portion of the jack housing 14b. Appropriate electronic components such as the common mode choke 30 and the isolation transformer 32 are mounted on one or both sides of the board 28. Signal leads 36 extend from the board 28 in the usual I/O pattern.

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Module shown in Fig. 3 is constructed by mounting the circuit elements 30 and 32 and the contact pins 36 on the board 28. The jack terminal insert 14c is then mounted on the board 28 with the terminal ends 15d of the terminals 15 extending through conductive holes in 34
5 along the upper edge of the board 28.

The thus assembled unit is then inserted within the housing 14b to form an integral connector module;

Fig. 5 illustrates a side elevational view of a module generally of the type shown in Fig. 1. In this arrangement, the plastic light fibers 20 are
10 carried in a common light fiber assembly 38. The light fiber assembly 38 is fixed by appropriate means, such as an adhesive, onto the top or into the housing of the jack 14. Placing the light fibers 20 into an assembly 38 can impart sufficient structural strength so that the need for an encapsulant becomes less important. Also, a module of the type shown in
15 Fig. 3 could be utilized in which the components 16 are essentially housed within the jack housing 14 as in the Fig. 3 embodiment. In this case, the LEDs 18 can be placed physically closer to the jack 14, but preferably remain electrically isolated therefrom. In such an arrangement, the element 38 can be significantly shortened;

20 Referring to Fig. 7, if desired, the module 10 can be provided with additional EMI shielding capabilities by enclosing the top, side and rear surfaces and also the front surfaces with a metal shield.

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Fig. 8 shows a modification to the module illustrated in Fig. 3. In this embodiment, LEDs 18 are mounted on board 28 and light pipes 21 carry the light to the front face of jack housing. The jack is mounted on a circuit board 12 that includes signal traces 12a and at least two
5 separated ground planes, one a "noisy" ground plane 12b and the other a quiet ground plane 12c. A terminal 36a provided for one or both of LEDs 18 is connected to the noisy ground plane 12b. A terminal 36b is provided for connection of the signal conditioning components of board 28 to the quiet ground plane 12c. Fig. 10 shows the mounting of LEDs 18 on
10 board 28.

The advantages of the disclosed system arise from providing a self contained module that provides necessary signal conditioning and/or visual indication functions. Such units increase the efficiency of the assembly process of equipment employing such components, as they
15 eliminate the need for separately mounting the connector and associated components onto the circuit board. The components will provide desired signal quality and can also provide desired visual indications of status.

While the present invention has been described in connection with the preferred embodiments of the various figures, it is to be
20 understood that other similar embodiments may be used or modifications and additions may be made to the described embodiment for performing the same function of the present invention without deviating therefrom. Therefore, the present invention should not be limited to any single

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embodiment, but rather construed in breadth and scope in accordance with the recitation of the appended claims.

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Claims**WHAT IS CLAIMED IS:**

1. A console including an electrical connector adapted to be mounted on a printed circuit board (PCB) comprising:
 - 5 (a) a base member mounted on the PCB;
 - (b) an insert member mounted on the base member;
 - (c) a jack member engaging said insert member; and
 - (d) a component member positioned on the base member remotely from said insert member and said jack member.
- 10 2. The module of claim 1 wherein the base member is remotely mounted on the PCB.
3. The console of claim 1 wherein the insert member is removably
15 mounted on the base member.
4. The console of claim 1 wherein the insert member has a plurality of conductive contacts and the jack has a plurality of conductive contacts and said insert member contacts engage the jack conductive contacts.
- 20 5. The module of claim 1 wherein the base member is superimposed over the PCB in parallel side by side relation.

6. The module of claim 2 wherein the insert has a vertical section and a horizontal section and the horizontal section is inserted to the housing of the jack and the vertical section removably engages the base member.
- 5
7. The module of claim 1 wherein the base member has an end and is mounted end wise on the PCB.
8. The module of claim 3 wherein the base member is mounted in
10 space end wise relation on the PCB.
9. The module of claim 8 wherein the insert member horizontally engages the base member.
- 15 10. The module of claim 9 wherein the insert horizontally engages the housing of the jack.
11. The module of claim 10 wherein the base has a plurality of
conductive contacts which extend first laterally toward and then
20 downwardly toward the PCB and the plurality of conductive contacts
which extend first laterally away from the jack and then downwardly to
engage the PCB.

12. The module of claim 1 wherein at least one of the electrical components is a signal conditioning means.

5 13. The module of claim 12 wherein the signal conditioning means is a low pass filter.

14. The module of claim 12 wherein the signal conditioning means is a common mode choke.

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15. The module of claim 12 wherein the signal conditioning means is an isolation transformer.

16. The console of claim 1 wherein the electrical component member is
15 a light emitting diode (LED).

17. The console of claim 16 wherein the jack has a front face and the LED is connected to said front face of the jack by a light conducting means.

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18. The console of claim 17 wherein the LED provides a visual indication of line status.

19. A console including an electrical connector adapted to be mounted on a printed circuit board (PCB) comprising:

- 5 (a) a base member superimposed on the PCB in parallel side by side relation;
- (b) a jack member having a housing with an insert receiving opening and a plurality of conductive contacts;
- (c) at least one light emitting diode (LED) mounted on the base member; and
- 10 (d) light conducting means connecting the LED and the front side of the jack.

20. A console including an electrical connector adapted to be mounted on a printed circuit board (PCB) comprising:

- 15 (a) a base member superimposed over the PCB in perpendicular spaced relation;
- (b) a jack having a housing with a front face and a jack receiving opening and a plurality of conductive contacts;
- (c) at least one light emitting diode (LED) mounted on the base member; and
- 20 (d) light conducting means connecting the LED and the front side of the jack.

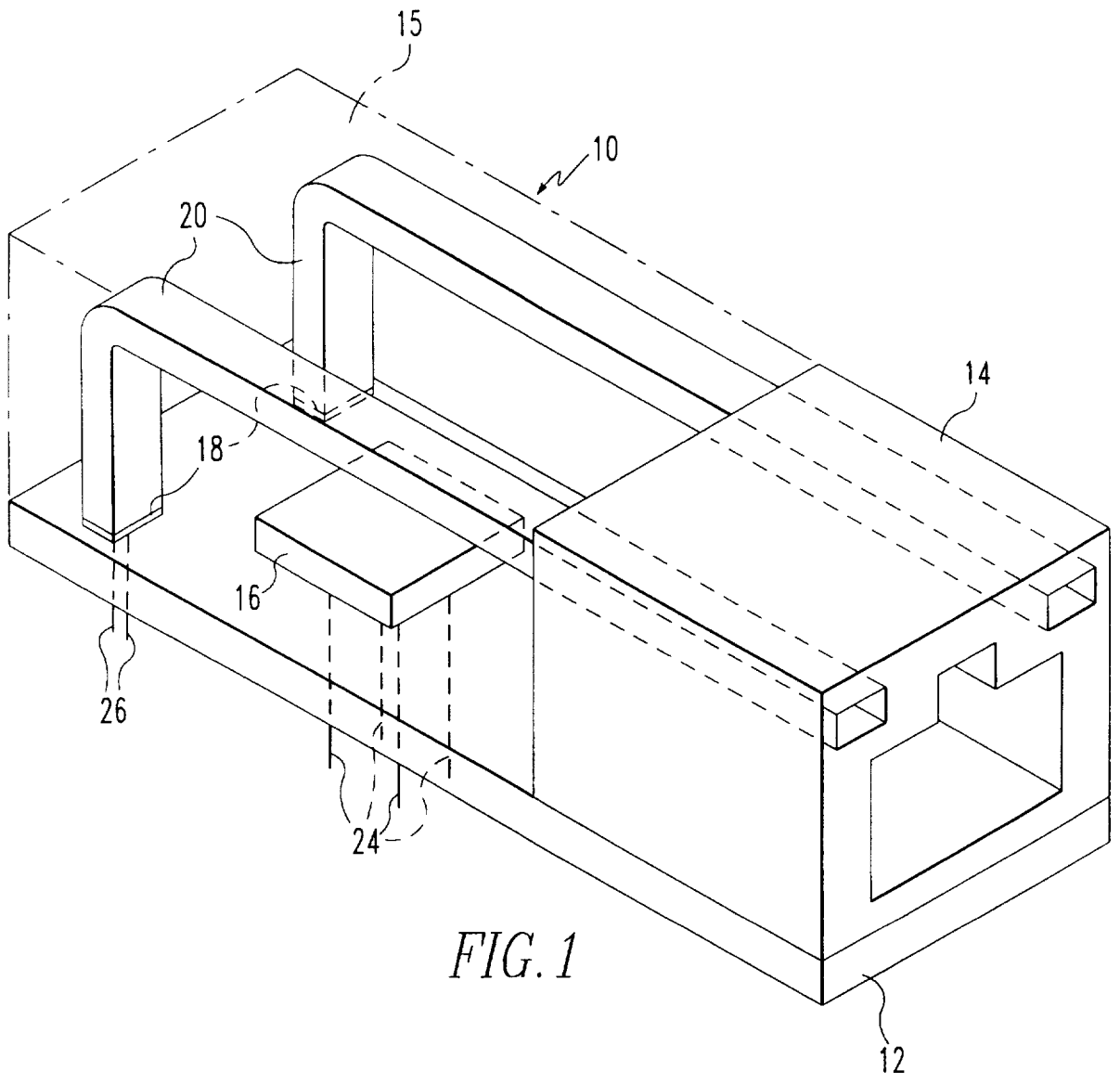
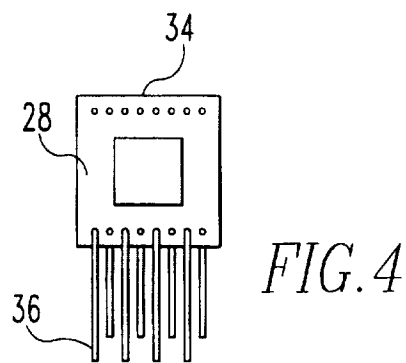
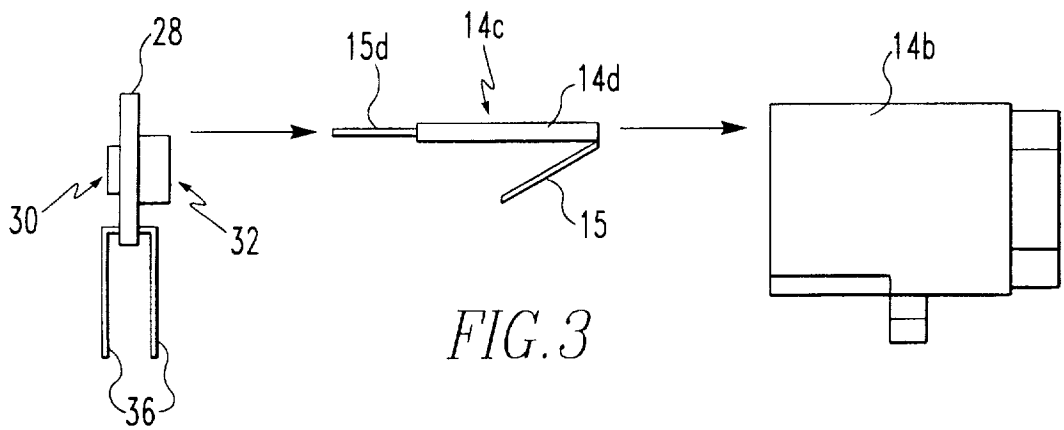
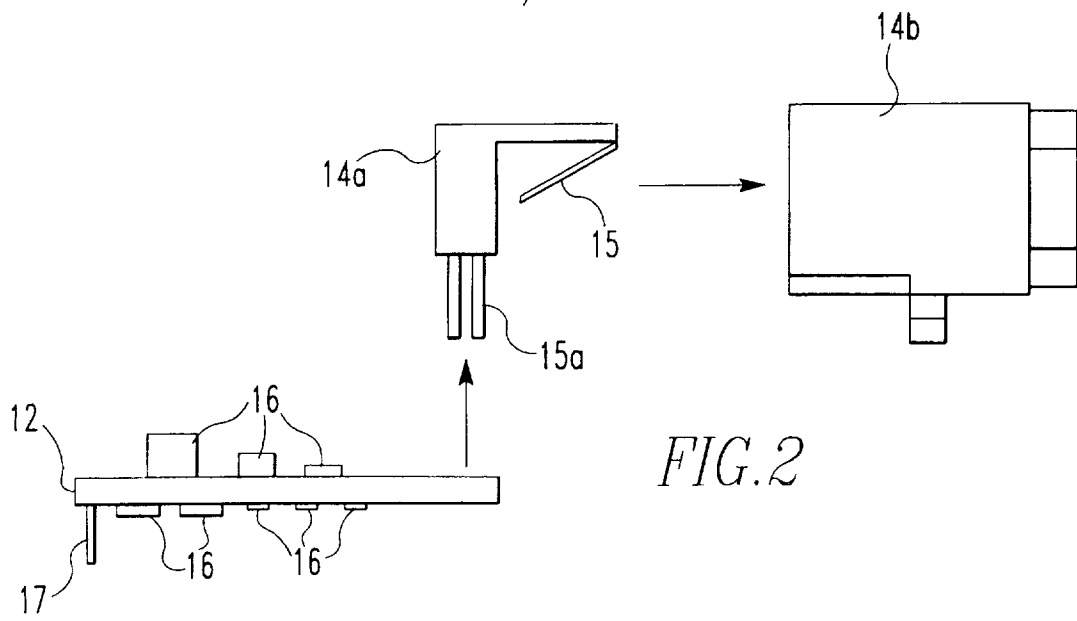


FIG. 1

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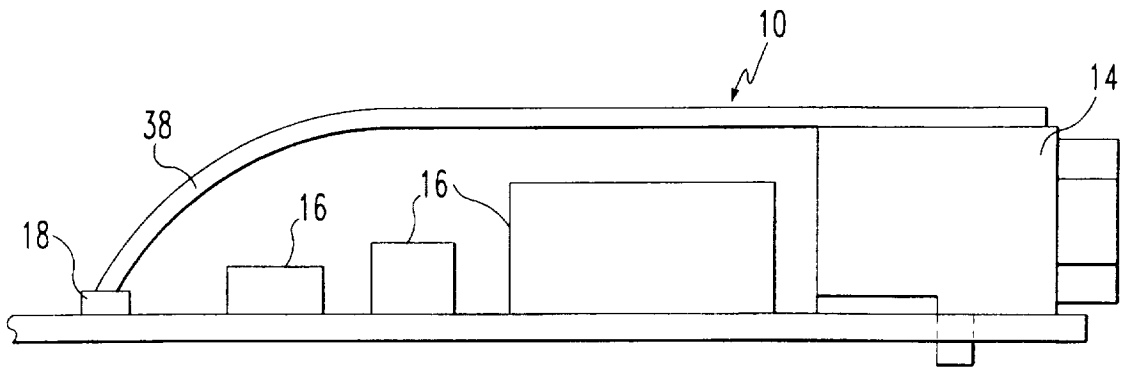


FIG. 5

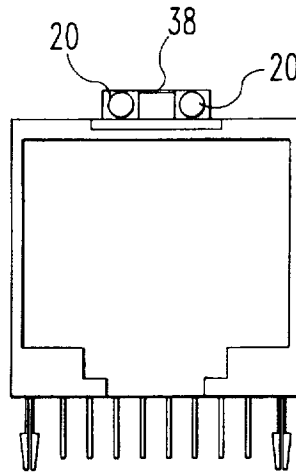


FIG. 6

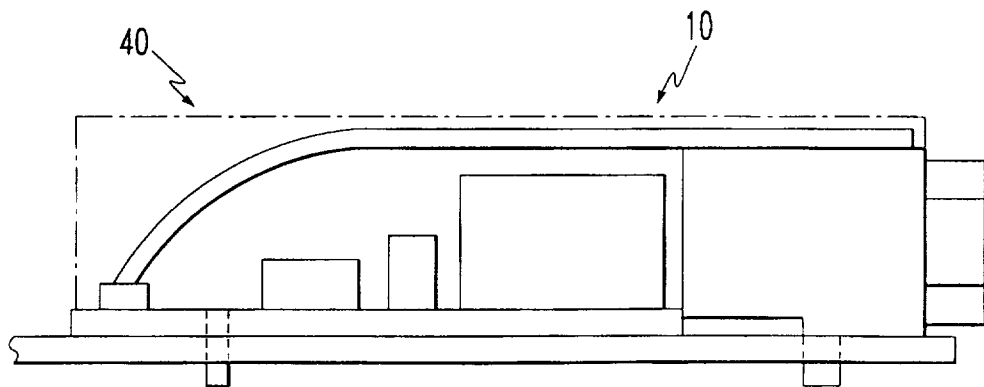


FIG. 7

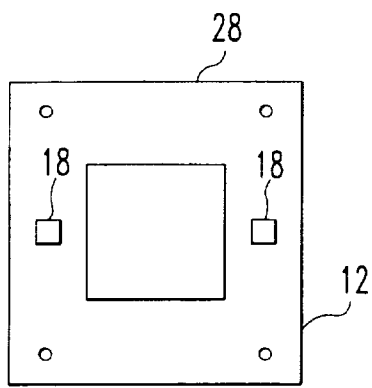


FIG. 9

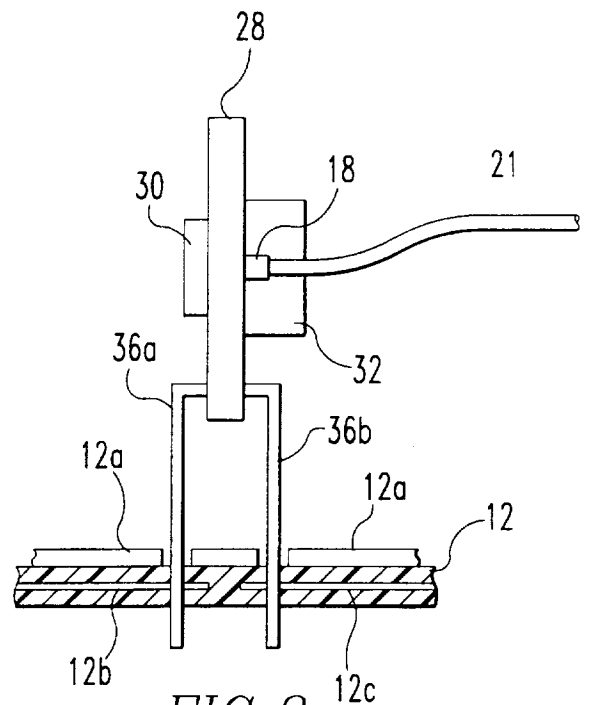


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/12205

A. CLASSIFICATION OF SUBJECT MATTER		
IPC(6) :HO1R 13/66 US CL :439/620, 488 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. : 439/620, 488, 489, 490, 676		
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.
Y	US, A, 5,456,619 (BELOPOLSKY ET AL) 10 OCTOBER 1995 SEE ENTIRE DOCUMENT	1-20
Y	US, A, 5,599,209 (BELOPOLSKY) 04 FEBRUARY 1997 SEE ENTIRE DOCUMENT	1-20
Y	US, A, 5,639,266 (PATEL) 17 JUNE 1997 SEE ENTIRE DOCUMENT	1-20
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
A	document defining the general state of the art which is not considered to be of particular relevance	*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
B	earlier document published on or after the international filing date	*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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Date of the actual completion of the international search 22 SEPTEMBER 1997		Date of mailing of the international search report 29 OCT 1997
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/12205**Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)**

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains claims directed to more than one species of the generic invention. These species are deemed to lack Unity of Invention because they are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for more than one species to be searched, the appropriate additional search fees must be paid. The species are as follows:

species 1: Figure 1; species 2: Figure 3; species 3: Figure 5; species 4: Figure 8.

The claims are deemed to correspond to the species listed above in the following manner:

species 1: claims 1-5,12-15; species 2: claims 6-11; species 3: claims 16-19; species 4: claim 20.

The following claims are generic: 1

The species listed above do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: species 2 has visual indicators; species 3 has a shield; species 4 has a modified visual indicator arrangement.