United States Patent

[11] 3,613,048

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[54] **WATERPROOF ELECTRICAL CONNECTOR**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **339/89 R,** 339/94 A, 339/185 R
[51] **Int. Cl.** **H01r 13/54**
[50] **Field of Search** 339/89, 90, 94, 185, 206, 207, 221

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Attorney—James E. Bryan

ABSTRACT: The connector includes a male and female member adapted to be interconnected with one another, and a fastening member draws the male and female members together to form a waterproof seal therebetween by means of a suitable sealing means. A clamping member is mounted on the male member for clamping the male member in place within a hole in a suitable support means and for providing a waterproof seal therewith. Adapter means and compressing means are also supported on the female connector member to provide an effective waterproof seal between the female connector member and an electrical lead means associated therewith.

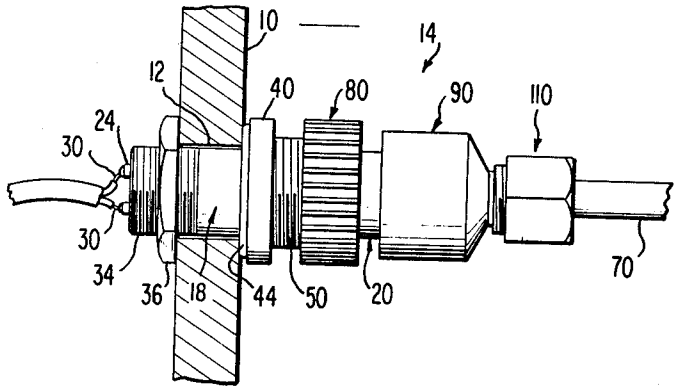


FIG. 1

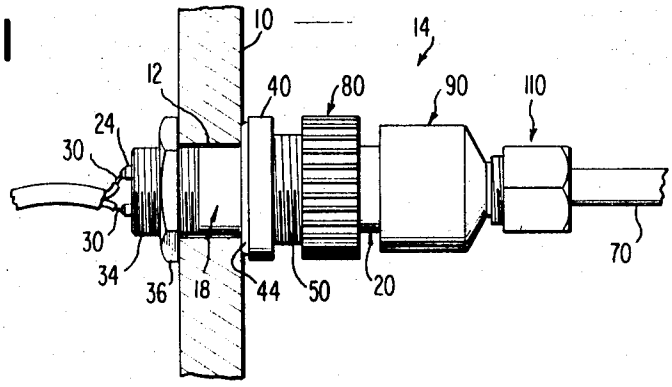
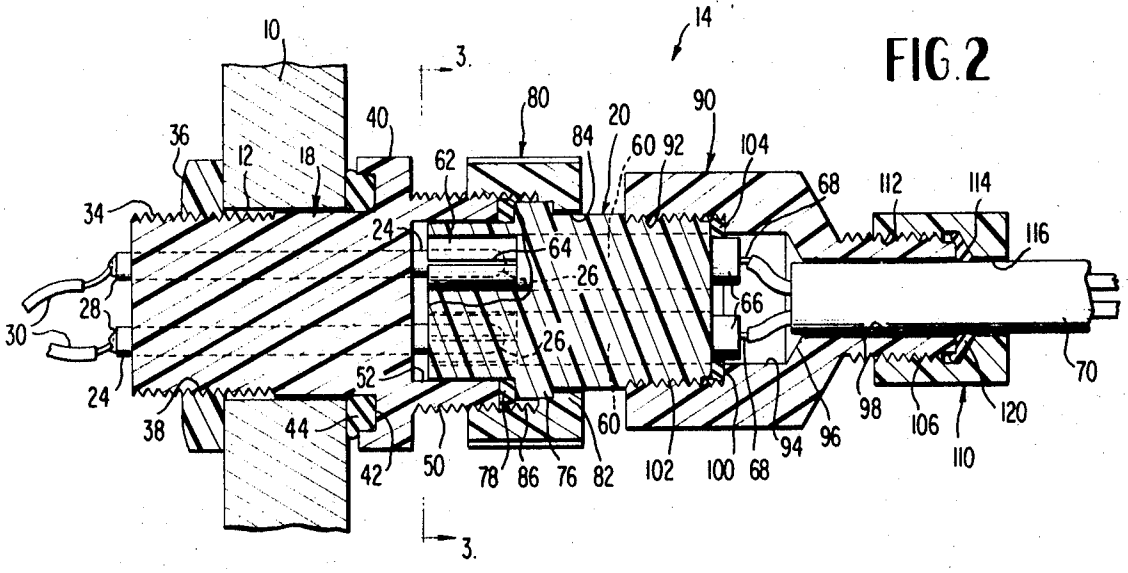


FIG. 2



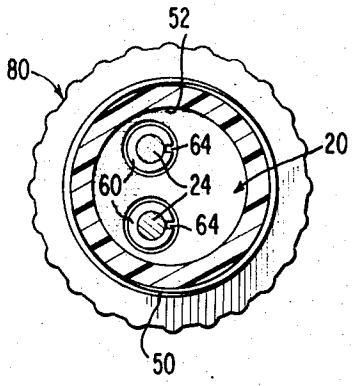


FIG. 3

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WATERPROOF ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

The present invention relates to a new and novel electrical connector which is substantially waterproof and is adapted to be used in underwater applications where it is constantly in the presence of water, and wherein the water may be under considerable pressure.

The present invention is especially adapted for many oceanographic applications such as providing electrical connections required in underwater photography and the like.

Electrical connectors used in such applications must of course be substantially waterproof and resistant to the deleterious results of sea water.

Prior art underwater electrical connectors have often proved not to be waterproof, and leakage encountered with such arrangements has caused serious problems resulting in ineffective electrical connections. Additionally, prior art structures have often been formed of materials which will not withstand the presence of sea water for extended periods of time.

A further disadvantage of many arrangements of this type is the fact that they often fail when subjected to substantial water pressures encountered in oceanographic applications at relatively large distances below the surface of the water.

Furthermore, conventional constructions for use in similar applications are of relatively complicated, bulky and expensive construction and have proved to be difficult to assemble and disassemble in the field.

SUMMARY OF THE INVENTION

In the arrangement of the present invention, the various components of the structure are threadedly interconnected with one another and provided with suitable sealing means therebetween so as to ensure a waterproof seal at all times. The exposed components of the present invention are also formed of a suitable substance such as plastic or the like which is substantially impervious to water and is corrosion resistant so that the connector is adapted to effectively function even when immersed in sea water for long periods of time.

The arrangement of the present invention is also such that it is adapted to withstand relatively high water pressures since all of the components are of rugged construction and are interconnected in such a manner as to provide maximum strength and rigidity to the overall assembly void of airspaces.

A further feature of the present invention is the fact that the construction is relatively simple, compact and cheap in construction, and yet at the same time is quite sturdy and reliable in use, and further may be assembled and disassembled with ease in the field.

An object of the present invention is to provide a new and novel waterproof electrical connector which is substantially waterproof and will retain the desired characteristics at relatively high pressures beneath the surface of water; which will withstand the presence of sea water over extended periods of time without deleterious results; and further, which is relatively simple, compact and inexpensive in construction and which may be readily assembled and disassembled when so desired.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an overall view of the connector of the present invention illustrating it mounted in operative position on a suitable support means and connected with suitable electrical lead means;

FIG. 2 is a longitudinal sectional view through the connector of the present invention on an enlarged scale; and

FIG. 3 is a cross-sectional view taken substantially along line 3—3 of FIG. 2 looking in the direction of the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, as seen particularly in FIG. 1, a suitable support means 10 in the form of a bulkhead, wall or plate and the like of any suitable material is provided, the support means having a hole 12 formed therethrough through which the electrical connector of the present invention is adapted to extend.

The electrical connector is indicated generally by reference numeral 14 and includes a male connector means 18 and a female connector means 20. These connector means as well as the remaining components of the connector other than the sealing rings hereinafter described are formed of a substantially water-impervious and corrosion-resistant material such as a suitable plastic or the like, and a particularly well-suited substance is Delrin.

The male connector means 18 includes a pair of elongated male pins 24 which are press fitted within corresponding bores formed in the male connector means 18. The inner ends 26 of these pins are rounded to facilitate insertion of the male pins in the female pins hereinafter described. The opposite ends 28 of male pins 24 extend beyond the outer end of connector means 18 and are suitably connected as by soldering or the like to a pair of electrical leads 30.

The outer end portion 34 of male connector means 18 is threaded and is adapted to receive a generally annular clamping means or member 36 having a threaded bore 38 formed therethrough which is adapted to be threaded onto end portion 34.

Male connector means 18 includes an integral annular shoulder 40 having a recess 42 formed therein and extending circumferentially about male connector 18. This recess is adapted to receive a sealing means in the form of a conventional O-ring 44 formed of a suitable resilient substance such as rubber or the like.

It is apparent as seen in FIG. 1 that in the operative position illustrated, the male connector means extends through the hole 12 formed in support member 10, and preferably fits relatively snugly therewith. The clamping member 36 serves to draw the sealing means 44 tightly against the right-hand surface of the support member as seen in this figure so as to provide a waterproof seal between the male connector means 18 and the right-hand surface of the support member. It will be understood that in the orientation illustrated, the right-hand surface of support member 10 would be exposed to the water in an underwater application, while the left-hand surface of the support member might comprise the inner surface of a suitable housing or the like within which suitable equipment is disposed, and air might be present within the chamber formed adjacent to the left-hand wall of the support member.

Referring to FIG. 2 of the drawing, the inner or opposite end of the male connector means 18 is provided with threads 50 on the outer surface thereof, and a recess 52 is formed at this end of the male connector means, the inner ends of the male pins being disposed within this recess. As seen particularly in FIG. 3, the male pins are asymmetrically disposed relative to the male connector means for a purpose hereinafter described.

The female connector means 20 includes a pair of female pins 60 press fitted within suitable bores provided in connector means 20. The inner ends 62 of the female pins are of resilient construction, and each includes a longitudinally extending slot 64 so that these resilient end portions are adapted to expand slightly and snugly receive the ends 26 of the male pins previously described.

The opposite end portions 66 of the female pins 60 extend beyond the outer end of female connector means 20 and are suitably secured as by soldering or the like to electrical leads 68 extending from an electrical lead means 70 in the form of a cable adapted for use in underwater applications, this cable being of the usual type including an outer surrounding layer of insulating material such as rubber or the like.

The female connector means 20 includes an integral annular collar 76 thereon, and in the operative relationship seen in FIG. 2, a suitable sealing means 78 in the form of a conventional O-ring is compressed between the collar 76 and the ad-

jacent end portion of the male connector means previously described. This sealing means is compressed in the operative relationship illustrated by a fastening means indicated generally by reference numeral 80.

Fastening means 80 includes an end wall 82 having a hole 84 formed therethrough which is adapted to receive the outer end of the female connector means 20, this hole being of smaller diameter than the collar 76 formed on the female connector means so that the fastening means is not adapted to fit over the collar 76. The fastening means includes an internally threaded bore 86, this threaded portion being adapted to thread on the inner threaded end 50 of the male connector means for drawing the male and female connector means together and compressing the sealing ring 78 therebetween as illustrated.

It will be noted that the female pins 60 as seen in FIG. 3 are also asymmetrically disposed with respect to the associated female connector means so that the male and female pins are adapted to fit together in only one relative position with respect to one another to thereby ensure proper polarity of the electrical connection therebetween.

An adapter means indicated generally by reference numeral 90 has a bore formed therethrough, the inner end 92 of this bore being threaded and joining with a further bore portion 94 which in turn joins with a tapered bore portion 96. This tapered bore portion joins with a reduced bore portion 98 opening through the opposite end of the adapter means. A flat shoulder 100 is formed between the threaded bore portion 92 and the bore portion 94 of adapter means 90. When the threaded bore portion 92 is threaded on the outer threaded end portion 102 of the female connector means, a suitable sealing means 104, such as a conventional O-ring is compressed between the flat shoulder 100 and the outer end of the female connector means to provide a waterproof seal therebetween.

The adapter means 90 comprises in effect a wire reducer within which electrical lead means of many different-sized outer diameters may be employed.

Compressing means indicated generally by reference numeral 110 has a threaded bore portion 112 formed therethrough which joins with a tapered bore portion 114, which further is connected with a reduced outer bore portion 116. The threaded bore portion 112 of the compressing means 110 is adapted to be threaded upon the outer threaded end portion 106 of the adapter means, a suitable sealing means 120 in the form of a conventional O-ring being compressed between the tapered bore portion 114 of the compression means and the outer insulated portion of the electrical lead means 70 previously described so as to provide an effective waterproof seal therewith.

It is apparent from the foregoing that there is provided according to the present invention a new and novel waterproof electrical connector wherein the parts thereof are adapted to withstand the presence of sea water and the like over extended periods of time. The various components of the structure are threadedly interconnected with one another and provide a suitable interengaging sealing means so as to provide a substantially waterproof construction which is quite rigid and sturdy so as to effectively withstand relatively high water pressures. Additionally, the overall arrangement is quite simple, compact and inexpensive to manufacture, and yet at the same time it may be readily assembled and disassembled by threading the various threaded portions thereof onto or off of one another as the case may be.

I claim:

1. A waterproof electrical connector comprising relatively rigid male connector means having bores formed therein, male pin means press fitted within each of said bores formed therein, female pin means press fitted within each of said last-mentioned bores and extending therefrom for engaging and providing an electrical connection with said male pin means, said female connector means including a threaded outer end portion, adapter means including a threaded end threaded on the threaded end portion of said female connector means, said adapter means having a bore formed therethrough including a tapered bore portion, sealing means for providing a water proof seal between said male connector means and said female connector means, and fastening means interengaging said male connector means and said female connector means for drawing the male and female connector means together with said sealing means compressed therebetween.

2. An electrical connector as defined in claim 1 wherein the bore formed through said adapter means includes a reduced bore portion, said adapter means having a threaded outer end portion formed thereon.

3. An electrical connector as defined in claim 2 including compressing means having threads formed thereon, the threads of said compressing means being threaded on the threaded outer end portion of said adapter means.

4. An electrical connector as defined in claim 3 wherein said compressing means has a bore formed therethrough said bore including a tapered bore portion, and sealing means engaging the tapered bore portion of said compressing means for providing an effective waterproof seal with an associated electrical lead means.

5. A waterproof electrical connector comprising relatively rigid male connector means having bores formed therein, male pin means press fitted within each of said bores and extending therefrom, relatively rigid female connector means having bores formed therein, female pin means press fitted within each of said last-mentioned bores and extending therefrom for engaging and providing an electrical connection with said male pin means, sealing means for providing a waterproof seal between said male connector means and said female connector means, and fastening means interengaging said male connector means and said female connector means for drawing the male and female connector means together with said sealing means compressed therebetween, said male pin means being asymmetrically mounted on the male connector means, said female pin means being asymmetrically mounted on the female connector means and receiving said male pin means, said male connector means including a threaded outer end portion, an annular clamping means including a threaded bore, said clamping means being threaded on the threaded outer end portion of said male connector means, said male connector means including an annular shoulder receiving a sealing means, the opposite end portion of said male connector means being threaded, said female connector means having an annular collar formed thereon, said fastening means being of generally annular construction and having a hole formed therethrough receiving said female connector means, said fastening means including an internally threaded portion threaded on said opposite threaded end portion of said male connector means, said male connector means defining a recess at one end thereof, said female connector means fitting at least partially within said recess, said female connector means including a threaded outer end portion, adapter means including a threaded portion threaded on said threaded end portion of the female connector means, sealing means disposed between and in engagement with said female connector means and said adapter means, said adapter means including a bore formed therethrough having a tapered bore portion and a reduced bore portion, the outer end portion of said adapter means being threaded, compression means including a threaded portion threaded on the threaded outer end portion of said adapter means, and sealing means in engagement with said compressing means and adapter to engage an associated electrical lead means to provide an effective waterproof seal therewith.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,613,048 Dated October 12, 1971

Inventor(s) Paul Brundza

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 68, after "bores" insert --- and extending therefrom, relatively rigid female connector means having bores ---.

Signed and sealed this 19th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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