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ELECTRICAL CONNECTOR AND SEALING MEANS THEREFOR

Filed Oct. 2, 1957

Fig. 1.

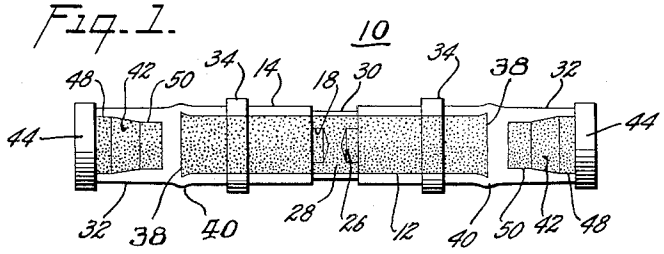


Fig. 2.

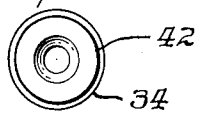


Fig. 3.

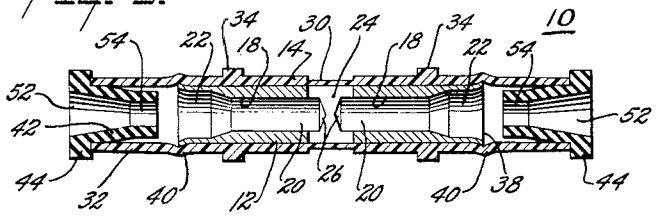


Fig. 4.

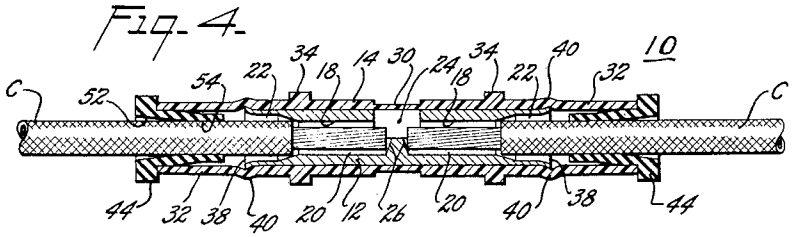


Fig. 5.

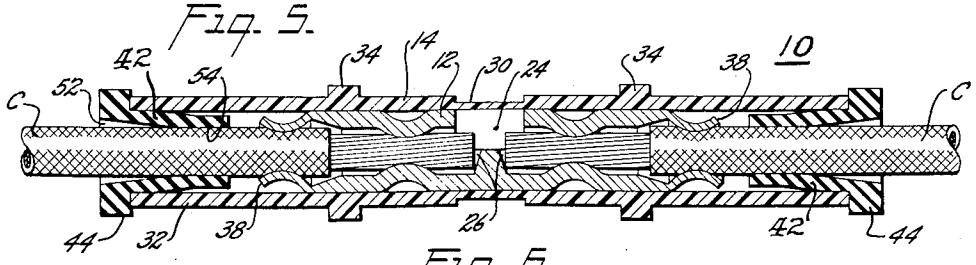
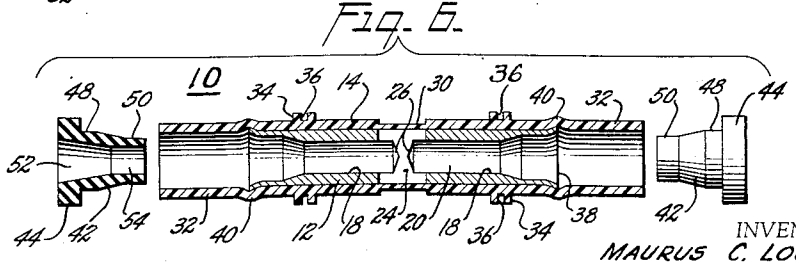


Fig. 6.



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ELECTRICAL CONNECTOR AND SEALING MEANS THEREFOR

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1 Claim. (Cl. 174—84)

The invention relates to insulated connectors of the type utilizable for joining bare end portions of a pair of insulated wire conductors in spaced, coaxial relation to form an approved mechanical and electrically conductive joint therebetween by means of a known crimping operation and wherein the bare ends of the conductors are visible by means of an inspection window intermediate the ends of the connector.

More specifically, the invention resides in a sleeve type connector wherein a conductive metal sleeve having a wall portion cut-out centrally thereof is disposed within a substantially transparent plastic sleeve of relatively greater length in fixed telescopic relation and forming a window over said cutout portion, each end of the plastic sleeve having a tapered, rubber-like, resilient sleeve plug frictionally inserted therein whereby, upon the intrusion of a stripped end portion of an insulated wire conductor through each sleeve plug into the respective ends of the metal sleeve, a fluid tight seal is formed on and about the entire periphery of the insulated portion of each conductor extending through said sleeve plugs.

In analogous sleeve type connectors, as known heretofore, the respective end portions of the outer plastic sleeve, usually of nylon, were deformed substantially on and about the insulation covering on a pair of coaxially related wire conductors intruded therein, by crimping a short metal ferrule on the outer periphery of the respective ends of the plastic sleeve, whereby to cold flow the end portions thereof on and about the intruded conductor portions in fluid sealing relation. However, such connectors possessed certain disadvantages by reason of the fact that in crimping the free end portions of the nylon sleeve on the intruded conductors, the nylon did not flow uniformly or completely about the periphery of the insulation covering of the intruded conductors with the result that a satisfactory fluid-tight seal therebetween was not obtained.

The present invention obviates the aforesaid disadvantages by the provision of a rubber-like resilient sleeve plug, having an internal and external taper, which is frictionally force-fitted one into each end opening of the outer plastic sleeve whereby when a stripped end portion of an insulated wire conductor is forced through each of the respective sleeve plugs, an effective annular seal therebetween is obtained by reason of the fact that the smallest inner diameter of each sleeve plug, disposed within the plastic sleeve, is always, in all sizes of the connector and its correlated sleeve plugs, less than the overall diameter of the intruded conductors, whereby an annular fluid-tight seal therebetween is readily obtained.

Accordingly, it is an object of the invention to provide an improved sleeve type connector which is not subject to the above-noted disadvantages.

Another object of the invention is to provide an improved sleeve type connector including resilient sleeve means therein, whereby the respective ends of the connector are automatically sealed against the entrance of moisture by the intrusion of an insulated wire conductor of predetermined diameter, into each end thereof.

A further object of the invention is to provide an improved sleeve type connector as specified which does not require a mechanical crimping operation to seal the respective ends thereof on a pair of insulated conductors intruded therein.

Another object of the invention is to provide an improved sleeve type connector as specified wherein the inner metallic sleeve and the outer plastic sleeve coact, in assembled telescopic relation, to prevent relative endwise movement of the metallic sleeve within said plastic sleeve.

A further object of the invention is to provide an improved sleeve connector of the non-through type wherein portions of the inner metal sleeve, centrally thereof, provide stops for limiting the intrusion of a wire conductor into the respective ends thereof.

Another object of the invention is to provide an improved sleeve type connector as specified wherein the wall thickness of the outer plastic sleeve is reduced centrally of its length to enhance the transparency thereof.

A further object of the invention is to provide an improved sleeve type connector as specified wherein the outer plastic sleeve includes a pair of spaced, circumferential flanges integral therewith and adapted to selectively coact with a complementary crimping tool for properly locating the connector therein preparatory to crimping portions of the metal sleeve on the stripped ends of a pair of intruded insulated conductors.

With the above and other objects in view, the invention resides in the novel construction, combination, and arrangement of parts, the novel features of which are set forth with particularity in the appended claims, the invention itself, however, both as to its organization and method of operation, together with additional objects and advantages thereof, being best understood from the following description of a specific embodiment thereof, when taken in connection with the accompanying drawing, in which:

Fig. 1 is a view in elevation of the insulated sleeve connector showing a resilient sleeve plug frictionally fitted in each end portion thereof;

Fig. 2 is an end view of the insulated sleeve connector shown in Fig. 1;

Fig. 3 is a longitudinal sectional view of the insulated sleeve connector and the resilient sleeve plugs frictionally fitted in the opposite ends thereof;

Fig. 4 is a longitudinal sectional view similar to Fig. 3, showing a stripped end portion of an insulated conductor intruded into each end of the connector through its correlated sleeve plug;

Fig. 5 is a longitudinal sectional view similar to Fig. 4, showing the respective insulated end portions as crimped within the inner metal member of the connector; and

Fig. 6 is a longitudinal sectional view similar to Fig. 3, showing a modified form of the spaced annular flanges about and intermediate the ends of the insulating sleeve.

Referring to the drawing, the hereindescribed insulated, two-way connector, generally indicated at **10**, comprises a cylindrical member **12**, of highly conductive metal such as soft copper, for example, a thermoplastic sleeve **14**, of substantially transparent plastic such, for example, as nylon, frictionally fitted thereon in telescopic relation, and a rubber-like sleeve plug frictionally fitted in each end of the plastic sleeve **14**, for a purpose presently to be described.

As best illustrated in Fig. 3, the cylindrical metal member **12** is provided with an axial bore **18** of predetermined diameter extending inwardly from each of its respective ends to a point short of the mid-length thereof, to define opposed conical inner ends **20**, the outer op-

posite end of each of said bores **18**, being suitably counterbored, as at **22**, whereby a stripped end portion of an insulated wire conductor C of smaller size or diameter may be freely intruded in each of said bores **18** to the depth thereof, with the adjacent end portion of the insulation covering on said conductors intruded in the counterbored end portions **22** of the bores **18**.

Further in accordance with the invention, a semi-circular void **24** of predetermined length is formed in the periphery of the cylindrical metal member **12**, centrally of its opposite ends in intersecting relation with its axial center, whereby to expose to view the remaining one-half of the circumference of each of the inner ends **20** of the bores **18** in the member **12**, presenting opposed substantially inclined shoulders **26** adapted for engaging and limiting the intrusion of a conductor end portion into each of the bores **18** in the cylindrical metal member **12**, as aforesaid. Thus, the substantially transparent plastic sleeve **14**, which is telescoped over the metal member **12**, coacts with the void **24** formed therein to form an inspection window **28** in the connector **10**.

As best shown in Figs. 3, 4 and 5, that portion of the outer plastic sleeve **14** overlying the void **24** formed centrally of the conductive metal member **12**, presents an annular wall thickness which is less than the thickness of the adjacent wall portions, as indicated at **30**, whereby to enhance the transparency of that portion of the outer plastic sleeve **14**, to facilitate inspection of the inner half ends **20** of the respective bores **18** in the conductive metal member **12**, as will be understood.

As illustrated throughout the several views in the drawing, the length of the plastic sleeve **14** is always such that its opposite end portions **32** extend beyond the opposite ends of the inner metal member **12**, for a purpose hereinafter described.

Further in accordance with the invention, the outer periphery of the plastic sleeve **14** is preferably, although not necessarily, provided with a pair of spaced annular flanges **34**, formed integral therewith intermediate the ends thereof for the purpose of reinforcing the plastic sleeve **14** against the forced insertion therein of the metal member **12**. The annular flanges **34** are also adapted to serve as a means for spacing a plurality of such connectors **10**, when bunched together in multi-electrical conductor connections, as in large aircraft assemblies and the like, for example, and also adapted to serve as a means for quickly locating a connector **10** in proper position transversely of the jaws of a known form of crimping tool or the like, for crimping spaced portions of the conductive metal member **12**, on the stripped end portion of an electrical conductor intruded thereinto from each end thereof.

Alternatively, the width of each of the annular flanges **34**, formed about the plastic sleeve **14**, may be substantially divided by means of a narrow annular groove **36** therein, as illustrated in Fig. 6, whereby to facilitate possible elongation or stretching of the nylon sleeve **14**, lengthwise of its axial center, particularly in the region of said annular flanges, in response to a crimping operation on the conductive metal member **12**, at spaced points thereon and through the plastic sleeve **14**, in known manner.

In order to prevent relative endwise movement of the conductive metal member **12** within the outer plastic sleeve **14**, the annular edge at each end face of the inner metal member **12** is substantially flared outwardly, as indicated at **38**, by means of a suitable internal upsetting operation simultaneously on each end of the metal member **12** to expand corresponding regions of the outer plastic sleeve **14**, in response thereto, whereby an annular groove **40** is formed internally of the plastic sleeve **14**, about each flared end **38** of the metal member **12**, whereby the member **12** is held in assembled position, as will be understood.

Further in accordance with the invention, a rubber-like resilient sleeve plug **42**, having an annular flange **44** at one end thereof to provide a shoulder thereon, is frictionally force-fitted into each open end portion **32** of the outer plastic sleeve **14**, with the shoulder provided by its annular flange **44** substantially in abutment with the end face thereof, whereby to provide a fluid-tight seal between the inner peripheral wall of each open end portion **32** of the plastic sleeve **14**, and the insulation covering on a conductor end portion C, when intruded through each sleeve plug **42** with its stripped or bare end portion in abutting engagement with one of the inclined shoulders **26** defined by the inner end **20** of each of the bores **18**, provided therefor in the conductive metal member **12**.

The outer periphery of each of the resilient sleeve plugs **42** is of uniform diameter, as at **48**, for a distance of at least one-sixteenth of an inch from the shoulder formed on one end thereof by the annular flange **44**, and corresponds substantially to the inner diameter of the respective end portions of the plastic sleeve **14**. The outer periphery of the opposite end of each sleeve plug **42** is of a uniform reduced diameter, as at **50**, for a distance of at least one-sixteenth of an inch, from which the intermediate outer periphery of each sleeve plug **42** tapers to the larger uniform diameter **48** adjacent the annular flange **44**. It is to be noted that the outer diameter of the flanged end **44** of the sleeve plugs **42** is at least equal to the outer diameter of the respective end portions **32** of the connector **10**, in all sizes thereof.

The inner periphery of each of the resilient sleeve plugs **42** is constituted by an axial opening **52** therethrough having a uniform diameter at the smallest end thereof, as at **54**, which is less than the size or over-all diameter of the insulated conductor C to be passed therethrough, and having a length of at least one-sixteenth of an inch from which the opening **52** tapers uniformly outwardly to the opposite flanged end of each sleeve plug **42** where the maximum diameter of the opening is greater than the over-all diameter of the insulated wire conductor C.

Accordingly, when the hereindescribed connector **10**, including the resilient sleeve plugs **42** intruded in the respective end portions **32** thereof, is to be utilized for forming a connection between a stripped end portion of each of a pair of insulated wire conductors in spaced coaxial relation, each conductor C is passed through one of the resilient sleeve plugs **42** into each of the respective bores **18**, provided therefor in the conductive metal member **12** as and for the purpose described.

From the foregoing, it will be readily apparent that the outer uniform diameter **48** of each sleeve plug **42** seals the open end portions **32** of the connector **10**, and that the smallest end opening **54** of each of the sleeve plugs **42** is sealed by the forced passage therethrough of the insulated end portion of the wire conductors C. It is to be observed that the diameter or size of the insulated conductors C, to be used with each connector **10**, is always larger than the size of the smallest end opening **54** in each sleeve plug **42**. Thus, the smallest end opening **54** of the sleeve plug **42** is always distended by the passage therethrough of the insulated portion of the conductor C, whereby a fluidtight seal is effected on and about the insulation covering on each of the conductors C intruded into the connector **10**, and the end portions **32** thereof thus sealed indirectly on the intruded conductors in fluid-tight relation. Moreover, it will also be apparent that the novel sleeve plug **42**, provided in each end portion **32** of the connector **10**, provides a resilient sealing means therefor which permits larger sizes of insulated conductors, within a limited range, to be utilized with each given size of the connector **10** and its associated sleeve plugs **42** in accordance with the invention herein illustrated and described.

While the invention has been illustrated and described with respect to a preferred embodiment thereof, it is to be expressly understood that various changes, modifica-

tions and substitutions in the material and/or construction of the improved electrical connector and the sealing means therefor may be made without departing from the inventive concept underlying the same. Therefore, the invention is not to be limited except as is necessitated by the prior art and the scope of the appended claim.

I claim:

In combination with an electrical connector comprising a cylindrical member of ductile conductive metal having a bore in each end portion thereof terminating short of its mid-length and adapted to be crimped on a bare end portion of a pair of insulated wire conductors intruded therein in spaced coaxial relation, said metal member having a semi-circular void in the periphery thereof centrally of its opposite ends to expose the respective inner ends of said bores, a substantially transparent plastic sleeve of relatively greater length and uniform internal diameter having an integral, annularly grooved flange about its outer diameter adjacent each end thereof and a reduced wall thickness mid-way thereof to increase its transparency, force-fitted over said metal member with its opposite end portions extending beyond the respective ends of said metal member and its reduced wall thickness coacting with the void in said metal member to provide an inspection window in said connector, of a tapered bushing of resilient rubber-like material having an annular flange on one end thereof and a short uniform outer diameter, extending from said flange to a point midway of its length, corresponding substantially to the inner diameter of the open ends of said plastic sleeve, frictionally

fitted in each end thereof in fluid-tight relation with its annular flange in abutment therewith, the remaining outer periphery of said bushing tapering from said mid point to a short uniform outer diameter smaller than the inner diameter of the extended open ends of said plastic sleeve whereby the intruded end of said bushing is adapted to be distended by the passage therethrough of insulated conductors of varying larger idameters, said bushing having a tapered axial opening in its flanged end portion terminating substantially midway of its length in a short uniform inner diameter smaller than the outer diameter of the insulated conductor to be extended therethrough whereby to provide a fluid-tight seal about the periphery thereof.

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