

March 17, 1964

O. M. HART

3,125,391

ELECTRICAL CONNECTOR ASSEMBLY

Original Filed Aug. 25, 1959

FIG. 1

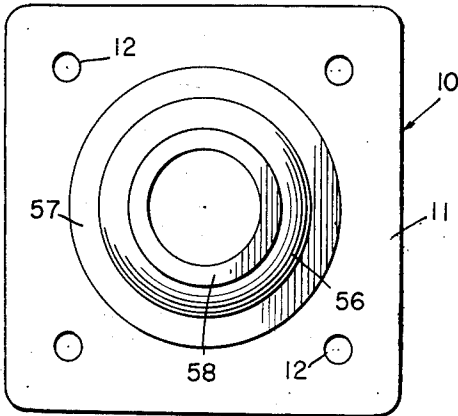


FIG. 2

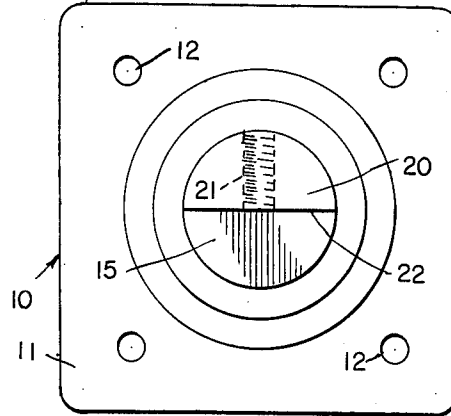


FIG. 4

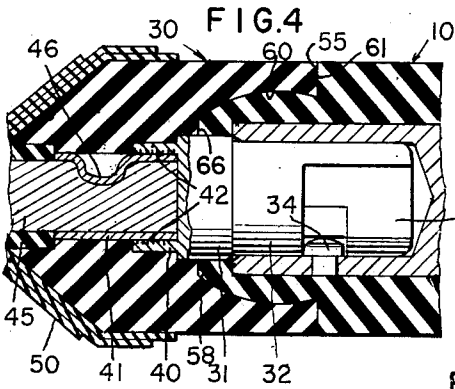


FIG. 3

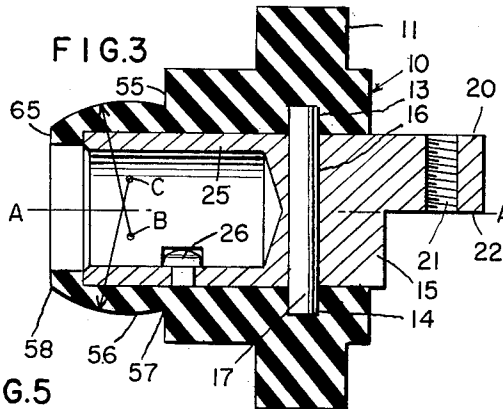
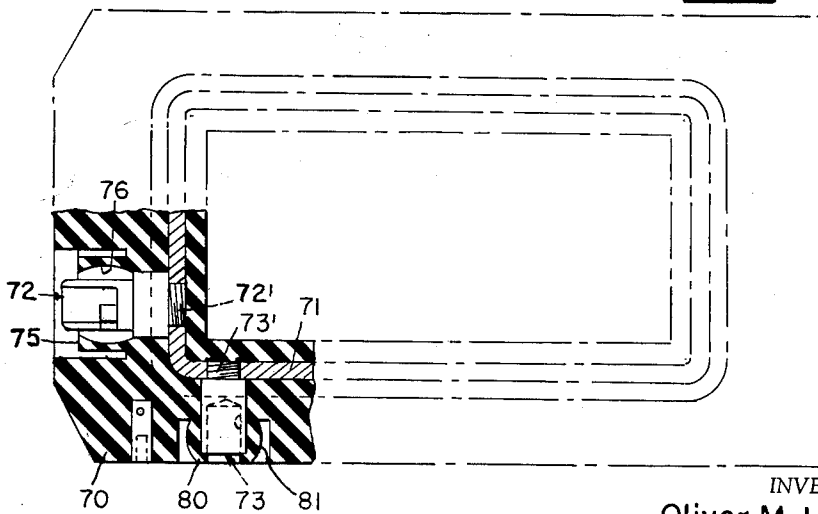


FIG. 5



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3,125,391

ELECTRICAL CONNECTOR ASSEMBLY

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Continuation of application Ser. No. 835,922, Aug. 25, 1959. This application Oct. 4, 1962, Ser. No. 229,274
1 Claim. (Cl. 339-60)

The present application is a continuation of copending U.S. patent application Ser. No. 835,922, filed August 25, 1959 now abandoned.

The present invention relates to an electrical connector assembly and more particularly to an assembly which is adapted for use with heavy-duty equipment to provide a good electrical and fluid-tight interconnection between various components thereof.

The invention apparatus is especially adapted for use in industrial type applications such as in welding assemblies and the like wherein it is necessary to provide heavy-duty fixtures for connecting large electric cables and the like to various other components. It is generally desirable to provide fittings which will permit quick and easy connection and disconnection of such electrical components, and the present invention is particularly directed to this end.

In such applications as in welding assemblies, the electrical connector apparatus is usually subjected to heavy use and must be of very rugged construction. In addition, the electrical connector assembly must provide a good electrical and mechanical interconnection between certain components and additionally provide a fluid-tight insulated seal to prevent moisture from contacting the electrical components and to eliminate electrical shock hazards.

The present invention incorporates a pair of body means formed of electrical insulating material. These body means are adapted to be mounted upon any suitable means, and in the illustrated example, one of the body means is shown as being adapted to be mounted upon an outlet box or similar support means. Each of the body means is provided with an electrical coupling means enclosed therein, these coupling means being interengageable to provide a good electrical and mechanical interconnection therebetween.

In addition, the two body means are provided with cooperating contacting surfaces which not only serve to provide an effective fluid-tight seal when in operative engagement with one another, but also permit ready assembly and disassembly with respect to one another. The contacting surfaces are so configured as to have a novel configuration which permits the two body means to be snapped into engagement with one another and subsequently released in a simple manner.

The contacting surfaces formed at the outer end portions of the two body means are of a novel configuration, and define a continuous curve extending in a direct parallel to the longitudinal axis of the body means and further define a plurality of cross-sectional areas disposed substantially normally to the longitudinal axis of the body means and spaced longitudinally along this axis, these cross-sectional areas being circular in configuration. This configuration represents an improvement over the type of arrangement as shown for example in U.S. Patent No. 2,907,973 wherein contacting surfaces of double bevelled configuration are employed. A particular advantage of the present invention is the fact that the continuously curved surfaces of the body means of the present invention are adapted to be interchangeable with the double bevelled surfaces as shown in the above-mentioned patent. This is highly advantageous since numerous units constructed according to the teaching of the above patent are now in use, and the structure of the present invention

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can be readily employed with the presently existing structures.

In addition to being quite versatile in view of the fact that the structure of the present invention can be utilized both with cooperating continuously curved surfaces and double bevelled surfaces, other important advantages are obtained. An important advantage of the present invention is the fact that when cooperating continuously curved surfaces are employed as disclosed in the present application, a better fluid-tight seal is obtained than is obtainable with the double bevelled arrangement as shown in the aforementioned patent, particularly when the two interengaging body means are subjected to forces which tend to cause one to be flexed or canted with respect to the other.

A primary advantage of the arrangement of the present invention as opposed to that shown for example in the above mentioned patent is the fact that the manufacturing costs are substantially less with the present invention thereby resulting in a considerable economy in producing the electrical connector assemblies. In actual practice, it has been found that in manufacturing the double bevelled sleeves as shown in the aforementioned U.S. patent, the sleeve is often torn and rendered unsatisfactory when removing the double bevelled end portion of the sleeve from the mold and mandrel employed in forming the sleeve. This results in rejection of approximately 8 percent of the sleeves manufactured incorporating the double bevelled arrangement. In contrast to this high rejection rate, it has been found in actual practice that in manufacturing the continuously curved contacting surface arrangement of the present invention, there are substantially no rejects whatsoever. It is accordingly apparent that a very great saving is thereby afforded.

In addition, it takes substantially less time to manufacture a mandrel for producing the structure of the present invention as opposed to that required to manufacture a mandrel which will produce the double bevelled arrangement shown in the aforementioned patent. When it is considered that dozens of these mandrels for different sizes and styles of sleeves must be made, this saving in the time required for manufacturing the mandrels also contributes toward substantially reducing the cost of manufacture.

It is accordingly apparent that the structure of the present invention in addition to being interchangeable with the structure as shown in the aforementioned patent also provides a better fluid seal and results in a major saving in the manufacturing costs of the assembly.

In addition, the invention contemplates the provision of a distribution means wherein a plurality of electrical coupling elements are embedded within an insulating body means, the coupling elements each being surrounded by an insulating sleeve provided with a novel contacting surface according to the present invention.

An object of the present invention is to provide a new and novel electrical connector assembly which provides a good electrical and mechanical connection between various electrical components, and which provides in addition a good fluid-tight insulated seal therebetween.

Another object is to provide an electrical connector assembly incorporating a pair of body means having outer end portions which are interengageable in such a manner as to facilitate quick and easy assembly and disassembly with regard to one another.

A further object of the invention is the provision of an electrical connector assembly which provides a better fluid-tight seal than prior art arrangements, and which results in a considerable saving in the manufacturing costs as opposed particularly to prior art arrangements employing a double bevelled configuration as shown in U.S. Patent No. 2,907,973.

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Yet another object of the invention is to provide an electrical distribution device providing a plurality of electrical coupling elements each of which can be quickly and easily connected to and disconnected from various other electrical coupling elements.

A further object of the invention is to provide an electrical connector assembly which is quite simple and inexpensive in construction and yet which is rugged and reliable in operation.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawing, wherein:

FIG. 1 is a front elevational view of a body means of the assembly;

FIG. 2 is a rear elevational view of the device shown in FIG. 1;

FIG. 3 is a longitudinal section through the device shown in FIGS. 1 and 2;

FIG. 4 illustrates a pair of body means connected in operative relationship to one another; and

FIG. 5 illustrates a distribution device incorporating the contacting surfaces for providing a fluid-tight seal.

Referring now to the drawing wherein like reference characters designate corresponding parts throughout the several views, there is shown in FIGS. 1-3 a body means 10 formed of a suitable electrical insulating material such as neoprene or the like, the body means including an integral radially outwardly extending attaching flange 11 which is of substantially square configuration. Attaching flange 11 is provided with a plurality of openings 12 formed therethrough, opening 12 being adapted to receive attaching bolts or the like for mounting the body means 10 in operative position.

A longitudinal bore is provided through body means 10 and a pair of openings 13 and 14 are provided in the inner surface of the body means at diametrically opposite sides of the bore therethrough. Snugly fitted within the bore in the body means is an electrical coupling element 15, coupling element 15 having an opening 16 formed diametrically therethrough and being aligned with openings 13 and 14 formed in body means 10.

A pin 17 formed of a relatively rigid material such as plastic or fiber or the like is mounted within the aligned openings 13, 14, 16, it being evident that in the position as shown in FIG. 3, pin 17 positively prevents any relative rotation between the body means and its associated coupling element.

One end portion 20 of the coupling element 15 extends outwardly beyond one end portion of the body means, portion 20 of the coupling element having a threaded opening 21 formed therethrough and being provided with a flat surface 22 thereon. Flat surface 22 and threaded opening 21 are adapted for mounting a bus bar thereto whereby an electrical connection can be quickly effected between a suitable bus bar and coupling element 15 which is formed of a suitable electrically conductive material such as brass or the like.

The opposite end portion of coupling element 15 comprises a hollow cylindrical portion 25 having a round headed pin 26 mounted therein and projecting radially inwardly thereof for a purpose hereinafter described.

As seen particularly in FIG. 4, a second body means 30 is also formed of a suitable insulating material similar to that of body means 11, a second electrical coupling element being embedded within body means 30, this second coupling element including a first cylindrical portion 31 and a reduced cylindrical portion 32 which as seen in FIG. 4 fits snugly within cylindrical portion 25 of coupling element 15. Portion 32 is provided with a longitudinally extending cutout portion 33 which is in communication with a circumferentially extending groove 34 which extends circumferentially around a major part of cylindrical portion 32.

When coupling element 15 is moved into coupling en-

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agement with the other coupling element, pin 26 rides along cutout portion 33 until it is adjacent groove 34 whereupon relative rotation of the two coupling elements causes pin 26 to ride into groove 34 thereby locking the two coupling elements in firm interengagement and additionally provide a good electrical connection therebetween.

A hollow cylindrical portion 40 is formed integral with the opposite side of portion 31, a hollow sleeve 41 being received within cylindrical portion 40 and silver-brazed thereto as illustrated by reference numeral 42. Sleeve 41 is formed of a suitable readily deformable substance such as copper or the like. An insulated cable 45 extends within body means 30 and has the bared ends thereof crimped to sleeve 41 as illustrated by the depression 46 to provide a good mechanical and electrical interconnection therebetween. Body means 30 is preferably sealed to the outer surface of cable 45 by wrapping tape 50 therearound so as to overlap adjacent portions of the body means and the cable. The tape is preferably formed of a vulcanizable material such as rubber or the like and is vulcanized in place to provide an effective seal thereat.

Referring again to FIG. 3 of the drawing, it will be noted that the outer surface of body means 10 is provided with an annular radially inwardly extending shoulder 55 which intersects the curved contacting surface 56 of the body means at what may be termed the base portion 57 thereof. The contacting surface 56 extends outwardly to a point 58 which may be termed the tip portion thereof. Contacting surface 56 defines a plurality of cross-sectional areas extending normally to the longitudinal axis AA of the body means and spaced longitudinally therealong which are circular in configuration. It will be noted that the diameter of the cross-sectional area defined at base portion 57 is greater than that of the area defined at tip portion 58.

Another way of defining the construction of contacting surface 56 is to consider it as comprising a plurality of arcs which extend parallel to the longitudinal axis AA. As seen in FIG. 3, only two of these arcs are visible, the upper arc being formed about a radius of curvature B and the lower part visible in FIG. 3 being formed about a radius of curvature C. It is noted that the center of curvature for each of these arcs is disposed at the opposite side of the longitudinal axis AA from the arc. The construction of surface 56 is such that the centers of all the arcs defining the surface define a circle disposed in concentric relationship to axis AA.

The inner surface of body means 30 is provided with a curved surface 60 which is completely complementary to surface 56 so as to provide a fluid-tight seal therewith. Body means 30 is also provided with an annular shoulder 61 at the outer end thereof which abuts shoulder 55 of the body means 10 as seen in FIG. 4 when the members are in operative position. Furthermore, the outer end of body means 10 is provided with an annular shoulder 65 which abuts against the annular shoulder 66 formed on the body means 30 when in operative position as shown in FIG. 4. The overall construction of the interengageable portions of body means 10 and 30 is such that an effective fluid-tight seal is provided therebetween and yet they may be readily engaged and disengaged with respect to one another.

Referring now to FIG. 5 of the drawing, a modification is disclosed in accordance with the novel concept as set forth in copending application Ser. No. 802,832 relating to an electrical distribution device. This type of apparatus is especially adapted for distributing electrical energy from a single power source to a number of different electrical devices. This is accomplished by providing a single relatively large body of insulating material 70 which may be neoprene or the like within which is embedded an electrically conductive bus bar 71. Secured to bus bar 71 may be a number of electrically conductive coupling elements, only two of which 72 and 73

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being illustrated in the drawing. Coupling element 72 may be substantially identical with the coupling element illustrated as enclosed within body means 30, and coupling element 73 may be substantially identical with that shown in FIG. 3 of the drawing of the present application. The only difference between the coupling elements shown in FIG. 5 and those shown in FIGS. 3 and 4 is the provision of inner threaded shanks 72' and 73' which are threaded into cooperating openings formed through the bus bar and are silver soldered in place to mount the coupling elements in operative position.

Coupling element 72 is surrounded by an annular sleeve 75 which is provided with an inner contacting surface 76 which is substantially identical with contacting surface 69 formed on body means 30 as shown in FIG. 4.

Coupling element 73 is surrounded by an annular sleeve 80 having an outer curved surface 81 formed thereon which is substantially identical to contacting surface 56 formed on body means 10 as shown in FIG. 3 of the drawing.

It is apparent that coupling element 73 of the device shown in FIG. 5 is adapted to receive a body means 30 and an associated coupling element to provide the same type of fluid-tight interconnection as illustrated in FIG. 4 of the drawing. In a similar manner, the coupling element 72 of the device shown in FIG. 5 is adapted to receive a body means and associated coupling element as shown in FIG. 3 of the present application to provide the same type of fluid-tight interconnection which can be quickly and easily assembled or disassembled.

It is apparent from the foregoing that there is provided a new and novel electrical connector assembly which provides a good electrical and mechanical interconnection between the components thereof and which additionally provides an effective fluid-tight seal. The body means of the present invention are provided with intercooperating surfaces which are adapted to be readily assembled and disassembled with respect to one another since they can readily snap into and snap out of engagement due to the special configuration of the contacting surfaces and the inherent resiliency of the material of the body means. The structure of the present invention provides a better fluid-tight seal than a double bevelled arrangement such as shown in U.S. Patent No. 2,907,973, and further results in a considerable saving in the manufacturing costs as opposed to the structure shown in this patent. An electrical distribution device is also disclosed employing similar structure for the hereinabove discussed purposes. The apparatus of the present invention is quite simple and inexpensive in construction and yet is quite reliable in operation.

As this invention may be embodied in several forms without departing from the spirit or essential characteris-

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tics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claim, all changes that fall within the metes and bounds of the claim or that form its functional as well as conjointly cooperative equivalents are therefore intended to be embraced by the claim.

While the body means 30 has been shown as sealed to the outer surface of cable 45 by vulcanizing tape around the joint therebetween, body means 30 may also be sealed to the cable by so dimensioning the opening in the body means which receives the cable that the body means will tightly fit around the insulation of the cable to provide an effective seal therewith without the necessity of providing an additional sealing means.

I claim:

An electrical connector assembly comprising a body means formed of electrical insulating material, a plurality of electrical coupling elements embedded within the insulating material of said body means, means electrically connecting said coupling elements to one another, said body means including a plurality of recesses formed in the outer surface thereof, each of said electrical coupling elements having a portion disposed within a central portion of one of said recesses, sleeves integral with said body means and being disposed in surrounding relationship to each of said coupling elements, each of said sleeves being disposed within one of said recesses and in spaced relationship to the adjacent wall of the associated recess, each of said sleeves having a contacting surface formed thereon, each of said contacting surfaces defining a continuous curve extending in a direction parallel to the longitudinal axis of the body means, and defining a plurality of cross-sectional areas extending substantially normally to the longitudinal axis of the sleeves and spaced along such axes which are circular, each of said contacting surfaces including a base portion remote from the outer end thereof, said contacting surfaces flaring outwardly from said base portion to an intermediate portion and tapering inwardly from said intermediate portion to the outer end thereof, said base portion and said outer end of each of said contacting surfaces having cross-sectional areas of different diameters.

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