

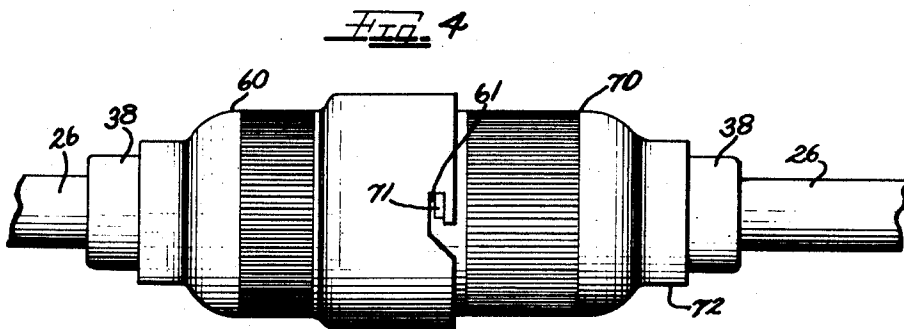
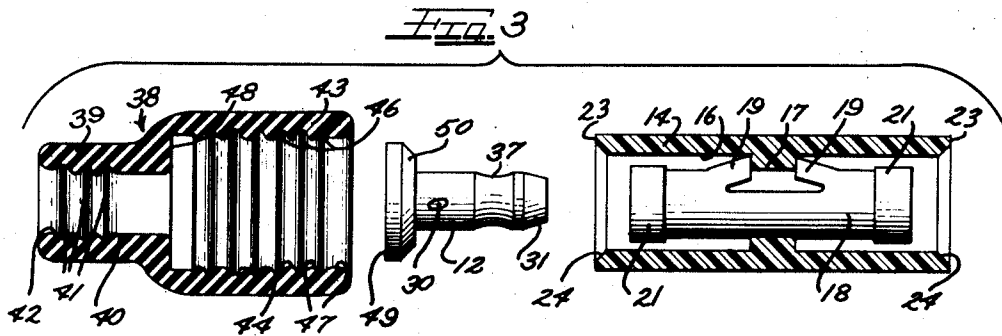
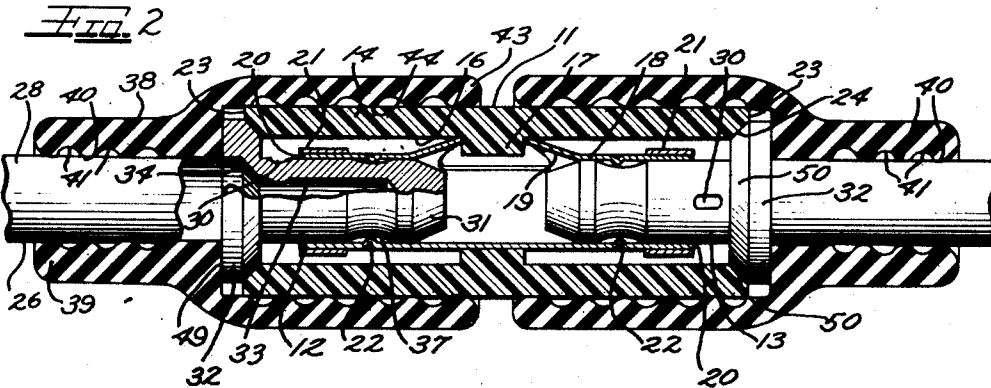
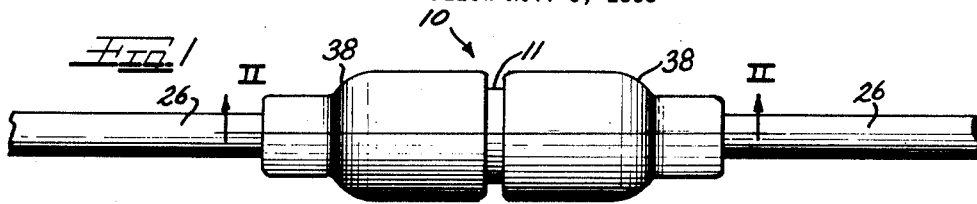
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J. D. LORIMER

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WATERPROOF CONNECTOR

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Inventor
JOHN D. LORIMER

By *Hill, Sherman, Morris, Kline & Simpson* Attys

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2,935,720

WATERPROOF CONNECTOR

John D. Lorimer, Birmingham, Mich., assignor to Kingston Products Corporation, Kokomo, Ind., a corporation of Indiana

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1 Claim. (Cl. 339—94)

This invention relates generally to separable connectors and particularly to a separable connector having components parts assembled in a novel manner in which certain of the parts are arranged to provide a watertight seal when the connector is placed in assembled relationship.

It is an object of the present invention to provide a waterproof line connector which has a reduced number of simplified elements and wherein the electrical components are sealed against liquid leakage.

Another object of the present invention is to provide a waterproof line connector wherein the parts are efficiently sealed so that no liquid will penetrate the enclosure in which the current-carrying means are housed but wherein the parts may be selectively separated, if desired.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

Figure 1 is an elevational view of a line connector incorporating the principles of the present invention;

Figure 2 is a cross-sectional view taken generally on line II—II of Figure 1 but with parts shown in elevation and with other parts broken away to illustrate additional details of construction;

Figure 3 is an exploded view illustrating additional details of construction of the component parts utilized in the connector of Figures 1 and 2; and

Figure 4 is an elevational view of the connector of Figures 1, 2 and 3 supplemented by an optional shell construction affording the user extra security against separation of the parts if desired.

As shown on the drawings:

In the preferred embodiment herein illustrated, a two wire connector is shown at 10 and comprises a socket member 11 receiving a first plug member 12 in one end and a second plug member 13 in the other end. Each of the plug members 12 and 13 is identical insofar as structural detail is concerned and, accordingly, only a single set of reference numerals will be applied in further describing the same.

Referring more specifically to Figures 2 and 3, it will be noted that the two wire connector 10 comprises a generally tubular housing 14 made of insulating material and having an open ended bore 16 provided with an internal medial shoulder or annular rib 17.

A current-continuing member indicated generally at 18 is inserted into the housing. The current-continuing member 18 preferably comprises a formed cylindrical tube having opposed struck-out ears indicated at 19 which engage opposite sides of the shoulder 17, thereby to retain the current-continuing member 18 firmly in place within the housing 14. The current-continuing member

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18 is preferably made of an electrically conductive metal embodying sufficient resilience so that insertion of the current-continuing member 18 into the housing 14 may be effected even though the tongues 19 extend radially outwardly beyond the inner diameter of the annular shoulder 17. Thus, as the current-continuing member 18 is inserted into the housing 14, the tongues 19 will be depressed in passing the shoulder 17 and will snap in behind the shoulder 17 so that the oppositely disposed tongues 19 will engage opposite sides of the annular shoulder 17.

On each end of the current-continuing member 18 is provided a generally cylindrical socket portion 20 which is surrounded by a sleeve 21 adapted to improve the resilience of the respective socket portions 20.

Each of the socket portions 20 is provided with a radially inwardly extending embossment or struck out portion providing an ear 22 which is adapted to cooperate with a plug member received in the socket portion 20 as will be more fully described hereinafter. Each socket portion 20 is longitudinally split to resiliently engage the plug member.

In connection with the housing 14, it will be noted that the end of the housing has a transverse end face 23 which lies on a plane normal to the axis of the tubular housing 14. Additionally, each end of the housing 14 has a tapered mouth 24.

Cooperating with each of the socket portions 20 is a plug member corresponding to the plug members 12 and 13, only one of which will be described in detail. Each plug member 12 comprises the terminal end of a conductor wire indicated generally at 26. The conductor wire 26 is covered by a layer of insulating material forming a cylindrical sheath 28. In making up the plug members 12 and 13, the conductor wire 26 is bared near the terminal end thereof by removing a portion of the cylindrical sheath 28 whereupon a generally cylindrical current-carrying plug member 12 is swaged to the conductor wire 26 as at a plurality of circumferentially spaced points indicated generally at 30, or it may be soldered.

The plug member or current-carrying member 12 has a closed tapered finding end 31 and a generally cylindrical body portion which terminates in an enlarged outwardly extending radial flange 32. Concentrically inwardly of the flange 32 is an axially extending center recess 33 which is formed in the end of the current-carrying member or plug member 12 to receive the bared end of the conductor wire 26. The recess 33 is counterbored or otherwise suitably enlarged as at 34 to accommodate not only the wire conductor 26 but also a portion of the insulating material or sheath 28 covering the wire.

A medial annular groove 37 is provided in the body portion of the current-carrying member or plug member 12 and is longitudinally aligned in predetermined spaced relation to the flange 32. The groove 37 cooperates with the embossments or tongues 22 which are formed on the socket portion 20 of the current-continuing member 18, thereby to exert an additional retaining force on the current-carrying member 12 which supplements the forces tending to retain the current-carrying member 12 in inserted assembly with respect to the current-continuing member 18.

Since each of the socket portions 20 takes the form of a split cylindrical tube surrounded by the sleeve 21, it is preferred that the mating parts are proportioned to resiliently engage one another when the current-carrying member 12 is inserted into the socket portion 20 of the current-continuing member 18.

In order to isolate the current-carrying components of the connector 10 in a watertight sealed relation within the housing 14, each of the plug members 12 and 13 carries a boot indicated generally at 38 which is made

of a resilient and elastic material such as rubber or an oil-resistant material such as "neoprene," or the like.

In Figures 2 and 3, the particular details of construction of the boot 38 are shown. The boot 38 preferably takes the form of a generally cylindrical tube having a first skirt portion 39 which is of a suitable diameter to provide a first cylindrical sealing surface 40 adapted to concentrically adjoin the outer cylindrical peripheral surface of the sheath 28 on the conductor wire 26, thereby to establish a generally longitudinally disposed sealing surface extending away from the plug member 12.

The sealing surface 40 is particularly characterized by the provision of a plurality of alternately axially spaced grooves 41 and ribs 42. Thus, at the grooves 41, there will be slight clearance displayed with the peripheral surface of the sheath 28 since only the ribs 42 will tightly contact the surface of the sheath 28. There is thus provided a plurality of separate glands or sealing zones which efficiently preclude the infiltration of liquid along the conductor wire 26 and towards the electrical components of the connector.

The boot 38 includes a second skirt portion 43 which is concentrically outwardly spaced of the skirt portion 39 and which extends axially in such a direction as to surround the body portion of the plug member 12, thereby providing an annular recess in which the housing 14 of the socket 11 is received.

The second skirt portion 43 provides a second generally cylindrical sealing surface 44 which is particularly characterized by the provision of a plurality of alternately axially spaced grooves 46 and ribs 47. The undulated surface provided by the grooves and ribs 46 and 47 in the sealing surface 44 insures the provision of an efficient sealing surface establishing a plurality of sealing zones to prevent liquid infiltration along the exterior surface of the socket 11 towards the electrical components of the connector. It also allows more compression of rubber on the seals, facilitates insertion of wires, and maintains a seal even when wire and boot are bent.

Between the sealing surface 40 and the sealing surface 44, the boot is provided with a radially extending shoulder 48. The shoulder 48 terminates the annular recess around the plug member 12 and forms an additional abutment surface for engaging against the radially extending wall 49 provided on the flange 32 of the plug member 12.

On the opposite side of the flange 32, there is provided a generally conically shaped tapered wall 50 which is received generally inside of the housing 14 on the socket member 11 in that the tapered wall 50 is complementally shaped to the tapered mouth 24 on the housing 14 and seats snugly thereagainst when the plug member 12 is assembled with the socket member 11.

When assembled as shown in Figure 2, the line connector components are firmly retained in sealed relationship since the housing 14 and the skirt portion 43 provide confronting cylindrical sealing surfaces including the undulated sealing surface 44, while the skirt portion 39 and the sheath 28 on the conductor wire 26 form confronting cylindrical sealing surfaces including the undulated sealing surface 40. The snug engagement of these sealing surfaces develops not only an efficient seal but also a retaining function. Moreover, because of the engagement of the tapered wall 50 with the tapered mouth 24 of the housing 14, there is no loose play of the connector components and a very stable waterproof connector construction is thus provided.

In the event extra securing means are required by a user, an additional shell retainer may be employed as illustrated in Figure 4.

In Figure 4, there is illustrated a pair of shells 60 and

70, respectively. The shell 70 is provided with a pair of diametrically opposed bayonet prongs 71 which are receivable in locking slots 61 formed in the shell 60. Each of the shells 60 and 70 are further provided with reduced diameter throats indicated at 72, of such a diameter as to be snugly seated upon the adjoining first skirt portions 39 of the corresponding boot members 38. The shells 60 and 70 will shoulder against the enlarged portions of the boot members 38 formed between the first skirt portion 38 and the second skirt portion 43. Thus, when the shells 60 and 70 are moved towards one another after the plugs have been assembled into the socket, the boot members 38 will be somewhat elastically deformed, thereby locking the shells 60 and 70 together with a positive resilient bias.

Although various minor structural modifications might be provided by those skilled in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

A line connector comprising an open-ended tubular housing providing an open-ended bore having an internal medial shoulder therein, a current-continuing member assembled in said housing and having socket portions at opposite ends thereof, said current-continuing member further including ears engaging opposite sides of said shoulder, each of said socket portions having an ear extending inwardly into the respective socket portion, a terminal plug inserted into each end of said housing and each having a current-carrying member engaging a corresponding socket portion of said current-continuing member, each of said current-carrying members having an annular groove formed therein cooperating with a corresponding one of said ears to retain said plugs and said socket in assembly, a tapered mouth surface at each end of the housing, an outwardly extending radial flange on the terminal plug with an outer diameter larger than the inner diameter of said housing and having an axially facing outer wall and a tapered axially inwardly facing wall to seat snugly against said tapered mouth of said housing and center the plug preventing lateral displacement, a boot on each of said plugs made of a resilient elastic material and including a first skirt portion extending axially away from the plug and forming together therewith a first longitudinally extending cylindrical sealing surface, said boot having a concentrically outwardly spaced second skirt portion extending axially to surround said housing, said second skirt portion providing a second longitudinally extending cylindrical sealing surface for engaging an adjoining exterior cylindrical sealing surface on the housing thereby to isolate the connection between the plugs and the current-continuing member, said cylindrical sealing surfaces on said boot having a plurality of concentric alternate axially spaced grooves and ribs formed therein to seal against the adjoining surfaces of the plug and housing, and an axially facing support surface on said boot between said first and second skirt portions engaging the outer wall of said plug flange to resiliently support the flange in its centered position.

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