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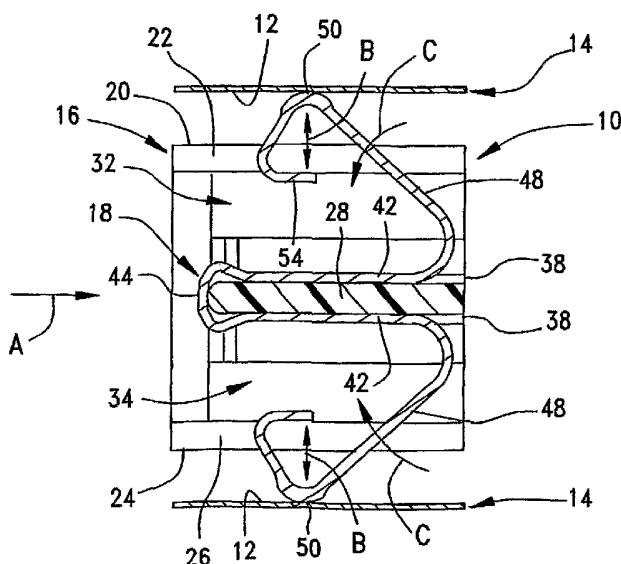
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(54) Title: ELECTRICAL CONNECTOR



(57) Abstract: An electrical connector is provided for interconnecting a pair of spaced conductors. The connector includes a dielectric housing having a top wall with a top opening, a bottom wall with a bottom opening generally aligned with the top opening, and a separator wall between the top and bottom walls and combining therewith to define top and bottom cavities above and below the separator wall. A one-piece conductive terminal includes a generally U-shaped body portion defined by a pair of mounting arms joined at proximal ends thereof by a cross portion. The U-shaped body portion is mounted in the housing by embracing the separator wall, with the mounting arms located on opposite sides of the separator wall in the top and bottom cavities. A pair of resilient contact arms extend from distal ends of the mounting arms into the top and bottom cavities. The contact arms have contact portions projecting through the openings in the top and bottom walls for engaging the spaced conductors.

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— with amended claims

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ELECTRICAL CONNECTOR

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to an electrical connector for interconnecting a pair of spaced conductors, such as a pair of generally parallel, spaced printed circuit boards.

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Background of the Invention:

Generally, electrical connectors are used to interconnect two electrical units. A typical electrical connector includes some form of insulating or dielectric housing mounting one or more conductive terminals. Basically, the terminal(s) electrically interconnects or couples the two electrical units. In some connectors, one electrical unit may be permanently attached to the connector and the terminal(s), such as attaching an electrical cable or wire to the terminal. An opposite end of the terminal is mateable and unmateable with a terminal or contact of a complementary mating connecting device or second connector.

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In other instances, an electrical connector includes one or more terminals having opposite ends which are sandwiched between the two electrical units which are to be electrically coupled or interconnected. For instance, an electrical connector may be mounted between a pair of spaced, generally parallel printed circuit boards. The terminal(s) of the connector has opposite ends engageable with conductors or circuit traces on the two spaced boards. Typically, the terminal(s) has resilient contact arms which engage the conductors of the printed circuit boards under pressure. Problems continue to be encountered with such electrical connectors. The stability and reliability of the connectors are not adequate, particularly because the terminals can shift or become loosened, which adversely affects the electrical contact capabilities of the connector. The contact arms of the terminals may shift or move away from their intended contacts or circuit traces on the printed circuit boards. This is particularly true when the connector is used for a long period of time or under conditions of multiple uses. The present invention is directed to solving these problems.

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Summary of the Invention:

An object, therefore, of the invention is to provide a new and improved electrical connector for interconnecting a pair of spaced conductors.

5 In the exemplary embodiment of the invention, the connector includes a dielectric housing having a top wall with a top opening, a bottom wall with a bottom opening generally aligned with the top opening, and a separator wall between the top and bottom walls and combining therewith to define top and bottom cavities above and below the separator wall. A one-piece conductive terminal includes a generally U-shaped body portion defined by a pair of mounting arms joined at proximal ends thereof by a cross portion. The U-shaped body portion is
10 mounted in the housing by embracing the separator wall, with the mounting arms located on opposite sides of the separator wall in the top and bottom cavities. A pair of resilient contact arms extend from distal ends of the mounting arms into the top and bottom cavities. The contact arms have contact portions projecting through the openings in the top and bottom walls for engaging the spaced conductors.

15 According to one aspect of the invention, each of the cavities in the housing is bounded on opposite sides thereof by a pair of spaced side walls. Guide slots are formed in the side walls for receiving side edges of the respective mounting arm of the terminal. The side edges of the mounting arms include fixing sections for fixing the mounting arms in the guide slots.

20 According to another aspect of the invention, the contact arms include stopping portions engageable with inside surfaces of the top and bottom walls of the housing adjacent the openings to limit the extent that the contact portions can project through the openings. The invention contemplates that the contact arms be assembled into the cavities with a spring preload, with the stopping portions maintained in engagement with the inside surfaces of the top and bottom walls.

25 As disclosed herein, the one-piece conductive terminal is stamped and formed of sheet metal material. The terminal is symmetrical on opposite sides of the separator wall of the housing. The cross portion of the U-shaped body portion of the terminal is enlarged to form a manual gripping knob of the terminal for facilitating inserting the terminal into the cavities on opposite sides of the separator wall.

30 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 an exploded perspective view of an electrical connector according to the invention;

FIG. 2 is a side elevational view of the terminal of the connector;

FIG. 3 is a perspective view of the terminal looking opposite the direction of FIG. 1;

FIG. 4 is a perspective view of the connector in assembled condition, interconnected between a pair of spaced printed circuit boards; and

FIG. 5 is a vertical, central section through the depiction of FIG. 4.

Detailed Description of the Preferred Embodiment:

Referring to the drawings in greater detail, and first to FIG. 1, the invention is embodied in an electrical connector, generally designated 10, for interconnecting a pair of spaced conductors. For instance, FIGS. 4 and 5 show the connector interconnecting a pair of spaced conductors or circuit traces 12 on opposing faces of a pair of generally parallel, spaced printed circuit boards, generally designated 14.

Referring back to FIG. 1, connector 10 basically includes two components, namely a dielectric housing, generally designated 16, and a conductive terminal, generally designated 18. The housing is a one-piece structure unitarily molded of dielectric material such as plastic or the like. The terminal is a one-piece structure which may be stamped and formed of conductive sheet metal material.

Before proceeding with the details of housing 16 and terminal 18, it should be stated that such terms as "top", "bottom", "above", "below" and the like are used herein and in the claims hereof to provide a clear and concise understanding of the invention in reference to the orientation of the components shown in the drawings. It should be understood that such terms

are in no way intended to be limiting in nature. Connector 10 obviously is useful in omni-directional applications.

With those understandings, and referring back to FIG. 1, housing 16 includes a top wall 20 having an opening 22 therein, along with a bottom wall 24 having an opening 26 therein. It can be seen that the openings are in the form of slots that extend completely through the top and bottom walls from front-to-rear of the housing. A separator wall 28 is disposed generally equidistant between the top and bottom walls. The separator wall extends between interior side walls 30. Top and bottom walls 20 and 24, respectively, combine with separator wall 28 and side walls 30 to define top and bottom cavities 32 and 34, respectively. A pair of outwardly flared flanges 36 are formed in the opposing inwardly facing surfaces of side walls 30 in each cavity 32 and 34 to define opposing guide slots 38 in each cavity. In other words, a pair of guide slots are formed in the inside surfaces of the two side walls at opposite sides of each cavity, for purposes described hereinafter.

Referring to FIGS. 2 and 3 in conjunction with FIG. 1, terminal 18 includes a generally U-shaped body portion, generally designated 40, which is defined by a pair of mounting arms 42 joined at proximal ends thereof by a cross portion 44. The U-shaped body portion, particularly mounting arms 42, define an open mouth 46. A pair of contact arms 48 are angled upwardly from mounting arms 42 and lead to contact portions 50 which will engage the spaced conductors, as will be seen hereinafter. Contact portions 50 may be plated with a highly conductive or precious metal. A support arm 52 is angled downwardly from each contact portion 50, and a generally horizontal stopper arm 52 is bent inwardly from each support arm. Each stopper arm has outwardly projecting stopper wings 56. Finally, the edges of mounting arms 42 project outwardly and are serrated, as at 58, to define fixing sections to rigidly secure the terminal within housing 16.

Terminal 18 is inserted or assembled into housing 20 by an operator grasping cross portion 44 of the U-shaped body portion 40 of the terminal and inserting the terminal into the housing in the direction of arrow "A" (Fig. 5). To that end, it can be seen clearly in FIGS. 2 and 5 that cross portion 44 is enlarged or "bulbous" in cross-section to form a manual gripping knob of the terminal for facilitating inserting the terminal into the connector.

During insertion of terminal 18 into housing 16, separator wall 28 enters open mouth 46, and mounting arms 42, along with the fixing sections 58 of the mounting arms, move into guide

slots 38 formed in the inside surfaces of interior side walls 30 of the housing. The fixing sections bite into the plastic material of the housing to securely lock the terminal in its inserted position of FIGS. 4 and 5.

When terminal 18 is fully inserted or mounted within housing 16, contact arms 48 project into cavities 32 and 34, and contact portions 50 project through openings 22 in the top and bottom walls of the housing. Stopper wings 56 of the terminals limit the extent that the contact portions can project through the openings. FIGS. 4 and 5 show contact portions 50 of the terminals engaging the conductors or circuit traces 12 on printed circuit board 14. The contact portions can flex in the direction of double-headed arrows "B" (Fig. 5) due to the flexibility of contact arms 48 which extend from the distal ends of the fixed mounting arms 42.

The above-described structural combination allows terminal 18 to be spring preloaded within housing 16. Specifically, contact arms 48 can be bent outwardly or away from separator wall 28 to an extent greater than that shown in FIG. 5, when the terminal is in an unstressed condition as shown in FIG. 1. Then, when the terminal is inserted into the housing, contact arms 48 can be caused to flex inwardly in the direction of arrow "C" (Fig. 5) as stopper wings 56 of stopper arms 54 ride along the inside surfaces of top and bottom walls 20 and 24, respectively. This effectively spring preloads contact arms 48 in the condition shown in FIGS. 4 and 5 to, thereby, be able to exert a higher pressure against conductors 12 of printed circuit boards 14.

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. An electrical connector for interconnecting a pair of spaced conductors, comprising:

a dielectric housing including a top wall having a top opening, a bottom wall having a bottom opening generally aligned vertically with the top opening, a separator wall between the top and bottom walls and combining therewith to define top and bottom cavities above and below the separator wall; and

a one-piece conductive terminal including a generally U-shaped body portion defined by a pair of mounting arms joined at proximal ends thereof by a cross portion, the U-shaped body portion embracing said separator wall with the mounting arms located on opposite sides of the separator wall in the top and bottom cavities, a pair of resilient contact arms extending from the distal ends of the mounting arms into the top and bottom cavities, and the contact arms having contact portions projecting through the openings in the top and bottom walls for engaging said spaced conductors.

2. The electrical connector of claim 1 wherein said one-piece conductive terminal is stamped and formed of sheet metal material.

3. The electrical connector of claim 1 wherein said one-piece terminal is symmetrical on opposite sides of said separator wall.

4. The electrical connector of claim 1 wherein each of said cavities is bounded on opposite sides thereof by a pair of spaced side walls, and including opposing guide slots in the side walls for receiving side edges of the respective mounting arm of the terminal.

5. The electrical connector of claim 4 wherein the side edges of the mounting arms include fixing sections for fixing the mounting arms in said guide slots.

6. The electrical connector of claim 1 wherein said contact arms include stopping portions engageable with inside surfaces of the top and bottom walls of the housing adjacent said openings to limit the extent that the contact portions can project through said openings.

7. The electrical connector of claim 6 wherein said contact arms are assembled into the cavities with a spring preload, with said stopping portions maintained in engagement with the inside surfaces of the top and bottom walls.

8. The electrical connector of claim 1 wherein the cross portion of said U-shaped body portion of the terminal is enlarged to form a manual gripping knob of the terminal for facilitating inserting the terminal into said cavities on opposite sides of said separator wall.

9. An electrical connector for interconnecting a pair of spaced conductors, comprising:

a dielectric housing including a top wall having a top opening, a bottom wall having a bottom opening generally aligned vertically with the top opening, a separator wall between the top and bottom walls and combining therewith to define top and bottom cavities above and below the separator wall, each of said cavities being bounded on opposite sides thereof by a pair of spaced side walls and including guide slots in the side walls; and

a one-piece conductive terminal stamped and formed of sheet metal material and being symmetrical on opposite sides of said separator wall, the terminal including a generally U-shaped body portion defined by a pair of mounting arms joined at proximal ends thereof by a cross portion, the U-shaped body portion embracing said separator wall with the mounting arms located on opposite sides of the separator wall in the top and bottom cavities within the guide slots in side walls of the housing, a pair of resilient contact arms extending from the distal ends of the mounting arms into the top and bottom cavities, and the contact arms having contact portions projecting through the openings in the top and bottom walls for engaging said spaced conductors.

10. The electrical connector of claim 9 wherein the side edges of the mounting arms include fixing sections for fixing the mounting arms in said guide slots.

11. The electrical connector of claim 9 wherein said contact arms include stopping portions engageable with inside surfaces of the top and bottom walls of the housing adjacent said openings to limit the extent that the contact portions can project through said openings.

12. The electrical connector of claim 11 wherein said contact arms are assembled into the cavities with a spring preload, with said stopping portions maintained in engagement with the inside surfaces of the top and bottom walls.

13. The electrical connector of claim 9 wherein the cross portion of said U-shaped body portion of the terminal is enlarged to form a manual gripping knob of the terminal for facilitating inserting the terminal into said cavities on opposite sides of said separator wall.

CLAIMS**AMENDED CLAIMS**

[received by the International Bureau on 22 February 2005 (22.02.05)
original claims 1-8 amended; original claims 9-13 cancelled.]

1. An electrical connector (10) for interconnecting a pair of spaced conductors (12), comprising:

a dielectric housing (16) including a top wall (20) having a top opening (22), a bottom wall (24) having a bottom opening (26) generally aligned vertically with the top opening, a separator wall (28) between the top and bottom walls and combining therewith to define top and bottom cavities (32,34) above and below the separator wall, each of the cavities being bounded on opposite sides thereof by a pair of spaced side walls (30), the separator wall (28) connecting the pair of spaced side walls; and

a one-piece conductive terminal (18) including a generally U-shaped body portion (40) defined by a pair of mounting arms (42) joined at proximal ends thereof by a cross portion (44), the U-shaped body portion embracing said separator wall with the mounting arms located on opposite sides of the separator wall in the top and bottom cavities, a pair of resilient contact arms (48) extending from the distal ends of the mounting arms into the top and bottom cavities, and the contact arms having contact portions (50) projecting through the openings in the top and bottom walls for engaging said spaced conductors.

2. The electrical connector of claim 1 wherein said one-piece conductive terminal (18) is stamped and formed of sheet metal material.

3. The electrical connector of claim 1 wherein said one-piece terminal (18) is symmetrical on opposite sides of said separator wall (28).

4. The electrical connector of claim 1 wherein opposing guide slots (38) are in the side walls (30) for receiving side edges of the respective mounting arm (42) of the terminal (18).

5. The electrical connector of claim 4 wherein the side edges of the mounting arms (42) include fixing sections (58) for fixing the mounting arms in

said guide slots (38).

6. The electrical connector of claim 1 wherein said contact arms (48) include stopping portions (56) engageable with inside surfaces of the top and bottom walls (20,24) of the housing (16) adjacent said openings (22,26) to limit the extent that the contact portions (50) can project through said openings.

7. The electrical connector of claim 6 wherein said contact arms (48) are assembled into the cavities (32,34) with a spring preload, with said stopping portions (56) maintained in engagement with the inside surfaces of the top and bottom walls (20,24).

8. The electrical connector of claim 1 wherein the cross portion (44) of said U-shaped body portion (40) of the terminal (18) is enlarged to form a manual gripping knob of the terminal for facilitating inserting the terminal into said cavities (32,34) on opposite sides of said separator wall (28).

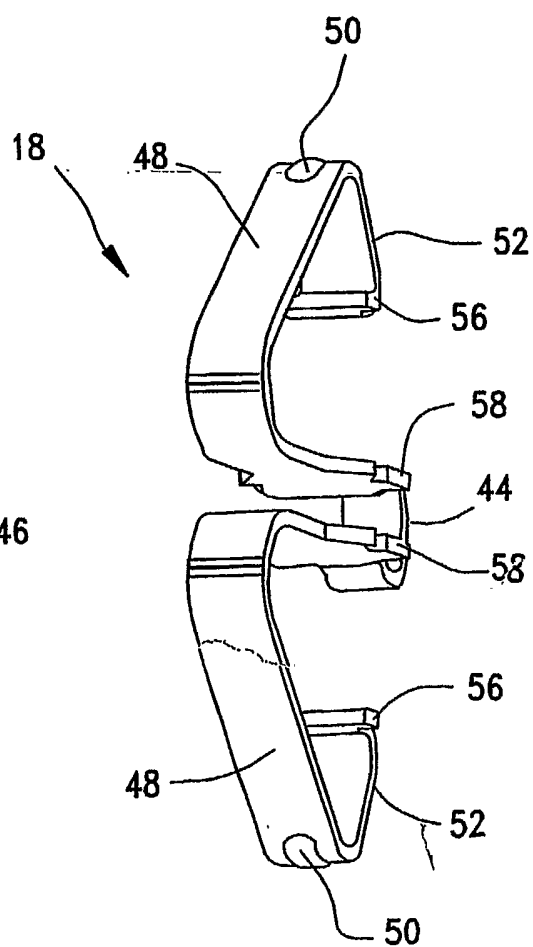
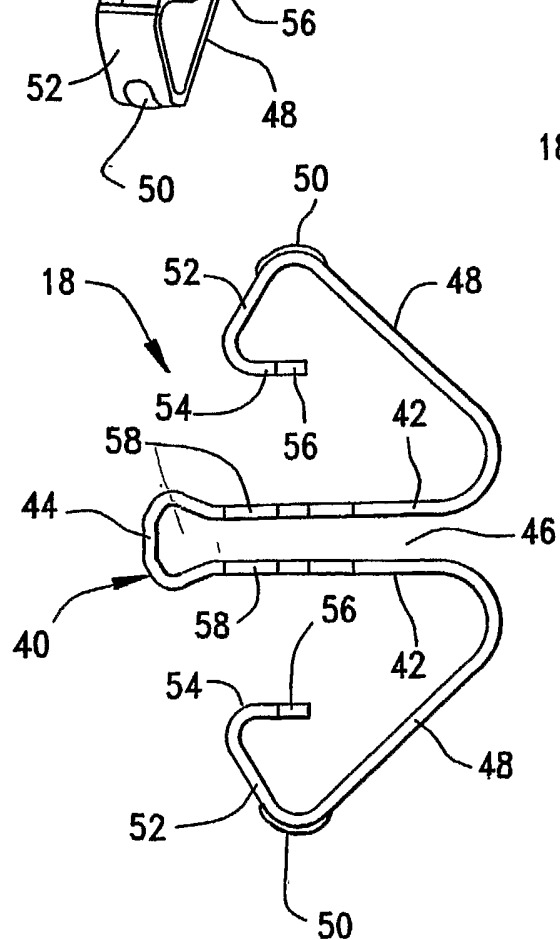
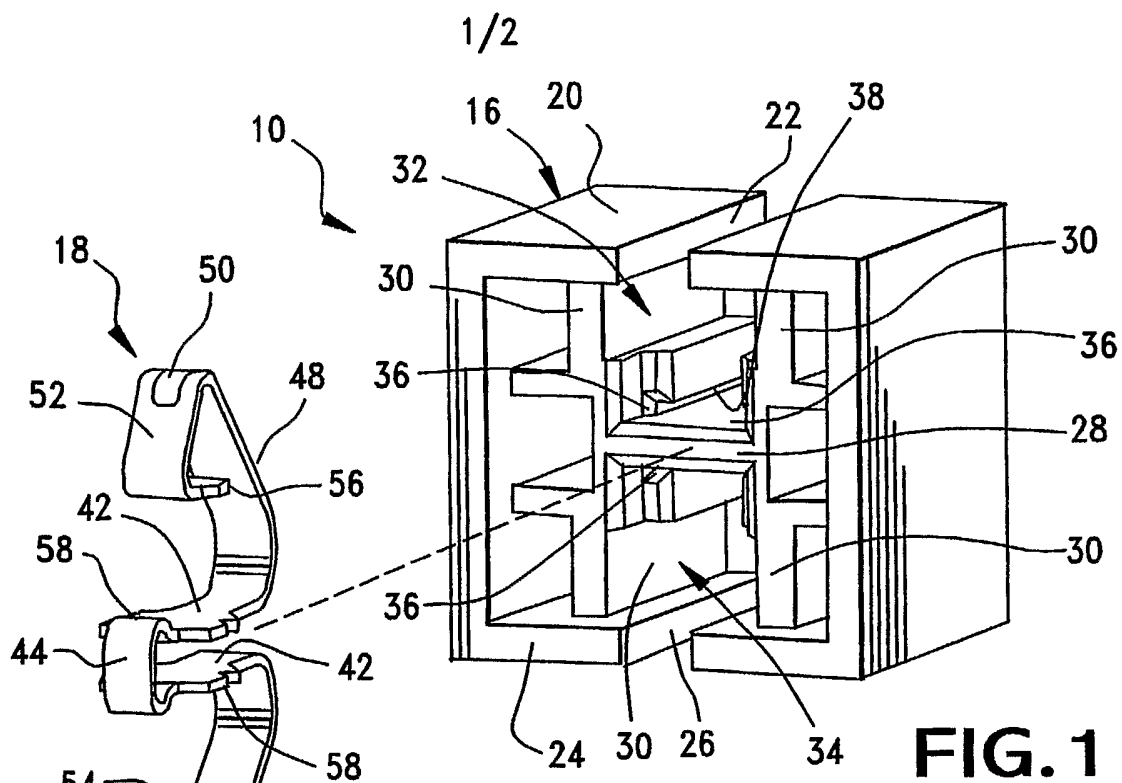


FIG.4

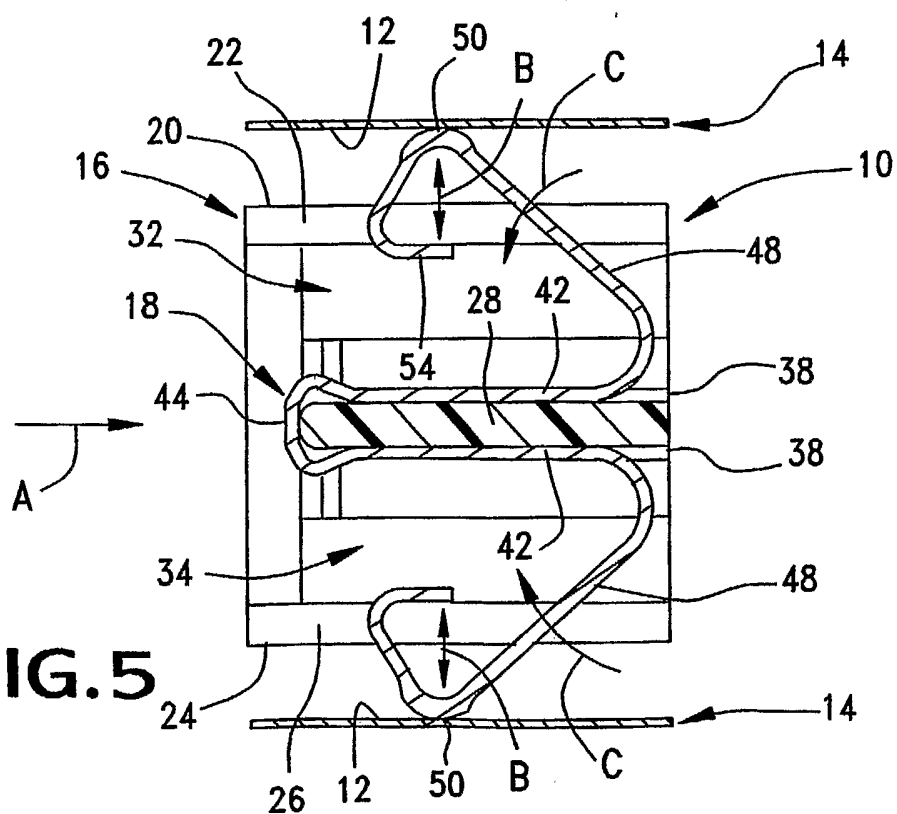
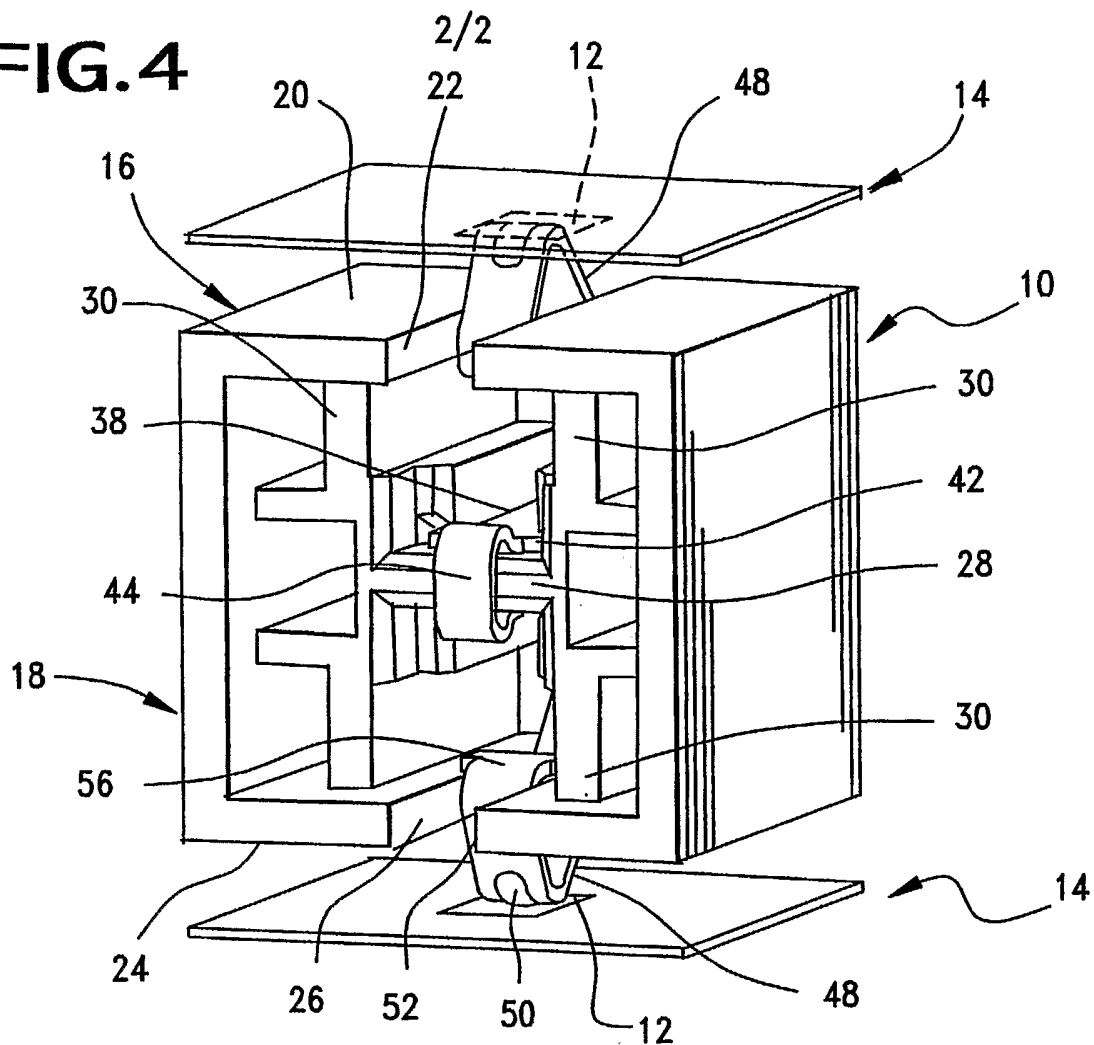


FIG.5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/031155

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01R13/24 H01R12/22

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)
IPC 7 H01R

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.
X	US 6 302 703 B1 (ALTON LEONARD HARRY ET AL) 16 October 2001 (2001-10-16) figure 1	1-3
X	US 6 315 576 B1 (NEIDICH DOUGLAS A) 13 November 2001 (2001-11-13)	1-3,7,8
Y	figures 13-21	4-6,9-13
X	US 6 077 089 A (BISHOP PETER G ET AL) 20 June 2000 (2000-06-20) figure 5A	1
Y	DE 100 27 600 C (AMPHENOL TUCHEL ELECT) 22 November 2001 (2001-11-22) the whole document	4-6,9-13



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *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
- *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
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

5 January 2005

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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