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EUROPEAN PATENT APPLICATION

(21) Application number : **92309874.3**

(51) Int. Cl.⁵ : **H01R 23/68, H01R 13/658**

(22) Date of filing : **28.10.92**

(30) Priority : **01.11.91 US 786644**
01.11.91 US 786696

(43) Date of publication of application :
05.05.93 Bulletin 93/18

(84) Designated Contracting States :
DE FR GB IT NL

(71) Applicant : **THE WHITAKER CORPORATION**
Suite 450, 4550 New Linden Hill Road
Wilmington, Delaware 19808 (US)

(72) Inventor : **Burgit, Richard Allen**
110 N. Pine Street
Middletown, Pennsylvania 17057 (US)
 Inventor : **Hillbish, Warren Christian**
24 Wagner Circle
Hummelstown, Pennsylvania 17036 (US)
 Inventor : **Kaufman, John Wilson**
729 Lexington Avenue
Hershey, Pennsylvania 17033 (US)
 Inventor : **Vogl, Brian J.**
128 N. 4th Street
Lemoyne, Pennsylvania 17043 (US)

(74) Representative : **Warren, Keith Stanley et al**
BARON & WARREN 18 South End Kensington
London W8 5BU (GB)

(54) **Electrical connector having externally mounted ground plates.**

(57) For securing an externally mounted ground plate (50,70) to electrical connector (12), the ground plate (50,70) is secured along one of the sides of the connector (10) and has a leading edge (54,74) thereof exposed at the mating face (14) of the connector (10) and adapted to be received within the housing of a complementary connector (84) upon the connector (10) being mated thereto. Means for securing the ground plate (50,70) to the electrical connector (10) includes a pair of tabs (60,80) extending from the ground plate (50,70) proximate the leading edge (54,74) thereof and engageable with and latchingly securable in cooperating slots (34) on end walls of the connector housing (12) and an inwardly directed rolled portion (56,76) extending substantially along the entire length of the leading edge of the ground plate (50,70), the rolled portion (56,76) being received within a cooperating recess (2) of the associated housing side wall. The recess (20) is configured to receive the rolled edge of the ground plate (50,70) such that the ground plate lies securely against the side wall and the overall dimensions of the mating face (14) are not substantially increased thereby.

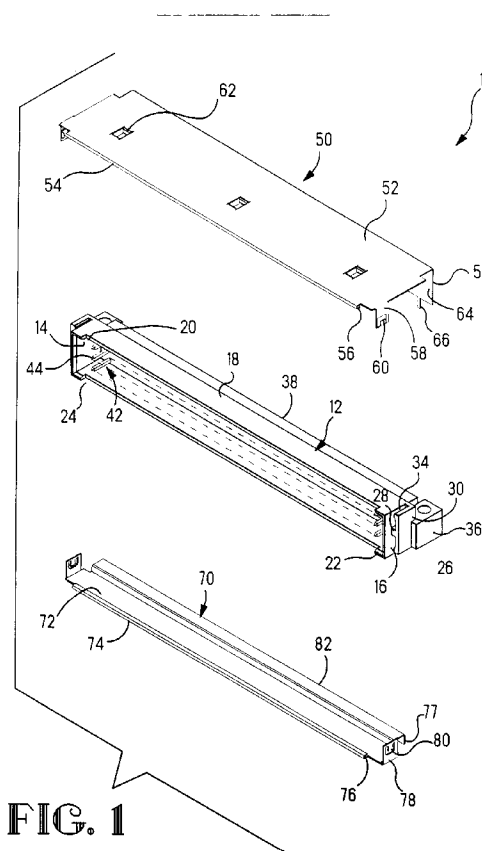


FIG. 1

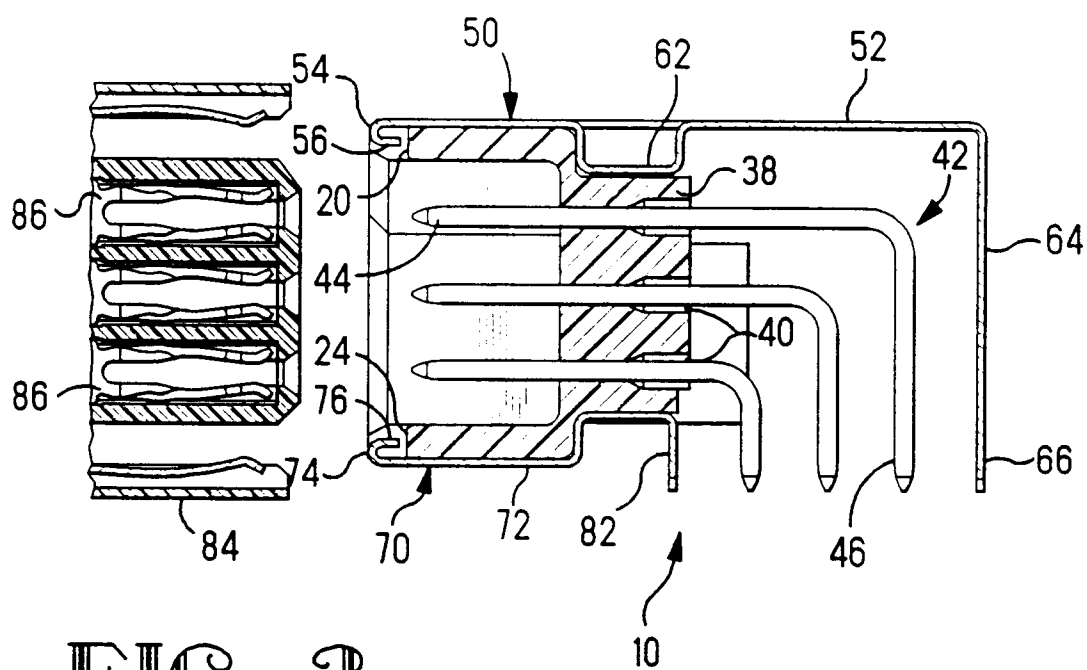


FIG. 3

This invention relates to an electrical connector assembly and more particularly to connector assemblies having externally mounted ground or shield plates.

Most electronic equipment uses a plurality of board-to-board connectors to interconnect circuitry plurality of daughter boards to a mother board or back plane. The circuit boards may be mounted in a vertical or horizontal relationship depending upon the configuration of the mating connector members. The demand for connectors that solve problems such as noise, ground inductance, and cross talk has increased with the density and speed of the electronic circuitry. It is desirable, therefore, that high density electrical connectors include means to provide low inductance and a low resistance ground connection from the connector to the circuit board to which it is attached. It is further desirable that the ground connection be of a type that mates first and breaks last.

U.S. Patent 5,035,631 discloses a grounding shield for a card edge connector. The ground shield is secured to the connector housing by a plurality of fingers that engage apertures along the mating face of the connector.

U.S. Patent Nos. 4,655,518 and 4,869,677 disclose a two-piece connector assembly that provides grounding contacts within the dielectric walls of the pin header and includes a plurality of ground plates secured by a plurality of tabs to the exterior wall adjacent the mating face of the receptacle member.

U.S. Patent Application Serial No. 07/767,344 discloses an electrical connector assembly having a plurality of ground pins in a pin header and ground plates mounted along the exterior walls of the mating receptacle member.

When mounting plates along the exterior walls, particularly along the mating face, it is important that the ground plate lie against the dielectric housing material along the full length to assure proper mating of the connectors without stubbing the contacts in the mating connectors. The problem of separation between the ground plate and housing wall is exacerbated if the dielectric member is at all bowed and tends to separate even slightly from the outer metal wall. It is desirable therefore to provide a means to secure these two layers approximate the mating face such that the overall dimension of the mating face of the connector is not increased. Furthermore, it is desirable that the means for securing be one that minimizes the need for extra parts, one that does not greatly increase the assembly steps and furthermore be one that is cost effective.

Accordingly, the present invention is directed to an electrical connector having externally mounted ground plates that eliminates the problems and disadvantages of the prior art. For purposes of illustrating the invention, the ground plates are being shown attached to the elongate sides of a connector known

as a "pin header".

The connector includes a housing having opposed elongate sides and opposed ends, which together define a mating face, and a plurality of electrical terminal members disposed within the housing and exposed at the mating face for electrical connection to corresponding terminals of a mating connector. The connector further includes at least one ground plate secured along one of the elongate sides and having a leading edge thereof exposed at the connector mating face, the mating face of the connector being adapted to be received within a complimentary housing. The improved means for securing the ground plate to the connector includes a pair of tabs extending from the side edges of the ground plate proximate the leading edges thereof and engageable with cooperating slots on the end walls of the housing. The tabs further include locking lances that cooperate with the housing wall slots to lockingly secure the tabs of the ground plate to the housing end walls. The leading edge of the ground plate further includes an inwardly directed rolled portion extending substantially along the entire length thereof. The rolled portion is received within a recessed portion of the elongate side wall of the housing. The recess is configured to receive the rolled edge such that the ground plate lies securely against the elongate side wall and the overall dimensions of the mating face are not substantially increased thereby. When the ground plate is secured to the housing, the pair of locking tabs hold the ground plate securely along the end walls of the housing. The rolled portion strengthens the leading edge of the ground plate and provides a gradually tapered surface at the connector mating face thereby minimizing stubbing of the ground plate when the connector mating face is received in the complimentary connector.

In the preferred embodiment the plate member is also provided with a plurality of inwardly directed stop portions rearwardly of the leading edge, which locate and align the leading edge of the plate with respect to the forward edge of the associated elongate housing wall.

It is an object of the invention to provide a means for securing the ground plate to an external surface of an electrical connector.

It is an additional object to provide a connector having a ground plate mounted externally thereto that minimizes stubbing at the mating face when the mating face is received in a complimentary connector housing.

It is another object of the invention to provide a means for securing a ground plate to an external housing wall in a manner to minimize interruption of the electrical paths.

It is a further object of the invention to provide a means for securing a ground plate to a connector in a manner that does not increase the overall dimen-

sions of the mating face of the connector.

It is yet another object of the invention to provide a means for securing a ground plate to a housing wall in a manner that minimizes separation of the ground plate and the associated wall at the mating face of the connector.

Another object of the invention is to provide a means for securing a ground plate to a connector to ensure that the ground shield mates first and breaks last.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is an exploded view of a connector having ground plate members secured to upper and lower surfaces in accordance with the invention.

FIGURE 2 is a flat plan view of front of the connector of Figure 1.

FIGURE 3 is a cross sectional view of the assembled connector being received by the mating portion of a complimentary connector.

FIGURE 4 is an enlarged cross sectional view of the connector of the present invention with the ground plates exploded therefrom, and

FIGURES 5 and 6 illustrate the interlocking features of the ground plate tabs and housing end walls.

Figure 1 shows an exploded view of a pin header connector 10 made in accordance with the invention. Connector 10 includes a housing 12 and upper and lower ground plates 50,70 respectively. Housing 12 includes a mating face 14, mounting face 16 and opposed upper and lower elongate side walls 18,22, opposed end walls 26 and rear wall 38. The opposed elongate side walls 18,22 and opposed end walls 26 define the mating face 14. As best seen in Figure 1, the upper and lower side walls 18,22 further include recessed portions 20,24 respectively. These portions 20,24 are adapted to cooperate with the respective upper and lower ground plate members 50,70 as more fully described below. A plurality of electrical terminal members 42 are disposed within respective terminal receiving passageways 40 and include first and second connecting portions 44,46 as best seen in Figure 3. Referring now to Figures 1 and 3, first terminal connecting portions 44 are exposed at the mounting face for electrical connection to corresponding terminal members 86 of a mating connector 84.

Housing end walls 26 further include outwardly extending first and second flange portions 28,36. First flange portion 28 extends outwardly from the end wall and includes oppositely directed wall portions 30 spaced from wall 26 and defining ground tab receiving cavities therebetween, as best seen in Figures 5 and 6. The inner wall portion of 30 further includes a stop ledge 32 at the end thereof for lockingly

engaging the ground plate tabs as described more fully below.

Referring now to Figures 1, 2 and 3, the upper ground plate 50 includes a top or plate portion 52 having a forward or leading edge 54 that extends to the mating face 14 of connector housing 12 and opposed side edges 57. The leading edge 54 includes a rolled portion 56 which extends substantially along the entire leading edge thereof and is adapted to be received within the cooperating recess 20 of the elongate housing wall 18. Recess 20 is configured to receive rolled edge 56 such that the ground plate 50 lies securely against side wall 18 and the overall dimensions of the mating face 14 are not substantially increased as best seen by Figures 2 and 3. Upper ground plate 50 further includes a pair of tabs 58 extending from the side 57 thereof and proximate the leading edge 54. Tabs 58 include outwardly directed locking lances 60 which cooperate with locking surfaces 32 within the tab receiving slots 34 proximate end wall 26 as best seen in Figures 5 and 6. Tabs 58 are preferably located as close to the mating face as possible to minimize the problem of separation of the housing side wall and plate member 50.

As best seen in Figures 1 and 3 ground plate 50 further includes a rear wall 64 having a plurality of terminal portions 66 for engaging the ground conductors within a circuit board (not shown) when connector 10 is mounted thereto. It is to be understood that the ground plate construction disclosed herein is not limited to right angle pin header connectors only. The connector shown herein is merely representative of various connectors with which the ground plate may be used. US Patent Application Serial No 07/796 696, filed concomitantly herewith, and a certified copy of which accompanies the present application, discloses another method for securing a ground plate to a connector housing, in which the leading edges of the wall and ground plate are interlocked at a plurality of locations.

Referring again to Figures 1 and 3, lower ground plate 70 includes a plate portion 72 having a leading edge 74 and side edges 77. Lower ground plate 70 further includes a rolled portion 76 extending substantially along the entire length thereof, the rolled portion being adapted to be received within the corresponding recess portion 24 of lower housing wall 22. Recess 24 is configured to receive rolled edge 76 such that the ground plate 70 lies securely against side wall 22 and the overall dimensions of the mating face 14 are not substantially increased as best seen by Figures 2 and 3. Lower ground plate 70 also includes tabs 78 extending from the side 77 of plate 72 proximate the leading edge 74 thereof. Tabs 78 include locking lances 80 which are secured in the corresponding lower tab receiving cavity 34 of housing 12 in the same manner as previously described and as best seen in Figures 5 and 6. As shown in Figure

3 the lower ground plate 70 includes terminal members 82 extending downwardly therefrom for being received in a ground plane of the circuit board.

In the preferred embodiment ground plate members 50, 70 further include at least one locating or positioning stops formed in the plate portion 52, 72 rearwardly of the connector mating face 14 to keep the respective leading edges 54, 74 of the ground plate members 50, 70 aligned with the housing walls 18, 22 at the mating face 14. Alternatively, the positioning means may comprise an elongate groove extending along the entire width of the ground plate, or the ground plate may be shaped to conform to the actual shape of the housings.

In assembling the connector of the present invention, the terminal members 42 are inserted into the housing prior to attaching the ground plates 50, 70. The ground plates are then positioned so that the stop means abut the shoulder of the housing 12 and the respective leading edges 54, 74 are received in the associated wall recesses 20, 24. The ground plate tabs 58, 78 are inserted into the tab receiving cavities 34 and are locked within the cavities by lances 60, 80 engaging corresponding locking ledges 32.

The ground plates 50, 70 are preferably stamped from a formable, electrically conductive metal, such as copper alloys, or the like. Suitable dielectric materials for the connector housing include glass filled polyesters and other similar materials, as known in the art.

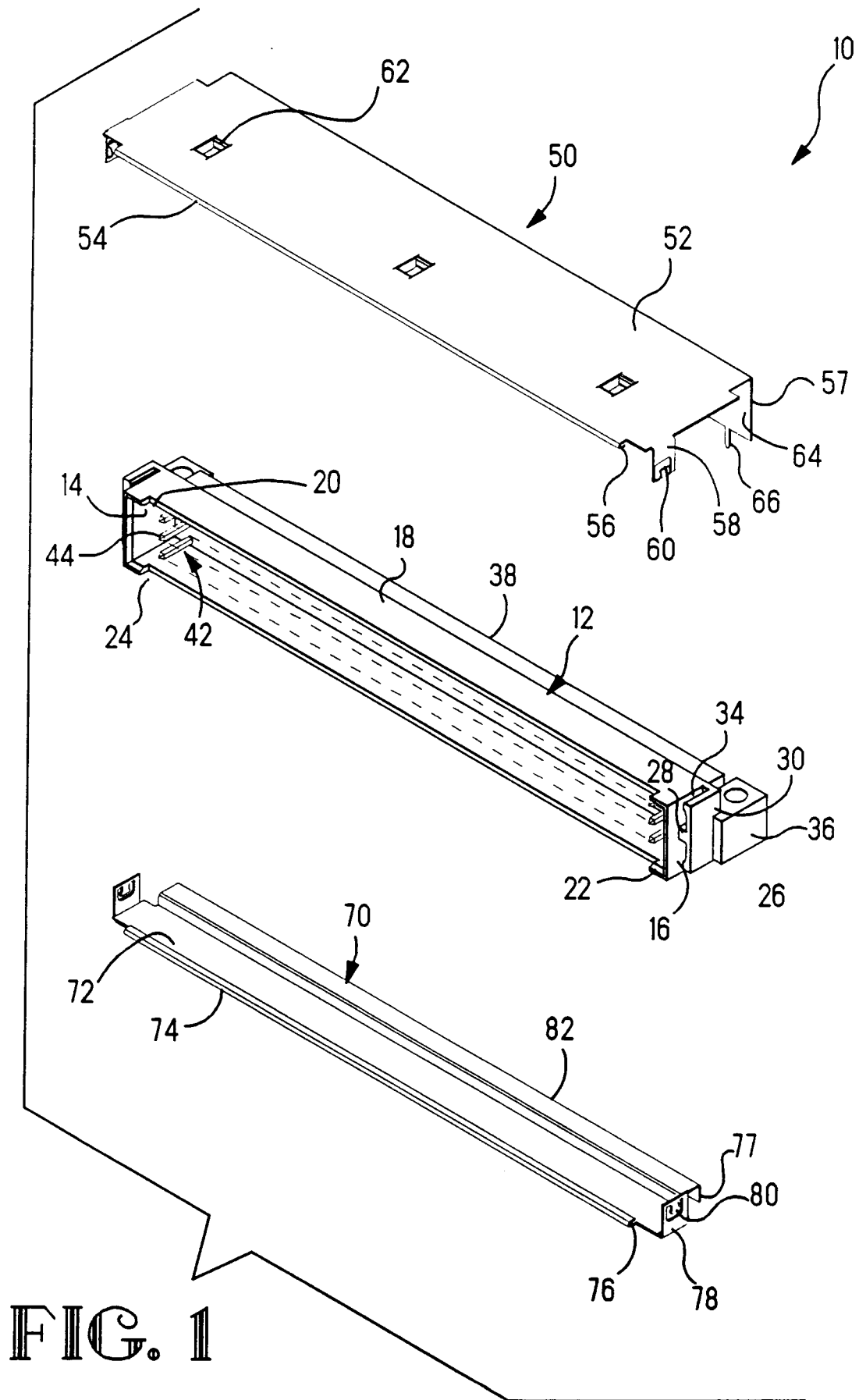
The respective rolled portions 56, 76 at the forward or leading edge 54, 74 of the respective ground plates 50, 70 strengthens the leading edge of the assembled connector. Furthermore by providing a recess in the leading wall edges of the housing member and filling that recess with the respective rolled portions 56, 76 there is less chance that stubbing will occur when connector 10 is mated to another connector, since there is a continuous surface along the bulk of the mating face of the connector. Stubbing is thereby minimized and insertion force is reduced by the gradual tapered rolled surface of the plate members 50, 70.

Claims

1. A right angle electrical connector (10) for providing multiple shielded circuit paths to a printed circuit board from a mating connector including a plastic housing (12) having a forward recess (20) defined by top (18), bottom (22), and end walls (26) with the said end walls (26) including latching surfaces contained therein, an array of terminal members (42) extending through said housing with contacts ends positioned in said recess and terminal ends extending from the rear face (38) of the housing at right angles to interconnect

to a printed circuit board to be terminated thereto, characterized by a pair of thin shielding members (50, 70) forming a shielding structure including portions extending over the top (18) and bottom (22) of the housing (12) and over the terminal ends to shield said terminal members (42), the ends (58) of the said shielding members extending around the ends of the housing to engage the housing end surfaces and including latching tabs (60, 80) latching said shielding members to said housing, each of the pair of shielding members (50, 70) having a leading edge (54, 74) rolled (56, 76) inwardly relative to said recess (20) to strengthen said shielding member with the leading edge extending forwardly of the terminal members to engage the shielding of the mating connector prior to an engagement of the contacts of the mating connector and the right angle connector during intermating of the connectors.

2. The connector according to claim 1, characterized in that the said latching surfaces (60, 80) are defined by apertures (34) in the ends of the housing and each of the pair of the shielding members (50, 70) include lances (60, 80) that fit into the apertures (34) to lock the members to the housing.
3. The connector, according to claim 1, characterized in that each of the pair of shielding members (50, 70) includes a tab (66) adapted to fit into printed circuit board and ground the shielding structure to the grounding circuit of a printed circuit board.
4. The connector, according to claim 1, characterized in that the said recesses dimensioned and terminal contacts are positioned to receive then end of the mating connector inserted within said recess (20) with the mating connector contacts engaging and terminal contacts of the right angle connector.
5. The connector, according to claim 1, characterized in that a pair of shielding members (50, 70) of the right angle connector (10) are positioned to fit within the outer shielding shell (84) of the mating connector.



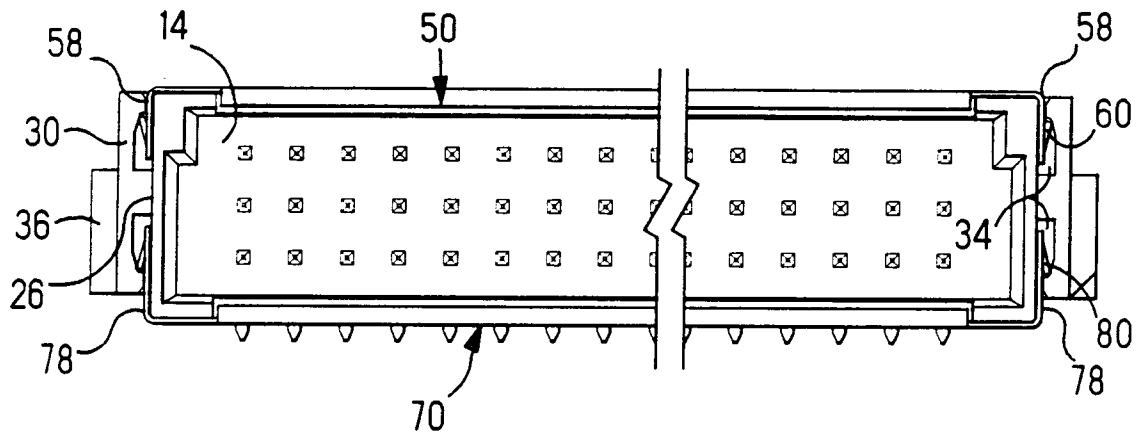


FIG. 2

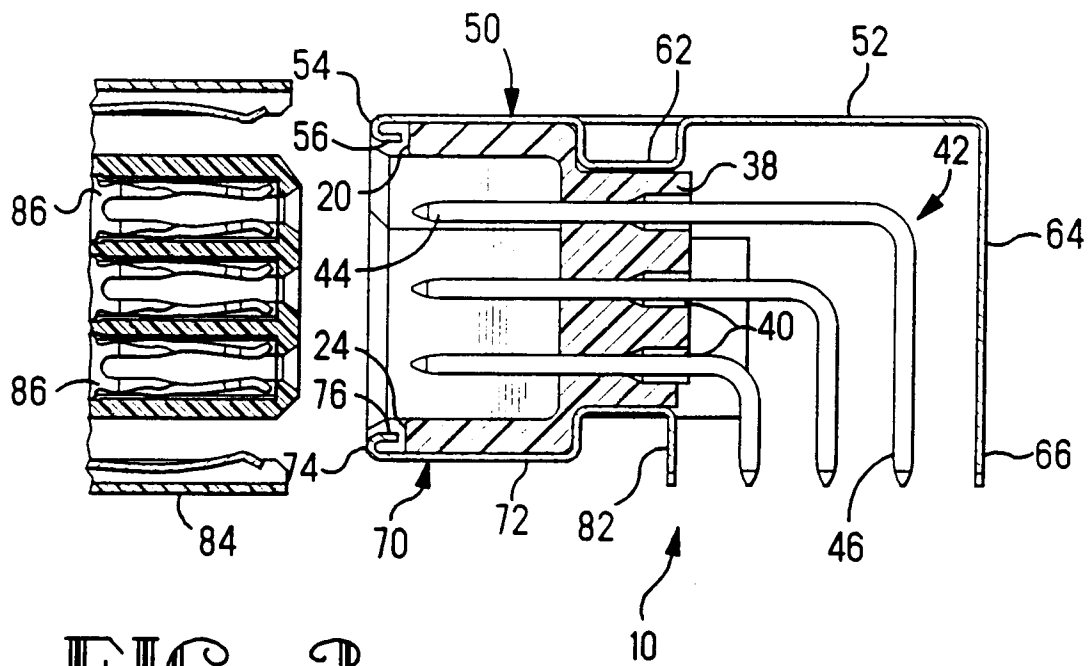
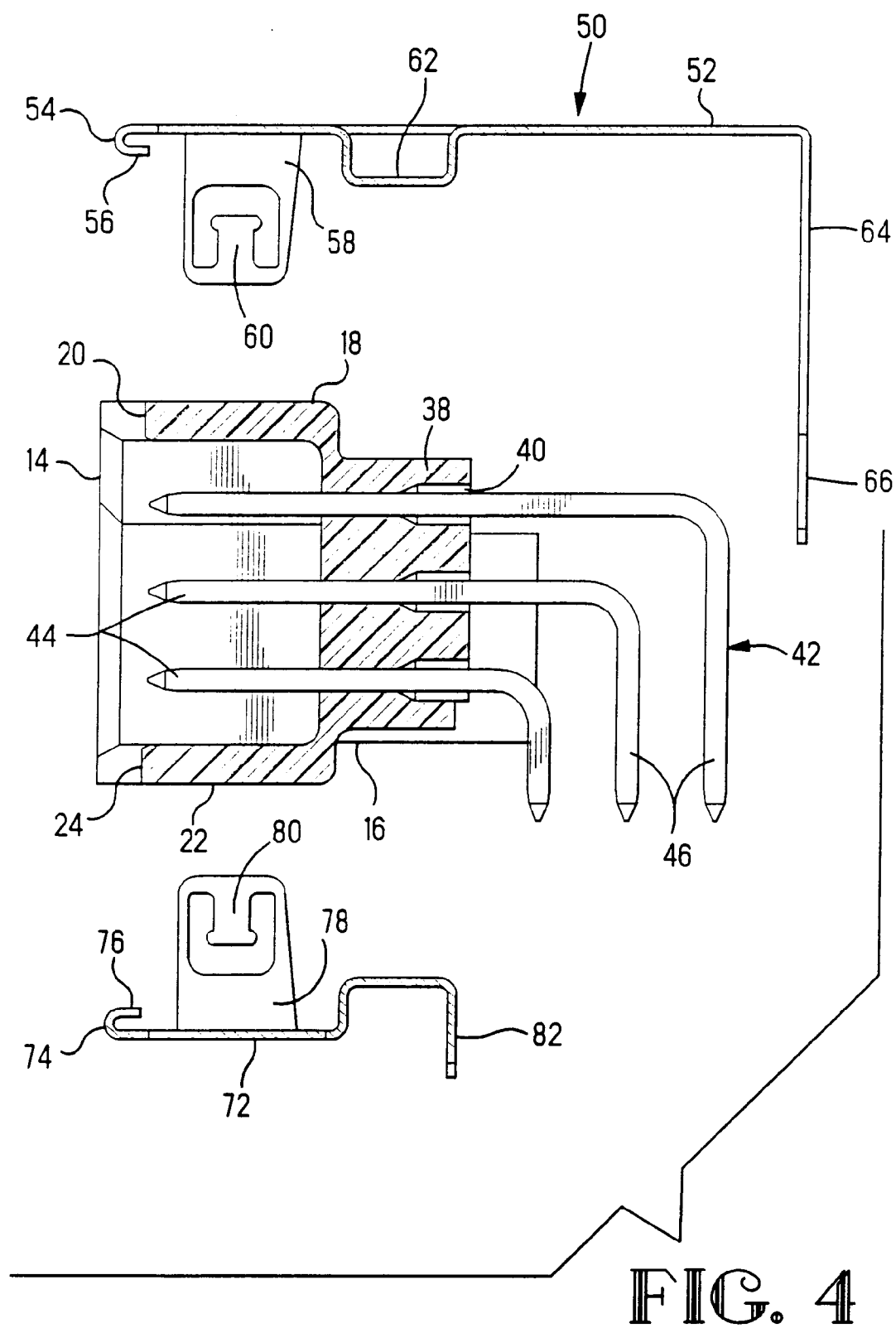


FIG. 3



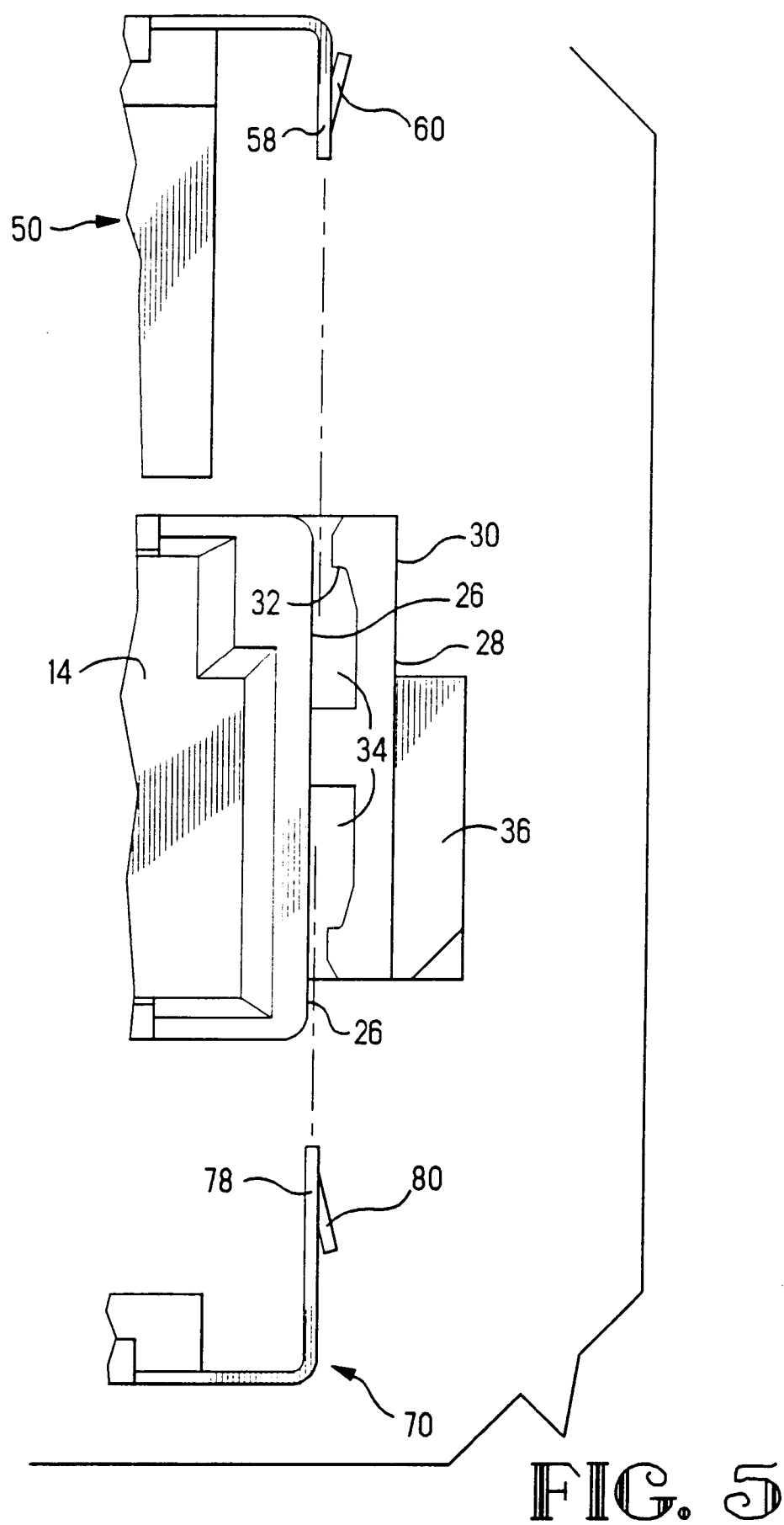


FIG. 5

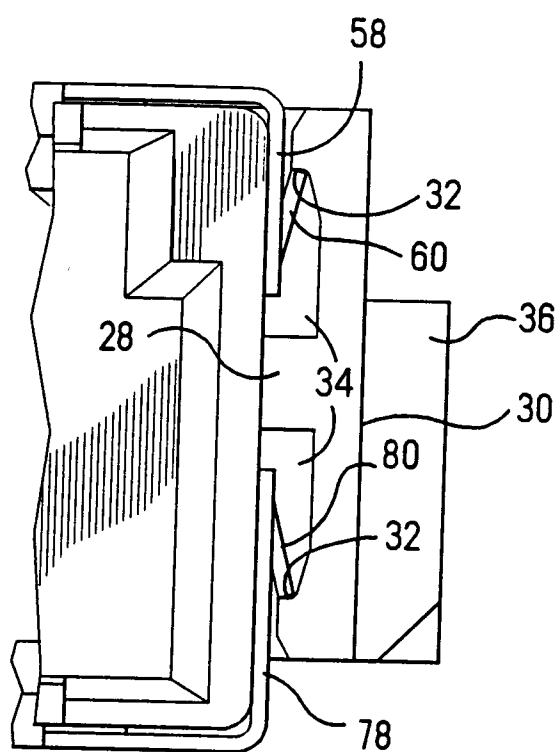


FIG. 6



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 9874

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 412 331 (SIEMENS AG) * column 3, last paragraph; figure 1 * ---	1-3,5	H01R 23/68 H01R13/658
A,D	GB-A-2 163 305 (TERADYNE INC.) * page 1, line 104 - line 107 * ---	1-3	
A	EP-A-0 344 972 (AMP INC.) * column 5, line 15 - line 17 * * column 5, line 38 - line 47; figures 11,15,17 * -----	1-3	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 JANUARY 1993	Examiner S. Sibilla
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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