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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; and

(75) Inventor/Applicant (for US only): **XU, Xiang** [CN/CN]; Yueshen Apartment, Yushan Town, Kunshan 215316 (CN).

(74) Agent: **WEISS, Stephen, Z.**; Molex Incorporated, 2222 Wellington Court, Lisle, IL 60532 (US).

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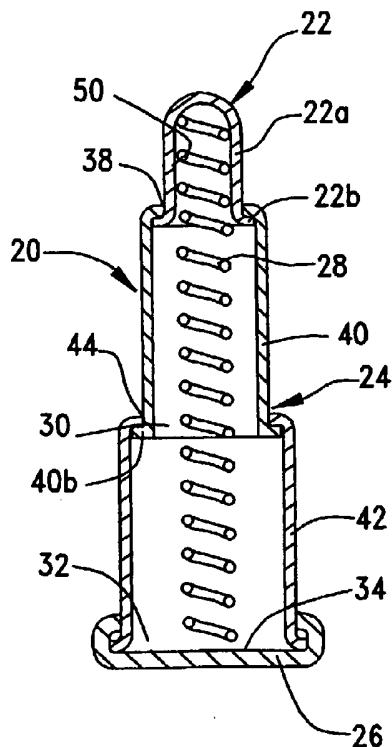
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(54) Title: PRESSURE-CONTACTING ELECTRICAL TERMINAL



(57) Abstract: A pressure-contacting electrical terminal includes a contact member having an outer pressure-contacting end portion for engaging an electrical device and an enlarged inner end portion. A sleeve assembly is formed by at least two sleeves which are telescoped one inside the other and defining a through hole having at least one open end through which the outer pressure contacting end portion of the contact member projects. A restricted stop is provided at the open end of the sleeve for abutting the enlarged inner end portion of the contact member to define an outer limit position of the outer pressure-contacting end portion. A biasing member is disposed in the through hole of the two telescoped sleeves to resiliently bias the contact member toward an electrical device.



— 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.

PRESSURE-CONTACTING ELECTRICAL TERMINAL

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to a pressure-contacting electrical terminal for electrically coupling a pair of electrical devices.

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 a battery plate or between a mobile phone and an antenna or in electrical connectors, testing probes or the like. FIG. 1 shows a conductive, pressure-contacting electrical terminal, generally designated 10, according to the prior art. The terminal is an assembly which includes a conductive housing, generally designated 12; a contact member, generally designated 14; and a coil spring 16. The contact member has a reduced-diameter front end 14a and an enlarged rear end 14b. Housing 12 is a two-part structure which includes an open-ended sleeve 12a and an end cap 12b. The housing has a through hole 12c within which the enlarged rear end of the contact member is slidably disposed. The housing has an open front end 12d and a closed rear end 12e. Front end 14a of the contact member projects through open front end 12d of the housing, and end cap 12b closes rear end 12e of the housing. Coil spring 16 is sandwiched between the contact member and the end cap to bias the contact member forwardly as shown in FIG. 1.

In assembly of prior art terminal 10, contact member 14 is inserted into through hole 12c such that the reduced-diameter front end 14a of the contact member projects through the open front end 12d of the housing. Coil spring 16 then is inserted into the through hole, and end cap 12b is inserted into the open rear end 12e of the housing to close the housing and maintain the components in assembly. The end cap can be held in place either by a press-fit or by a permanent fixation, such as epoxy or the like. A stop shoulder 18 near the front, inside of sleeve 12a defines the outer limit position of the pressure-contacting front end 14a of the contact member. The terminal can be used to electrically couple a pair of electrical devices in engagement with front end 14a of the contact member and end cap 12b of the housing.

With the ever-increasing miniaturization of electronic devices, problems are encountered with prior art terminals such as the pressure-contacting terminal 10. The problems revolve around the fact that the compressing capabilities of the terminal are limited by the compressing space required by housing 12 and particularly sleeve 12a of the housing. The height of terminal 10 cannot be reduced due to the height limitations of sleeve 12a, thereby adversely affecting attempts to miniaturize the terminal in a miniaturized electronic system. 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 pressure-contacting electrical terminal of the character described.

In the exemplary embodiment of the invention, the electrical terminal includes a contact member having an outer pressure-contacting end portion for engaging an electrical device and an enlarged inner end portion. A sleeve assembly is formed by at least two sleeves which are telescoped one inside the other and defining a through hole having at least one open end through which the pressure-contacting end portion of the contact member projects. Restricted stop means are provided at the open end of the sleeve for abutting the enlarged inner end portion of the contact member to define an outer limit position of the outer pressure-contacting end portion. A biasing member is disposed in the through hole of the two telescoped sleeves to resiliently bias the contact member toward an electrical device.

As disclosed herein, the sleeve assembly has a closed end opposite the open end, and the biasing member comprises a coil spring extending between the closed end and the contact member. A first of the two sleeves is open-ended, with the outer pressure-contacting end portion of the contact member extending through one open end of the first sleeve. The one open end is smaller in diameter than the enlarged inner end portion of the contact member to define the stop means which limits the extension of the contacting end portion of the contact member. The first sleeve is telescoped within a second of the two sleeves, and stop means are operatively associated between the two sleeves to define an extended limit position of the sleeves.

In one embodiment of the invention, the contact member is generally hollow, with an inner open end. One end of the coil spring extends into the hollow contact member through the open inner end thereof.

In another embodiment of the invention, the coil spring comprises a first biasing member which is disposed within the first sleeve and abutting the contact member. A second biasing member is disposed in the second sleeve abutting the first sleeve.

In a further embodiment of the invention, the first sleeve has a smaller diameter than the second sleeve, and the first biasing member or coil spring has a given diameter. The second biasing member comprises a second coil spring of a diameter larger than the given diameter, with the second coil spring surrounding a rear portion of the first coil spring.

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 longitudinal sectional view through the prior art terminal described in the Background, above;

FIG. 2a is a side elevational view of a first embodiment of a pressure-contacting electrical terminal according to the invention;

FIG. 2b is a vertical section taken along line 2b-2b of FIG. 2a;

FIG. 2c is a top plan view of the terminal in FIG. 2a;

FIG. 3 is an exploded perspective view of the terminal in FIGS. 2a-2c;

FIG. 4 is a view similar to that of FIG. 2b, but of a second embodiment of the invention;

FIG. 5 is a view similar to that of FIG. 2b, but of a third embodiment of the invention;

FIG. 6 is a view similar to that of FIG. 2b, but of a fourth embodiment of the invention;

FIG. 7 is a view similar to that of FIG. 2b, but of a fifth embodiment of the invention;

FIG. 8 is an exploded perspective view of the third embodiment of the invention shown in FIG. 5; and

FIG. 9 is an exploded perspective view of the fifth embodiment of the invention shown in FIG. 7.

Detailed Description of the Preferred Embodiments:

Referring to the drawings in greater detail, a first embodiment of a pressure-contacting electrical terminal, generally designated 20, is shown in FIGS. 2a-3. The terminal includes a contact member, generally designated 22; a sleeve assembly, generally designated 24; an end cap 26; and a biasing member in the form of a coil spring 28 which is disposed in a through hole 30 which extends completely through sleeve assembly 24. In essence, end cap 26 closes a rear open end 32 of the sleeve assembly, and coil spring 28 extends between an inner surface 34 of the end cap and a closed end 36 (see Fig. 3) of contact member 22.

More particularly, contact member 22 of terminal 20 includes an outer pressure contacting end portion 22a and an outwardly flared, enlarged inner end portion 22b. The outer end portion 22a projects through a front open end 38 of sleeve assembly 24 for engaging an appropriate electronic device. The enlarged inner end portion 22b forms part of a stop means to define an outer limit position of the pressure contacting end portion 22a as shown in FIGS. 2a and 2b.

Sleeve assembly 24 is formed by at least two sleeves 40 and 42 which are telescoped one inside the other and defining through hole 30. As best seen in FIG. 2b, both sleeves 40 and 42 are generally hollow, cylindrical and open-ended. Sleeve 40 will be referred to as the "first" sleeve herein and is of a given diameter. Sleeve 42 will be referred to as the "second" sleeve and is of a diameter larger than the first sleeve. Therefore, first sleeve 40 is telescoped and reciprocally movable within second sleeve 42. First sleeve 40 has an inwardly crimped front end 40a and an outwardly flared rear end 40b. The inwardly crimped front end 40a of the first sleeve defines an abutting stop means for engagement by the enlarged inner end portion 22b of contact member 22.

The second sleeve 42 has an inwardly crimped front end 42a and an outwardly flared rear end 42b. The inwardly crimped front end 42a cooperates with the outwardly flared rear end 40b of first sleeve 40 to form a second stop means which defines the extended limit position of the two sleeves as shown in FIG. 2b. First sleeve 40 extends through an open front end 44 of second sleeve 42. End cap 26 has an inwardly crimped flange 46 which embraces the outwardly flared rear end 42b of second sleeve 42 to hold the end cap in position.

In assembly of electrical terminal 20, first sleeve 40 is inserted through rear open end 32 of second sleeve 42 until the outwardly flared rear end 40b of the first sleeve abuts against the

inwardly crimped front end 42a of the second sleeve. Either before or after the first sleeve is telescoped into the second sleeve, contact member 22 is inserted into the first sleeve until the enlarged inner end portion 22b of the contact member abuts against the inwardly crimped front end 40a of the first sleeve. Coil spring 28 then is inserted into through hole 30 formed by the two sleeves, and end cap 26 is crimped over the outwardly flared rear end 42b of second sleeve 42. At least the first and second sleeves, along with end cap 26, may be fabricated of formable sheet metal material. When the terminal is fully assembled, contact member 22 and end cap 26 can be electrically positioned or coupled between two spaced electronic devices, and first sleeve 40 can telescope into second sleeve 42, compressing coil spring 28, and significantly reducing the overall length of the terminal versus the fixed length of the prior art terminals.

Other embodiments of the invention are shown in FIGS. 4-9, and like reference numerals have been applied in those drawings corresponding to like components described above in relation to the first embodiment of FIGS. 2a-3. Therefore, the descriptions of those like components will not be repeated.

With those understandings, FIG. 4 shows a second embodiment of the invention wherein a front end of coil spring 28 projects forwardly all the way into a hollow interior cavity 50 of contact member 22. In other words, closed end 36 (see Figs. 2b and 3) of the first embodiment has been eliminated so that the coil spring can extend all the way into contact member 22 as shown in FIG. 4. With this second embodiment, the force of the coil spring acting on the contact member is more even and steady.

FIGS. 5 and 8 show a third embodiment of the invention wherein the inner end of first sleeve 40 is closed, as at 52. Coil spring 28 has been made shorter and is sandwiched between the closed end 52 of the first sleeve and closed end 36 of contact member 22. A second coil spring 28A is disposed within second sleeve 42 and is sandwiched between end cap 26 and closed end 52 of the first sleeve. It can be seen that the second coil spring 28A is of a larger diameter than coil spring 28 and, therefore, the second coil spring has a higher biasing force than the first coil spring 28. In operation of the third embodiment in FIGS. 5 and 8, contact member 22 is forced into first sleeve 40 before the first sleeve is forced into second sleeve 42. This embodiment will allow terminal 20 to be easily positioned between a pair of closely spaced electronic devices, while second coil spring 28A provides a significant pressure contacting force.

FIG. 6 shows a fourth embodiment of the invention which is the same as the third embodiment in FIG. 5, but coil spring 28 projects into the interior cavity 50 of contact member 22 as in the second embodiment of FIG. 4. The fourth embodiment of FIG. 6, thereby, includes the above-described advantages of both the second and third embodiments of FIGS. 4 and 5, respectively.

FIGS. 7 and 9 show a fifth embodiment of the invention. By comparing FIG. 7 with FIG. 4, it can be seen that the fifth embodiment of FIG. 7 is substantially identical to the second embodiment of FIG. 4, except that a second coil spring 28A has been added within second sleeve 42. The second coil spring is of a significantly larger diameter than first coil spring 28, and the second coil spring is sandwiched between end cap 26 and the outwardly flared rear end 40b of first sleeve 40. Like the third embodiment of FIG. 5, the second coil spring significantly increases the pressure contacting forces when terminal 20 is disposed between a pair of electronic devices. However, with the fifth embodiment of FIG. 7, the combined spring forces of the two superimposed coil springs 28 and 28A further increase the biasing, contact forces.

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 an outer pressure-contacting end portion for engaging an electrical device and an enlarged inner end portion;
a sleeve assembly formed by at least two sleeves which are telescoped one inside the other and defining a through hole having at least one open end through which the outer pressure-contacting end portion of the contact member projects, with restricted stop means at said open end for abutting the enlarged inner end portion of the contact member to define an outer limit position of the pressure-contacting end portion; and
a biasing member in the through hole of the two telescoped sleeves to resiliently bias the contact member toward an electrical device.
2. The electrical terminal of claim 1 wherein said sleeve assembly has a closed end opposite said open end, and the biasing member comprises a coil spring extending between the closed end and the contact member.
3. The electrical terminal of claim 1 wherein a first of said two sleeves is open-ended with the outer pressure-contacting end portion of the contact member extending through one open end of the first sleeve whereat said stop means is located.
4. The electrical terminal of claim 3 wherein the one open end of said first sleeve has a smaller diameter than the enlarged inner end portion of the contact member.
5. The electrical terminal of claim 3 wherein said first sleeve is telescoped within a second of said two sleeves.
6. The electrical terminal of claim 5, including stop means operatively associated between the two sleeves to define an extended limit position of the sleeves.

7. The electrical terminal of claim 1 wherein said contact member is generally hollow with an inner open end, said biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

8. The electrical terminal of claim 1 wherein said contact member projects from a first of said two sleeves which is telescoped within a second of the two sleeves, said biasing member comprising a first biasing member disposed within the first sleeve and abutting the contact member, and including a second biasing member in the second sleeve abutting the first sleeve.

9. The electrical terminal of claim 8 wherein said first sleeve has a smaller diameter than the second sleeve, the first biasing member comprises a coil spring of a given diameter, and the second biasing member comprises a second coil spring of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil spring.

10. The electrical terminal of claim 8 wherein said contact member is generally hollow with an inner open end, said first biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

11. The electrical terminal of claim 1 wherein said contact member projects from a first of said two sleeves which is telescoped within a second of the two sleeves, said biasing member comprising a first biasing member which extends through the through hole in both sleeves, and including a second biasing member in the second sleeve abutting the first sleeve.

12. The electrical terminal of claim 11 wherein said first sleeve has a smaller diameter than the second sleeve, the first biasing member comprises a coil spring of a given diameter, and the second biasing member comprises a second coil spring of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil spring.

13. The electrical terminal of claim 11 wherein said contact member is generally hollow with an inner open end, said first biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member though the open inner end thereof.

14. An electrical terminal, comprising:

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

5 a sleeve assembly formed by a first sleeve telescoped within a second sleeve and a through hole, the first sleeve having an open front end through which the outer pressure-contacting end portion of the contact member extends for engaging a first electronic device, the open front end of the first sleeve being smaller than the enlarged inner end portion of the contact member to form a restricted stop means and define an outer limit position of the outer pressure-contacting end portion, a closed rear end of the second sleeve being engageable with a second
10 electronic device, and including second stop means operatively associated between the two sleeves to define an extended limit position of the sleeves; and

a biasing member in the through hole of the two telescoped sleeves to resiliently bias the contact member toward an electrical device.

15. The electrical terminal of claim 14 herein said contact member is generally hollow with an inner open end, said biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member though the open inner end thereof.

16. The electrical terminal of claim 14 wherein said biasing member comprises a first biasing member disposed within the first sleeve and abutting the contact member, and including a second biasing member in the second sleeve abutting the first sleeve.

17. The electrical terminal of claim 16 wherein said first sleeve has a smaller diameter than the second sleeve, the first biasing member comprises a coil spring of a given diameter, and the second biasing member comprises a second coil spring of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil
5 spring.

18. The electrical terminal of claim 16 wherein said contact member is generally hollow with an inner open end, said first biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

19. The electrical terminal of claim 14 wherein said through hole extends through both the first and second sleeves for receiving said biasing member, and including a second biasing member in the second sleeve abutting the first sleeve.

20. The electrical terminal of claim 19 wherein said first sleeve has a smaller diameter than the second sleeve, the first biasing member comprises a coil spring of a given diameter, and the second biasing member comprises a second coil spring of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil
5 spring.

21. The electrical terminal of claim 19 wherein said contact member is generally hollow with an inner open end, said first biasing member comprises a coil spring with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

AMENDED CLALIMS
(Received by the International Bureau on 06 January 2006)

CLAIMS

1. An electrical terminal (20), comprising:
a contact member (22) having an outer pressure-contacting end portion (22a) for engaging an electrical device and an enlarged inner end portion (22b);
a sleeve assembly (24) defining a through hole (30) having at least one open end (38) through which the outer pressure-contacting end portion of the contact member projects, with restricted stop means (40a) at said open end for abutting the enlarged inner end portion of the contact member to define an outer limit position of the pressure-contacting end portion, the sleeve assembly having a closed end (26) opposite said open end (38); and
a biasing member (28,28A) in the through hole of the sleeve assembly to resiliently bias the contact member toward an electrical device
characterised in that:
the sleeve assembly is formed by at least two sleeves (40,42) which are telescoped one inside the other and the biasing member extending within the two sleeves between the closed end of the sleeve assembly and the contacting member.
2. The electrical terminal of claim 1 wherein a first (40) of said two sleeves is open-ended with the outer pressure-contacting end portion (22a) of the contact member (22) extending through one open end (38) of the first sleeve whereat said stop means (40a) is located.
3. The electrical terminal of claim 2 wherein the one open end (38) of said first sleeve (40) has a smaller diameter than the enlarged inner end portion (22b) of the contact member (22).
4. The electrical terminal of claim 2 wherein said first sleeve (40) is telescoped within a second (42) of said two sleeves.
5. The electrical terminal of claim 4, including stop means (40b,42a) operatively associated between the two sleeves (40,42) to define an extended limit position of the sleeves.

6. The electrical terminal of claim 1 wherein said contact member (22) is generally hollow with an inner open end (50), said biasing member comprises a coil spring (28) with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

7. The electrical terminal of claim 1 wherein said contact member (22) projects from a first (40) of said two sleeves which is telescoped within a second (42) of the two sleeves, said biasing member comprising a first biasing member (28) disposed within the first sleeve and abutting the contact member and the closed end (26) of the sleeve assembly (24), and including a second biasing member (28A) in the second sleeve abutting the first sleeve and the closed end of the sleeve assembly..

8. The electrical terminal of claim 7 wherein said first sleeve (40) has a smaller diameter than the second sleeve (42), the first biasing member comprises a coil spring (28) of a given diameter, and the second biasing member comprises a second coil spring (28A) of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil spring.

9. The electrical terminal of claim 7 wherein said contact member (22) is generally hollow with an inner open end (50), said first biasing member comprises a coil spring (28) with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

10. The electrical terminal of claim 1 wherein said contact member (22) projects from a first (40) of said two sleeves which is telescoped within a second (42) of the two sleeves, said biasing member comprising a first biasing member (28) which extends through the through hole (30) in both sleeves, and including a second biasing member (28A) in the second sleeve abutting the first sleeve.

11. The electrical terminal of claim 11 wherein said first sleeve (40) has a smaller diameter than the second sleeve (42), the first biasing member comprises a coil spring (28) of a given diameter, and the second biasing member comprises a second coil spring (28A) of a diameter larger than said given diameter, with the second coil spring surrounding a portion of the first coil spring.

12. The electrical terminal of claim 10 wherein said contact member (22) is generally hollow with an inner open end (50), said first biasing member comprises a coil spring (28) with one end of the coil spring extending into the hollow contact member through the open inner end thereof.

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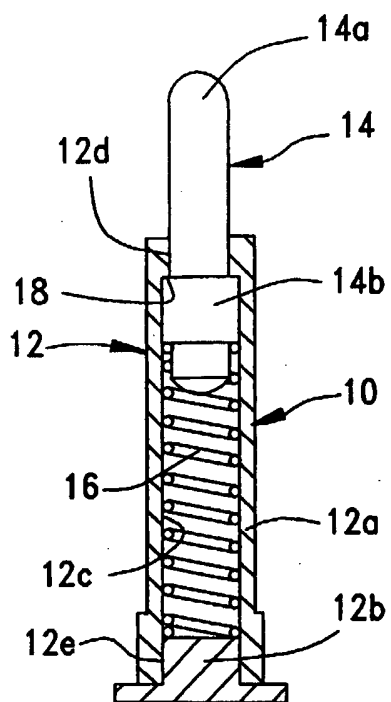


FIG. 1
(PRIOR ART)

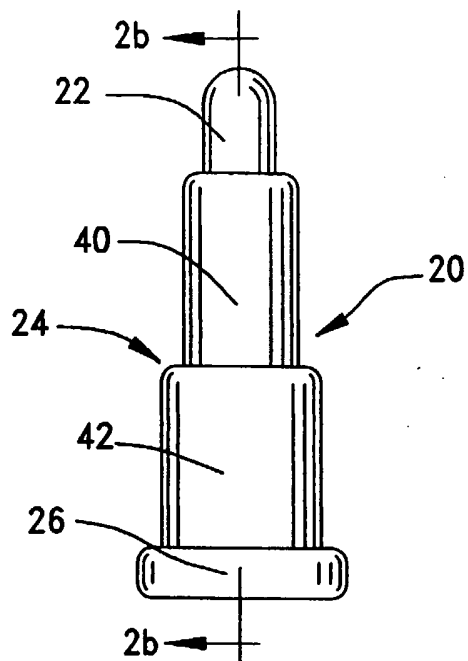


FIG. 2a

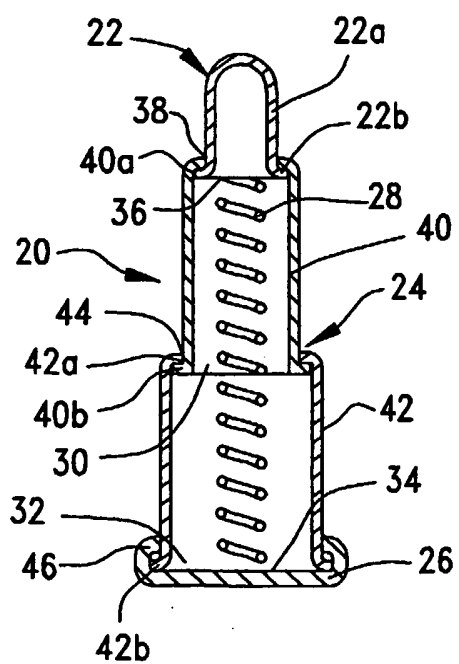


FIG. 2b

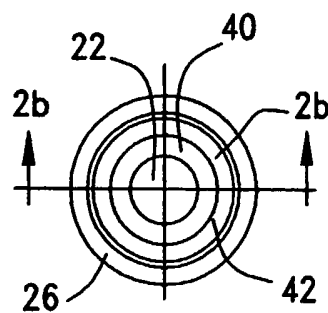


FIG. 2c

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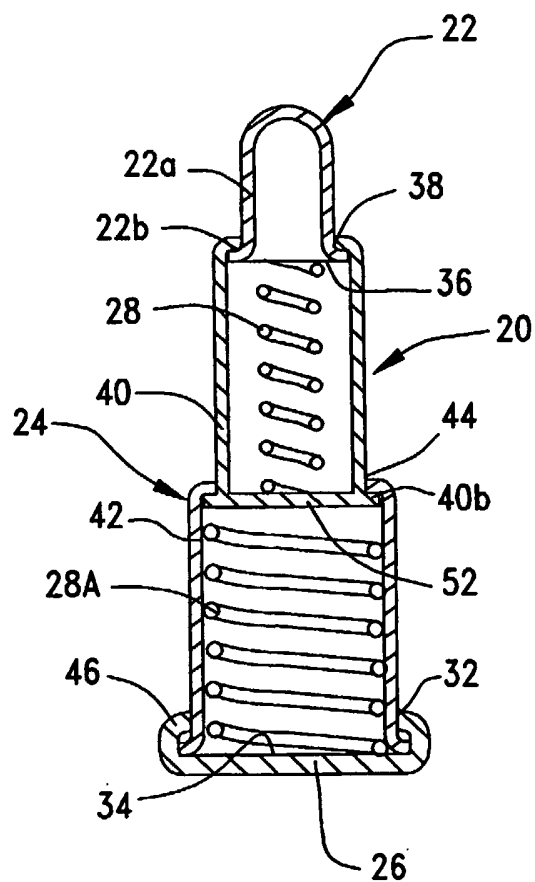
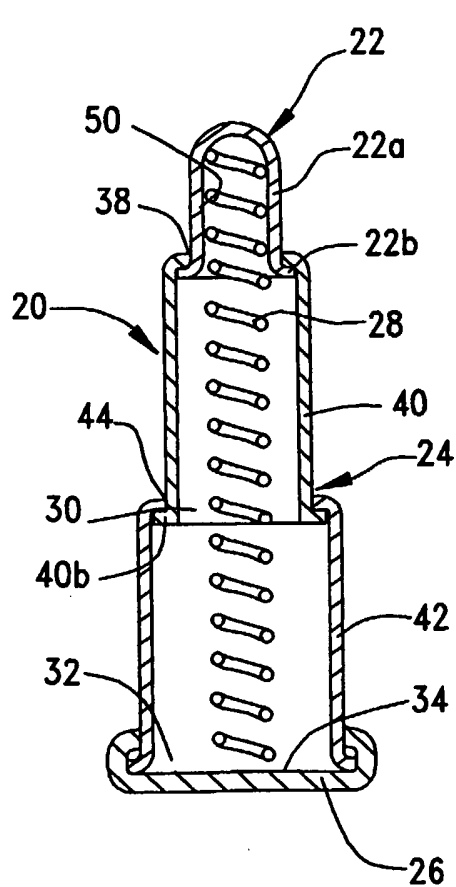
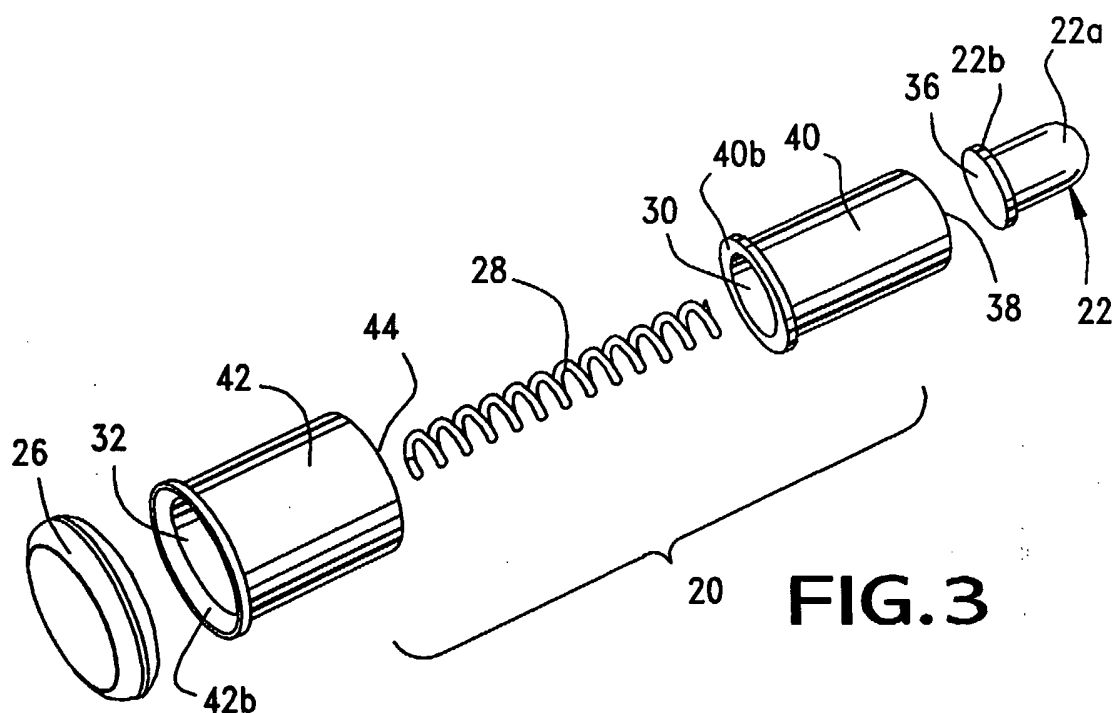


FIG.4

FIG.5

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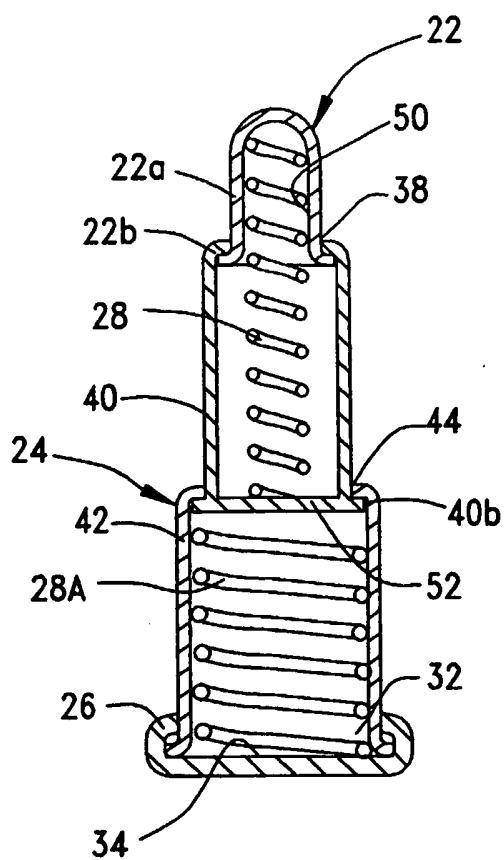


FIG. 6

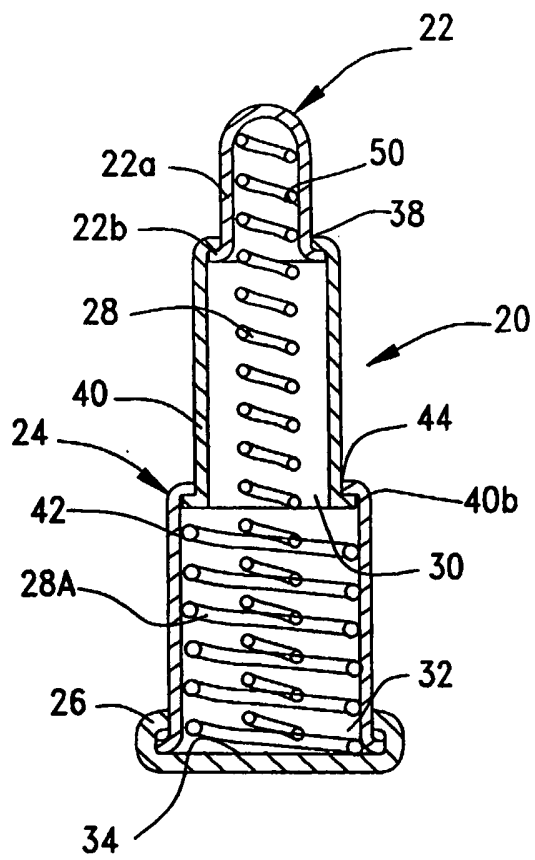


FIG. 7

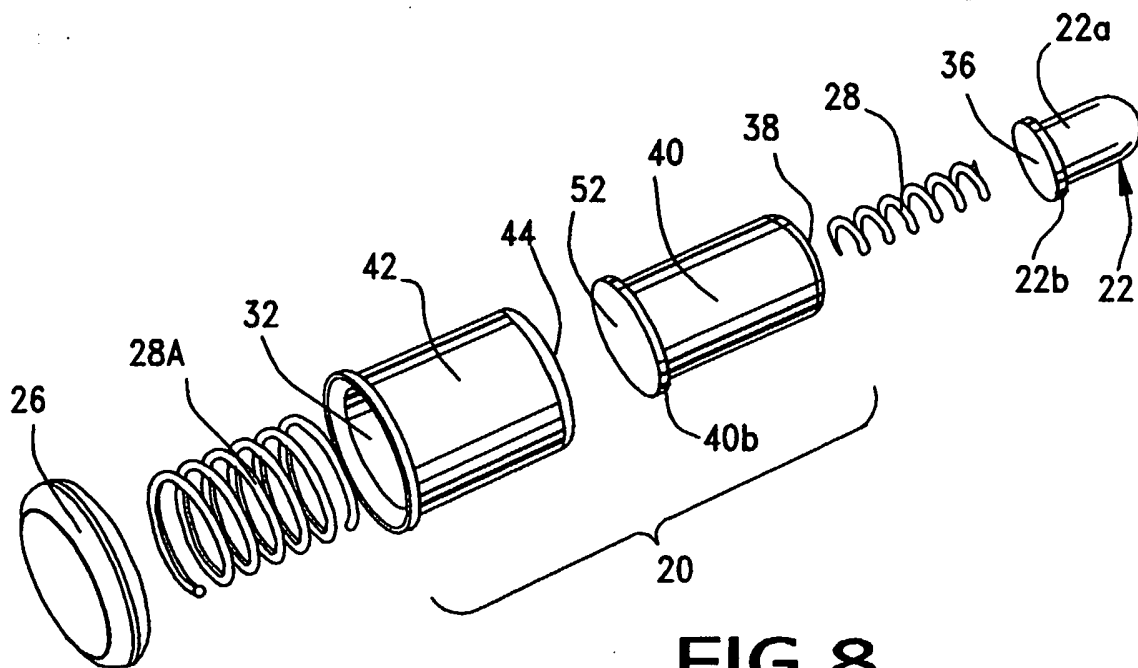
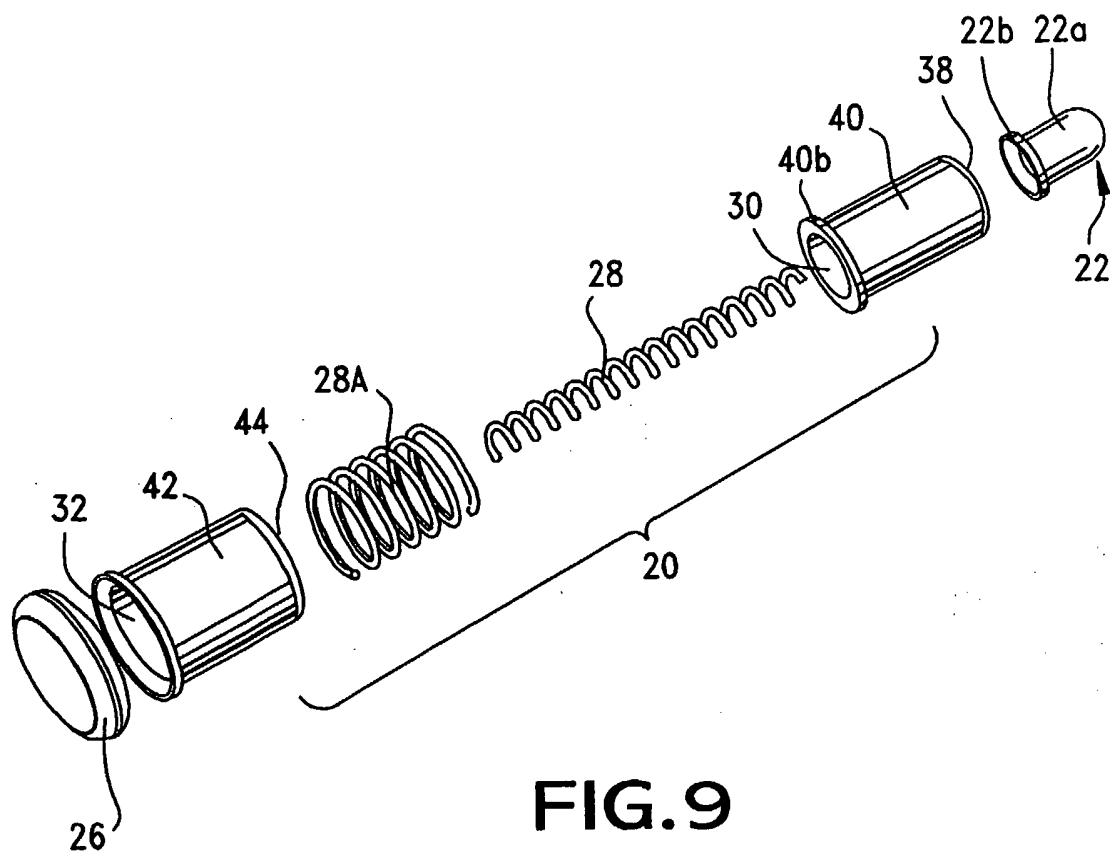


FIG. 8

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2005/031504

A. CLASSIFICATION OF SUBJECT MATTER
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)
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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 193 810 A (IMS CONNECTOR SYSTEMS GMBH) 3 April 2002 (2002-04-03) abstract; figures 1,2 column 3, line 11 - column 5, line 36 -----	1-5,7-21
A	US 6 140 905 A (SHOJI ET AL) 31 October 2000 (2000-10-31) abstract; figures 4,5 column 5, line 40 - column 7, line 64 -----	1,14
A	US 2004/161981 A1 (MATSUI MAKOTO ET AL) 19 August 2004 (2004-08-19) abstract; figures 1,2 paragraph '0018! - paragraph '0032! ----- -/--	2,7,9, 10,15, 16,20,21

☒ 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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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US2005/031504

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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