

Oct. 13, 1970

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3,534,322

HIGH VOLTAGE, HIGH ALTITUDE COAXIAL CONNECTOR

Filed Aug. 1, 1968

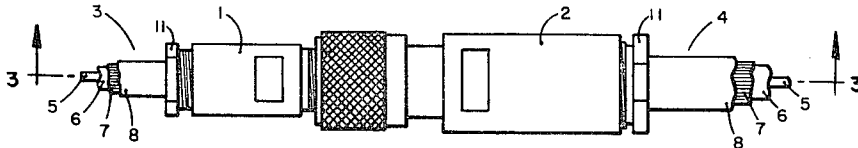


FIG. 1

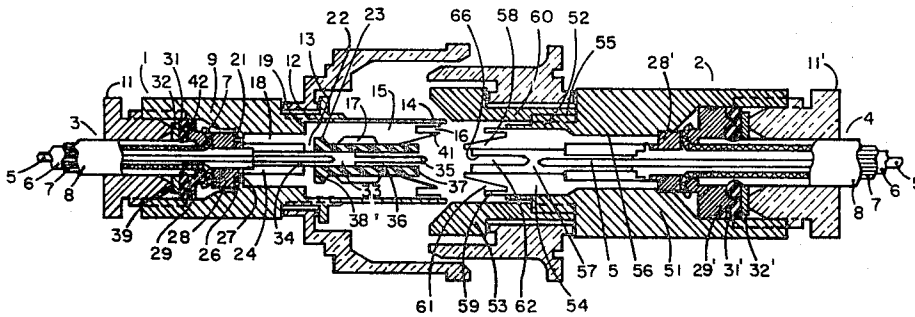


FIG. 2

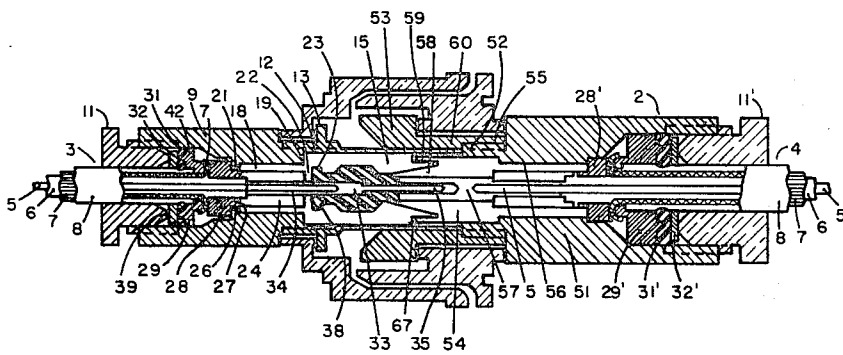


FIG. 3

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HIGH VOLTAGE, HIGH ALTITUDE COAXIAL CONNECTOR

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Filed Aug. 1, 1968, Ser. No. 749,410
Int. Cl. H01r 17/04, 33/34

U.S. Cl. 339—94

3 Claims

ABSTRACT OF THE DISCLOSURE

Disclosed is a coaxial connector particularly adapted for high voltage, high altitude use. The connector comprises two complementary connector members each having a hollow cylindrical insulating member telescopically received therein, the insulating members being joined in a tongue and groove arrangement and surrounding a collapsible tubular member which forms an air tight seal around the junction of the internal connecting pins of the connector members.

This invention relates to electrical connectors, and more particularly relates to connectors for coaxial lines or cables used in a high voltage, high altitude environment.

Since the advent of extremely high flying aircraft such as, for example 50,000 feet above sea level, considerable research has been conducted throughout the industry in an effort to develop a coaxial connector for high voltage applications which precludes the occurrence of corona and which is of reliable and rugged character. One proposed solution to the problem is the use of single or multiple tongue and groove arrangements at the connector interface which creates a long corona creep path and, when manufacturing tolerances are held high, reduces the amount of air in the connector. This proposed solution has not been completely satisfactory for very high voltage, high altitude uses, and the high manufacturing tolerances necessary to obtain a tight fit of the tongue and groove arrangement has resulted in manufacturing difficulties and increased cost for the connectors.

It is a general object of this invention to provide an electrical connector comprising two complementary connector members which are adapted to be secured to the ends of cables of the coaxial type, respectively, for making an electrical connection of efficient and high power transfer properties.

It is a further object of this invention to provide a quick disconnect type coaxial connector designed to transmit high frequency currents with minimum impedance losses.

It is an additional object of the invention to provide an electrical connector wherein the amount of air therein is reduced to a minimum and corona discharges are prevented.

These and other objects of the invention are attained by the invention which provides an electrical connector comprising two complementary connector members which are adapted to be secured to the ends of cables of the coaxial type, and in which a tongue and groove interface between the complementary conductor members is combined with a collapsible tubular insert which acts as an air seal at junction of the mating internal connecting pins of the complementary connector members.

The many objects and advantages of this invention will appear in the following part of the specification wherein details of construction and mode of operation of the preferred embodiment are described with reference to the accompanying drawing, in which:

FIG. 1 is a side elevation showing two complementary connector members of this invention in engaged position;

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FIG. 2 is a central longitudinal section similar to FIG. 3 in which the connector members are slightly spaced; and FIG. 3 is a central longitudinal section through the connector members taken on line 3—3 of FIG. 1.

In FIG. 1 of the drawing, numeral 1 designates one of the complementary connector members, which for convenience will be called the plug connector. The other complementary connector member will be referred to as the receptacle connector and is identified by numeral 2. The plug member is secured to coaxial cable 3 and the receptacle member is secured to coaxial cable 4. For purposes of illustration only, the illustrated cables are single shielded and comprise a braided center conductor 5, dielectric tube 6 around the center conductor, braided wire tubular conductor 7, and outer insulation jacket 8.

The plug connector 1 comprises a metallic tubular casing 9 having a centrally disposed axial bore therethrough and having internal screw threads at the coaxial cable receiving end for engagement with the external screw threads of tubular nut 11, and having external screw threads 12 for engagement with the internal threads of nut 13. Casing 9 also includes stem portion 14 of reduced cross section for telescopic insertion into receptacle plug 2 as shown. Included within casing 9 in telescopic relation therewith is hollow cylindrical insulating member 15 having groove or slot 16 in one end thereof for engagement with a tongue number of the receptacle plug 2 as hereinafter described. Insulating member 15 may be of any suitable insulating material, such as silicone rubber, nylon, or Teflon, but Teflon is preferred. Insulating member 15 further includes recessed portion 17 in the internal surface thereof, and stem portion 18 of reduced cross section located longitudinally opposite stem 15 so that the formed shoulder abuts with a corresponding shoulder of casing 9 at surface 19, and the end of the stem 18 abuts internal rim or flange 21 of casing 9 and the end of stem 27 of an annular hollow metallic flange member 28. Insulating member 15 further includes internal flange 22 and internal recessed portion 23 for telescopically receiving flange portion 38 of collapsible tubular insulating member 37. Received within the stem 18 of member 15 is insulating tubular member 24 having an axial bore therein, member 24 abutting against flange 22 at surface 25. Also included within casing 9 are metallic member 29, annular rubber member 31, and annular metal washer 32, all having an axial bore for receiving parts of cable 3. Connecting pin 33 is telescopically received within insulating members 15 and 24, and contains axial bore 34 for receiving internal conductor 5, and has reduced cross section plug portion 35 for insertion into the receptacle pin of receptacle member 2 as shown. As shown in FIG. 2, plug portion 35 forms opening 36 with surrounding tubular collapsible member 37. Member 37, together with the tongue and groove arrangement as hereinafter described, forms the improvement of this invention over the prior art. With the parts assembled as shown, nut 11 is screwed into tight engagement with casing 9 so that surface portion 39 of nut 11 applies pressure to metal washer 32, rubber member 31, metallic flange member 29, outer conductor 7, metallic flange member 28, and projection 21 of casing 9 so that a rigid electrical connection is made between outer conductor 7 and casing 9 and projection 42 of flange member 29 forms an airtight seal with casing 9, nut 11, washer 32 and jacket 8 as shown in FIG. 3.

Hollow receptacle member 2 comprises an outer casing 51 having internal threads at the cable receiving end thereof for engagement with the external thread screw of nut 11', metallic washer 32', rubber member 31', metallic member 29', and metal flange 28' arranged in the same manner as the parts of corresponding number were arranged with casing 9 of plug member 1, and further description thereof is believed unnecessary. Stem portion 52

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of casing 2 is externally threaded and is mated with the internal screw threads of stem portion 60 of metallic member 53. Tubular insulating member 54, which may be of the same material as insulating member 15 of plug member 1, is telescopically received by casing 2. As shown in FIG. 2, tapered portion 58 and stem portion 59 of member 54 cooperate to form groove 61 which is adapted to receive tongue 41 of insulating member 15 of plug connector 1. Simultaneously, groove 16 of member 15 receives stem portion 59 of member 54. Pin 57 is telescopically inserted into tubular member 54 and receives conductor 5 in a hollow portion thereof at one end and receives at hollow portion 62 the portion 35 of pin 33 of plug member 1.

It will be noted that metallic member 53 is beveled to easily receive member 14 of plug member 1.

As can be seen from FIG. 3, when plug member 1 and receptacle member 2, are firmly engaged, member 37 deforms into recessed portion 17 and around stem 35 of pin 33 and presses against portion 58 of insulating member 54, pin 57, pin 33, and insulating member 15, to form an air tight seal which in conjunction with the tongue and groove arrangement illustrated, produces exceptional resistance to corona discharge. Tests conducted in the laboratory show that voltage breakdown at the connector interface occurs at about 4600 volts D.C. at 50,000 feet simulated altitude, and the same connector without tubular insulating member 54 fails at 2300 volts D.C. at 50,000 feet altitude.

It is further apparent from FIGS. 2 and 3 that manufacturing tolerances of the tongue and groove arrangement are greatly increased since there is no necessity that the tongue and groove arrangement be precisely fitted in order to obtain an air tight seal as deformable rubber gasket forms such a seal even while tongue member 59 leaves space 67 when parts 1 and 2 are engaged. This is made possible by the use of recess 17 which allows a long silicon rubber collapsible member to be utilized and then collapse in a controlled manner into the recess upon engagement of parts 1 and 2. The collapsible member in conjunction with recess 17 provides for a substantially constant spring rate as members 1 and 2 are engaged.

While the preferred embodiment of the invention has been disclosed, it is emphasized that the particular embodiment of the invention which is shown and described herein is intended to be illustrative and not as restrictive of the invention.

What is claimed is:

1. An electrical connector comprising:

(a) complementary plug and receptacle connector members for interconnecting the ends of two coaxial line sections, each of said coaxial line sections com-

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prising a center conductor, a dielectric surrounding said center conductor, and a tubular outer conductor surrounding said dielectric,

- (b) each of said connecting members including a casing having a centrally disposed axial bore therethrough and a hollow cylindrical insulating member telescopically received within the bore, said hollow cylindrical insulating members being joined in a tongue and groove arrangement,
- (c) a collapsible tubular insulating member telescopically arranged within said hollow cylindrical insulating member of said plug connector, and abutting at one end against a flange portion of said cylindrical insulating member,
- (d) a metallic plug pin telescopically received within said collapsible tubular member and said hollow insulating member of said plug connector, said plug pin having an extended portion of reduced cross section,
- (e) a metallic receptacle pin received in telescopic relation by said hollow cylindrical insulating member of said receptacle member, said receptacle pin having at one end a hollow portion telescopically receiving the reduced cross section portion of said plug pin, said collapsible tubular member being compressed between said one end of said receptacle pin and said flange portion of said cylindrical insulating member of said plug connector to form an airtight seal at the junction of said plug pin and said receptacle pin, and
- (f) means for respectively electrically connecting the outer conductors of said coaxial cables to said metallic casing.

2. On electrical connector as in claim 1 wherein said tubular collapsible member has a flange portion received by a first recessed portion of said hollow cylindrical insulating member.

3. On electrical connector as in claim 2 wherein said hollow cylindrical insulating member has a second recessed portion into which a portion of said collapsible tubular member is deformably compressed.

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U.S. Cl. X.R.

339—177