Nov. 23, 1954 L. L. WOOLSTON ET AL 2,695,390

PLUG AND SOCKET CONNECTOR

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FIG. 1.

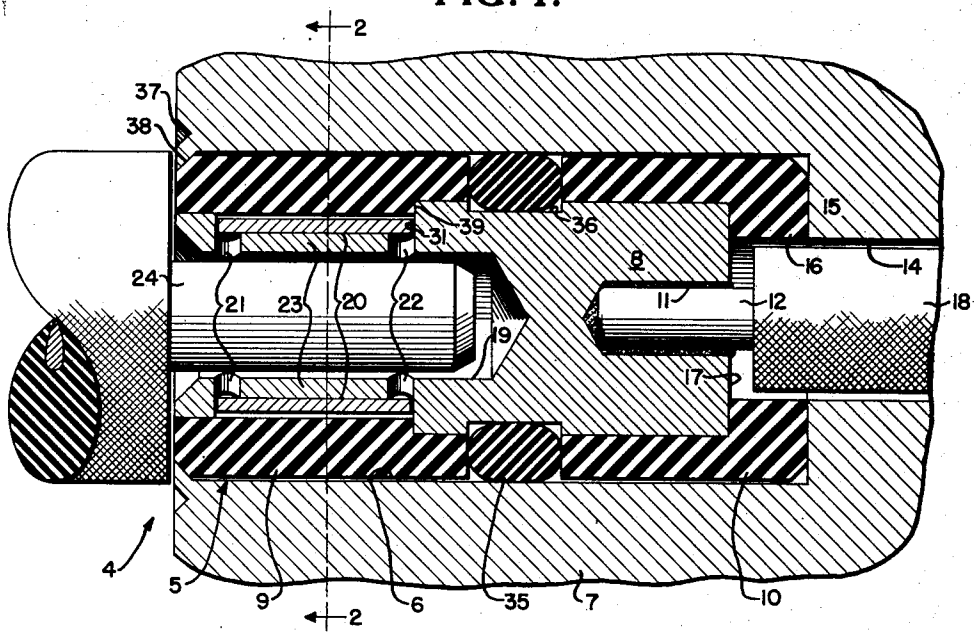


FIG. 2.

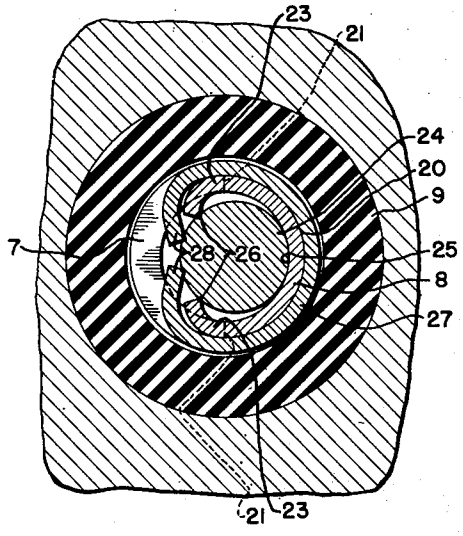
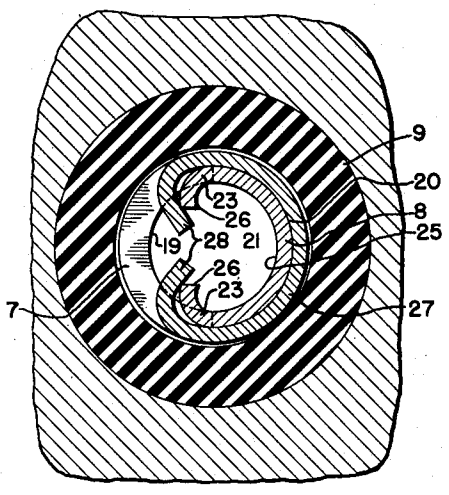


FIG. 3.



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PLUG AND SOCKET CONNECTOR

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This invention relates generally to electrical couplers and more specifically to a new and improved waterproof connector of the plug and socket type wherein, as the connector is received within a bore provided therefor in the part wherein the connector is to be mounted, there is established a waterproof connection therebetween and the bore simultaneous with the connector being electrically insulated from the bore.

The connector as herein set forth further provides a socket arrangement wherein the plug when received within the socket is applicable to expand the edges of a separately formed U-shaped gripping element incorporated in and forming a part of the socket and adapted to seize the plug in a manner to resist extraction thereof from the socket while also rendering the electrical connection between the plug and socket more effective.

Whereas plug and socket connectors of this general type have been extensively employed with considerable success commercially, their use in underwater ordnance such, for example, as torpedoes, mines or the like has been limited largely because of the difficulty of waterproofing such connectors against high hydrostatic pressures and further because of their susceptibility to corrosion which has the effect of reducing considerably their electrical conductivity.

By this arrangement there is provided a connector socket wherein as a plug is received therein a pair of spring gripping elements of the socket are caused to be sprung outwardly to bear upon the plug in such a manner that the edges of these elements are yieldably directed radially inwardly into the softer metal of the plug thereby to provide an electrical connection therebetween comparable to soldering and relatively unaffected by vibration or corrosion so long as the connector remains intact.

This arrangement also provides means for maintaining a high pressure seal about the connector as the latter is mounted within a bore therefor and which is accomplished by the arrangement of an O-ring gasket between insulating sleeves of the connector being compressed between the socket portion of the connector and the bore as the connector is secured therein as by staking.

It is an object of the present invention to provide a new and improved electrical connector of the plug and socket type wherein as the plug is received within the socket, biting edges of spring gripping elements of the socket are caused to penetrate the surface of the plug thereby to provide a corrosion and vibration proof connection therebetween.

A further object is to provide a new and improved socket connector about which an O-ring is novelly arranged for forming a moisture and pressure proof seal about the socket as it is received within the part wherein it is to be mounted.

A still further object is to provide a new and improved socket connector wherein the gripping force of the socket is increased by an additional spring element arranged about and forming a part of the socket.

A still further object is to provide an electrical connector of the plug and socket type wherein opposingly arranged sleeves maintain a sealing ring in bearing contact between the socket and the part wherein the latter is mounted for maintaining a pressure and moisture proof seal therebetween.

Other objects and many attendant advantages of this invention will be more readily appreciated as the same

becomes better understood by referring to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a sectional view of the socket of the connector as mounted in the supporting part therefor and showing a plug, in elevation, inserted therein;

Fig. 2 is a sectional view taken along the section line 2—2 of Fig. 1; and

Fig. 3 is a sectional view taken along section line 2—2 of Fig. 1 with the plug removed.

Referring now to the drawing and more particularly to Fig. 1 thereof, the electrical connector of the present invention, generally designated 4 is shown with the generally designated socket assembly 5 thereof mounted within a bore 6 provided therefor in the supporting part 7 and which, for the purposes of description, may be the housing of a torpedo or mine firing mechanism or the like.

The socket 5 of the connector is comprised of a body section or member 8 preferably machined from bar stock and of material such as beryllium copper with the end 17 thereof drilled at 11 for securing thereto as by soldering the terminal connection 12.

Insulating the body member 8 from the bore 6 is a pair of insulating sleeves 9 and 10 with the latter thereof including an inwardly extending flange section 16 suitable for so spacing the end 17 of the member 8 from the base of the bore 6 as to insure proper overlapping of the insulation 18 of the terminal 12 with the insulation of the flange 16 whereby is lessened the possibility of the terminal becoming grounded with the part 7 as the socket is assembled therein.

In the opposite end of the body member 8 from the bore 11 is a bore 19 wherein is to be received the terminal plug 24 which preferably is formed of soft metal such as brass. In order to insure proper electrical conductivity between the plug and socket under conditions of shock, moisture or corrosion, the body section 8 is provided with a necked-down or reduced section 20, Fig. 2, which, after having been transversely cut at 21 and 22, is rolled inwardly to form a pair of spring gripping elements 23 yieldably responsive to the insertion therebetween of the plug 24, Fig. 2, to compress the plug forcefully to the surface 25 of the bore 19 while the edges 26 of the elements are caused, by reason of their spring action and sharp edges, to penetrate into the softer metal of the plug 24 for maintaining thereby a highly conductive substantially shock proof electrical connection therebetween.

To provide upon the socket 5 further gripping means for the plug 24, a second gripping element 27 substantially U-shaped in form and of material similar to that of the member 8 is arranged about the reduced or necked-down portion 20 of the body member and with the edges 28 thereof rolled inwardly between the elements 23 for bearing upon the surface of the plug 24, as illustrated in Fig. 2, thereby to approximately double the gripping force applied by the socket to the plug during such time as the plug is retained therein. Because of the shoulders 30 and 31 formed in the body member 8 by the reduction 20, means are thusly provided for securing the gripping element 27, arranged between the shoulders, against axial movement upon the body during insertion therein or removal of the plug 24.

As the socket assembly 5 is received within the bore 6, an O-ring gasket 35 arranged, as illustrated, between the insulating sleeves 9 and 10 is compressed between the surface 36 of the body section and the bore 6 in such a manner as to provide a moisture proof seal therebetween as the socket assembly 5 is secured within the bore as by staking therewithin at 37. The arrangement of the gasket 35 in the manner described, prevents moisture from entering the mine or firing mechanisms by way of the terminal bore 14. This method of securing the socket assembly within the bore 6 is accomplished by the arrangement about the bore of a circular like punch, not shown, which, upon being struck, deflects the metal about the periphery of the bore inwardly and over a chamfered edge 38 of the sleeve 9 as illustrated in Fig. 1.

As the socket assembly 5 is secured in the manner described within the bore 6, the shoulder 39, as formed

on the inner surface of the sleeve 9, is forcefully directed against the shoulder 31 formed on the body member 8 whereby the rear face 17 of the body member is, in turn, compressed to the inner face of the flange 16 which is likewise compressed to the base 15 of the bore 6.

From the foregoing it should now be apparent that an insert type socket assembly has been provided having provision for establishing an effective electrical connection with a mine firing mechanism, or the like, while also having provision for maintainng an effective pressure seal between the socket assembly and the mine casing whereby moisture is prevented from reaching the mechanisms of the mine by way of the electrical connection. Moreover, the construction of the socket assembly is such as to engage the coacting plug inserted therein in a manner to penetrate any corrosive film or oxide coating which has formed on the plug and to prevent any corrosion thereafter forming between the contacting surfaces. This connector arrangement also has the further advantage of preventing interruption of the circuit completed therethrough by reason of the particular gripping engagement between the plug and socket which prevents separation of the contacting surfaces in response to vibration, shock, and the like.

Obviously many other modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described. The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a device of the character described, a housing, a cylindrical bore in said housing opening to the exterior thereof and communicating with the interior thereof, socket means received within said housing, said socket means comprising a cylindrical body, a recess at one end of said cylindrical body for receiving a terminal, a cylindrical recess in the opposite end of said body member for receiving therein a plug to be connected with said socket, said recess being closed at the end thereof remote from said opposite end, said body member having a necked-down portion adjacent said recess defining thereon a pair of spaced shoulders, transverse slots formed in said body section adjacent said shoulders and substantially intersecting the axis of said recess, a longitudinal slot in said necked-down portion connecting said transverse slots and forming edges adjacent said longitudinal slot, said edges being turned inwardly for engaging said plug when received in said recess, a substantially U-shaped spring element arranged about the necked-down portion of said body member and secured by said shoulders against axial movement upon said body member, said spring element having the ends thereof extending inwardly into said bore through said longitudinal slot for gripping said plug concurrently with gripping thereof at the edges of said slot.

2. In a device of the character described, a housing, a cylindrical bore in said housing opening to the exterior thereof and communicating with the interior thereof, a socket member received within said housing, said socket comprising a cylindrical body, means at one end of said body for securing a terminal thereto, means forming a blind cylindrical bore in the opposite end of said body for receiving therein a plug to be connected with said socket, said bore being of greater diameter than the plug diameter and terminating short of one end of said body, gripping means formed from said body by slotting and arcuately deforming a portion thereof into adjacency with the interior thereof at the bore and disposed to project into contacting relation with two remote areas of a plug inserted in the bore of said body for yieldably gripping said plug and asymmetrically positioning the same against the body interior when the plug is received therein, said body having an elongated transverse opening intersecting said bore between the deformed portions of the gripping means, an arcuate gripping element arranged about the body member and being arcuately re-entrant through said transverse body opening for gripping said plug concurrently with the gripping of the plug by said gripping means, insulating means forming a part of said socket and disposed between said body and said housing, and compressible means engaging and encircling said body and forming a pressure seal between the body and said housing whereby to prevent passage of moisture to the interior of the housing.

3. In a device of the character described, a housing, a cylindrical bore in said housing opening to the exterior thereof and communicating with the interior thereof, socket means received within said housing, said socket means comprising a cylindrical body member, a recess at one end of said cylindrical body for receiving a terminal, a cylindrical recess at the opposite ends of said body member for asymmetrically receiving therein a plug to be connected with said socket means, a pair of insulating sleeves opposedly arranged over the respective end portions of said body member, and a compressible O-ring gasket interposed between said insulating sleeves and closely fitted between said body member and the housing whereby to form a pressure seal between said body member and housing to prevent penetration of moisture into the housing.

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