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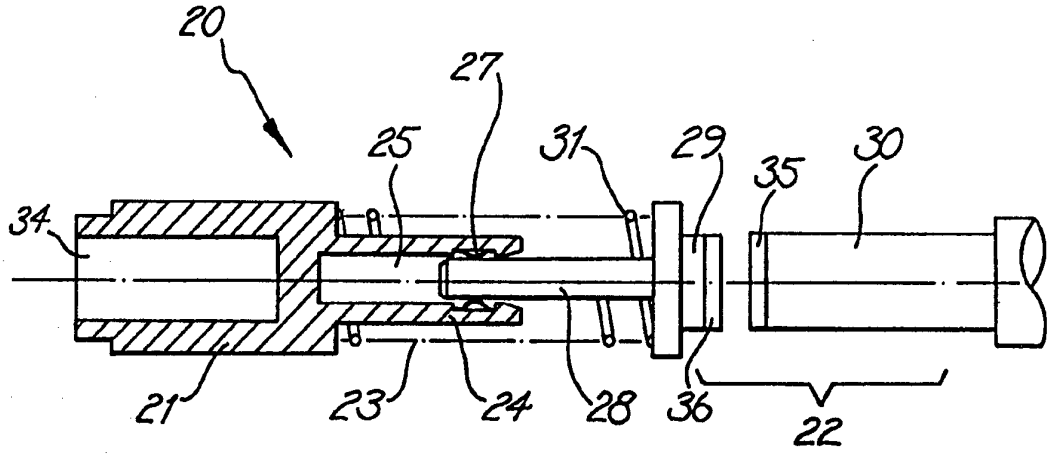
(54) Title: ELECTRICAL CONNECTOR



(57) Abstract

An electrical connector (20) has a first connecting end (21) and a second connecting end (22) with the first connecting end (21) being electrically conductively slidable with respect to the second connecting end (22). The connecting end (22) has an electrically conductive pin (28) protruding therefrom and the connecting end (21) has a socket (23) defined by an electrically conductive cylinder (24). The cylinder (24) has a circumferential groove (26), located on an inner surface of the cylinder (24), adapted to retain a spring element (27). The spring element (27) permits an electrically conductive sliding friction connection with the exterior of the pin (28).

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ELECTRICAL CONNECTOR

FIELD OF INVENTION

The present invention relates to an electrical connector and, more particularly, to an electrical connector which can maintain conduction over a limited displacement during expansion or contraction of the connector.

BACKGROUND ART

A typical prior art connector includes a first connecting end electrically conductively connected to a second connecting end. The electrical connection between the two is made by a braid woven from conductive material such as copper strands or the like.

Removeable electrical connection is made to the end of the second connecting end by a contact arm. In use, cables or other electrically conductive arrangements are connected to both the first connecting end and to the contact arm of the second connecting end.

When such a prior art connector expands or contracts the braid is stretched and then compressed.

Problems with such prior art include the fact that the wires of the braid can become loose or rupture after repetitive stretching and compression. Also, the prior art does not permit of easy or simple construction as part of an automated assembly line process.

SUMMARY OF THE INVENTION

According to one aspect of the invention, there is provided an electrical connector having a first connecting

end and a second connecting end and wherein the first connecting end is electrically conductively slidable with respect to the second connecting end.

Preferably one of the connecting ends has an electrically conductive pin protruding therefrom and the other end has a socket defined by an electrically conductive cylinder, the pin being adapted for electrically conductive slidable insertion within said cylinder.

The cylinder may have a circumferential groove located on an inner surface thereof adapted to retain a spring element. Such a spring element may comprise a mid section lying in a first plane and end sections lying in a second plane, the second plane being offset a radial distance from the first plane. Preferably, the first plane is parallel to said second plane.

The mid section of the spring element may be adapted to be urged against an exterior surface of said pin whilst said end sections are adapted to be urged against an inside surface of said electrically conductive cylinder as a consequence of radially induced tension within said spring element.

Preferably, the inside diameter of said spring element permits of an electrically conductive sliding friction connection with the exterior surface of said pin as said pin moves past said spring element within said cylinder.

In a particular form of the invention, the electrical connector includes an additional helical spring adapted to resist displacement of the connecting ends towards each

other. Preferably, the helical spring comprises an outer spring mounted around and longitudinally along the outside of said socket and pin.

Where the helical spring is utilised, it may be necessary to ensure that the tensile strength of the helical spring is sufficient to overcome frictional forces encountered as the pin slides within the socket. These frictional forces will be the result, primarily, of the action of the spring element.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a partly sectioned side view of an electrical connector according to one embodiment of the present invention, with the connector shown in an expanded position,

Fig. 2 is a view similar to Fig. 1 with the connector shown in a contracted position, and

Fig. 3 is an enlarged view of the spring element shown in Figs. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The electrical connector 20 comprises a first connecting end 21 and a second connecting end 22 adapted for relative axial movement with respect to one another whilst maintaining an electrical connection therebetween.

In this instance, the first connecting end 21 includes a socket portion 23 protruding therefrom in the direction of second connecting end 22. The socket portion 23

comprises an electrically conductive, open ended, hollow cylinder 24 that defines a cylindrical cavity 25 therein.

On the inner surface of the cylinder 24, located towards its open end, there is a circumferential groove 26 adapted to receive and retain electrically conductive spring element 27. The spring element 27 is sized so that it can be inserted when compressed into the cylindrical cavity 25 from the open end of the cavity. The spring element 27 expands into and is retained by groove 26 as it is moved down cavity 25 at the time when the electrical connector 20 is being assembled.

Spring element 27 is sized and shaped such that when pin 28 is slidably inserted into cavity 25, it will be frictionally electrically connected via spring element 27 to socket 23 and hence to first connecting end 21.

In this particular embodiment (see Fig. 3) spring element 27 comprises a mid section 37 lying in a first plane and end sections 38, 39 lying in a second plane. The end sections 38, 29 are attached to opposed ends of mid section 37 by way of respective connecting portions 40, 41 such that the plane of the mid section 37 is offset a predetermined radial distance from the plane of end sections 38, 39.

Pin 28 protrudes in the direction of first connecting end 21 from second connecting end 22. The first connecting end 21 terminates in a first cylindrical member 29 fixedly and electrically connected to pin 28. The second connecting end 22 includes a second cylindrical member 30

adapted for abutting electrical connection to first cylindrical member 29 by way of contact surfaces 35, 36.

Outer helical spring 31 is mounted around and longitudinally along the outside of socket 23 and pin 28, as generally illustrated in Figs. 1 and 2, so as to provide resistance to the approach of pin 28 towards and into socket 23 by action against faces 32, 33.

In use, an electrically conductive member such as a wire (not shown) is constrained for electrical conduction within the first connecting end 21 by compressive fit within aperture 34. The second cylindrical member 30 is also electrically conductively connected to an electrically conductive member (not shown).

The second cylindrical member 30 can be electrically connected to the first cylindrical member 29 by axial abuttment of contact surfaces 35, 36 which, in the process of being effected, causes the second connecting end 22 including pin 28 to approach the first connecting end 31 whereby pin 28 slides within socket 23 to a limit of contracted movement as shown in view B of Fig. 2. Throughout this manoeuvre, electrical connection between the first connecting end 21 and the second connecting end 22 is maintained by virtue of the electrically conductive frictional movement of the outer surface of pin 28 within spring element 27.

In practice at least the components comprising the first connecting end 21, (including cylinder 24), the spring element 27, the pin 28, the first cylindrical member

29 and the second cylindrical member 30 will be made from electrically conductive material so as to effect an electrically conductive connection throughout the electrical connector 20. Insulating material may be applied to the outside of the connector as appropriate and if necessary.

INDUSTRIAL APPLICABILITY

The electrical connector of the invention may be used wherever two electrical leads are to be releasably connected together.

CLAIMS

1. An electrical connector having a first connecting end and a second connecting end and wherein the first connecting end is electrically conductively slidable with respect to the second connecting end.

2. An electrical connector according to claim 1 wherein one of the connecting ends has an electrically conductive pin protruding therefrom and the other end has a socket defined by an electrically conductive cylinder, the pin being adapted for electrically conductive slidable insertion within said cylinder.

3. An electrical connector according to claim 2 wherein the cylinder includes a circumferential groove located on an inner surface thereof adapted to retain a spring element therein.

4. An electrical connector according to claim 3 wherein the spring element comprises a mid section lying in a first plane and end sections lying in a second plane, the second plane being offset a radial distance from said first plane.

5. An electrical connector according to claim 4 wherein the first plane is parallel to said second plane.

6. An electrical connector according to claim 4 wherein the mid section of the spring element is adapted to be urged against an exterior surface of said pin whilst said end sections are adapted to be urged against an inside surface of said electrically conductive cylinder as a consequence of radially induced tension within said spring element.

7. An electrical connector according to claim 6 wherein the inside diameter of said spring element permits an electrically conductive sliding friction connection with the exterior surface of said pin as said pin moves past said spring element within said cylinder.

8. An electrical connector according to claim 1 further including a helical spring adapted to resist displacement of the connecting ends towards each other.

9. An electrical connector according to claim 8 wherein the helical spring comprises an outer spring mounted around and longitudinally along the outside of said socket and pin.

10. An electrical connector according to claim 9 wherein the tensile strength of the helical spring is sufficient to overcome frictional forces encountered as the pin slides within the socket.

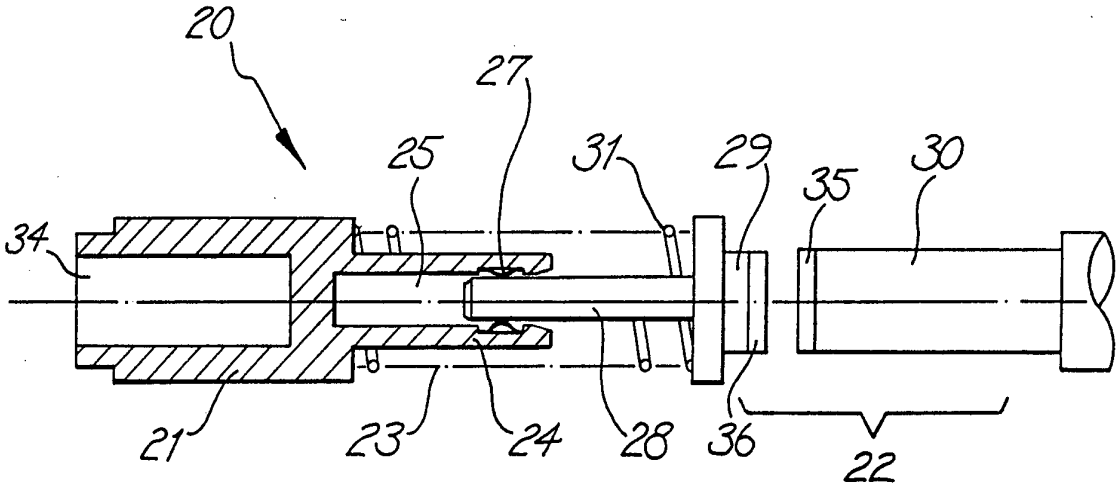

FIG. 1

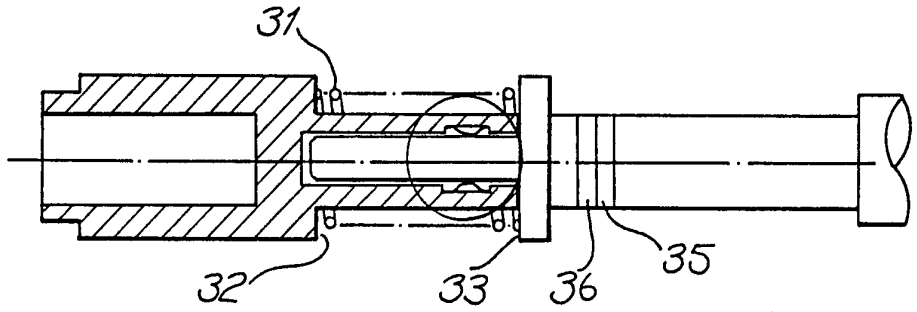

FIG. 2

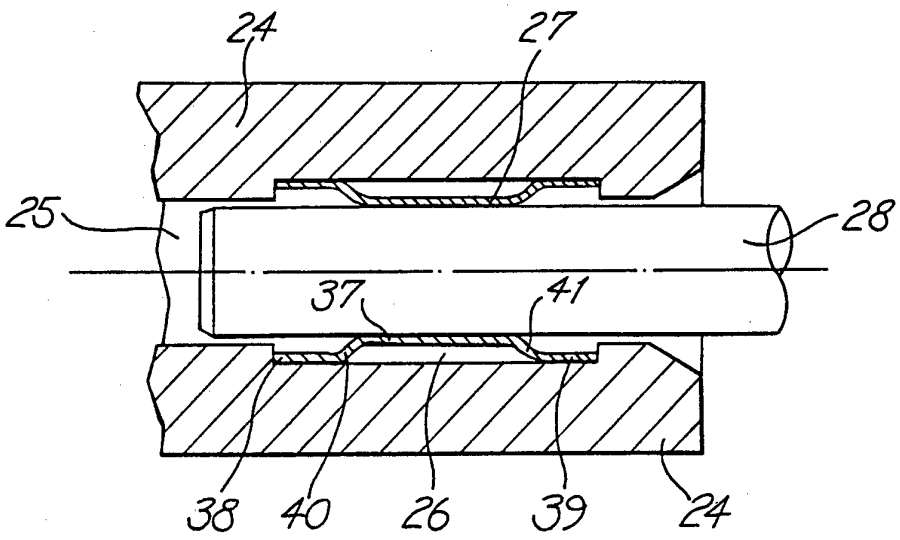

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00604

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.[6] H01R 13/187

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 H01R 13/10, 13/12, 13/15, 13/187

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
	CH,A, 455905 (AMP INC) 15 July 1968 (15.07.68)	
X	Fig 1-5	1-7
Y		6-7,8
	FR,A, 786021 (VAN NOORDEN) 24 August 1935 (24.08.35)	
X	Fig 1-2	1-3
Y		8
	US,A, 4693002 (NEUMANN) 15 September 1987 (15.09.87)	
X	Fig 5	1-7
Y		8

[X] Further documents are listed in the continuation of Box C.

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11 November 1994 (11.11.94)	18 NOV 1994 (18.11.94)

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INTERNATIONAL SEARCH REPORT

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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X	Fig 1,2	1-7
Y		8
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X	Fig 1-4	1-7
Y		8
	FR,A, 910748 (ETABLISSEMENTS D.F.) 17 June 1946 (17.06.46)	
X	Fig 1,2	1-7
Y		8
	US,A, 4128293 (PAOLI) 5 December 1978 (05.12.78)	
X	Fig 1-8	1-5
Y		6-8
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X	Fig 1-4	1-5
Y		6-8
	US,A, 4039238 (JOHNSON) 2 August 1977 (02.08.77)	
X	Fig 1-4	1-5
Y		6-8

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PCT/AU 94/00604

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Minimum documentation searched (classification system followed by classification symbols)
IPC H01R 33/46

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
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Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)

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X	AU, A, 23147/29 (COOK) 21 October 1930 Figure 1, 2 and description	1-5 (AMENDED)

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Patent Document Cited in Search Report		Patent Family Member					
US	4693002	AT	1012/85	AU	40530/85	BE	902100
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		DK	1552/85	ES	541918	FI	851346
		FR	2562727	GB	2157099	IT	1186856
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US	4039238	AU	84588/75	BE	833093	CA	1061877
		CH	614566	DE	2539675	FR	2284203
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