United States Patent

Cripps

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[54] ELECTRICAL CONNECTORS

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[52] **U.S. Cl.** .....**339/90 C,** 285/DIG. 22, 339/177 R

[51] **Int. Cl.** **H01r 13/54**

[58] **Field of Search** .....339/59–61, 89, 339/90, 177; 285/387, 388, DIG. 22

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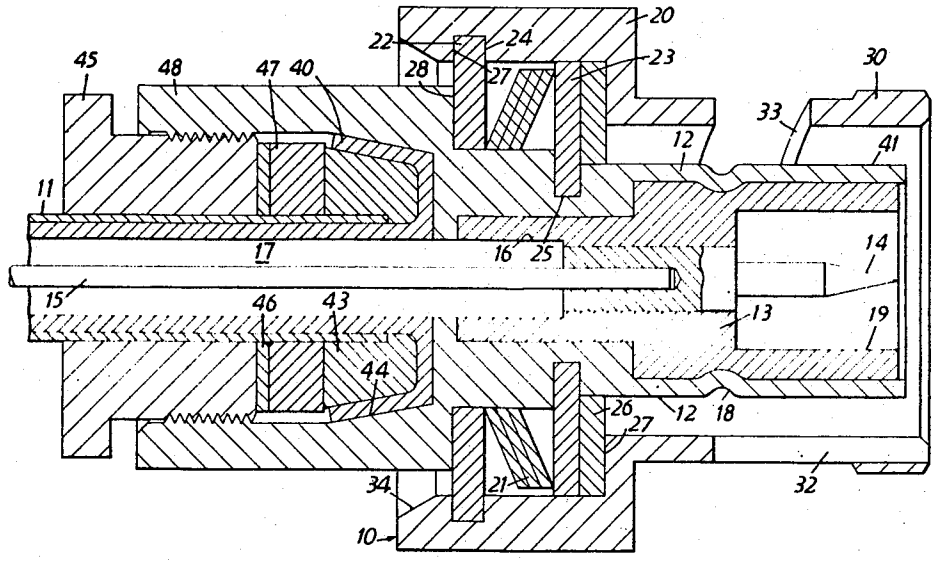
[57] **ABSTRACT**

Electrical plug-and-socket connectors have plastics locking sleeves, preferably colored for coding, for couping and retaining the connectors to mating connectors, and the sleeves can yield outwardly, have some resilience and are arranged to interlock onto the respective connector bodies with a "snap" action when the sleeves are pushed onto their bodies in assembly. In one connector, the body carries a washer that is a snap-in fit in a groove in the resilient locking sleeve, and in another connector, the resilient locking sleeve has an inwardly-pointing lip which snaps into a space between two shoulders on the body. The sleeve can be one-half of a bayonet- or screw-type coupling.

11 Claims, 2 Drawing Figures



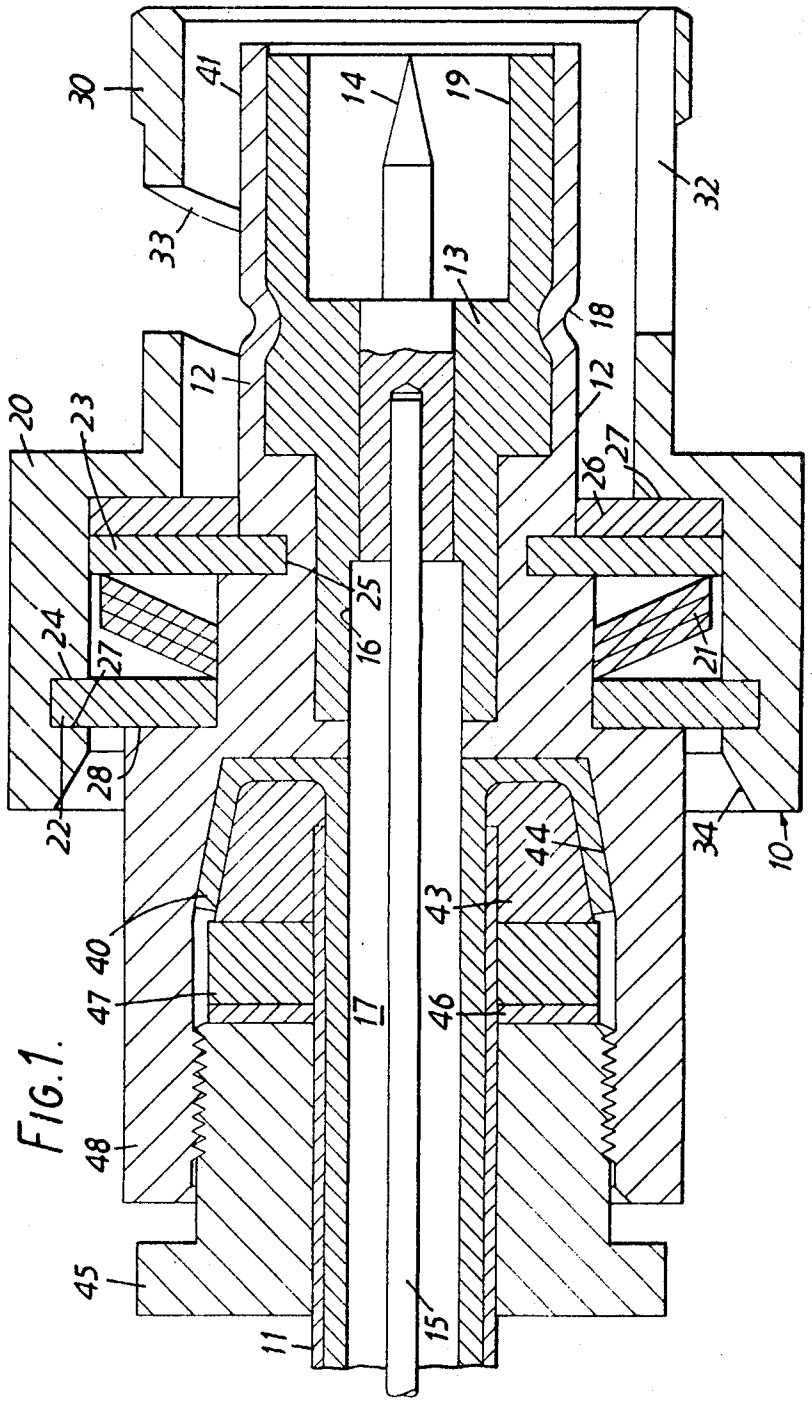

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FIG. 1.

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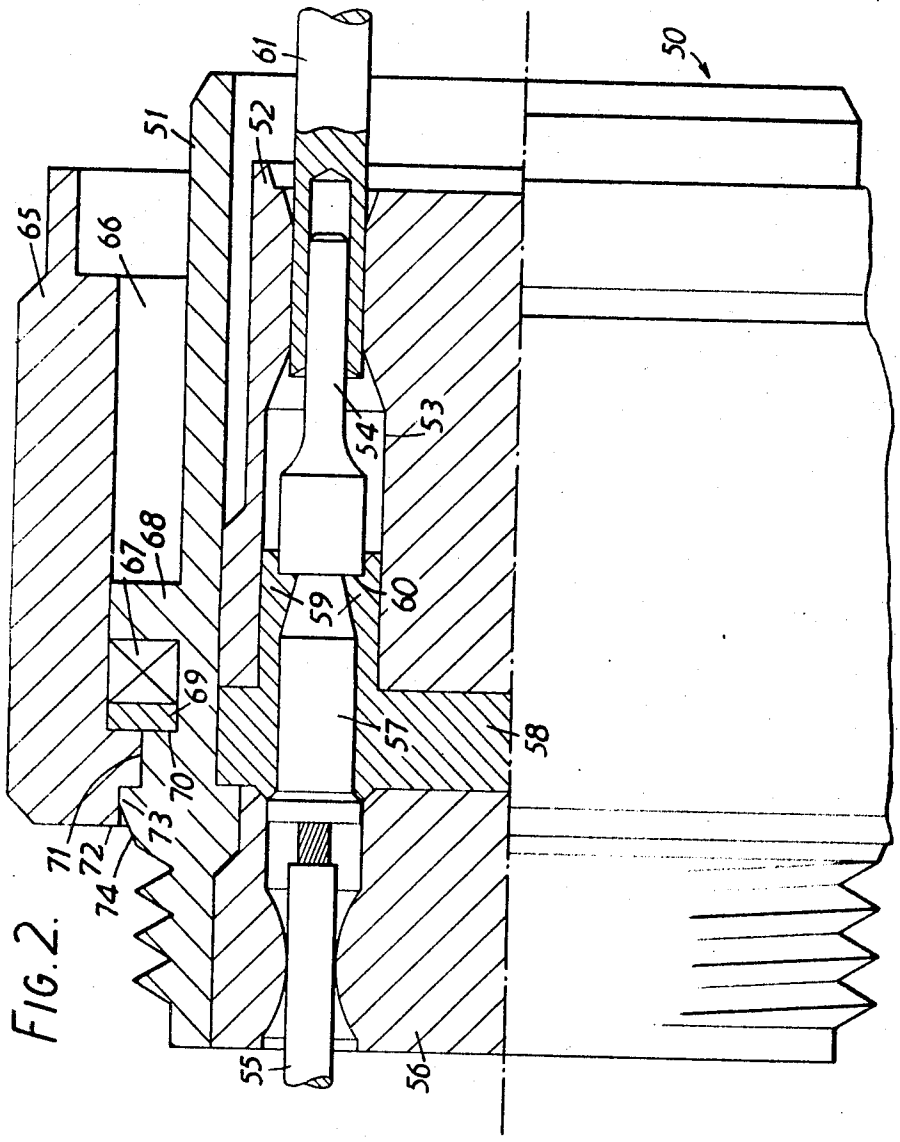

FIG. 2.

ELECTRICAL CONNECTORS

This invention relates to an improved electrical connector which is adapted to be united with and locked to a mating connector.

According to the present invention, there is provided an electrical connector having a retaining outer sleeve member which is adapted to engage a mating connector to secure both connectors together, the sleeve member surrounding and being movable relative to an inner member, there being two spaced abutments on each of the two members and the retaining sleeve member having at least a portion of resilient plastics material which contains the two abutments of the sleeve member such that during assembly the retaining sleeve member can be pushed over the inner member and the plastics portion yields radially outwardly to permit the two abutments of one of the members to snap into a trapped position between the two abutments on the other member thereby locking the two members together. The retaining sleeve can be one-half of a screw-type coupling, but preferably is one-half of a bayonet-type coupling, the other half of the coupling being carried by the mating connector. In a preferred embodiment the two abutments which snap into the trapped position are formed by the opposite faces of a washer which embraces and is retained by the inner member, the two abutments of the sleeve member being the opposite faces of an internal circumferential groove provided in the plastics portion to accommodate the peripheral part of the washer. The sleeve member may be arranged so as to be capable of axial movement relative to the inner member. In the preferred embodiment this can be achieved for example by making the washer slidable over the inner sleeve between fixed, spaced abutment surfaces or shoulders which govern the distance through which the washer can move, and hence govern the permitted movement of the sleeve member.

In another embodiment, the plastics portion has an integrally-formed, inwardly-directed lip and the two abutments of the sleeve member are constituted by the opposite, inner and outer surfaces of the lip, the abutments on the inner member being a pair of opposed shoulders on its external surface and between which the lip is accommodated and trapped. In this embodiment the sleeve member can be made axially movable relative to the inner member, by making the distance between the shoulders, which form fixed abutment surfaces, greater than the effective thickness of the inwardly-directed lip.

In either embodiment, where the sleeve member is axially movable and is one-half of a bayonet-type coupling for instance, biasing means may be provided to urge the sleeve member in one, locking direction. The biasing means can be one or more spring or Bellville washers or coil springs which surround the inner sleeve.

The biasing means and fixed abutments or shoulders are smaller than the opening at one end of the retaining sleeve so that this end can be slipped over them when assembling the retaining sleeve on the inner sleeve. In the preferred embodiment however, the movable washer is larger than the opening, and it is therefore necessary to force the retaining sleeve over the movable washer. The resilient portion of plastics material is capable of deforming when it is forced over the movable washer, and when the circumferential groove formed in its inner surface is aligned with the movable washer, the resilient plastics portion snaps to its original shape and size and so embraces the movable washer. A lead is advantageously provided to assist in causing the resilient plastics portion to yield as it is forced over the washer.

It will be appreciated that in either embodiment, manufacture and assembly of the connector is facilitated, it being necessary only to push the retaining sleeve over the inner member and the springs, where provided, until the washer snaps into engagement in its receiving groove or until the inwardly-directed lips snap into engagement between the shoulders provided on the inner member. Hitherto, retaining sleeves were metallic, and after positioning them on their corresponding inner members and biasing means, a further operation was necessary, namely to spin or otherwise deform the metallic retaining sleeve to provide an inwardly-directed lip upon which the biasing means could act.

The resilient plastics portion could be an insert retained in the sleeve member, but advantageously, the retaining sleeve is made of a one piece, self-colored plastics moulding. It will be appreciated that identification by means of a colored sleeve is particularly advantageous where connections between numerous cables have to be made.

The invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of an electrical connector incorporating one embodiment of the present invention; and

FIG. 2 is a portion cross-sectional view of another electrical connector incorporating a second embodiment of the invention.

The electrical connector **10** shown in FIG. 1 of the drawings is for connecting one coaxial cable **11** to another through a co-operating, mating connector (not shown). The connector **10** has an inner member in the form of a tubular inner sleeve **12**, made of metal such as aluminum, within which is housed an insulating plastics insert **13**, made for example from P.T.F.E. A contact pin **14** is disposed axially within the insert **13** and is bored to receive the inner conductor **15** of the coaxial cable **11**. The insert is bored to receive the contact pin **14** and is counterbored at **16** to accommodate the inner insulation **17** of the cable **11**. Dimples **18** secure the insert **13** within the inner sleeve **12**. The contact pin **14** is accessible to the co-operating contact of a mating connector by means of the enlarged opening **19**.

A moulded, thermo-plastics outer retaining sleeve member **20** surrounds the inner sleeve **12**, is rotatable therearound and is slidable therealong. The retaining sleeve **20** forms one-half of a bayonet-type coupling. The other half of the coupling is mounted upon the co-operating, mating connector. Spring-biassing means in the form of a plurality of spring washers **21** are seated on the inner sleeve **12** and urge the retaining sleeve **20** to the left, as shown in the drawing. The spring washers **21** are disposed between an axially movable washer **22** and one of a pair of fixed abutments **23**. The opposite faces of the washer **22** form the two abutments held by the inner sleeve and the washer **22** is seated in a groove **24** provided in the inner surface of the retaining sleeve **20** and moves therewith during sliding movement of the retaining sleeve. The opposite faces of the groove form the two abutments of the retaining sleeve. The fixed abutment **23** is in the form of a pair of split, half washers and is held stationary with respect to the inner sleeve **12** by its location in a groove **25** therein. A rubber packing **26** is positioned between the fixed abutment **23** and a shoulder **27** of the retaining sleeve **20**. Movement of the retaining sleeve **20** towards the left under the action of the spring washers **21** is limited by the contact of the movable washer **22** and a shoulder **28** on the inner sleeve **12**, the shoulder **28** forming the other of the said pair of fixed abutments. Movement of the washer **22** is allowed by the fixed abutments **23** and **28** being a greater distance apart than the thickness of the washer, but it will be appreciated that movement in one direction is resisted by the spring washers **21**.

A nose portion **30** of the retaining sleeve **20** is spaced apart from the inner sleeve **12**, to accommodate a tubular portion of a co-operating mating connector. The nose portion **30** is grooved and helically slotted at **32** and **33** to provide channels forming part of the bayonet coupling, in which lugs carried by the tubular portion of the co-operating connector are received.

When coupling the electrical connector to a mating connector, the tubular portion of the latter is pushed into the annular space between the inner and retaining sleeves **12** and **20**, with the lugs carried by the tubular portion entering the grooves **32**. Twisting movement of the retaining sleeve **12** effects the bayonet coupling action, by moving the helical slots **33** relative to the lugs. Due to the helical configuration of the slots

33, upon twisting, simultaneous axial movement of the retaining sleeve 20 to the right occurs, which movement is resisted by the spring washers 21. The two connectors become locked together in known manner when the said lugs are accommodated in an enlarged portion at the inner end of the helical slots 32. When the lugs are positioned in the enlarged portion, the retaining sleeve 20 is moved back towards its extreme left-hand position as shown in the drawing. To assist twisting, the retaining sleeve 20 is provided with ribs on its external surface.

When assembling the connector the retaining sleeve 20 is pushed over the inner sleeve from the right. As will be seen from the drawing, the diameter of the opening extending through the retaining sleeve 20 is larger than that of the inner sleeve 12, the spring washers 21 and the fixed abutment or half washers 23. The diameter of the movable washer is however greater than the diameter of the opening. In order for the washer 22 to be accomodated within the groove 24, it is therefore necessary to force the retaining sleeve 20 into place, causing deformation thereof. This deformation is made possible owing to the resilient nature of the plastics material from which the retaining sleeve 20 is made. The mouth 34 of the opening in the retaining sleeve 20 is made frusto-conical providing a lead of assistance only when forcing the retaining sleeve 20 into position, that is when moving the sleeve in the direction which brings the groove 24 towards the washer 22. A "snap" interfitting of the washer 22 and its accommodating groove 24 results. By arranging that the diameter of the washer 22 somewhat exceeds the diameter of the groove 24, the retaining sleeve 20 embraces and securely grips the washer 22 about its periphery.

The metallic inner sleeve 12 provides electrical continuity between the screening braid 40 of the co-axial cable 11, a corresponding sleeve of a mating connector and the screening braid of a length of coaxial cable connected thereto. The nose portion 41 of the inner sleeve 1 is oversize to ensure that it fits snugly within a mating connector and establishes electrical continuity therewith. Longitudinal slots (not shown) permit inward flexing of the nose portion 41 when coupling to a mating connector.

Contact between the screening braid 40 and the inner sleeve 12 is achieved by known means. The means include a conducting externally frusto-conical member 43 which co-operates with a tapering bore 44 in the inner sleeve to grip an exposed end of the braid therebetween. The member 43 is urged towards the tapering bore 44 by means of a screw-threaded plug 45 through which the cable 11 passes. The plug 45 engages threads in an entry portion 48 of the inner sleeve 12. As the plug is screwed in, its movement is transmitted to the member 43 through a washer 46 and an elastomeric gasket 47. The plug 47 has a hexagonal end configuration and the entry portion 48 has flats in its outer surface so that spanners may be used to tighten the plug 47 and urge the member 43 and braid 40 against the tapering bore 44.

While a coaxial connector having the improved plastics locking and retaining sleeve arrangement has been described, it will be appreciated that noncoaxial or multi-pin connectors may likewise incorporate a locking and retaining arrangement. An example is illustrated in FIG. 2 of the drawings.

The connector 50 is a multi-pin type of which only one pin is shown in the partial sectional view of FIG. 2. The connector 50 has an inner member or sleeve 51 within which there is an insulating insert 52. The insert 52 is apertured, as at 53 to receive a pin contact 54. An electric cable 55 is led to the pin contact 54 through a grommet 56, and the bared end of the cable is received in a bored rear portion 57 of the contact which is electrically continuous with the pin contact 54. The rear portion is accommodated in and extends through a retention disc 58 and protrudes into the aperture 53 in the insert 50. The retention disc 58 is located within the inner sleeve 51 and has projecting fingers 59 which are shouldered at 60 to engage the pin contact 54 and prevent axial displacement thereof when the connector 50 is united with a mating connector, not shown. The mating connector has tubular contacts 61 to co-operate with the pin contacts 54 of the connector 50. It will be appreciated that instead of the pin contacts 54, the connector 50 might have sockets 61.

The connector 50 has a thermo-plastics outer retaining sleeve member 65 which is slotted or grooved at 66 to form one-half of a bayonet-type coupling. The other half of the bayonet coupling is carried by the mating connector. The retaining sleeve 65 is arranged to be axially movable along the inner sleeve and spring biasing for the retaining ring 65 is provided at 67, for example by wavy-spring or Bellville washers. The spring washers 67 are located between a fixed abutment or ledge 68 on the outer surface of the inner sleeve 51 and a movable abutment washer 69. The fixed abutment 68 is shown as being formed integrally with the inner sleeve 51, but it could be arranged in the manner described in relation to FIG. 1. The movable abutment 69 and the spring washers are formed by split or half washers where the fixed abutment 68 is an integral ledge on the inner sleeve 51. Alternatively however, the movable abutment 69 may be a split-ring device which is capable of being opened out and wound onto the inner member; a device similar to a key-ring would be satisfactory. Also, the biasing means 67 could be in the form of one or more coil springs, which likewise can be wound around the inner sleeve 51. The spring biasing urges the movable abutment 69 to the left in FIG. 2 and hence urges the retaining sleeve in this, the locking direction of movement by engagement of the movable abutment with an inwardly directed lip 71 located adjacent the mouth 72 of the retaining sleeve 65. Movement of the movable abutment 69 to the left in FIG. 2 is limited by a shoulder 70 on the inner sleeve 51 and movement of the retaining sleeve 65 to the left is limited by another, second fixed abutment or obstructing shoulder 73 likewise on the inner sleeve 51. In assembling the connector 50, the retaining sleeve 65 is pushed over the inner sleeve 51 from the left until the inwardly-directed lip 71 contacts the shoulder 73. The retaining sleeve 65 is forced into place momentarily deforming it as the lip 72 is urged outwardly while it rides up the frusto-conical surface 74 of the shoulders 73 and then over the shoulders 73. The frusto-conical surface 74, co-operates with the lip 71 and provides a lead of assistance in deforming the retaining sleeve 65 only while it is being pushed in the direction which moves the lip towards and into the space between the fixed abutments 68 and 70.

Axial movement of the retaining sleeve 65 is permitted by arranging that the fixed abutments 73 and 68 are separated by a distance greater than the combined thickness of the inwardly directed lip 71 and the movable abutment 69, but movement in one direction is resisted by the biasing means 67. Although in the connector shown in FIG. 2 a movable abutment 69 is provided, this could be omitted so that the biasing means 67 would then bear directly against the lip 71.

I claim:

1. An electrical connector adapted for uniting with and locking to a mating connector, comprising:

a retaining outer sleeve member adapted to engage

a mating connector to secure both said connectors together,

an inner member located within said sleeve member, said sleeve member surrounding and being movable relative to said inner member,

two spaced abutments on said sleeve member,

two spaced abutments on said inner member,

said sleeve member having at least a portion of resilient plastics material containing said two abutments of said sleeve member,

said portion of resilient plastics material being radially outwardly yieldable, whereby

during assembly said sleeve member can be pushed over said inner member and said portion of resilient plastics material yields radially outwardly to permit the two abutments of one of said members to snap into a trapped position between the two abutments of the other of said members thereby locking the two members together, said two

abutments which snap into said trapped position being opposite faces of a washer which embraces and is retained by said inner member, said two abutments of said sleeve member being the opposite faces of an internal circumferential groove provided in said plastics portion to accommodate the peripheral part of said washer.

2. A connector according to claim 1, wherein said sleeve member and said washer are axially movable between limits relative to said inner member when said washer is in said trapped position, there being two fixed abutment surfaces formed by shoulders on the external surface of said inner member, said shoulders being spaced further apart than the thickness of said washer whereby said shoulders permit limited axial movement of said washer therebetween and whereby said shoulders retain said washer on said inner member.

3. A connector according to claim 1, wherein a lead is provided to assist yielding of said plastics portion during assembly, said lead consisting of an outwardly-flared mouth at one end of said plastics portion and which is contacted by the periphery of said washer as said sleeve member is pushed over said inner member, whereby said plastics portion is only forced radially outwardly with ease while said washer rides across said flared surface of said mouth in the direction of said accommodating internal circumferential groove.

4. An electrical connector adapted for uniting with and locking to a mating connector, comprising:

a retaining outer sleeve member adapted to engage a mating connector to secure both said connectors together,

an inner member located within said sleeve member, said sleeve member surrounding and being movable relative to said inner member,

two spaced abutments on said sleeve member,

two spaced abutments on said inner member,

said sleeve member having at least a portion of resilient plastics material containing said two abutments of said sleeve member,

said portion of resilient plastics material being radially outwardly yieldable, whereby

during assembly said sleeve member can be pushed over said inner member and said portion of resilient plastics material yields radially outwardly to permit the two abutments of one of said members to snap into a trapped position between the two abutments of the other of said members thereby locking the two members together,

said sleeve member being axially movable between limits relative to said inner member when said two abutments in one of said members are trapped between said two abutments of the other of said members, and

said connector including biasing means operative between said inner member and said sleeve member to urge said sleeve member along said inner member towards a position for securing said connector to a mating connector.

5. A connector according to claim 4, wherein said biasing means is a spring which contacts one of a pair of shoulders, forming fixed abutments, on the external surface of said inner member, thereby to urge said sleeve member in a direction away from said one shoulder, said one shoulder being a pair of split washers held in a groove in the external surface of said inner member.

6. A connector according to claim 4, wherein said biasing means comprise a spring which contacts one of a pair of shoulders, providing fixed abutments, that are integrally formed on the external surface of the said inner member thereby to urge said sleeve member away from said one shoulder.

7. A connector according to claim 6, wherein said biasing means comprise at least one split, wavy-spring washer.

8. A connector according to claim 6, wherein said biasing means includes a coil-type spring capable of being wound onto said inner member in the space between said pair of shoulders.

9. A connector according to claim 6, wherein one of said two abutments between which the other said two abutments snap into said trapped position is a face of a washer which embraces said inner member and is retained between said shoulders providing said fixed abutments thereon, said washer being a split-ring device capable of being opened and wound around said inner member into the space between said shoulders.

10. A connector according to claim 4, wherein said sleeve member forms one-half of a bayonet-type coupling.

11. A connector according to claim 10, wherein said sleeve member is helically grooved or slotted to co-operate with the other half of a bayonet-type coupling carried by a mating electrical connector.

* * * * *