

[54] AXIALLY MATING POSITIVE LOCKING CONNECTOR

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[58] Field of Search..... 339/74, 91

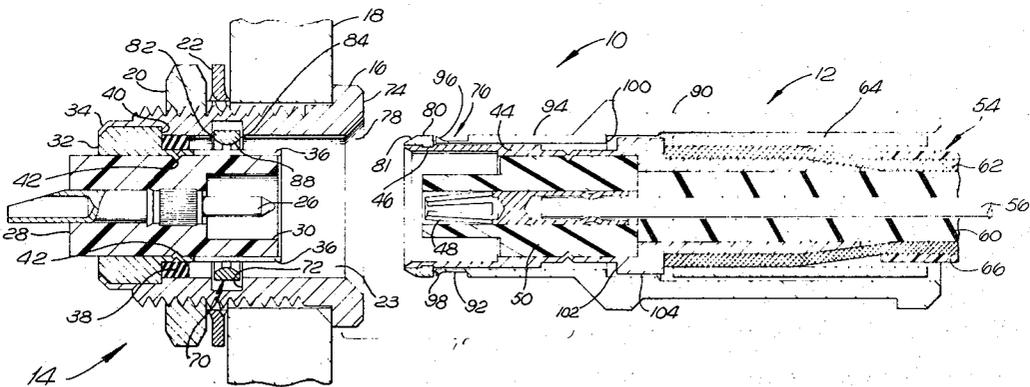
[57] ABSTRACT

A quick connect-disconnect axially mating electrical connector comprising interengageable receptacle and plug members carrying electrical contacts which engage upon mating of the connector members. One connector member carries a split ring which engages in an annular groove formed in the other connector member when the two members are mated. A slidable sleeve is provided on one of the members for disengaging the split ring from the groove upon disengagement of the two connector members.

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10 Claims, 4 Drawing Figures



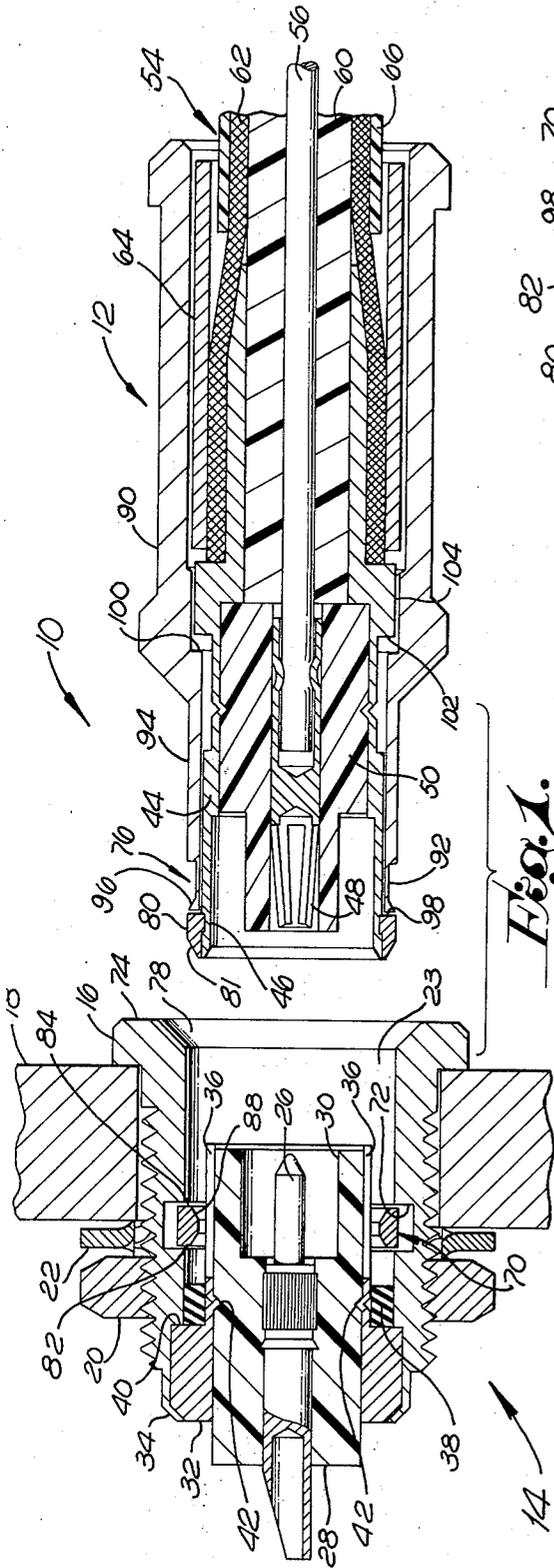


Fig. 1.

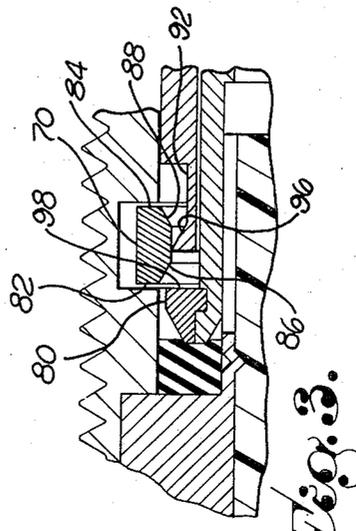


Fig. 3.

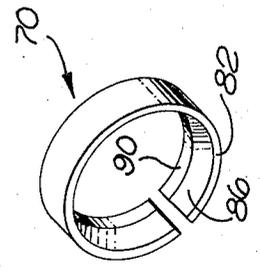


Fig. 4.

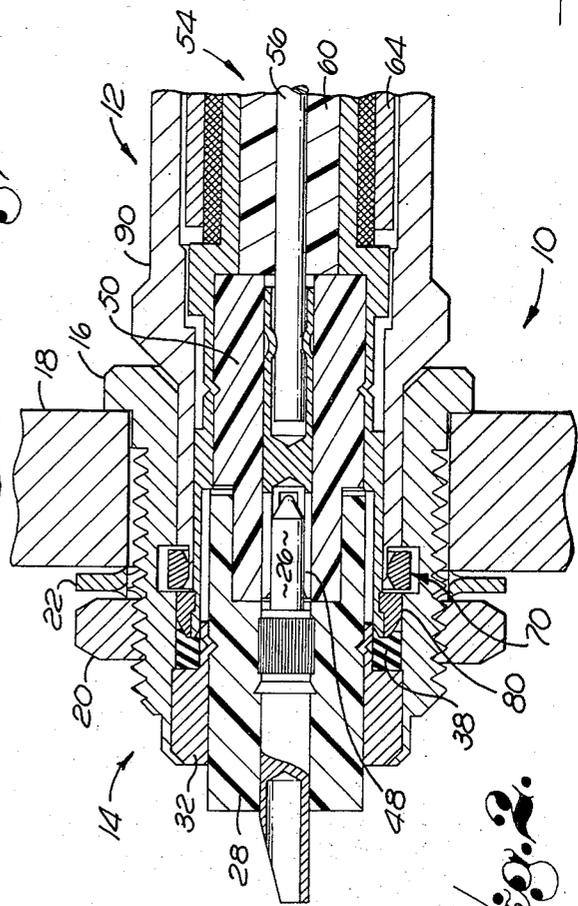


Fig. 2.

AXIALLY MATING POSITIVE LOCKING CONNECTOR

BACKGROUND OF THE INVENTION

Separable connectors have long been known in the art. Most of these connectors are mated together by insertion of one into the other and are then retained together by means of threaded members. For some applications quick connect-disconnect connectors are required. Such connectors are mated strictly in axial line, thus not requiring a form of rotational movement for complete engagement. For such axially engaged connectors, there is required a positive locking means to prevent accidental unmating resulting from tension applied to the connector cables. Such locking features have generally been expensive and require many additional parts. The purpose of the present invention is to provide an axially engageable connector having relatively simple yet effective means for locking the connector members together when mated and means for rapidly releasing the locking means to allow for quick disengagement of the connector members.

SUMMARY OF THE INVENTION

It is the principal object of the present invention to provide an axially mating electrical connector having novel means for positively locking the connector members together.

According to the principal aspect of the present invention, there is provided a quick connect-disconnect electrical connector including a pair of connector members which are axially engageable. One of the connector members carries a radially deformable locking ring which is expanded upon initial engagement of the connector members and contracts into an annular groove in the other connector member after the two members are fully mated, thus providing a positive lock for the two members. Releasing means is provided on the member forward with the annular groove which releases the locking ring from the groove upon disengagement of the connector members. Preferably, such releasing means is in the form of a slidable sleeve surrounding the body of the plug connector member of the connector assembly and effects disengagement of the locking ring from the plug connector member simultaneously with the disengagement of the two members.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a partial longitudinal sectional view of the connector of the present invention showing the receptacle connector member and plug connector member disengaged from each other;

FIG. 2 is a partial longitudinal sectional view of the connector members interengaged;

FIG. 3 is an enlarged fragmentary sectional view of the connector of the present invention showing details of the locking ring when being released during initial disengagement of the connector members; and

FIG. 4 is a perspective view of the novel locking ring of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in detail, there is shown a mating pair of connector members, generally designated 10, which comprise a plug connector 12 and

a receptacle connector 14. The receptacle connector member comprises an externally threaded cylindrical body or shell 16 which is secured to a panel 18 by means of a nut 20 and lock washer 22. A cylindrical bore 23 extends through the shell 16.

A male center contact 26 is mounted in an annular insulator 28 which is formed with a recess 30 opening at its forward end into which the contact 26 extends. The insulator 28 is mounted in an inner body 32 which is secured within the shell 16 by a rolled flange 34 on the rear portion of the shell. The inner body 32 is formed with a reduced diameter forwardly extending portion 33 terminating in a plurality of circularly-arranged, axially-extending spring members 36 which surround the forward portion of insulator 28.

An annular gasket 38 is positioned between forward portion 33 of the inner body 32 and the inner surface of the shell 16. The gasket abuts against a forwardly-facing shoulder 40 on the body 32. The gasket 38 will expand when it is compressed axially upon engagement of the plug connector member 12 with the receptacle connector 14. The forward portion 33 of the body 32 is staked at several points about its periphery as indicated at 42 to lock the insulator 28 within the body.

The plug connector member 12 includes a main body 44 formed with a recess 46 which opens at its forward end. A female socket contact 48 is coaxially positioned within the body 44 and is separated therefrom by annular insulator 50. The outer diameter of the forward portion of the plug connector member is slightly less than the diameter of the bore 23 in the shell 16 of the receptacle connector member 14. The contact 48 and insulator 50 are positioned in the recess 46 of the body 44 so that when the plug connector 12 is engaged in the receptacle connector 14 the male center contact 26 will be engaged in socket contact 48.

A cable, generally designated 54, is connected in the plug connector 12. The cable includes a center conductor 56 which is secured in the female center contact by crimping the contact at the point 58. An insulator sleeve 60 surrounds the center conductor 56. The outer conductor or cable braid 62 of the cable 54 is secured against the outer surface of the main body 44 of the plug connector by a crimp ferrule 64. A second insulating layer 66 covers the outer conductor 62 on the cable.

The center male contact 26 in the receptacle connector 14 is shown as being of the type that terminates a single wire. However, it may also be constructed to terminate a coaxial cable as the plug connector 12. In addition, the plug connector does not necessarily have to terminate in a cable, as shown. Moreover, the plug and receptacle connectors may contain more than one contact, if desired. The construction of the plug and receptacle connectors described so far is generally conventional and is given by way of example only, it being understood that the locking device of the present invention can be applied to any form of connector in which the main parts are axially engageable.

The locking device of the present invention includes a longitudinally split or C-shaped ring 70, best seen in FIG. 4. The ring is positioned in an annular recess 72 opening at the surface of the bore 23 in the receptacle connector 14 behind the forward face 74 thereof. The ring 70 is formed of a spring-like material which allows the ring to expand when a radially outwardly-directed

force is applied to the inner surface thereof and to thereafter contract when such force is removed. In general, the locking ring 70 is arranged to engage within an annular groove 76 formed in the plug connector member 12. The shell 16 is chamfered adjacent to the forward face 74 to provide a frusto-conical surface 78 to facilitate entry of the plug connector 12 into the receptacle connector. An outwardly extending flange 80 is fixedly mounted on the forward end of body 44. The outer diameter of the flange is greater than the inner diameter of the ring 70 but less than the diameter of bore 23. The forward surface 81 of the flange 80 is chamfered to facilitate engagement of the connector members and also to effect expansion of the locking ring 70 upon engagement of these parts as will be more clearly seen later.

The locking ring 70 is formed with generally parallel side surfaces 82 and 84, respectively, which lie in planes extending perpendicular to the axes of the connector members. These surfaces extend to the outer periphery of the ring. The ring is also formed with oppositely inclined frusto-conical guide surfaces 86 and 88 which extend from the respective side surfaces to the inner cylindrical surface 90 of the ring. The frusto-conical forwardly-facing surface 88 on the ring is generally complementary to the frusto-conical surface 81 on the plug connector 12 so that when the plug connector is moved axially into engagement with the receptacle connector, the frusto-conical surface 81 will engage the surface 88 of the ring 70 thereby causing the ring to expand radially outwardly into the recess 72. Upon further movement of the plug connector into the receptacle connector, the ring will become axially aligned with the groove 76 in the plug connector. The ring will then contract inwardly to become engaged in the groove 76 and thereby lock the two connector members together.

The plug connector 12 includes a cylindrical sleeve 90 which surrounds the body 44. An annular recess 92 is formed in the forward portion 94 of the sleeve. The outer diameter of the forward portion 94 is less than the diameter of bore 23 in the receptacle connector 14 and preferably is the same as the diameter of flange 80. The recess 92 opens at the outer surface of the sleeve. A rearwardly facing annular ramp or camming surface 96 is formed at the forward end of the sleeve. The outer diameter of the ramp is less than the diameter of the flange 80. The annular rear surface 98 of flange 80, the ramp 96 and the surfaces of the recess 92 define the groove 76 which receives locking ring 70. The outer diameter of flange 80 is greater than the diameter of the inner periphery of the side surface 82 on the ring 70 so that the rear surface 98 of the flange will engage the surface 82 on the ring when the two connector members are interengaged.

When the forward end of the sleeve 90 is positioned adjacent to flange 80, a rearwardly facing shoulder 100 on the interior of the sleeve is spaced from the forward face 102 on a flange 104 on body 44. Thus, the sleeve may be shifted rearwardly relative to the body 44, yet the flanges 80 and 104 serve to retain the sleeve on the body.

To engage the connector members 12 and 14, an axial force is applied to the sleeve 90 of the plug connector in a direction toward the receptacle connector. This causes the forward portion of connector 12 to slide into the bore 23 in the receptacle connector

bringing the contacts 26 and 48 into engagement. Forward movement of the connector 12 toward connector 14 will cause the frusto-conical surface 88 on the flange 81 to engage the forwardly-facing frusto-conical surface 88 on the ring 70 thereby causing the ring to expand into the recess 72. After the flange passes under the locking ring, the ring will contract to its original size by falling into the groove 76 thereby locking the two connector members in engagement as seen in FIG. 2. Any axial force applied to the plug connector will not dislodge it from the receptacle connector due to the engagement of the rear surface 98 on flange 80 with the side surface 82 on the locking ring.

To disengage the connector members, axial force is applied to sleeve 90 in the direction away from the receptacle connector 14. As best seen in FIG. 3, rearward movement of the sleeve 90 will cause the ramp 96 on the sleeve to expand the locking ring 70 outwardly into the recess 92 to the extent that the flanges 80 can engage frusto-conical surface 86 on the ring. Further rearward movement of the plug connector will cause the flange 80 to further expand the locking ring until the flange passes under the ring thus disengaging the two connectors.

Thus, by the present invention, there is provided means for positively locking axially-engageable plug and receptacle connector members and means for rapidly disengaging the locking device to allow quick disconnect of the connector members.

Although I have herein shown and described my invention with what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention which is not to be limited to the details disclosed herein but shall embrace any and all equivalent structures and devices.

What is claimed is:

1. An axially mating electrical connector comprising:

a first connector member having a first contact therein;
 a second connector member having a second contact for electrical connection with said first contact upon mating of said first and second connector members;
 said first connector member including a cylindrical body;
 said second connector member being formed with an axial bore slidably receiving said body;
 an annular groove in said first connector member opening at the outer surface thereof;
 radially deformable locking ring means carried by said second connector member, said ring means contracting into said groove to lock said connector members when said members are mated; and
 ring release means carried by said first connector member, said ring release means comprising an axially slidable sleeve surrounding said body and received within said bore, said sleeve being formed with a rearwardly facing camming surface which releases said ring means from said groove upon axial rearward movement of said sleeve away from said second connector member.

2. A connector as set forth in claim 1 wherein: the forward portion of said sleeve underlies said locking ring means when said connector members are engaged, the forward end of said forward portion

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being disposed behind said ring means and embodying said rearwardly facing camming surface.

3. A connector as set forth in claim 1 wherein: said second connector member is formed with an annular recess opening at the surface of said bore; and

said ring means comprises a split ring positioned in said recess, the inner diameter of said ring being less than the diameter of said bore.

4. A connector as set forth in claim 1 wherein: the forward end of said body is formed with an outwardly extending flange having a diameter less than that of said bore, said flange being forward of said sleeve; an annular recess is formed in the forward portion of said sleeve behind said camming surface and opening at the outer surface of said sleeve; and the rear of said flange and the surface of said recess define said first connector member annular groove.

5. A connector as set forth in claim 4 wherein: said second connector member is formed with an annular recess opening at the surface of said bore; and said ring means comprises a split ring positioned in said recess, the inner diameter of said ring being

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less than the diameter of said bore.

6. A connector as set forth in claim 5 wherein: the diameter of said flange is greater than the inner diameter of said ring.

7. A connector as set forth in claim 4 wherein: the outer dimension of said camming surface is less than the outer dimension of said flange.

8. A connector as set forth in claim 7 wherein: said split ring has generally parallel side surfaces extending to the outer periphery thereof and oppositely inclined frusto-conical guide surfaces extending from said side surfaces to the inner periphery of said ring; and

the outer dimension of said flange is greater than the diameter of the inner periphery of said side walls.

9. A connector as set forth in claim 8 wherein: said camming surface engages the rearwardly-facing frusto-conical guide surface on said split ring.

10. A connector as set forth in claim 8 wherein: the forward end of said flange is formed with a frusto-conical guide surface engageable with the forwardly-facing frusto-conical surface on said split ring when said connector members are being engaged.

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