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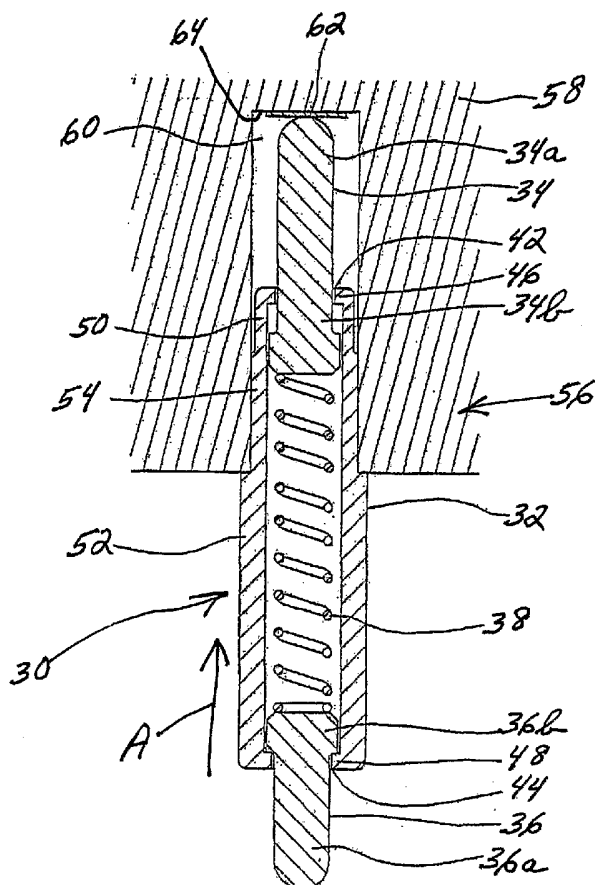
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- (71) Applicant (for all designated States except US): **MOLEX INCORPORATED** [US/US]; 2222 Wellington Court, Lisle, IL 60532 (US).
- (72) Inventor: **XU, Xiang** [CN/CN]; Room 601, No. 20, Yuesheng Apartment House, Xiaolin Road, Yushan Town, Kunshan City, Jiangsu (CN).
- (74) Common Representative: **MOLEX INCORPORATED**; 2222 Wellington Court, Lisle, IL 60532 (US).
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[Continued on next page]

(54) Title: ELECTRICAL TERMINAL



(57) Abstract: An electrical terminal includes first and second contact members having outer pressure contacting end portions for pressure engaging a pair of spaced electrical devices. The contact members have enlarged inner end portions. A sleeve includes a through hole for slidably receiving the inner end portions of the contact members at opposite ends thereof. The through hole has opposite open ends through which the pressure contacting end portions of the contact members project. Restricted stops are formed at the open ends of the through holes for abutting the enlarged inner ends of the contact members to define outer limit positions of the pressure contacting end portions of the contact members. A biasing member is disposed in the through hole to resiliently bias the contact members in opposite directions. The invention contemplates that an outside diameter of the sleeve at a first end thereof be smaller than an outside diameter of the sleeve at a second end thereof. Thereby, the smaller diameter end is easily formed into a restricted stop, and the larger diameter end of the sleeve can be used for clamping and disassembling the terminal from an electrical device without damaging the sleeve.

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- with international search report
- 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 TERMINAL

### Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to a double-ended pressure contacting terminal for establishing an electrical connection between two spaced electrical devices.

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### Background of the Invention:

As is known in the art, pressure contacting electrical terminals are used to form a conductive circuit between two electrical devices by pressure engagement therebetween, such as establishing a connection between a mobile phone and an antenna. During assembly, one end of the terminal first is pressure engaged with a first electrical device, and an opposite end of the terminal then is pressure engaged with the second electrical device, thereby establishing an electrical connection between the two electrical devices.

For instance, FIG. 1 shows a prior art electrical terminal, generally designated 10, of the character described above. The terminal includes a sleeve or housing 12 having an inner conductive liner 14 forming a through hole 16 through the housing. The through hole has opposite open ends 18. A pair of contact members 20 have outer pressure contacting end portions 20a and enlarged inner end portions 20b. The inner end portions are reciprocally mounted within through hole 16, while outer end portions 20a project through openings 18 and outwardly of the housing. A coil spring 22 is disposed within through hole 16 and has opposite ends in engagement with the enlarged inner end portions 20b of contact members 20 to bias the contact members in opposite directions. It can be seen that the outer pressure contacting end portions 20a of contact members 20 have identical lengths.

It can be seen in FIG. 1 that sleeve 12 has a uniform thickness or cross-sectional dimension, as indicated by double-headed arrow 24, which extends the entire length of the sleeve. This creates problems because inwardly directed flanges 26 are formed to provide restricted stops which abut the enlarged inner end portions 20b of contact members 20. The stops define the outer limit positions of outer end portions 20a of the contact members. During assembly, one of the contact members, along with coil spring 22, are inserted through hole 16 against the flange 26 which has been pre-formed on one end of the sleeve. The opposite contact member is inserted into the through hole, compressing the coil spring, and

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the flange 26 at the opposite end of the sleeve is formed inwardly, typically by a riveting or bending operation. This riveting or bending procedure is difficult due to the thickness of the sleeve. If the outer diameter (i.e., thickness) of the sleeve is reduced, the sleeve is easily bent or damaged by a clamp or other tool if it is desired to disassemble the entire terminal from an electrical device.

In other words, a problematic dilemma is created because, on the one hand, it is desirable to have a thin sleeve to facilitate the riveting or bending operation which forms flanges 26, but, on the other hand, it is desirable to have a thick sleeve for clamping and disassembling the terminal from an electrical device. The present invention solves these problems by providing a unique terminal with a sleeve or housing of varying dimensions.

**Summary of the Invention:**

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

In the exemplary embodiment of the invention, the terminal includes first and second contact members having outer pressure contacting end portions for pressure engaging a pair of spaced electrical devices. The contact members have enlarged inner end portions. A sleeve includes a through hole for slidably receiving the inner end portions of the contact members at opposite ends thereof. The through hole has opposite open ends through which the pressure contacting end portions of the contact members project. Restricted stops are formed at the open ends of the through hole for abutting the enlarged inner ends of the contact members to define outer limit positions of the pressure contacting end portions of the contact members. A biasing member is disposed in the through hole to resiliently bias the contact members in opposite directions. The invention contemplates that an outside diameter of the sleeve at a first end thereof be smaller than an outside diameter of the sleeve at a second end thereof. Thereby, the smaller diameter end is easily formed into a restricted stop, and the larger diameter end of the sleeve can be used for clamping and disassembling the terminal from an electrical device without damaging the sleeve.

As disclosed herein, the biasing member comprises a coil spring. The restricted stops comprise inwardly turned flanges of the sleeve at the opposite open ends thereof. The outer pressure contacting end portions of the contact members are dome shaped to present a rounded convex contact surfaces for engaging the electrical devices.

The invention contemplates that an electrical device be provided with a housing having a mounting cavity, with a fixed contact at a base of the cavity. The sleeve is mounted

in the cavity with the smaller diameter end of the sleeve projecting into the cavity and the larger diameter end of the sleeve projecting outside the cavity. The pressure contacting end of the contact member at the smaller diameter end of the sleeve is resiliently biased against the fixed contact at the base of the cavity.

5 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:

10 FIG. 1 is a longitudinal or axial section through an electrical terminal according to the prior art and described in the Background, above;

FIG. 2 is an exploded perspective view of an electrical terminal according to the invention;

FIG. 3 is a perspective view of the terminal of FIG. 1 in assembled condition;

FIG. 4 is a longitudinal or axial section through the terminal; and

20 FIG. 5 is a view similar to that of FIG. 4, but showing the terminal mounted in an electrical device.

#### **Detailed Description of the Preferred Embodiment:**

Referring to the drawings in greater detail, and first to FIGS. 2-4, the invention is embodied in an electrical terminal, generally designated 30, which is extremely simple and includes only four components, namely: a sleeve 32, a first contact member 34 mounted at one end of the sleeve, a second contact member 36 mounted at an opposite end of the sleeve, and a coil spring 38 within the sleeve and biasing the contact members in opposite directions. The sleeve defines an elongated through hole 40 within which the coil spring is disposed.

30 More particularly, first contact member 34 includes an outer pressure contacting end portion 34a for pressure engaging a first electrical device as will be seen hereinafter. The first contact member includes an enlarged inner end portion 34b.

Second contact member 36 of terminal 32 has an outer pressure contacting end portion 36a for pressure engaging a second electrical device. The second contact portion also has an enlarged inner end portion 36b.

Through hole 40 of sleeve 32 slidably receives the inner end portions 34b and 36b of  
5 contact members 34 and 36, respectively. The through hole has a first open end 42 through  
which the pressure contacting end portion 34a of first contact member 34 projects. The  
through hole has a second open end 44 through which the pressure contacting end portion 36a  
of second terminal 36 projects. Sleeve 32 has first and second restricted stops 46 and 48,  
10 respectively, at the first and second open ends, respectively, of the through hole for abutting  
the enlarged inner ends 34b and 36b, respectively, of the contact members to define outer  
limit positions of the pressure contacting end portions of the contact members. Coil spring 38  
abuts against the enlarged inner end portions 34b and 36b of the contact members to bias the  
contact members in opposite directions. It can be seen that the outer end portion 34a of first  
15 contact member 34 is longer than end portion 36a of second contact member 36.

The invention contemplates that at least the opposite ends of sleeve 32 be of different  
15 diameters and/or thicknesses. Specifically, as best seen in FIG. 4, a first end 50 of sleeve 32  
is of a given or smaller diameter than a second end 52 of the sleeve. With the diameter of  
through hole 40 being constant throughout its length, first end 50 of the sleeve, thereby, is  
thinner than second end 52 of the sleeve. The diameter of first end 50 is indicated by double-  
20 headed arrow "d1", and the diameter of second end 52 of the sleeve is indicated by double-  
headed arrow "d3". In the preferred embodiment, the diameter of the sleeve is progressively  
varied by providing an intermediate section 54 which is larger than the diameter of first end  
50 but smaller than the diameter of second end 52. The diameter of the intermediate section  
is indicated by double-headed arrow "d2". The sleeve can be fabricated of metal material and  
25 machined to provide the different diameters.

Referring to FIG. 5, the invention contemplates that terminal 30 can be assembled to  
an electrical device, generally designated 56 in the direction of arrow "A". The electrical  
device includes a housing 58 having a mounting cavity 60, with a fixed contact 62 at a base  
64 of the cavity. Sleeve 32 is mounted into cavity 60 in the direction of arrow "A", with the  
30 smaller diameter first end 50 of the sleeve projecting into the cavity, and the larger diameter  
second end 52 of the sleeve projecting outside the cavity. The pressure contacting end  
portion 34a of first contact member 34 is resiliently biasingly engaged with fixed contact 62  
at the base of the cavity by the pressure from coil spring 38. Intermediate section 54 of the

sleeve bears against the inside walls of cavity 60, while the smaller diameter first end 50 of the sleeve can act as a lead-in to easily insert the sleeve into the cavity.

The advantages of the invention can best be seen by again referring to FIGS. 4 and 5. The restricted stop flange 48 at the wider or thicker end 52 of the sleeve can be easily pre-  
5 formed in an appropriate jig. Contact members 34 and 36 and coil spring 38 then are assembled into through hole 40 of sleeve 32. Restricted stop flange 46 then is formed by a riveting or bending operation. This riveting or bending procedure is facilitated by the “thinness” of the smaller diameter end 50 of sleeve 32. Once terminal 30 is mounted into  
10 cavity 60 of electrical device 56 as shown in FIG. 5, the thin or smaller diameter end 50 of sleeve 32 is protected within cavity 60. However, the more robust, thicker and wider diameter second end 52 of the sleeve is exposed exteriorly of the electrical device and can be clamped to remove the terminal, without damaging or crushing the thicker end of the sleeve.

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  
15 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 terminal, comprising:

a first contact member having an outer pressure contacting end portion for pressure engaging a first electrical device and an enlarged inner end portion;

5 a second contact member having an outer pressure contacting end portion for pressure engaging a second electrical device and an enlarged inner end portion;

a sleeve including

a through hole for slidably receiving the inner end portions of the first and second contact members,

10 said through hole having a first open end through which the pressure contacting end portion of the first contact member projects and a second open end through which the pressure contacting end portion of the second contact member projects,

restricted stops at the first and second open ends of the through hole for abutting the enlarged inner ends of the contact members to define outer limit positions of the pressure contacting end portions of the contact members, and

15 an outside diameter of the sleeve at a first end thereof being smaller than an outside diameter of the sleeve at a second end thereof; and

a biasing member in the through hole of the housing to resiliently bias the contact members in opposite directions.

2. The electrical terminal of claim 1 wherein said sleeve includes an intermediate section between said first and second ends of the sleeve, the intermediate section having an outside diameter larger than the diameter of the first end but smaller than the diameter of the second end of the sleeve.

3. The electrical terminal of claim 1 wherein said restricted stops comprise inwardly turned flanges of the sleeve at said first and second open ends thereof.

4. The electrical terminal of claim 1 wherein the outer pressure contacting end portion of said first contact member is dome shaped to present a rounded convex contact surface for engaging the first electrical device.

5. The electrical terminal of claim 1 wherein the outer pressure contacting end portion of said second contact member is dome shaped to present a rounded convex contact surface for engaging the second electrical device.

6. The electrical terminal of claim 5 wherein the outer pressure contacting end portion of said first contact member is dome shaped to present a rounded convex contact surface for engaging the first electrical device.

7. In combination with the electrical terminal of claim 1, said first electrical device including a housing having a mounting cavity with a fixed contact at a base of the cavity, said sleeve being mounted in the cavity with the smaller diameter first end of the sleeve projecting into the cavity and the larger diameter second end of the sleeve projecting  
5 outside the cavity, and with the pressure contacting end portion of the first contact member resiliently biasingly engaging the fixed contact at the base of the cavity.

8. The combination of claim 7 wherein said sleeve includes an intermediate section between said first and second ends of the sleeve, the intermediate section having an outside diameter larger than the diameter of the first end but smaller than the diameter of the second end of the sleeve.

9. The combination of claim 8 wherein said intermediate section of the sleeve bears against inside walls of said mounting cavity, leaving the smaller diameter first end of the sleeve spaced inwardly of the inside walls of the cavity.

## AMENDED CLAIMS

[received by the International Bureau on 17 May 2005 (17.05.05);  
original claims 2 and 8 cancelled; original claims 1, 3-7 and 9 amended. ]

1. An electrical terminal (30), comprising:
  - a first contact member (34) having an outer pressure contacting end portion (34a) for pressure engaging a first electrical device (56) and an enlarged inner end portion (34b);
  - a second contact member (36) having an outer pressure contacting end (36a) portion for pressure engaging a second electrical device and an enlarged inner end portion (36b);
  - a sleeve (32) having a constant inner diameter and an outside diameter (d1) at a first end (50) thereof being smaller than an outside diameter (d3) at a second end (52) thereof and including an intermediate section (54) between said first and second ends (50,52) of the sleeve, the intermediate section having an outside diameter (d2) larger than the diameter of the first end of the sleeve but smaller than the diameter of the second end of the sleeve, the wall thickness at the first end (50) being thinner than the wall thickness at the second end (52) whereby a riveting or bend procedure at the first end can be facilitated by the thinness of the wall of the smaller diameter end (50);
  - a through hole (40) for slidably receiving the inner end portions of the first and second contact members;
  - said through hole having a first open end (42) through which the pressure contacting end portion of the first contact member projects and a second open end (44) through which the pressure contacting end portion of the second contact member projects;
  - restricted stops (46,48) at the first and second open ends of the through hole for abutting the enlarged inner ends of the contact members to define outer limit positions of the pressure contacting end portions of the contact members; and
  - a biasing member (38) in the through hole of the housing to resiliently bias the contact members in opposite directions.
3. The electrical terminal of claim 1 wherein said restricted stops comprise inwardly turned flanges (46,48) of the sleeve (32) at said first and second open ends (42,44) thereof.
4. The electrical terminal of claim 1 wherein the outer pressure contacting end portion (34a) of said first contact member (34) is dome shaped to present a rounded convex contact surface for engaging the first electrical device.

5. The electrical terminal of claim 1 wherein the outer pressure contacting end portion (36a) of said second contact member (36) is dome shaped to present a rounded convex contact surface for engaging the second electrical device.

6. The electrical terminal of claim 5 wherein the outer pressure contacting end portion (34a) of said first contact member (34) is dome shaped to present a rounded convex contact surface for engaging the first electrical device.

7. In combination with the electrical terminal of claim 1, said first electrical device (56) including a housing (58) having a mounting cavity (60) with a fixed contact (62) at a base (64) of the cavity, said sleeve (32) being mounted in the cavity with the smaller diameter first end (50) of the sleeve projecting into the cavity and the larger diameter second end (52) of the sleeve projecting outside the cavity, and with the pressure contacting end portion (34a) of the first contact member (34) resiliently biasingly engaging the fixed contact at the base of the cavity.

9. The combination of claim 7 wherein said intermediate section (54) of the sleeve (32) bears against inside walls of said mounting cavity (60), leaving the smaller diameter first end (50) of the sleeve spaced inwardly of the inside walls of the cavity.

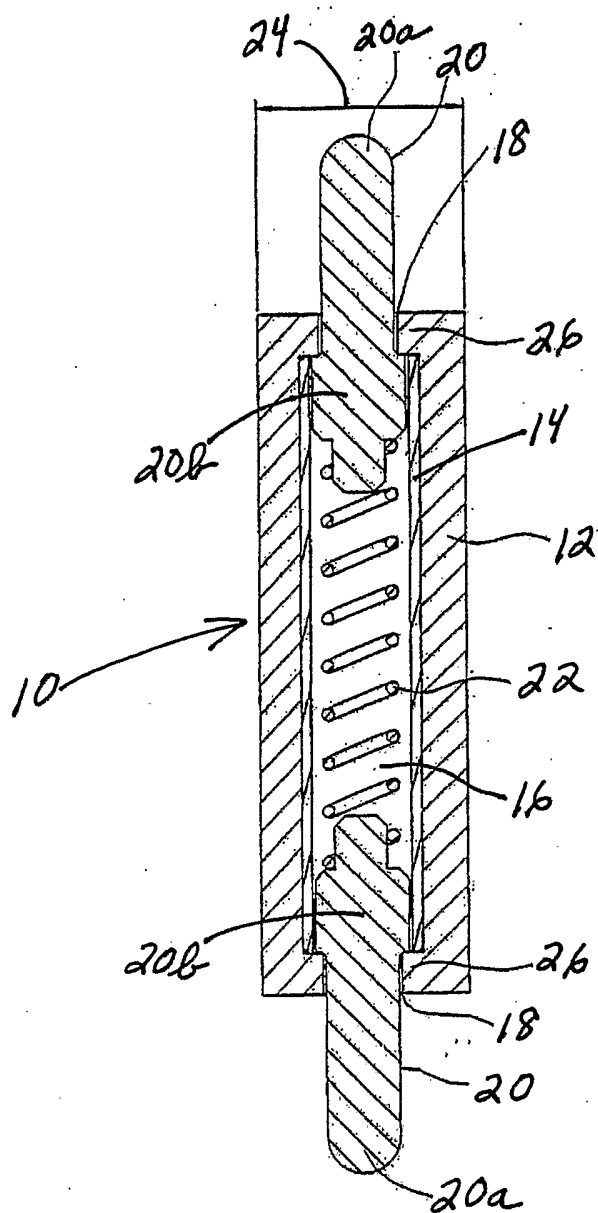


FIG. 1  
(PRIOR ART)

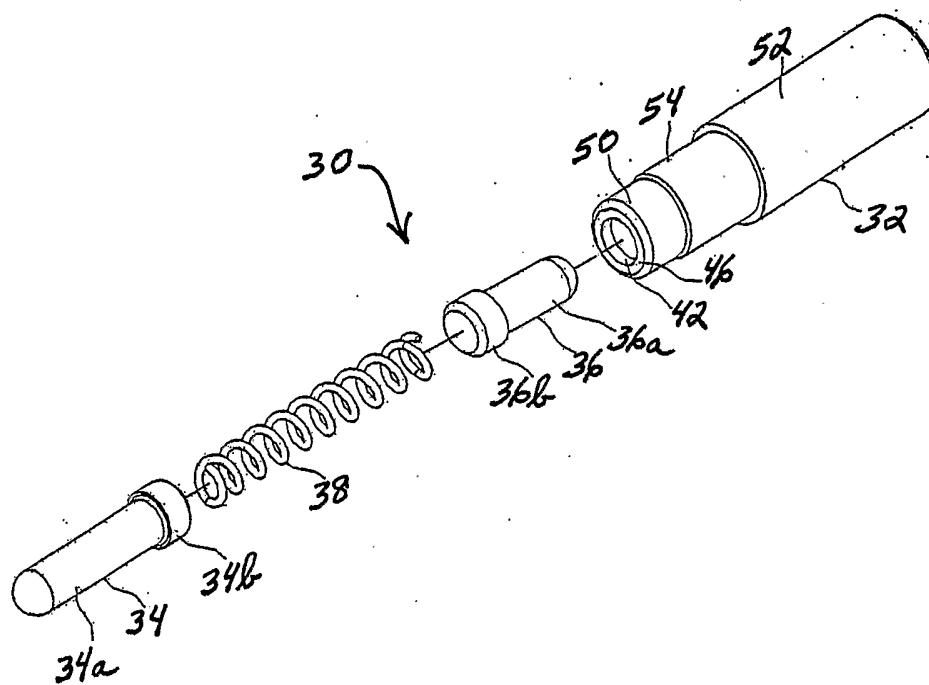


FIG. 2



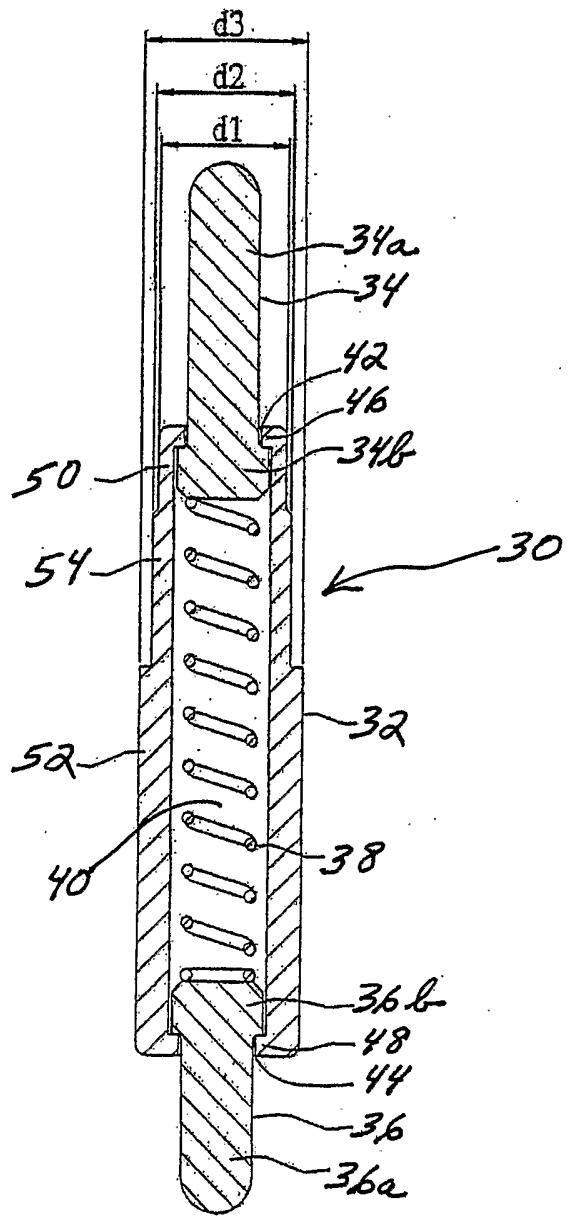


FIG. 4

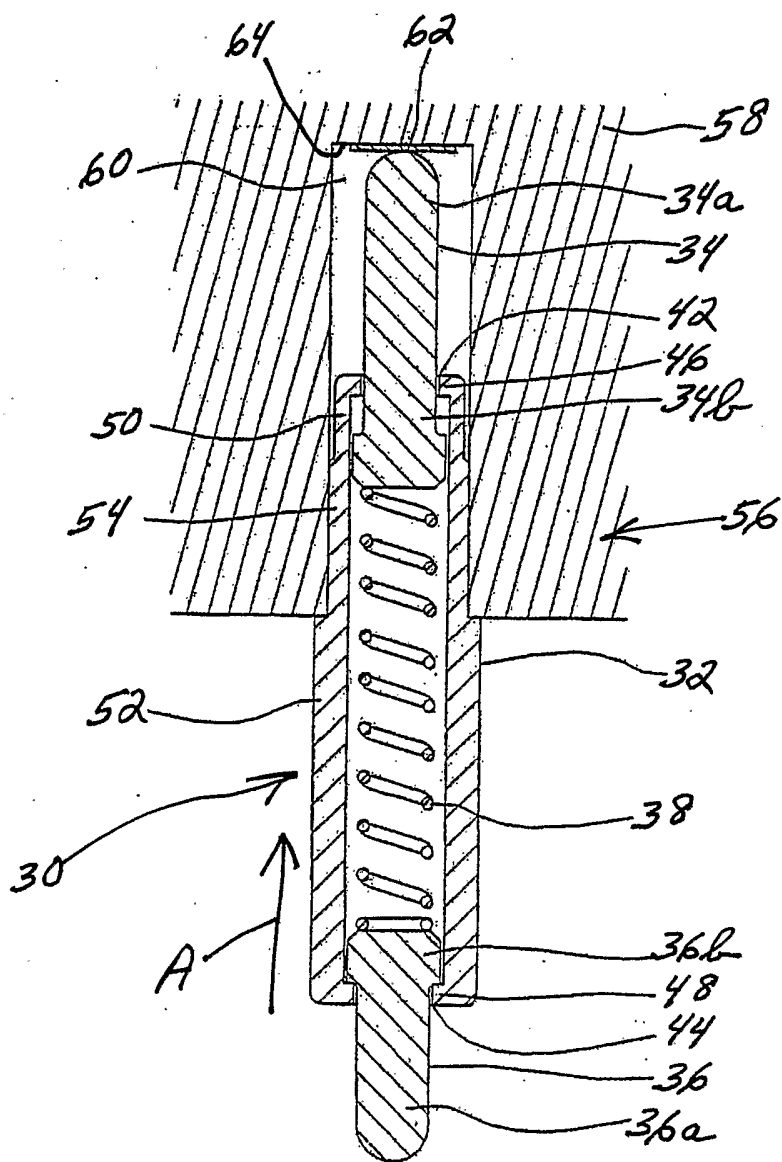


FIG. 5

# INTERNATIONAL SEARCH REPORT

International Application No PCT/US2004/041354
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**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H01R13/24

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 G01R

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 4 528 500 A (LIGHTBODY ET AL) 9 July 1985 (1985-07-09)	1,3
Y	column 5, line 28 - line 37; figure 3 -----	2,4-9
Y	US 5 936 421 A (STOWERS ET AL) 10 August 1999 (1999-08-10)	2,8,9
	column 13, line 16 - line 42; figure 23 -----	
Y	EP 1 172 658 A (INTERCONNECT DEVICES INC) 16 January 2002 (2002-01-16)	4-6
	page 4, column 4, line 5 - line 7 page 4, column 4, line 25; figures 6,7 -----	
Y	US 5 393 246 A (DU ET AL) 28 February 1995 (1995-02-28)	7-9
	column 4, line 16 - line 20; figure 5 ----- -/--	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

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- \*O\* document referring to an oral disclosure, use, exhibition or other means
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- \*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.
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Date of the actual completion of the international search

6 April 2005

Date of mailing of the international search report

02/05/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Criqui, J-J

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US2004/041354

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 046 597 A (BARABI ET AL) 4 April 2000 (2000-04-04) column 4, line 4 - line 7; figure 4 -----	1-9

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			US	6559665 B1	06-05-2003