May 12, 1970 J. K. CAMERON 3,512,119

ELECTRICAL CONNECTOR

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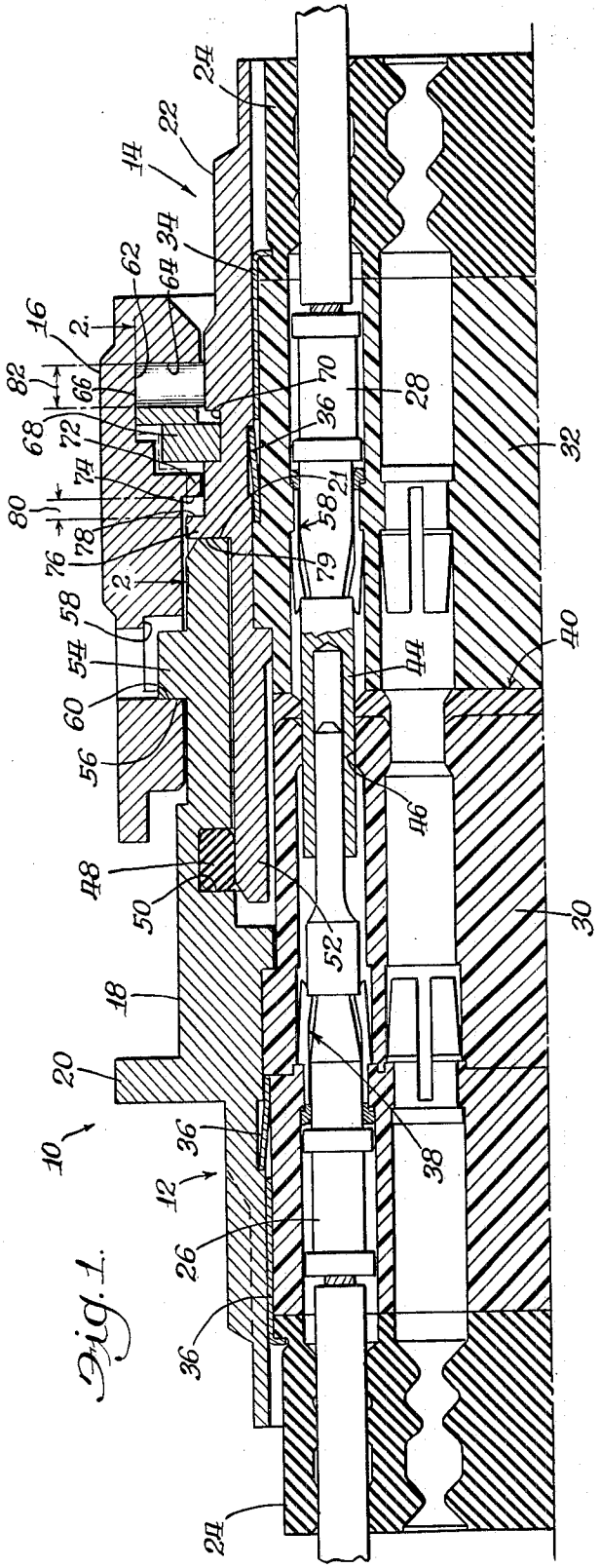

Fig. 1.

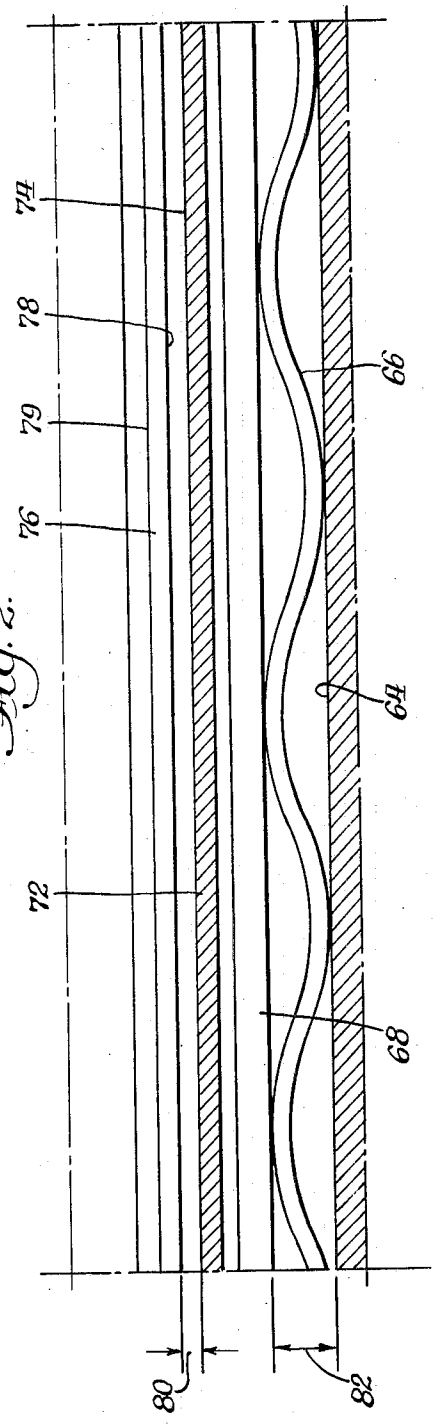

Fig. 2.

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ELECTRICAL CONNECTOR

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ABSTRACT OF THE DISCLOSURE

An electrical connector including a receptacle and a plug, both having hollow shells surrounding an insulating insert carrying corresponding contacts which interconnect when the receptacle and plug are joined. The connector includes a coupling ring surrounding the shell to releasably connect the receptacle and plug together, with a resilient spring washer interposed between the coupling ring and one of the shells, to provide more effective and uniform sealing between the parts, and wherein limiting shoulders are provided on the coupling ring and said one of the shells, which provide a positive stop means limiting movement of the ring and that shell to an extent less than the range of safe deflection of the resilient means, with the advantage of providing positive captivation between those elements and, eliminating overstressing of the resilient spring washer.

Other objects and advantages of the invention will appear from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is an axial sectional view of an electrical connector made according to the present invention; and

FIG. 2 is a detailed developed view taken at line 2—2 of FIG. 1.

Referring now in detail to the accompanying drawings, the electrical connector including the feature of the present invention is indicated in its entirety at **10** and includes a receptacle **12**, a plug **14** and a coupling ring **16**.

The receptacle **12** includes a shell **18** which may have a flange **20** for mounting it on a panel and a terminal end surface **21**, while the plug **14** includes a shell **22**, the coupling ring **16** acting through the shells in securing the connector parts together.

The internal elements of the connector parts do not, for the most part, enter into the features of the present invention, except as referred to as specifically hereinbelow. The connector parts include grommets **24** having apertures receiving the contacts of the cable to which the connector parts are attached, these contacts including pin contacts **26** in the receptacle **12** and socket contacts **28** in the plug **14**. These contacts extend through holes in the grommets **24** and through holes in hard dielectric inserts **30** and **32**. The grommets in the inserts may be connected together by suitable retainer sleeves **34** having engagement with the shells as indicated at **36**. The contacts **26** and **28** are secured in the dielectric inserts by suitable snap-in contact retention clips **38**. A center seal **40** may be provided between the dielectric inserts **30**, **32**.

The pin contacts **26** have terminal pin elements **42** which in the present instance terminate forwardly adjacent the end of the dielectric insert **30**. The socket inserts **28** have socket elements **44** which extend beyond the corresponding dielectric insert **32** and when the connector parts are connected, they extend into the apertures **46** in the dielectric inserts **30** and receive the pin elements **42** in telescoping relation throughout a range of substantial axial extent, this dimension being referred to again hereinbelow. The electrical contact engagement between the contacts **26**, **28** is established through the pin elements **42** and

socket elements **44**, these elements being appropriately dimensioned for that purpose.

Interposed between the shells is an O-ring **48** fitted in an annular groove **50** in the shell **18** and, when the connector parts are connected, surrounding the terminal end element **52** of the shell **22** in sealing engagement therewith. The O-ring as shown in FIG. 1 engages the shells throughout a substantial axial extent, this dimension also being referred to again hereinbelow.

The coupling ring **16** normally remains mounted on the plug **14** and has bayonet type, releasable connection with the receptacle **12**. The connection elements include radial projections **54** on the shell **18**, distributed therearound and defining shoulders **56** of substantial total circumferential extent. The coupling ring **16** includes internal grooves **58** receiving the projections **54** and having shoulders **60** engageable with the shoulders **56**.

The coupling ring **16** at its other end encircling the plug **14** has an internal groove **62** having a shoulder **64**, in which is fitted a yieldable and resilient means **66** which is in the form of a spring wave washer of corrugated spring steel capable of yielding axially of the connector and biasing the engaged parts axially in separating direction. The specific dimensions of this member may be as desired but it has substantial dimension axially.

The resilient spring member **66** is confined between the shoulder **64** and a retainer ring **68** fitted in an external groove **70** in the shell **22**, this retainer ring also extending into the groove **62**. The groove **62** is defined at its opposite end by a radially inwardly extending rib **72** defining a shoulder **74**. This rib **72** faces another rib **76** formed externally on the shell **22** and defining a shoulder **78**. The end of the shell forms a shoulder **79**.

In connecting the connector parts, they are fitted together and the connecting ring **16**, on the plug **14**, is connected with the receptacle in the usual way through the bayonet type connection referred to. In turning up the connecting ring in the connecting operation, forces are exerted through the shoulders **56**, **60**, working the connecting ring in direction toward the receptacle, thereby compressing the resilient means **66**. The normal extended dimension of the resilient means **66**, is such, in relation to the dimensions and proportions of other elements, that when the connector parts are connected as described, the resilient means is compressed to an axial dimension less than its maximum dimension whereby it maintains a constant biasing force between the connector parts to maintain those connector parts in snug connected condition. This yieldable and resilient means, acting between the shoulder **64** and the retainer ring **68**, biases the connecting ring **16** in corresponding direction (to the right, FIG. 1) whereby the receptacle **12** is pulled up through force exerted at the shoulders **56**, **60** on the receptacle **12**, and the end surface **21** of the shell firmly engages the end surface or shoulder **79** on the plug shell **22**.

The spacing between the opposed shoulders **74**, **78** as indicated at **80** is always less than the spacing **82** which represents the axial dimension of the spring **66** in any condition of compression of the spring. Actually, the spacing **80** is always appreciably less than the spacing **82** and in fact less than the axial movement which would cause overloading or overstressing of the spring. As a consequence, if the coupling ring **16** should be moved in uncoupling direction (to the left, FIG. 1) against the biasing effect of the spring, the shoulders **74**, **78** would engage before the danger point of the spring would be reached, these shoulders providing positive limiting means against further movement of the coupling ring as mentioned. Thus the spring **66** will always remain in full effect for biasing the connector parts in connecting direction.

The space **80** representing the maximum possible disconnecting movement of the parts is also considerably less than the telescoping relation between the contact elements **42** and **46** so that in the event that maximum movement in disconnecting direction should be reached, i.e., the shoulders **74**, **78** engaged, the good contact engagement between those contact elements will remain. Also the spacing **80** is less than the axial extent of the engagement by the O-ring **48** with both shells so that again, if the shoulders **74**, **78** should engage, perfect sealing effect will be maintained by the O-ring **48**.

The shoulders **74** and **78** extend entirely around the connector whereby to maintain perfect alignment and good connection between the connector parts, if these shoulders should come into interengagement.

Because of the spring **66** only low connecting and disconnecting torque is required, while it also provides uniform torque and even engagement between the engaged parts in the connecting action.

While I have herein disclosed a preferred form of the invention it will be understood that changes may be made therein within the spirit and scope of the appended claims.

I claim:

1. An electrical connector construction comprising a receptacle and a plug, each having a hollow shell surrounding and supporting an insulating insert carrying at least one electrical contact therein, with each contact in electrical engagement with a corresponding contact carried in the other insert, a coupling ring surrounding adjacent portions of the shells and having connecting engagement with both the shells to draw the insulating inserts therein toward each other and to hold the contacts therein in engagement; resilient means interposed between the coupling ring and one of the shells and having a predetermined range of deflection axially of the connector without impairing its resilience characteristics, and positive stop means on the coupling ring and said one shell limiting movement therebetween in separating direction an extent less than said range.

2. The invention according to claim **1** wherein the stop means are of substantial peripheral extent whereby to maintain accurate alignment between the connected parts when those stop means are interengaged.

3. The invention according to claim **1** wherein the receptacle and plug have respective contacts interengaging when the parts are connected throughout an axial extent substantially greater than the maximum spacing between said positive stop means.

4. The invention according to claim **1** wherein said shells have telescoping portions, sealing means is provided between the telescoping surfaces of these portions of the shells, and the sealing means provides sealing effect throughout an axial extent substantially greater than the maximum spacing between said positive stop means.

5. The invention according to claim **1** wherein the coupling ring is mounted on the plug and a bayonet type releaseable connection is provided between the coupling ring and the receptacle, said coupling ring is provided with an internal peripheral groove adjacent its inner end removed from the terminal end of the plug, said groove having a shoulder facing toward the terminal end of the plug, the resilient means includes a corrugated spring ring in said groove, the shell of the plug having an external peripheral groove, a retainer ring in said external groove, said spring ring being confined between said shoulder and said retainer ring, said shell of the plug having an external peripheral bead spaced from said retainer ring in the direction of the terminal end of the plug and defining a shoulder facing inwardly from said outer end, the coupling ring having a radially inwardly directed peripheral bead having a shoulder facing toward the terminal end of the plug and facing said shoulder on the bead of the plug shell, said coupling ring having limited axial movement relative to the plug and upon connection with the receptacle pursuant to the connecting movements of connecting the bayonet connection, the connecting rig moves axially along the plug toward the outer end of the latter, compressing said spring ring, and the parts having such dimensions and proportions that when the coupling ring is in fully coupled position, said shoulders on said beads are spaced apart, but at a distance substantially less than the movement required for impairing the resilience characteristics of the spring ring.

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