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International Bureau



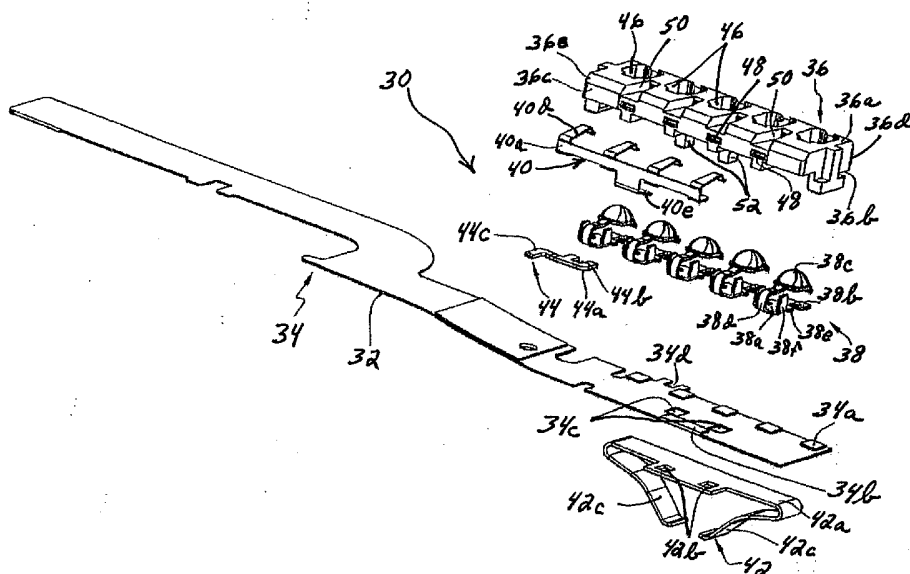
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(54) Title: GROUNDED ELECTRICAL CONNECTOR FOR CIRCUIT BOARDS



(57) Abstract: A grounded electrical connector is provided with a dielectric body having an upper mating face and a lower board mounting face. A plurality of terminals are mounted on the body and have contact portions exposed at the upper mating face for engaging appropriate terminals of a mating connector. Terminating portions of the terminals are exposed at the lower board mounting face of the body for connection to appropriate circuits pads on the circuit board. A grounding element has a plurality of grounding fingers exposed at the upper mating face of the dielectric body for engaging an appropriate ground member of the mating connector and at least one tail portion at the lower board mounting face for connection to an appropriate ground pad on the circuit board.

GROUNDING ELECTRICAL CONNECTOR FOR CIRCUIT BOARDS

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to a grounded electrical connector such as for terminating an end of a circuit board.

Description of the Related Art:

FIG. 1 shows a prior art electrical connector, generally designated 10, as might be used in a mobile telephone for terminating an end of a flexible printed circuit, generally designated 12. The connector include a dielectric body, generally designated 14, and an elastic support member, generally designated 16, which sandwiches an end of the flexible circuit board between a flat lower face 18 of the body and the elastic support member. The dielectric body has a pair of fixing posts 20 which project through holes in the flexible circuit board and through holes in the support member. The posts may be thermally melted to fix the support member to the dielectric body, sandwiching the end of the flexible circuit board therebetween. A plurality of signal terminals, generally designated 22, are mounted within a plurality of terminal-receiving passages 24 in dielectric body 14. The signal terminals have contact portions 22a, which project above an upper face 26 of the dielectric body for engaging appropriate terminals of a mating connector (not shown).

Prior art connector 10 includes a grounding terminal, generally designated 28, which has a contact portion 28a that projects above upper face 26 of the body higher than contact portions 22a of signal terminals 22 for engaging appropriate ground means of the mating connector before contact portions 22a of signal terminals 22 engage the terminals of the mating connector. Therefore, the grounding terminal filters noise interference, such as electrostatic charges, before the signal terminals transmit signals. Unfortunately, the single grounding terminal is inadequate and high transmission quality of electrical connector 10 cannot be maintained. The present invention is directed to improvements in such a grounded electrical connector.

Summary of the Invention:

An object, therefore, of the invention is to provide a new and improved grounded electrical connector of the character described.

In the exemplary embodiment of the invention, a grounded electrical connector is provided for terminating an end of a circuit board. The connector includes a dielectric body having an upper mating face and a lower board mounting face. A plurality of terminals are mounted on the body and have contact portions exposed at the upper mating face for engaging appropriate terminals of a mating connector. Terminating portions of the terminals are exposed at the lower board mounting face of the body for connection to appropriate circuit pads on the circuit board. A grounding element has a plurality of grounding fingers exposed at the upper mating face of the dielectric body for engaging appropriate ground means of the mating connector and at least one tail portion at the lower board mounting face for connection to an appropriate ground pad on the circuit board.

According to one aspect of the invention, the grounding fingers are flexible, and the dielectric body includes a plurality of recesses in the upper mating face thereof and within which the flexible grounding fingers can flex. The grounding fingers may have rounded distal ends for engaging the ground means of the mating connector. As disclosed herein, the grounding element has an elongated base portion along which the grounding fingers are spaced and from which the grounding fingers project.

According to another aspect of the invention, the grounding element has at least one mounting portion for mounting to the dielectric body. The mounting portion comprises a mounting tab insertable into a receiving slot in the dielectric body. In the exemplary embodiment, the dielectric body includes a front face extending between the upper mating face and the lower board mounting face, and the receiving slot is located in the front face. The preferred grounding element has an elongated base portion with a plurality of the mounting tabs spaced therealong and extending therefrom into a plurality of the receiving slots in the dielectric body.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings:

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIG. 1 is a side elevational view of the prior art connector described in the Background, above;

FIG. 2 is a side elevational view of the grounded electrical connector of the invention;

FIG. 3 is an exploded perspective view of the connector in FIG. 2;

FIG. 4 is an enlarged perspective view of the grounding element of the connector;

FIG. 5 is a bottom plan view of the connector; and

FIG. 6 is a top plan view of the connector.

Detailed Description of the Preferred Embodiment:

Referring to the drawings in greater detail, and first to FIGS. 2, 3, 5 and 6, the invention is incorporated in a grounded electrical connector, generally designated 30, for terminating an end 32 of a flat flexible circuit board, generally designated 34. As best seen in FIG. 3, the system includes a dielectric connector body, generally designated 36; a plurality of conductive terminals, generally designated 38, mounted on the body; a grounding element, generally designated 40, mounted on the body; an elastic support member, generally designated 42, for fixing the flexible circuit board to the body; and a fastening member, generally designated 44, for fastening the flexible circuit board to the body spaced from and independent of support member 42.

Connector body 36 is a one-piece structure molded of dielectric material such as meltable plastic or the like. Before proceeding further, it should be understood that such terms as “upper”, “lower”, “top”, “bottom” and the like herein and in the claims hereof are used solely for providing a clear and concise understanding of the invention as depicted in the drawings. Obviously, the connector of the invention is omni-directional in manufacture, assembly and use, particularly when used in such applications as mobile phones and the like.

With those understandings, connector body 36 has an upper mating face 36a, a lower board mounting face 36b, a front face 36c and a rear face 36d as viewed in the drawings. The body is elongated, and a chamfered edge 36e extends longitudinally at a corner of the body between upper mating face 36a and front face 36c. A plurality of terminal-receiving passages 46 extend vertically through the body. A plurality of receiving slots 48 extend through front face 36c into the body. A plurality of grooves 50 are spaced along the body and open at the upper and front faces thereof. A pair of fixing posts 52 project downwardly from the lower board mounting face 36b of the body. Finally, a fastening post 54 (Fig. 5) also projects downwardly from the lower board mounting face of the body and is spaced outwardly therefrom.

Terminals 38 of connector 30 maybe stamped and formed of conductive sheet metal material. Each terminal includes a base 38a having a solder tail portion 38b offset downwardly from the base and a dome-shaped contact portion 38c spaced above the base by a generally U-shaped bent portion 38d of the terminal. Teeth 38e are formed at opposite edges of the base, and a pair of mounting tabs 38f project upwardly from the base. Terminals 38 are mounted within the terminal-receiving passages 46 of connector body 36, and teeth 38e and mounting tabs 38f facilitate mounting the terminals in the passages. Solder tail portions 38b are offset downwardly from the bases of the terminals so that the solder tail portions are exposed at the lower board mounting face 36b of the connector body for solder connection to appropriate circuit pads on flexible circuit board 34 as described hereinafter.

Referring additionally to FIG. 4, grounding member 40 of electrical connector 30 filters interference and surrounding noise from the electrical connections of the connector. The grounding element may be stamped and formed of conductive sheet metal material. The grounding element includes an elongated base portion or strip 40a which abuts against front face 36c of connector body 36. The grounding element is mounted to the body by means of a plurality of mounting tabs 40b which are inserted into receiving slots 48 in front face 36c of the body. Teeth 40c are stamped at opposite edges of mounting tabs 40b for skiving into the plastic material within slots 48 to secure the grounding element to the body. When so mounted, grounding element 40 has a plurality of grounding fingers 40d disposed within grooves 50 in the upper mating face 36a of the body. A solder tail 40e projects downwardly from the grounding member and is exposed at the bottom of the body for connection to an appropriate grounding pad on flexible circuit board 34 as described hereinafter. Grounding fingers 40d of the grounding

element are flexible and can flex within grooves 50 of the body. The grounding members project at least slightly above the upper mating face 36a of the body for engaging an appropriate grounding member of the mating connector. The grounding fingers may have rounded distal ends 40f for engaging the grounding member of the mating connector.

Flexible circuit board 34 includes a plurality of circuit pads 34a for connection, as by soldering, to the solder tail portions 38b of terminals 38. The flexible circuit board has a ground pad 34b for connection, as by soldering, to the solder tail 40e of grounding element 40. The flexible circuit board has a pair of openings or fixing holes 34c for receiving fixing posts 52 of connector body 36. The flexible circuit board has an opening or fastening notch 34d for receiving fastening post 54 of the connector body.

Elastic support member 42 of electrical connector 30 is stamped and formed of elastic or spring sheet metal material. The support member has a flat plate portion 42a which is provided with a pair of fixing openings or holes 42b through which fixing post 52 of connector body 36 project. A pair of spring arms 42c project inwardly from opposite ends of the flat plate portion 42a, underlying and spaced from the flat plate portion.

Fastening member 44 has a flat plate portion 44a which is generally F-shaped and includes a fixing opening or fastening notch 44b at one side thereof. The fastening member is stamped or formed with a bent holding portion 44c.

Electrical connector 30 is assembled as follows. Terminals 38 and grounding element 40 are mounted in or on connector body 36 as described above. Contact portions 38c of the terminals and grounding fingers 40d of the grounding element project upwardly from the upper mating face 36a of the connector body for engaging appropriate terminals and a grounding member of the mating connector. Solder tail portions 38b of the terminals and solder tail 40e of the grounding element are connected, as by soldering, to circuit pads 34a and ground pad 34b of flexible circuit board 34. The flexible circuit board is positioned against the lower board mounting face 36b of the body by inserting fixing posts 52 of the body through fixing holes 34c of the flexible circuit board. Of course, this is done prior to solder connecting the flexible circuit to terminals 38 and grounding element 40.

Elastic support member 42 is assembled by inserting fixing posts 52 through fixing holes 42b of the support member. The flat plate portion 42a of the support member sandwiches end 32 of the flexible circuit board between the support member and the lower board mounting face 36b

of the connector body. The support member is securely fixed in place by thermally melting fixing posts 52 to fix the support member and the flexible circuit board securely to connector body 36.

Fastening member 44 is assembled by placing the flat plate portion 44a of the fastening member against the bottom of flat circuit board 34 and aligning fastening notch 44b of the fastening member with fastening notch 34d of the flat circuit board, and embracing fastening post 54 at the bottom of connector body 36. This sandwiches the flexible circuit board between the fastening member and the lower board mounting face 36d of the connector body. Fastening post 54 then is thermally melted to secure the fastening member and the flexible circuit board against the bottom of the connector body at a point spaced from and independent of support member 42. It can be seen in FIG. 5 that holding portion 44c of the fastening member extends or projects inwardly over an area of the flexible circuit board.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

CLAIMS:

What is claimed is:

1. A grounded electrical connector for terminating an end of a circuit board, comprising:
 - a dielectric body having an upper mating face and a lower board mounting face;
 - a plurality of terminals mounted on the dielectric connector body and having contact portions exposed at the upper mating face of the body for engaging appropriate terminals of a mating connector and terminating portions at the lower board mounting face for connection to appropriate circuit pads on the circuit board; and
 - a grounding element having a plurality of grounding fingers exposed at the upper mating face of the dielectric body for engaging appropriate ground means of the mating connector and at least one tail portion at the lower board mounting face for connection to an appropriate ground pad on the circuit board.
2. The grounded electrical connector of claim 1 wherein said grounding fingers are flexible.
3. The grounded electrical connector of claim 2 wherein said dielectric body includes a plurality of recesses in the upper mating face thereof and within which the flexible grounding fingers can flex.
4. The grounded electrical connector of claim 1 wherein said grounding fingers have rounded distal ends for engaging the ground means of the mating connector.
5. The grounded electrical connector of claim 1 wherein said grounding element has an elongated base portion along which the grounding fingers are spaced and from which the grounding fingers project.
6. The grounded electrical connector of claim 1 wherein said grounding element has at least one mounting portion for mounting to the dielectric body.

7. The grounded electrical connector of claim 6 wherein said mounting portion comprises a mounting tab insertable into a receiving slot in the dielectric body.

8. The grounded electrical connector of claim 7 wherein said dielectric body includes a front face extending between the upper mating face and the board mounting face, and said receiving slot is located in the front face.

9. The grounded electrical connector of claim 8 wherein said grounding element has an elongated base portion with a plurality of said mounting tabs spaced therealong and extending therefrom into a plurality of said receiving slots in the dielectric body.

10. A grounded electrical connector for terminating an end of a circuit board, comprising:

a dielectric body having an upper mating face, a lower board mounting face, a front face extending between the upper mating face and the board mounting face, a plurality of recesses in the upper mating face and a receiving slot in the front face;

a plurality of terminals mounted on the dielectric connector body and having contact portions exposed at the upper mating face of the body for engaging appropriate terminals of a mating connector and terminating portions at the lower board mounting face for connection to appropriate circuit pads on the circuit board; and

a grounding element having an elongated base portion, a plurality of grounding fingers spaced along the base portion and projecting into the recesses in the upper mating face of the dielectric body, the grounding fingers being exposed at the upper mating face for engaging appropriate ground means of the mating connector, at least one tail portion at the lower board mounting face for connection to an appropriate ground pad on the circuit board, and a mounting tab projecting from the base portion into the receiving slot in the front face of the dielectric body to mount the grounding element to the body.

11. The grounded electrical connector of claim 10 wherein said grounding fingers are flexible.

12. The grounded electrical connector of claim 10 wherein said grounding fingers have rounded distal ends for engaging the ground means of the mating connector.

13. The grounded electrical connector of claim 10 wherein said dielectric body includes a plurality of said receiving slots in the front face thereof, and the grounding element includes a plurality of said mounting tabs spaced therealong and extending therefrom into the plurality of receiving slots.

AMENDED CLAIMS

[received by the International Bureau on 14 March 2006 (14.03.2006);
Original claims 1-13 are replaced by Amended Claims 1-13]

CLAIMS

1. A grounded electrical connector (30) for terminating an end (32) of a
2 circuit board (34), comprising:
a dielectric body (36) having an upper mating face (36a) and a lower board
4 mounting face (36b); and
a plurality of terminals (38) mounted on the dielectric connector body and
6 having contact portions (38c) exposed at the upper mating face of the body for engaging
appropriate terminals of a mating connector and terminating portions (38b) at the lower board
8 mounting face for connection to appropriate circuit pads on the circuit board;
characterised in that:
10 a grounding element (40) having a plurality of grounding fingers (40d)
exposed at the upper mating face of the dielectric body for engaging appropriate ground
12 means of the mating connector and at least one tail portion (40e) at the lower board mounting
face for connection to an appropriate ground pad on the circuit board.
2. The grounded electrical connector of claim 1 wherein said grounding
2 fingers (40d) are flexible.
3. The grounded electrical connector of claim 2 wherein said dielectric body
2 (36) includes a plurality of recesses (50) in the upper mating face (36a) thereof and within
which the flexible grounding fingers (40d) can flex.
4. The grounded electrical connector of claim 1 wherein said grounding
2 fingers (40d) have rounded distal ends (40f) for engaging the ground means of the mating
connector.
5. The grounded electrical connector of claim 1 wherein said grounding
2 element (40) has an elongated base portion (40a) along which the grounding fingers (40d) are
spaced and from which the grounding fingers project.
6. The grounded electrical connector of claim 1 wherein said grounding
2 element (40) has at least one mounting portion (40b) for mounting to the dielectric body (36).

7. The grounded electrical connector of claim 6 wherein said mounting
2 portion comprises a mounting tab (40b) insertable into a receiving slot (48) in the dielectric
body (36).

8. The grounded electrical connector of claim 7 wherein said dielectric body
2 (36) includes a front face (36c) extending between the upper mating face (36a) and the board
mounting face (36b), and said receiving slot (48) is located in the front face.

9. The grounded electrical connector of claim 8 wherein said grounding
2 element (40) has an elongated base portion (40a) with a plurality of said mounting tabs (40b)
spaced therealong and extending therefrom into a plurality of said receiving slots (48) in the
4 dielectric body (36).

10. A grounded electrical connector (30) for terminating an end (32) of a
2 circuit board (34), comprising:

a dielectric body (36) having an upper mating face (36a), a lower board
4 mounting face (36b), a front face (36c) extending between the upper mating face and the
board mounting face, a plurality of recesses (50) in the upper mating face and a receiving slot
6 (48) in the front face; and

a plurality of terminals (38) mounted on the dielectric connector body and
8 having contact portions (38c) exposed at the upper mating face of the body for engaging
appropriate terminals of a mating connector and terminating portions (38b) at the lower board
10 mounting face for connection to appropriate circuit pads on the circuit board;

characterised in that:

12 a grounding element (40) having an elongated base portion (40a), a plurality
of grounding fingers (40d) spaced along the base portion and projecting into the recesses in
14 the upper mating face of the dielectric body, the grounding fingers being exposed at the
upper mating face for engaging appropriate ground means of the mating connector, at least
16 one tail portion (40e) at the lower board mounting face for connection to an appropriate
ground pad on the circuit board, and a mounting tab (40c) projecting from the base portion
18 into the receiving slot in the front face of the dielectric body to mount the grounding element

to the body.

11. The grounded electrical connector of claim 10 wherein said grounding
2 fingers (40d) are flexible.

12. The grounded electrical connector of claim 10 wherein said grounding
2 fingers (40d) have rounded distal ends (40f) for engaging the ground means of the mating
connector.

13. The grounded electrical connector of claim 10 wherein said dielectric
2 body (36) includes a plurality of said receiving slots (48) in the front face (36c) thereof, and
the grounding element (40) includes a plurality of said mounting tabs (40b) spaced
4 therealong and extending therefrom into the plurality of receiving slots.

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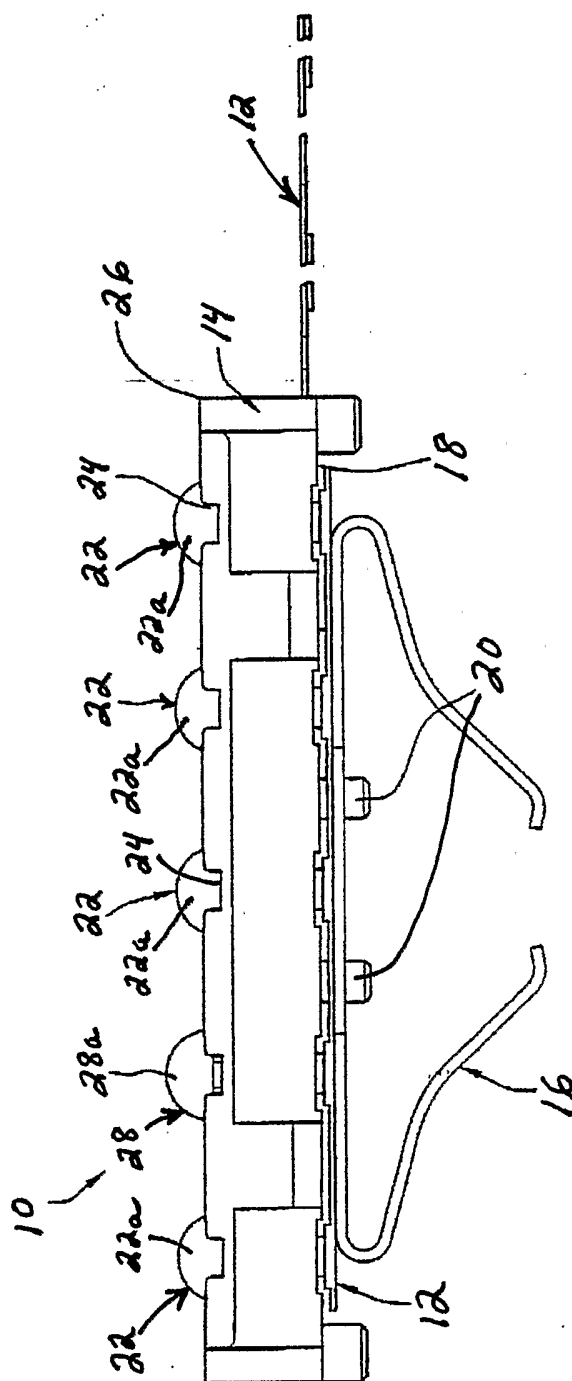


FIG. 1 (Background Art)

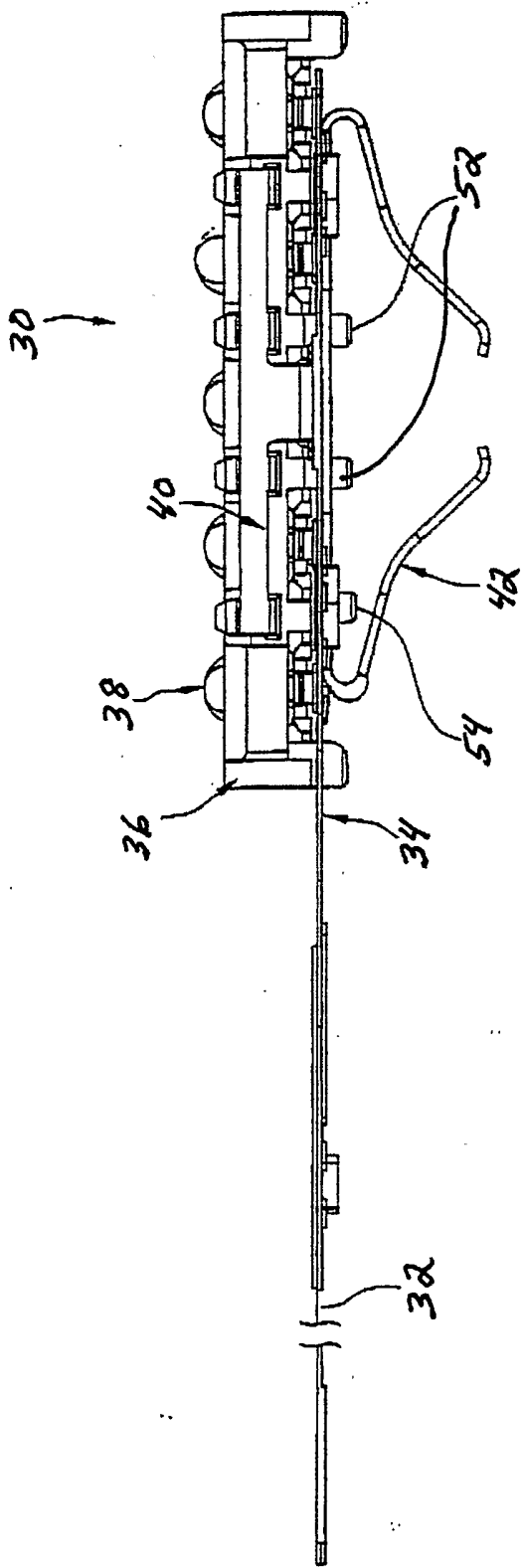


FIG. 2

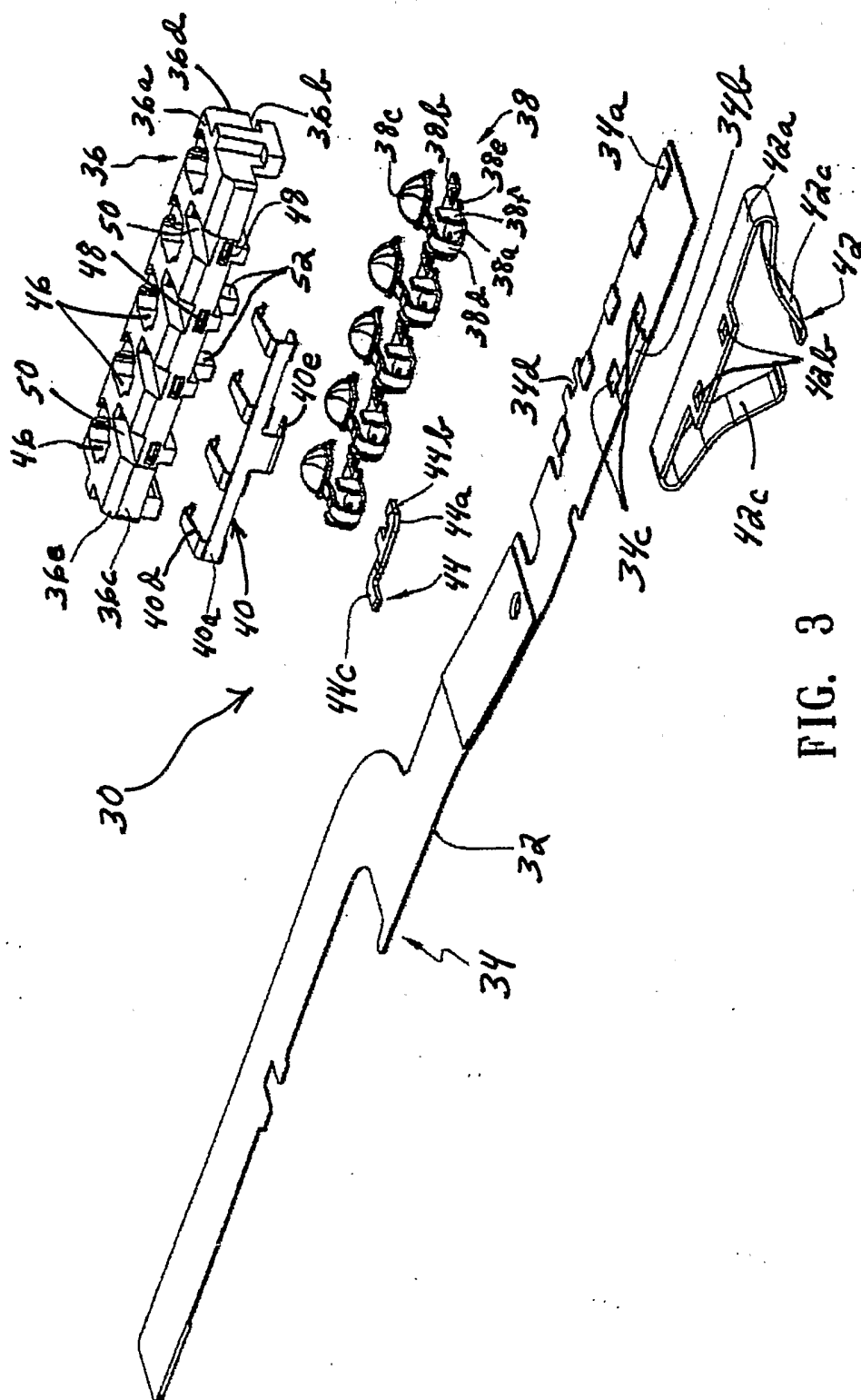


FIG. 3

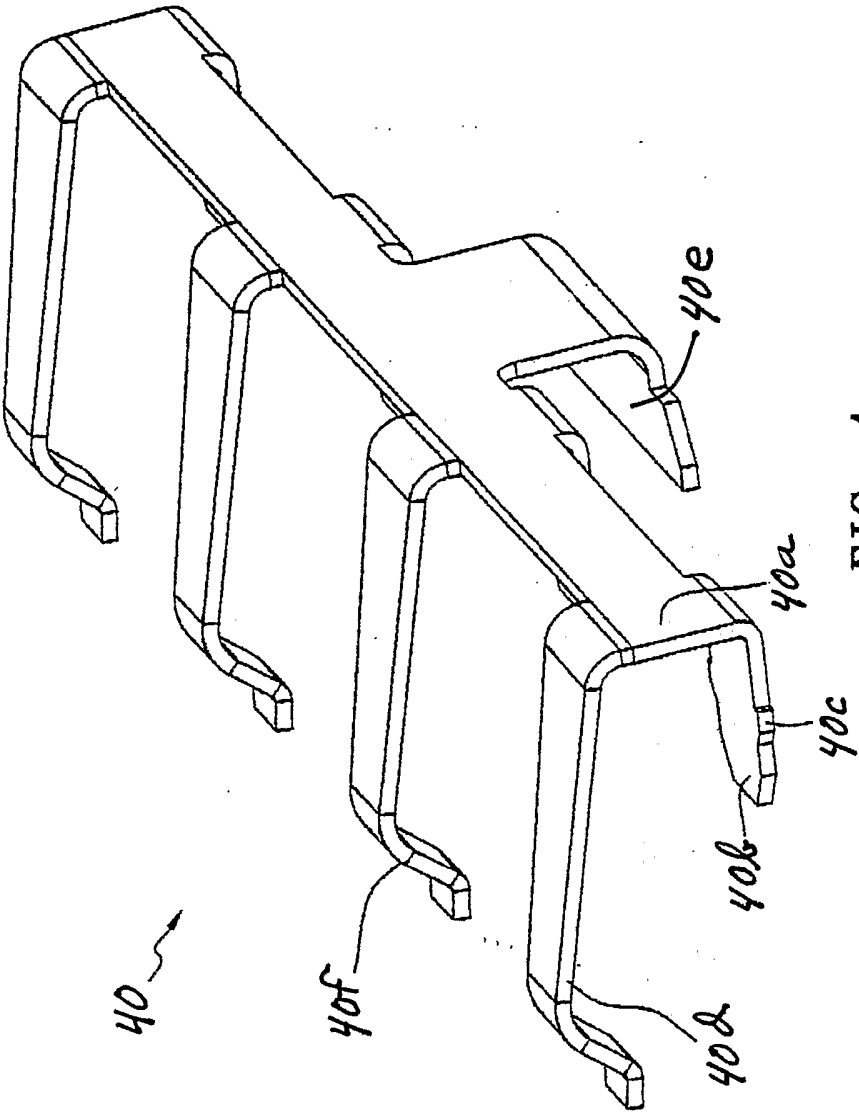


FIG. 4

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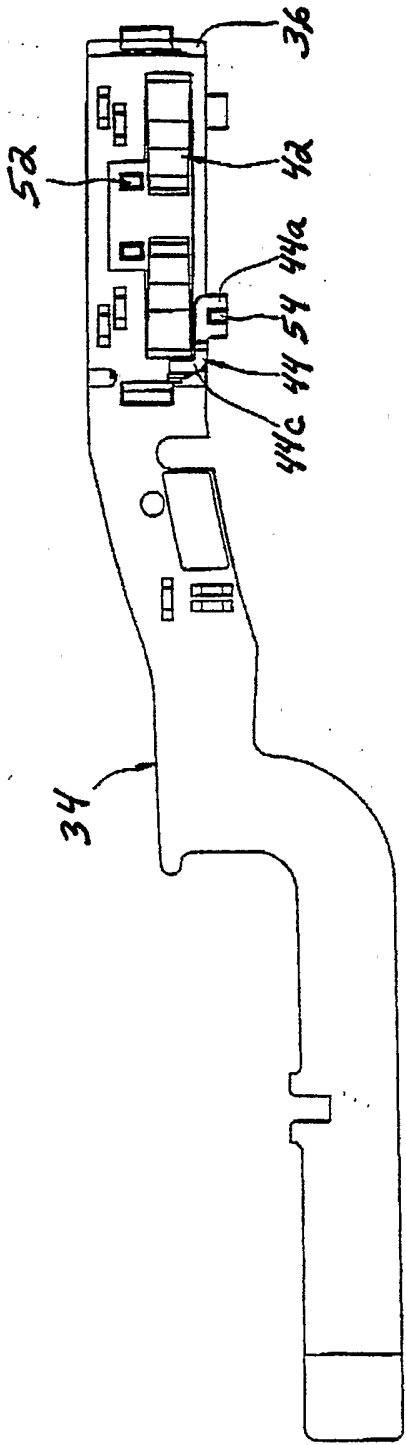


FIG. 5

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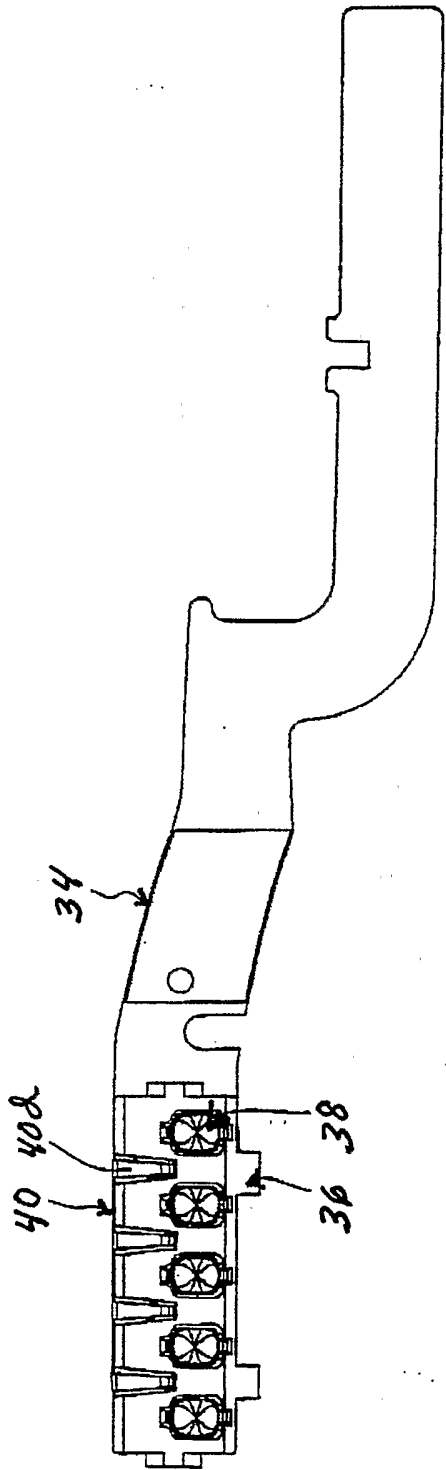


FIG. 6

INTERNATIONAL SEARCH REPORT

national application No

T/US2005/039149

A. CLASSIFICATION OF SUBJECT MATTER

G06K7/00

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)
H01R G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 425 651 A (THRUSH ET AL) 20 June 1995 (1995-06-20) abstract; claims; figures	1-13
A	WO 2004/068391 A (MOLEX INCORPORATED; SAN-SHAN, HUANG; LEI, ZHAO; YOU, SUN ZHAO) 12 August 2004 (2004-08-12) abstract; claims; figures	1-13
A	US 4 509 811 A (AMANO ET AL) 9 April 1985 (1985-04-09) claims; figures	1-13
A	US 2004/121629 A1 (YOU SUN ZHAO) 24 June 2004 (2004-06-24) abstract; claims; figures	1-13
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Further documents are listed in the continuation of Box C.



See patent family annex.

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- *G* document member of the same patent family

Date of the actual completion of the international search

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24/02/2006

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INTERNATIONAL SEARCH REPORT

ational application No

/US2005/039149

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 414 114 A (J.S.T. MFG. CO., LTD) 28 April 2004 (2004-04-28) claims; figures -----	1-13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2005/039149

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