

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
24 February 2005 (24.02.2005)

PCT

(10) International Publication Number
WO 2005/018057 A1

(51) International Patent Classification⁷: **H01R 12/22**,
13/24

(21) International Application Number:
PCT/US2004/026208

(22) International Filing Date: 12 August 2004 (12.08.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
03 2 08125.1 12 August 2003 (12.08.2003) CN

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

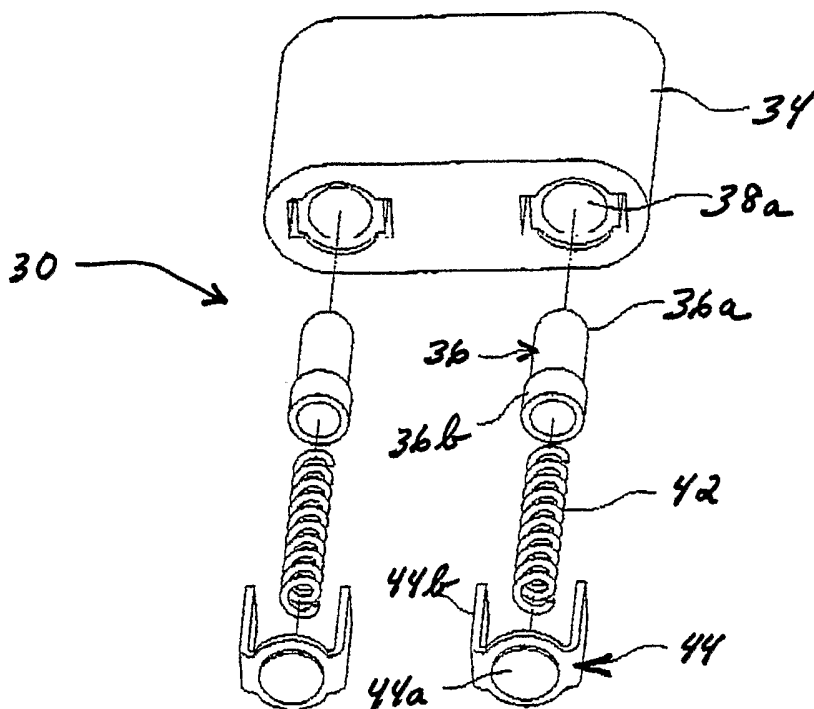
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- 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.

(54) Title: SPRING-LOADED ELECTRICAL TERMINAL



(57) Abstract: An electrical terminal includes a contact member having a front end portion of a given diameter and an enlarged rear end portion of a diameter at least slightly larger than the given diameter. A plastic housing has a through hole for slidably receiving the rear end portion of the contact member. The through hole includes an open rear end through which the contact member can be inserted into the housing. The through hole has an open front end through which the front end portion of the contact member extends and is exposed exteriorly of the housing for engaging a complementary contact device. A restricted stop is formed at the front end of the through hole for abutting the enlarged rear end portion of the contact member to define a forward limit position of the contact member. A spring is disposed in the through hole behind the contact member to

resiliently bias the contact member forwardly.

SPRING-LOADED ELECTRICAL TERMINAL

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to a spring-loaded electrical terminal for use in electrical connectors, testing probes or the like.

Background of the Invention:

FIG. 1 shows a conductive electrical terminal, generally designated 20, which can be used in electrical connectors or testing probes, according to the prior art. The terminal is an assembly which includes a housing 22, a contact member 24 and a coil spring 26. The contact member has a reduced-diameter front end 24a and an enlarged rear end 24b. The housing has a bore 22a within which the enlarged rear end of the contact member is slidably disposed. The housing also has an open front end 22b and a closed rear end 22c. Coil spring 26 is sandwiched and "loaded" between closed rear end 22c of the housing and rear end 24b of the contact member to bias the contact member forwardly as shown in FIG. 1.

During assembly, coil spring 26 and contact member 24 are assembled into housing 22 through the front open end of the housing. After the spring and the contact member are assembled in the housing, the front end of the housing is reformed by coining, crimping, riveting or other process to form a reduced-diameter hole through which the reduced-diameter front end 24a of contact member 24 protrudes. The reduced-diameter front end of the housing, thereby, forms a stop to define the forward limit position of the contact member and also to provide a bearing hole through which front end 24a of the contact member is reciprocally slidable. In essence, the surface area between the housing and the contact member at the reduced-diameter open front end of the housing is the thickness of the metal material of the housing. This thickness is rather small, particularly when the housing typically is stamped and formed of sheet metal material.

In practical use, closed rear end 22c of housing 22 may be fixed to a circuit trace on a printed circuit board by surface soldering techniques or by securing the rear end of the housing in a hole in the circuit board. The front end of contact member 24 may be used for engaging an appropriate contact of a complementary connecting device, or the front end of the contact member

may be used in a testing probe apparatus, both applications providing a terminal for transmitting signals to the circuit board.

FIG. 2 shows prior art terminal 20 mounted in a through hole 28a of an appropriate casing 28 of dielectric material. For instance, the casing may be of plastic material. In that instance, the plastic material may be overmolded about housing 22 of the terminal, as shown. FIG. 2A shows a pair of the prior art terminals 20 mounted in a pair of through holes 28a in plastic casing 28, in a side-by-side relationship.

Various problems are encountered in manufacturing and using prior art terminal 20. For instance, with housing 22 fabricated of metal material, the housing is relatively heavy and the manufacturing costs thereof are not desirable. In addition, the reduced-diameter front end 22b of the housing must be coined, crimped or riveted which adds processing time, expense and difficulty in manufacture. Quite importantly, the aperture diameter formed by these processes (through which front end 24a of the contact member protrudes) is difficult to control. Quite often, the aperture diameter is too big or too small. When the aperture diameter is too big, the contact member is undesirably loose or can tilt relative to the housing. When the aperture diameter is too small, the contact member is stiff and often binds. The present invention is directed to solving these problems.

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 a contact member having a front end portion of a given diameter and an enlarged rear end portion of a diameter at least slightly larger than the given diameter. A plastic housing has a through hole for slidably receiving the rear end portion of the contact member. The through hole includes an open rear end through which the contact member can be inserted into the housing. The through hole has an open front end through which the front end portion of the contact member extends and is exposed exteriorly of the housing for engaging a complementary contact device. A restricted stop is formed at the front end of the through hole for abutting the enlarged rear end portion of the contact member to define a forward limit position of the contact member. A biasing member is disposed in the through hole behind the contact member to resiliently bias the contact member forwardly.

According to one aspect of the invention, the front end portion of the contact member, the enlarged rear end portion of the contact member, the through hole and the open front end of the through hole, all are circular in cross-section. As disclosed herein, the biasing member comprises a spring.

According to another aspect of the invention, a base cap is provided for closing of the open rear end of the through hole in the plastic housing to hold the biasing and contact members therein. The base cap includes a closure portion for blocking the open rear end of the through hole and a mounting portion for securing the base cap to the housing.

In one embodiment of the invention, the mounting portion of the base cap comprises a mounting leg, and the plastic housing has a mounting hole extending generally parallel to the through hole for receiving the mounting leg. As disclosed herein, the base cap according to a first embodiment is generally U-shaped and includes a pair of the mounting legs at opposite sides of the closure portion inserted into a pair of mounting holes at opposite sides of the through hole.

In another embodiment of the invention, the mounting portion of the base cap is provided by a pair of mounting flanges at opposite sides of the closure portion. The mounting flanges are inserted into a pair of mounting slots in the housing extending generally perpendicular to the through hole at opposite sides thereof.

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:

FIGS. 1, 2 and 2A are sectional views through the prior art terminal as described in the Background, above;

FIG. 3 is an electrical terminal assembly according to a first embodiment of the invention;

FIG. 4 is an exploded perspective view of the assembly of FIG. 3;

FIG. 5 is a top plan view of the assembly of FIG. 3;

FIG. 6 is a vertical section taken generally along line 6-6 of FIG. 5, with the base caps removed from the housing;

FIG. 7 is a vertical section taken generally along 7-7 of FIG. 5;

FIG. 8 is a view similar to that of FIG. 6, with the base caps installed;

FIG. 9 is a perspective view of an electrical terminal assembly according to a second embodiment of the invention;

FIG. 10 is an exploded perspective view of the assembly of FIG. 9;

FIG. 11 is a perspective view similar to that of FIG. 10, but taken at a different angle;

FIG. 12 is a top plan view of the assembly of FIG. 9;

FIG. 13 is a vertical section taken generally along line 13-13 of FIG. 11, with the base caps removed from the housing;

FIG. 14 is a view similar to that of FIG. 13, with the base caps installed;

FIG. 15 is a side elevational view of the assembly of FIG. 9; and

FIG. 16 is a vertical section taken generally along line 16-16 of FIG. 15.

Detailed Description of the Preferred Embodiments:

Referring to the drawings in greater detail, and first to FIGS. 3-7; the invention is embodied in an electrical terminal assembly, generally designated 30, which is a dual-terminal assembly in that the assembly includes two electrical terminals, generally designated 32 (Fig. 4) incorporated in a common or single housing 34. However, in order to provide a concise and clear understanding of the invention, a single electrical terminal 32 will be described hereinafter, with the understanding that the other terminal 32 within common housing 34 is identical.

With that understanding, each electrical terminal 32 includes a contact member, generally designated 36, having a front end portion 36a of a given or reduced-diameter, and an enlarged-diameter rear end portion 36b of a diameter at least slightly larger than the given diameter of the front end portion. In the illustrated embodiment, contact member 36, including front end portion 36a and rear end portion 36b, is circular in cross-section.

Housing 34 is of dielectric material such as molded plastic or the like. The housing is a one-piece structure and includes a through hole 38 for each terminal 32. Each through hole includes an open rear end 38a through which the respective contact member 36 of the terminal is inserted into the housing. The through hole has an open front end 38b through which front end portion 36a of the

contact member extends and is exposed exteriorly of the housing as shown clearly in FIG. 6, for engaging a complementary contact device or acting as a testing probe.

According to the invention, plastic housing 34 is molded so that open front end 38b of through hole 38 is of a reduced diameter to define a restricted stop 40 for abutting the enlarged rear end portion 36b of the contact member to define a forward limit position of the contact member as shown clearly in FIG. 6. By molding the restricted open front end of the through hole, the aperture dimensions of the open front end (within which the front end portion 36a of the contact member reciprocally slides) can be precisely controlled. The too big and too small dimensions of the prior art are eliminated. The dimensions of the molded front end 38b of through hole 38 are precisely controlled in a molding die during the molding process for housing 34 prior to even assembling contact member 36 therein, and not after the contact member is assembled as in the prior art.

During assembly and after contact member 36 is inserted into through hole 38 in the direction of arrows "A" (Fig. 6), a coil spring 42 also is inserted in the direction of arrow "A" to abut against the rear of contact member 36. A base cap, generally designated 44, then is mounted to housing 34 in the direction of arrow "A" from the position shown in FIGS. 6 and 7 to the assembled position shown in FIG. 8. The base cap closes the open rear end 38a of through hole 38 in housing 34 to hold coil spring 42 and contact member 36 in their assembled condition as shown in FIG. 8.

FIGS. 3-8 show a first embodiment of the base cap 44 to include a closure or cap portion 44a sort of in the form of a disc. Base cap 44 is generally U-shaped and includes a pair of mounting legs 44b which are press-fit into a pair of mounting holes 46 in housing 34 generally parallel to and at opposite sides of through hole 38. This fixes the end cap(s) as shown in FIG. 8 to hold coil spring 42 and contact member 36 in their assembled condition.

FIGS. 9-16 show a second embodiment of the invention. The second embodiment is different from the first embodiment of FIGS. 3-8 in the provision of a different base cap configuration. Consequently, like reference numerals have been applied in FIGS. 9-16 to designate like components described above in relation to the first embodiment of FIGS. 3-8. In order to avoid unduly burdening this specification, the description of the like referenced components and their functions will not be repeated in describing the second embodiment.

With those understandings, the second embodiment of FIGS. 9-16 includes an end cap, generally designated 44A, which includes a closure or cap portion 44a, mounting flanges 44b and a recess 44c as seen best in FIG. 10. The recess receives and positions a rear end 42a of coil spring

42. Housing 34 has a pair of mounting slots 46A which extend generally perpendicular to through hole 38 at opposite sides thereof.

The assembly of each conductive terminal 32 according to the second embodiment of FIGS. 9-16, is similar to the assembly described above in relation to the first embodiment of FIGS. 3-8. Specifically, contact member 36 first is inserted into through hole 38 through the open rear end 38a of the through hole in the direction of arrow "A". Coil spring 42 then is inserted behind the contact member to push the front end portion 36a of the contact member out of the open front end 38b of the through hole as seen in FIG. 13. Base caps 44a then are assembled to hold the coil spring and the contact member in assembled condition. This is performed by inserting mounting flanges 44b of end cap 44A into mounting slots 46A in housing 34, in a direction generally perpendicular to the direction of arrow "A". FIGS. 14 and 15 show the base caps in their assembled position press-fit into the housing to hold the coil springs and the contact members in assembled condition.

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 terminal, comprising:
a contact member having a front end portion of a given diameter and an enlarged rear end portion of a diameter at least slightly larger than said given diameter;
a plastic housing having a through hole for slidably receiving the rear end portion of said contact member and the through hole including
an open rear end through which the contact member can be inserted into the housing,
an open front end through which the front end portion of the contact member extends and is exposed exteriorly of the housing for engaging a complementary contact device,
a restricted stop at the front end of the through hole for abutting the enlarged rear end portion of the contact member to define a forward limit position of the contact member; and
a biasing member in the through hole of the housing behind the contact member to resiliently bias the contact member forwardly.
2. The electrical terminal of claim 1 wherein the enlarged rear end portion of said contact member and said through hole are circular in cross-section.
3. The electrical terminal of claim 1 wherein the front end portion of said contact member and the open front end of said through hole are circular in cross-section.
4. The electrical terminal of claim 3 wherein the enlarged rear end portion of said contact member and said through hole are circular in cross-section.
5. The electrical terminal of claim 1 wherein said biasing member comprises a spring.
6. The electrical terminal of claim 1, including a base cap for closing of the open rear end of the through hole in said plastic housing to hold the biasing and contact members therein.

7. The electrical terminal of claim 6 wherein said base cap includes a closure portion for blocking the open rear end of the through hole and a mounting portion for securing the base cap to the housing.

8. The electrical terminal of claim 7 wherein said mounting portion of the base cap comprises a mounting leg and said plastic housing has a mounting hole extending generally parallel to said through hole for receiving the mounting leg.

9. The electrical terminal of claim 8 wherein said base cap is generally U-shaped and includes a pair of said mounting legs at opposite sides of the closure portion inserted into a pair of mounting holes at opposite sides of the through hole.

10. The electrical terminal of claim 7 wherein said mounting portion of the base cap comprises a pair of mounting flanges at opposite sides of the closure portion inserted into a pair of mounting slots in the housing extending generally perpendicular to the through hole at opposite sides thereof.

11. An electrical terminal, comprising:

a contact member having a front end portion of a given diameter and an enlarged rear end portion of a diameter at least slightly larger than said given diameter, the contact member including the front and rear end portions thereof being circular in cross-section;

a plastic housing having a through hole for slidably receiving the rear end portion of said contact member and the through hole including

an open rear end through which the contact member can be inserted into the housing,

an open front end through which the front end portion of the contact member extends and is exposed exteriorly of the housing for engaging a complementary contact device,

a restricted stop at the front end of the through hole for abutting the enlarged rear end portion of the contact member to define a forward limit position of the contact member, and

the through hole and the open front end thereof being circular in cross-section;

a spring in the through hole of the housing behind the contact member to resiliently bias the contact member forwardly; and

a base cap for closing the open rear end of the through hole in said plastic housing to hold the biasing and contact members therein, the base cap including a closure portion for blocking the open rear end of the through hole and a mounting portion for securing the base cap to the housing.

12. The electrical terminal of claim 11 wherein said mounting portion of the base cap comprises a mounting leg and said plastic housing has a mounting hole extending generally parallel to said through hole for receiving the mounting leg.

13. The electrical terminal of claim 12 wherein said base cap is generally U-shaped and includes a pair of said mounting legs at opposite sides of the closure portion inserted into a pair of mounting holes at opposite sides of the through hole.

14. The electrical terminal of claim 11 wherein said mounting portion of the base cap comprises a pair of mounting flanges at opposite sides of the closure portion inserted into a pair of mounting slots in the housing extending generally perpendicular to the through hole at opposite sides thereof.

AMENDED CLAIMS

[received by the International Bureau on 29 December 2004 (29.12.04);
original claims 1-14 are replaced by amended claims 1 (1 page);]

1. An electrical terminal (32), comprising:

a contact member (36) having a front end portion (36a) of a given diameter and an enlarged rear end portion (36b) of a diameter at least slightly larger than said given diameter;

a plastic housing (34) having a through hole (38) for slidably receiving the rear end portion of said contact member and the through hole including an open rear end (38a) through which the contact member can be inserted into the housing,

an open front end (38b) through which the front end portion of the contact member extends and is exposed exteriorly of the housing for engaging a complementary contact device,

a restricted stop (40) at the front end of the through hole for abutting the enlarged rear end portion of the contact member to define a forward limit position of the contact member;

a biasing member (42) in the through hole of the housing behind the contact member to resiliently bias the contact member forwardly;

a base cap (44,44A) for closing of the open rear end (38a) of the through hole (38) in said plastic housing (34) to hold the biasing and contact members therein, said base cap (44,44A)

including a closure portion (44a) for blocking the open rear end (38a) of the through hole (38) and a mounting portion (44b) for securing the base cap to the housing; and

said mounting portion of the base cap (44A) comprising a pair of mounting flanges (44b) at opposite sides of the closure portion (44a) inserted into a pair of mounting slots (46A) in the housing extending generally perpendicular to the through hole (38) at opposite sides thereof.

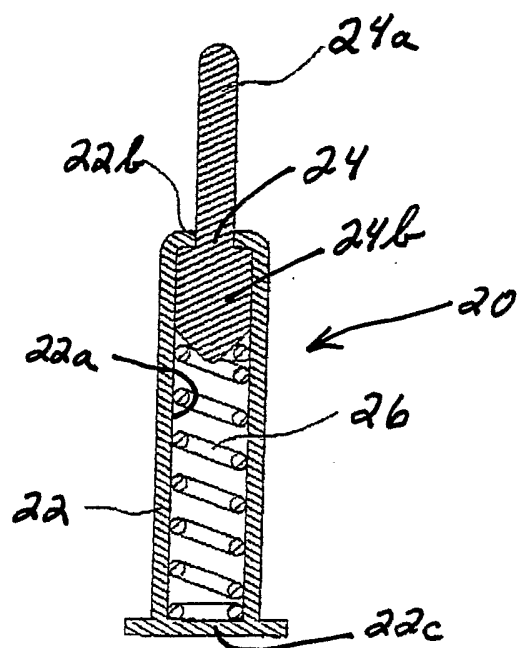


FIG 1 (PRIOR ART)

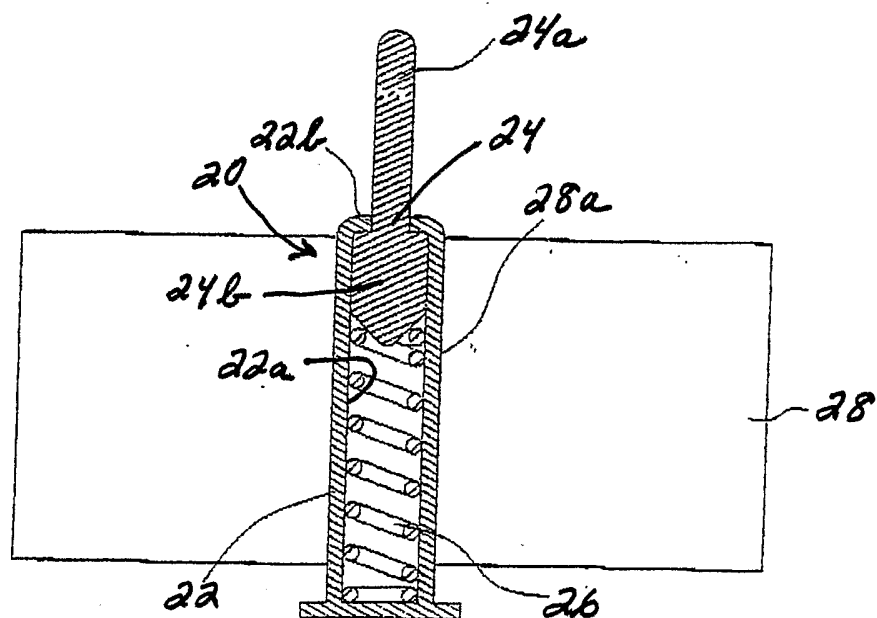


FIG. 2 (PRIOR ART)

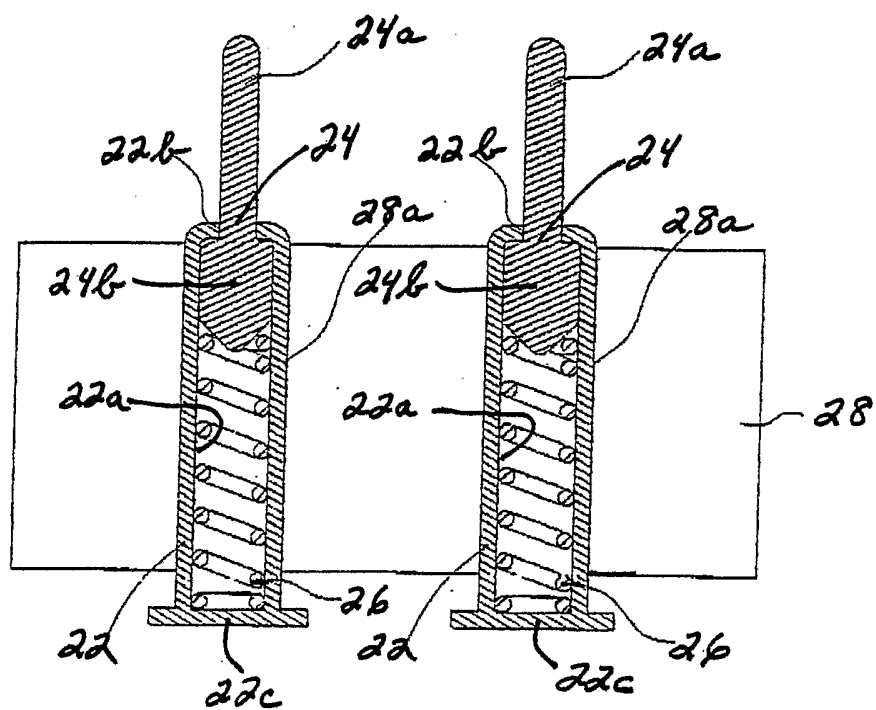


FIG. 2A (PRIOR ART)

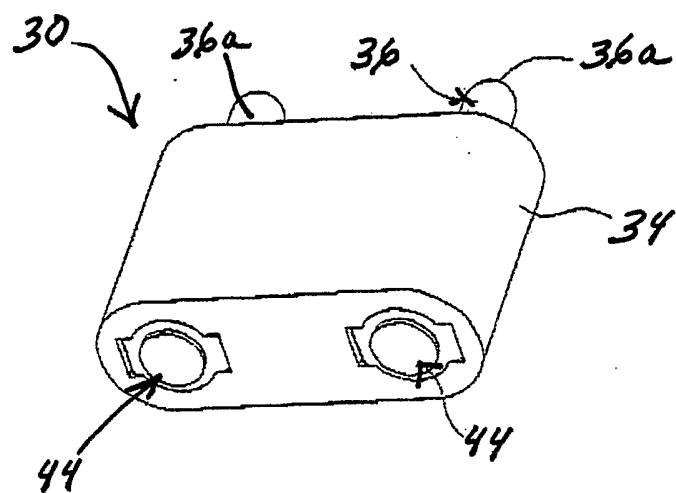


FIG. 3

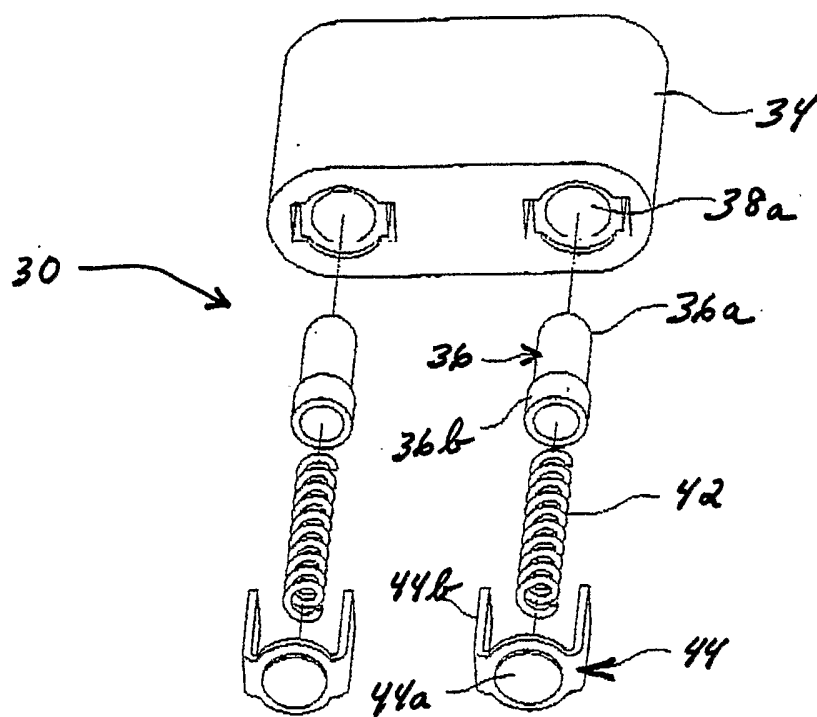


FIG. 4

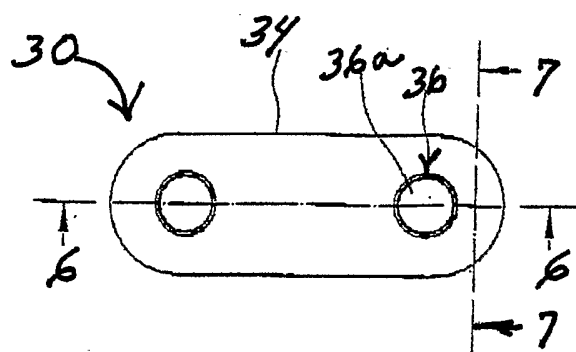


FIG. 5

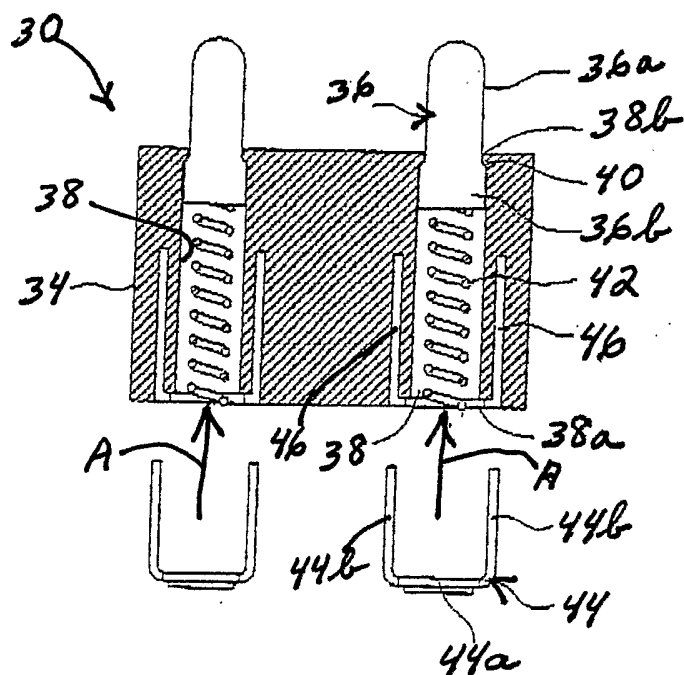
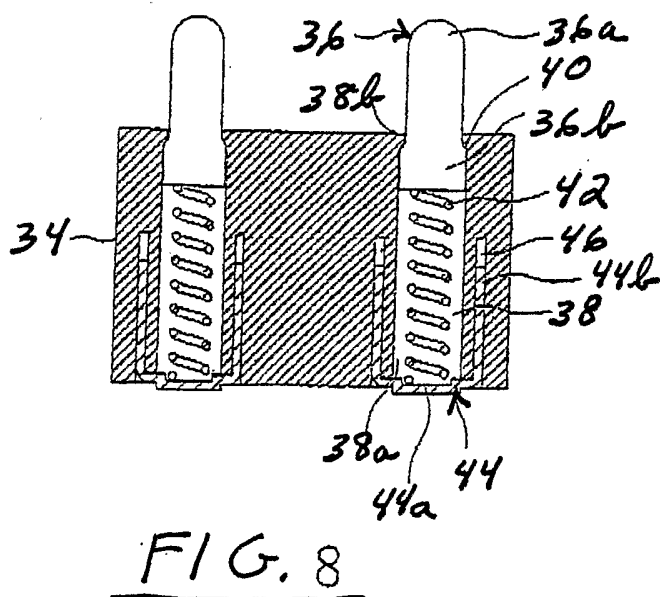
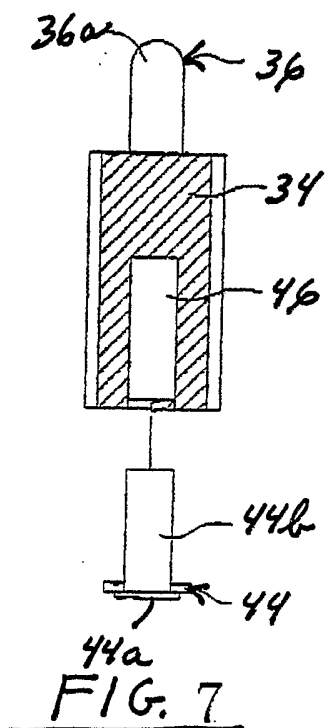


FIG. 6



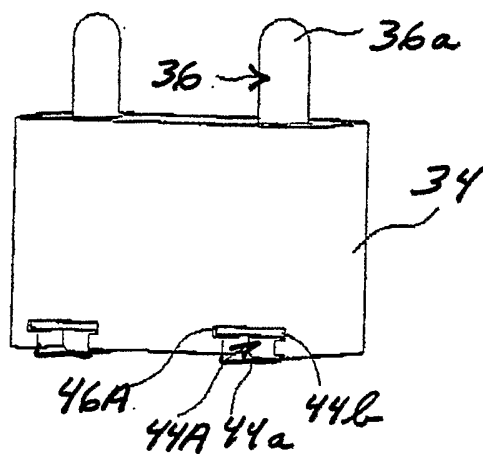


FIG. 9

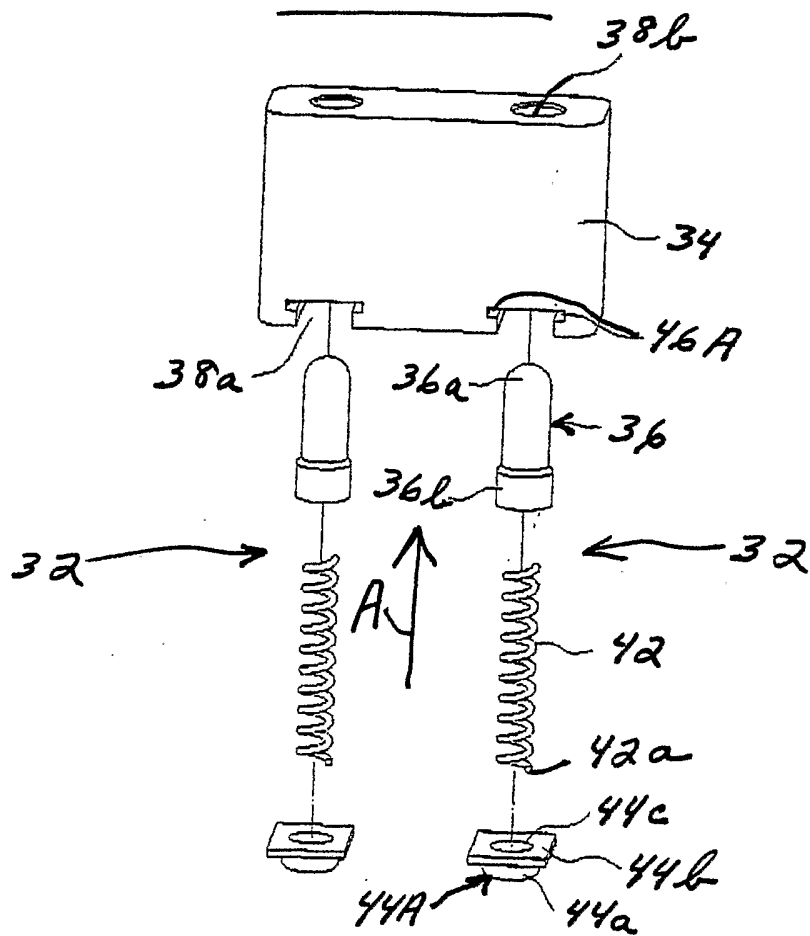


FIG. 10

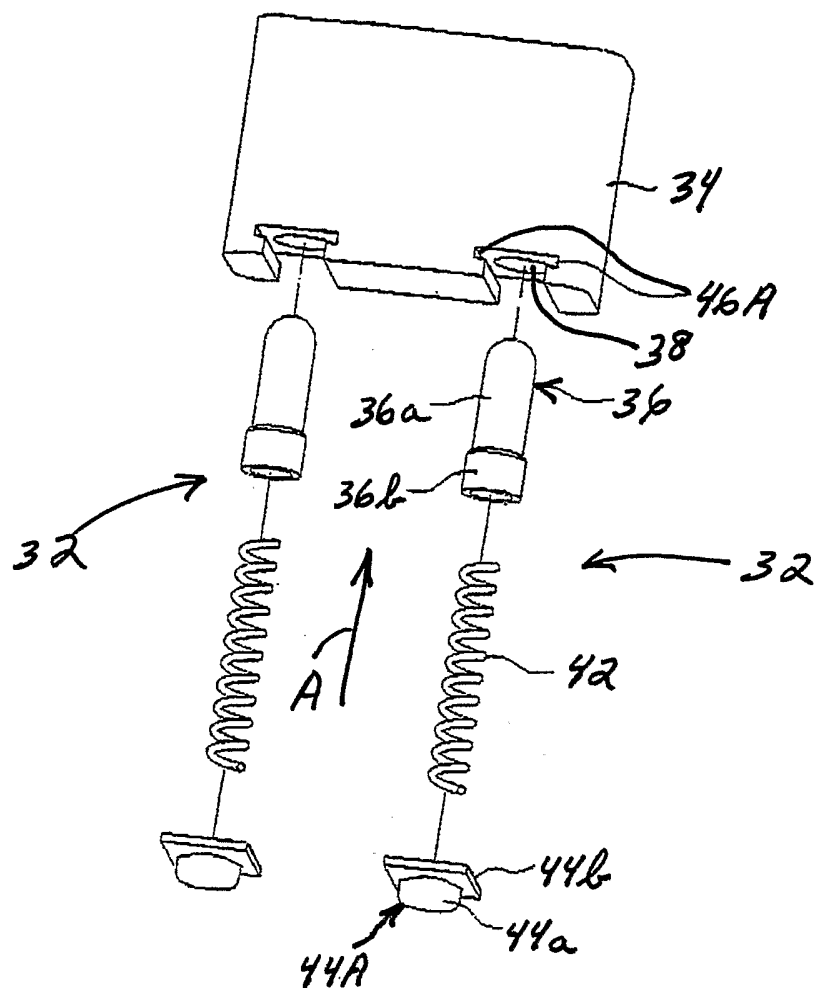


FIG. 11

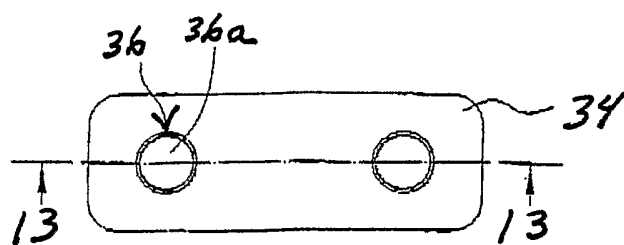
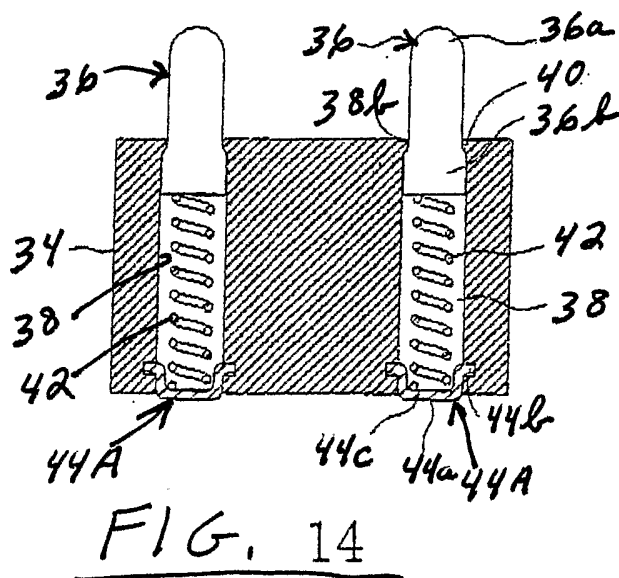
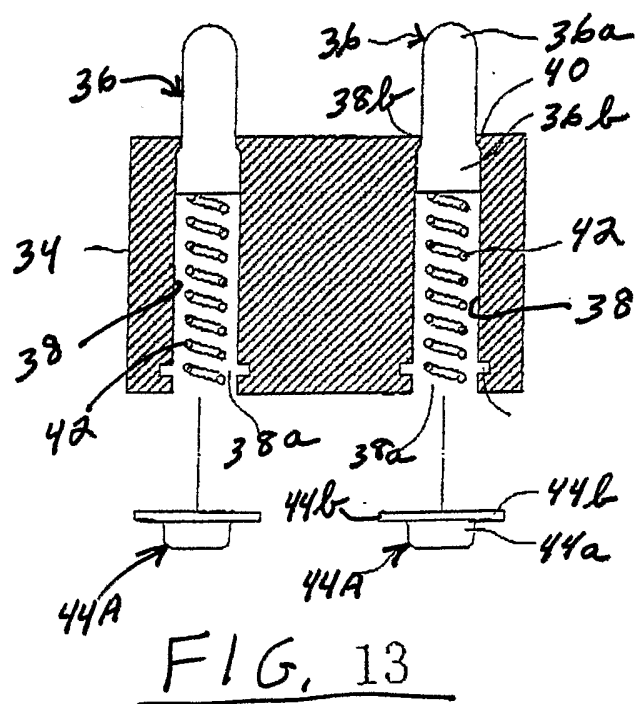


FIG. 12



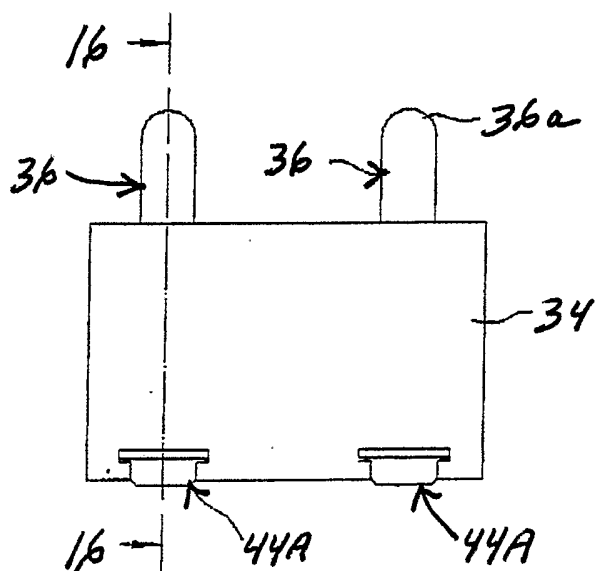


FIG. 15

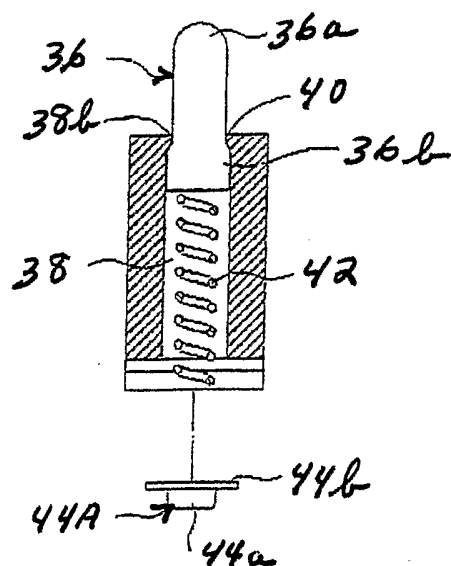


FIG. 16

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/026208

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01R12/22 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

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 2003/114203 A1 (LEE DONG HEE) 19 June 2003 (2003-06-19) the whole document	1-7, 10, 11, 14
Y	-----	12, 13
X	US 2002/123271 A1 (HENRY RANDALL R ET AL) 5 September 2002 (2002-09-05) the whole document	1, 5-9
Y	-----	12, 13

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *&* document member of the same patent family

Date of the actual completion of the international search

15 November 2004

Date of mailing of the international search report

24/11/2004

Name and mailing address of the ISA

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Authorized officer

Salojärvi, K

INTERNATIONAL SEARCH REPORT

nation on patent family members

Intern

Application No

PCT/US2004/026208

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