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HIGH TEMPERATURE LEAD ASSEMBLY

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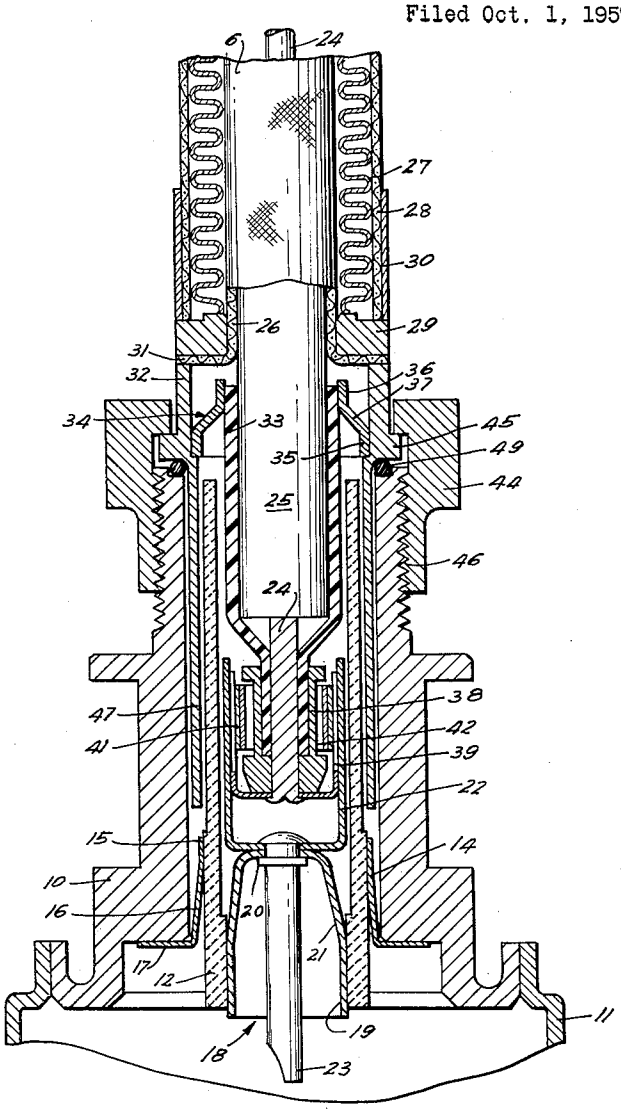

FIG. 1

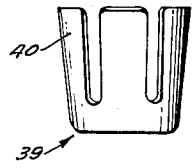

FIG. 2

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HIGH TEMPERATURE LEAD ASSEMBLY

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4 Claims. (Cl. 339—89)

This invention relates to electrical apparatus and more particularly to means for effecting terminal connections between electrical conductors.

One of the objects of the present invention is to provide a novelly constructed electrical terminal which will provide a satisfactory electrical connection throughout a wide range of temperatures and at substantially high temperatures.

Another object of the invention is to provide novel cooperating male and female electrical terminals for effecting a connection between conductors in hermetically sealed units.

Another object is to provide electrical terminal means wherein parts having different coefficients of expansion are novelly constructed and assembled to compensate for expansion and contraction of such parts resulting from temperature variations extending from below −65° F. to 1000° F. and more.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is an elevation view, mostly in section and with parts broken away, showing one form of electrical connector means embodying the present invention; and

Fig. 2 is a detail elevation view of a part of said terminal.

The single embodiment of the invention illustrated in the accompanying drawings, by way of example, is in the form of separable or detachable connector means adapted for making an electrical connection between electrical conductors in hermetically sealed containers or conduits. The novel construction shown is designed to withstand the high temperatures encountered in use on jet type engines, missiles and the like and to hermetically seal an insulated conductor in a flexible shielding conduit for protection against electrical flashovers at low atmospheric pressures occurring at high altitudes.

In the form illustrated, the socket contact assembly of the novel structure contemplated by the invention comprises a tubular metallic shell **10** hermetically secured in an opening of a casing **11**. The shell and casing may be integral if desired. A tube or sleeve **12** of heat resistant refractory insulating material is novelly supported or suspended in shell **10** in radially spaced relation thereto, and the annular space between the two is hermetically sealed by a flanged metal tube **14** which may be made, for example, of nickel or nickel plated steel. The latter may be made of stainless steel or other suitable metal and comprises a cylindrical portion **15**, a central cone-like portion **16** and an external annular flange **17** which engages and is soldered or brazed throughout its circumference to a downwardly facing

shoulder in shell **10**. Within cylindrical portion **15**, insulating tube **12** is provided with a metallic surface coating to which said cylindrical portion is circumferentially brazed by means of a fine silver or nickel braze. The central cone-like portion **16** and the inner unsecured portion of flange **17** function as a flexible diaphragm which absorbs or compensates for differences in the expansion and contraction of the various assembled parts when the same are subjected to wide variations of temperature. An hermetic seal is also formed by member **14** between insulator **12** and shell **10**.

A novel socket contact assembly is provided within and hermetically seals the bore through insulating tube **12**. Said assembly comprises an inverted cup-like metallic member **18** having a cylindrical portion **19** and an internal flange **20** connected by a cone-like portion **21**. Cylindrical portion **19** is circumferentially brazed to a metallic coating on the inner surface of the end portion of insulating tube **12**. A cup-like socket contact **22** has a clearance fit in the bore of insulator **12** and engages the closed end of member **18**. The adjacent ends of cup members **18** and **22** are preferably provided with matching holes for receiving a rigid pin **23** which may function as a rivet mechanically connecting said members and as a connector for a conductor within casing **11**. The parts may be silver soldered or brazed together around the pin-receiving hole to complete the hermetic sealing of the bore of insulator **12**. Member **18** functions as a diaphragm while member **22** is slidable in tube **12** to compensate for relative movement of the parts caused by expansion and contraction caused by the heating and cooling of the parts in operation. Cup member **22** is advantageously made of nickel or is nickel plated to prevent its becoming oxidized during use.

The plug or male terminal of the connector is likewise novelly constructed to function with complete satisfaction at high as well as low temperatures and to provide an hermetic end seal for a conductor conduit. As shown, the lead assembly embodying the plug terminal comprises a conductor **24** covered with electrical insulation **25** which will withstand high temperatures. In one suitable embodiment, conductor **24** was wrapped with tape consisting of ceramic fibers in sheet form laminated with glass cloth and covered with one or more braided layers of yarn made of silica fibers. The insulated conductor may be covered by a tube **26** of woven metallic strands. Surrounding the shielded cable above described, is a flexible, impervious conduit comprising a corrugated metal tube **27** covered by a braided metal tube **28**. The ends of tubes **27** and **28** are connected together, such as by heliarc welding, in a welded assembly with a ring **29** and a metal sleeve **30** to form an hermetically sealed joint. The braided cover **26** of the cable is cut off short of the end of insulated conductor **24**, **25** and is circumferentially fanned out at **31** to lie between ring **29** and the end of a metal tube **32**. The engaging parts are welded, as by heliarc welding, to form an hermetically sealed joint.

The insulated conductor **24**, **25** extends into a ceramic tube **33** which is novelly suspended or supported within and in radially spaced relation to metal tube **32** by a metal diaphragm **34**. The latter may consist of two cylindrical portions **35** and **36**, one of which fits into and is circumferentially brazed to metal tube **32**, and the other of which surrounds and is brazed to an external metallic coating on the end portion of ceramic tube **33**. The cylindrical portions **35**, **36** are integrally joined by a conical portion **37** which provides for any necessary relative movement or expansion between the connected parts when the same are subjected to temperature variations.

The lower or outer end portion of insulating sleeve

33, as viewed in the drawing, is of reduced diameter for passing an uninsulated end portion of conductor 24. Surrounding said reduced end portion and brazed to a metallic coating thereon in a hermetic manner is a tubular metallic tip or nose piece 38, the end of which preferably extends beyond ceramic tube 33. Conductor 24 extends beyond the tip piece and through a central opening in the bottom of a cup-shaped male contact terminal 39, and the three are heliarc or otherwise suitably welded to form an hermetic seal at the end of the bore through tip piece 38.

Contact member 39 has the side walls thereof slotted to form a plurality of resilient fingers 40 (Fig. 2) and is adapted to slidably fit into socket contact 22 for electrical contact therewith. For the purpose of assuring firm and good electrical contact between fingers 40 and socket 22 under high heat conditions, contact terminal 39 may be of bi-metal construction and of such a nature that fingers 40 will bend or push outwardly when subjected to heat. Preferably, however, contact member 39 is fabricated from soft annealed nickel or the like and a split annular bi-metallic member 41 capable of withstanding extremely high temperatures is provided within terminal member 39 and held against axial displacement by an annular groove 42 in tip piece 38. Member 41 exerts some expansive force upon member 39 at room temperature to assure good contact between members 39 and 22. When subjected to high temperatures, the bi-metallic member 41 expands to maintain fingers 40 in firm and good electrical contact with socket contact 22.

The connector parts may be positively held in assembled position by detachable means, as shown. A flanged nut 44 fits over and contacts the edge of a flange 45 on housing member 32. The nut has threaded engagement at 46 with the confronting end of housing 10, thereby to draw and maintain the two housings together. If desired, the two housings may be sealed to each other by an annular sealing ring 49 which is carried in a seat on the end of housing 10 and is compressed between the ends of the housings. Housing 32 may be extended, if desired, in a circular cylindrical portion 47 which lies between housing 10 and tubular insulator 12. Portion 47 aids in the preliminary aligning of the connector parts upon their assembly, and also functions to guard the parts of the male or pin connector against injury when it is disconnected and withdrawn from socket 22 and housing 10.

Although only a limited number of embodiments of the invention have been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions in the parts, materials used, and the like as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art.

What is claimed is:

1. A a separable electrical connector adapted for high temperature service and being adapted to effect a seal between two impermeable conduits, said connector having two main parts, each main part comprising an elongated metal shell, a gas impermeable electrically insulating ceramic tube mounted generally coaxially within the shell, a yieldable annular metal gas impermeable diaphragm interposed between and sealingly connected to the tube and shell for supporting the tube in the shell, an electrical conductor extending along the bore in the tube, and a contact affixed to the tube within the shell and connected to said conductor, the contacts on the respective parts of the connector being adapted to mate with each other when the connector parts are in confronting assembled relationship, and means for sealingly connecting the shells of the two connector parts in such relationship.

2. A separable electrical connector as defined in claim 1, wherein each of the annular diaphragms has an inner and an outer terminal flange, said flanges being sealed, respectively, to the tube and the shell, each diaphragm having a flexible generally transversely extending portion between the shell and the tube.

3. A separable electrical connector as defined in claim 2, wherein the first tube, of a first connector part, mounts a socket contact, said first tube is of larger diameter than the other, second tube of the second connector part, said second tube mounts a pin-type contact on its inner end confronting the first connector part, the socket contact is mounted intermediate the ends of the first tube, and the second tube is telescopically received within the first tube when the pin and pin-type contact and socket contact are in engagement.

4. A separable electrical connector as defined in claim 3, wherein the first shell is appreciably spaced radially of the first tube, wherein the second shell is appreciably spaced radially from the second tube, and wherein the parts are so constructed and arranged that, when the connector parts are in mating confronting engagement, the inner end of the second shell is telescopically received within the space between the first shell and the first tube, and the inner end of the first tube is telescopically received within the space between the second shell and the second tube.

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