Aug. 4, 1970 J. L. CAIRNS 3,522,576

UNDERWATER ELECTRICAL CONNECTOR

Filed April 26, 1968

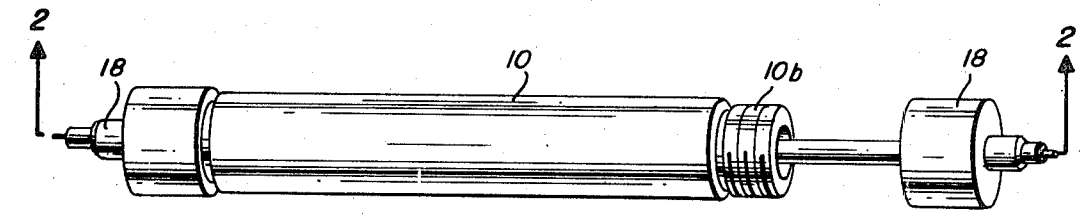

FIG. 1

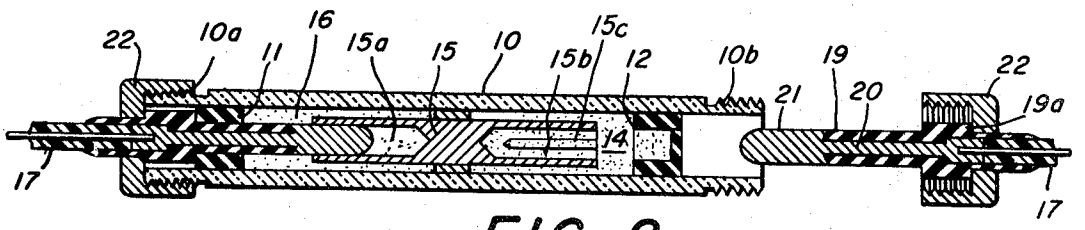

FIG. 2

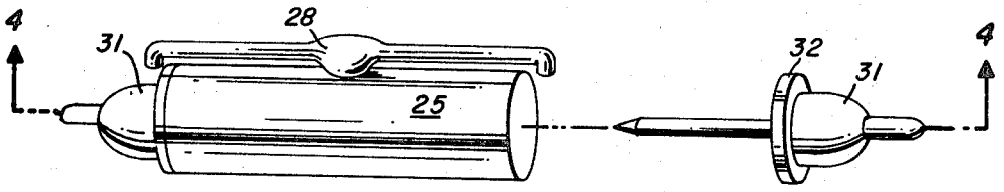

FIG. 3

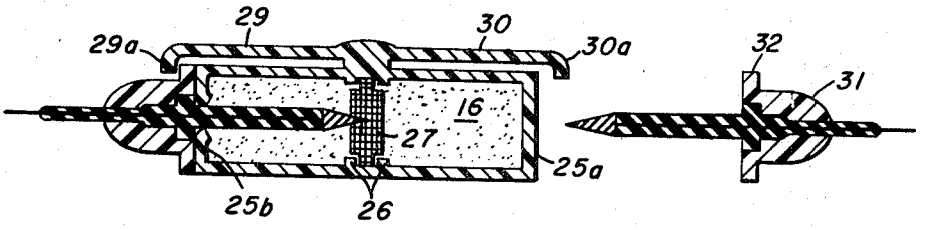

FIG. 4

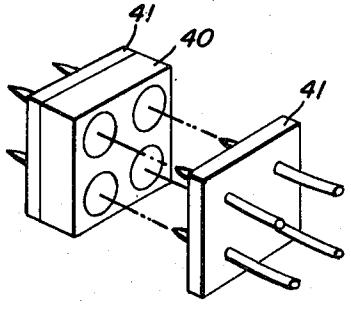

FIG. 5

INVENTOR.
JAMES L. CAIRNS
BY Thomas Glenn Keough
Paul D. Gilchrist
ATTORNEYS

United States Patent Office 3,522,576 Patented Aug. 4, 1970

3,522,576

UNDERWATER ELECTRICAL CONNECTOR

James L. Cairns, 2327 Cowley Way,
San Diego, Calif. 92110

Filed Apr. 26, 1968, Ser. No. 724,352
Int. Cl. H01r 13/54, 11/20
U.S. Cl. 339—91 2 Claims

ABSTRACT OF THE DISCLOSURE

The present invention relates to an underwater electrical connector that is nonresponsive to changes in the surrounding pressure. A body element in the form of a tubular shell is filled with a dielectric viscous substance such as gel or grease. A conductive plate having female recesses or honeycomb surfaces is mounted inside the body element and is completely encased in the dielectric substance. Grommets or penetrable walls are disposed at opposite ends of the housing element substantially isolating the gel-filled chamber from the exterior to permit the insertion of bayonet type probes therethrough and into the conductive plate to effect an electrical connection between the probes. The wiping action of the grommet or penetrable wall and the dielectric gel prevents impurities from being introduced into the connection and the conductive plate having female shaped recesses or honeycomb surfaces ensures a positive electrical interconnection between the probes. Having the interior of the connector filled with the dielectric gel renders the connector insensitive to changes in the surrounding pressure.

STATEMENT OF GOVERNMENT INTEREST

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.

BACKGROUND OF THE INVENTION

The present invention pertains to the field of electrical connectors and in particular to underwater electrical connectors capable of passing an undistorted signal while being subjected to water pressure changes and other adverse marine conditions. Presently, the problem that frequently occurs where electrical connections are made underwater is that an introduction of salt and sediment into the connection device results in a distorted transferred signal. In addition, existing underwater connectors are prone to failure or collapse when subjected to water pressure increases and decreases. Furthermore, most present connectors serve only as a device for ensuring electrical connections and do not provide a mechanical linkage for holding the conductors in mechanical engagement.

SUMMARY OF THE INVENTION

The present invention is directed to providing an apparatus for ensuring a watertight electrical connection. By providing a tubular shaped body member with grommets or penetrable walls at opposite ends, a chamber is formed in which a conductive element is disposed. The conductive element, having oppositely disposed recesses or being formed of a honeycomb plate, is encased in a dielectric viscous material such as gel or a silicone grease substantially filling the chamber. Bayonet probes inserted through the grommets or the penetrable walls pass through the dielectric gel and into the recesses or the honeycomb plate to complete an electric path from one bayonet probe, through the conductive element, and out

through the other bayonet probe. Inserting a probe through the walls and the gel wipes off dirt or grit and ensures a positive connection free from any impurities that could distort the transferred signal. Providing recesses or a honeycomb structure in the conductive element guarantees a good conductive path.

It is a prime object of the present invention to provide an electrical connection specifically adapted for underwater use.

Another object of the instant invention is to provide a watertight electrical connection that minimizes signal distortion.

Still another object is to provide an underwater connection that is uneffected by changes in surrounding water pressure.

A further object of the invention is to provide a connector that ensures a sound mechanical connection while providing a superior electrical connection.

These and other objects of the present invention will be more readily understood by taking into consideration the drawings and ensuing description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of one form of the invention.

FIG. 2 is a longitudinal cross-sectional view of the invention taken along lines 2—2 in FIG. 1.

FIG. 3 is an isometric view of a preferred form of the invention.

FIG. 4 is a longitudinal cross-sectional view of the invention taken along lines 4—4 in FIG. 3.

FIG. 5 is an isometric view of a multiple connector.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2 of the drawings, showing a first embodiment of the invention, the connector is formed of a housing or body element **10** provided with threaded end portions **10***a* and **10***b*. For reasons which will become apparent, the body element is preferably constructed of a rigid transparent material that permits inspection of the electrical interconnection inside. A pair of axially displaceable resilient grommets **11** and **12** are provided with an orifice, or in the alternate, with a thin, penetrable wall, note grommet **12**, and are disposed within the body element to form a chamber **14**. A metallic, tubularly shaped conductor **15** is frictionally fitted or adhered to the inner walls of the housing element to align a pair of oppositely disposed recesses **15***a* and **15***b* substantially adjacent to the holes provided in the grommets. The walls of the recesses are splined, note **15***c* to permit a flexing of the conductor when a probe is inserted therein. A dielectric substance such as gel, oil, silicon grease, or similar product **16** completely fills the remainder of the chamber to isolate the conductor from the exterior of the body element.

An insulated electric lead **17** terminates in a bayonet type probe **18** including an insulating sheath **19** having its outer end shaped to receive the insulated electric lead interconnection. The remainder of the sheath snugly fits about an electrically conductive shaft **20** with the exception of an exposed tip portion **21** located on the inner end of the shaft. Joining the insulated electric lead to the conductor shaft requires that the insulating sheath be of a sufficient resilience to permit exposure of the juncture point between the shaft and the lead during the soldering operation. The diameter of the exposed tip and sheathed conductive shaft is such as to permit a forced fitting through the grommet and is of sufficient length to ensure a contiguous fitting between the exposed tip and a recess in the tubular shaped conductor.

A locking nut **22** is provided with an axial bore sized to fit around the insulating sheath and to abut a rim **19***a* and thus, prevents its sliding over the sheath and past the exposed tip. Tapping the inside of the nut with threads matching the threads died onto the threaded end portions **10***a* or **10***b* enables mechanical connection between the body element and the leads.

To operatively engage the connector, the bayonet probe is forcibly inserted through a grommet, through the dielectric gel, and into a recess in the tubularly shaped conductor. Upon complete insertion of the bayonet probe, the locking nut is turned onto a threaded end portion to secure the probe in the body element. Forcing the probe through the grommet creates a pressure on the dielectric substance forcing the grommet axially outwardly within body element **10** while still maintaining a sealed relationship about the probe. The combined wiping and sealing action by the grommet, having or not having a thin penetrable wall, and the dielectric gel prevents impurities and water from being introduced into the electrical interconnection and thusly eliminates signal distortion attributed to a faulty connection. The mechanical co-action between the locking nut and the body element ensures that such electrical connection is maintained.

A second embodiment of the invention utilizes a molded, ductile housing **25** internally shaped with a pair of annular guide ridges **26** that secure a honeycomb conductive plate **27**, although a tubular-shaped conductor **16** could be substituted for the honeycomb plate. The remainder of the housing interior is substantially filled with a dielectric gel, oil, or similar product **16**. A securing latch **28** having a pair of oppositely extending arms **29** and **30** are molded integrally with the housing, or the securing latch is molded separately and attached to the housing by straps or similar means. The arms extend beyond the length of the housing element and terminate in a pair of right angled projections **29***a* and **30***a*.

The probes used in this embodiment are similar to those set out above, the exception being that in place of the locking nut, a molded probe guide **31** is provided with a guide rim **32**.

Operation of this embodiment involves inserting the probe through the penetratable end walls, through the gel or oil and into the honeycomb conductive plate. The combined wiping action of the end walls and gel again removes impurities and water from the point of electrical contact and seals the interior of the housing from the surrounding water. As insertion of the probes progresses, the resilient arms are bent slightly outwardly to allow the guide rims to bypass right angled projections. After complete insertion, the projections are allowed to snap over the guide rims to securely hold the probes in secure electrical interconnection.

Using this embodiment of the invention a multiple connector unit can be manufactured by merely molding a multiple contact housing **40** and multiple contact probes **41** according to the teachings set out above.

Because repeated use of an underwater connector results in accumulated impurities inside of the connector, an advantage of the second embodiment is that the penetratable molded housing ensures a distortion free electrical interconnection since it is used only once. Because

of the simplicity of construction, mass production at a nominal cost is realized. By filling the chamber entirely with a dielectric gel, oil, or similar agent, air pockets within the connection apparatus are eliminated and the apparatus is rendered impervious to the effects of fluctuating or extreme water pressures. In addition, because of the wiping action of the walls and dielectric gel, a nearly perfect, secure electrical interconnection is made under water by a diver.

Obviously many modifications and variations of the present invention are possible in light of the above disclosure. It is therefore to be understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An apparatus ensuring a watertight electrical connection comprising:

a ductile shell enclosing a chamber and provided with a pair of axially arranged, oppositely facing penetrable walls integrally molded with said shell permitting access to said chamber;

a dielectric viscous material substantially filling said chamber;

a metallic honeycomb plate secured to an inner surface of said chamber and being encased in said dielectric viscous material;

a pair of bayonet probes formed to penetrate said walls and to pass through said dielectric viscous material, each bayonet probe having an exposed conductive tip configured to ensure a piercing, sliding electrical coupling with said honeycomb plate; and

a pair of arms externally mounted on said ductile shell positioned for each mechanically engaging a separate said bayonet probe to provide a secure mechanical interconnection between said probes and said shell ensuring a positive said electrical coupling therebetween.

2. An apparatus according to claim **1** further including:

a plurality of ductile shells molded as a single unit with each having a discrete said honeycomb plate disposed therein; and

a plurality of said bayonet probes integrally molded in a juxtaposed relationship for separately effecting said electrical coupling, simultaneously, with individual ones of the honeycomb plates upon insertion thereof in said shells.

References Cited

UNITED STATES PATENTS

2,841,635	7/1958	Witzell et al.	174—77
2,858,518	10/1958	Chrystie et al.	339—96
3,044,037	7/1962	Honig	339—89
3,127,230	3/1964	Marquis et al.	339—118
3,158,420	11/1964	Olson et al.	339—96
3,241,095	3/1966	Phillips.	
3,263,205	7/1966	Chandler	339—198

RICHARD E. MOORE, Primary Examiner

J. H. McGLYNN, Assistant Examiner

U.S. Cl. X.R.

339—96, 205