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McNeel

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[54] **REPAIRABLE ELECTRICAL GEOPHYSICAL CONNECTOR**

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[73] Assignee: **Geo Space Corporation**, Houston, Tex.

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[51] **Int. Cl.**[6] **H01R 13/40**

[52] **U.S. Cl.** **439/589**; 439/281

[58] **Field of Search** 439/589, 148, 439/281, 282

[56] **References Cited**

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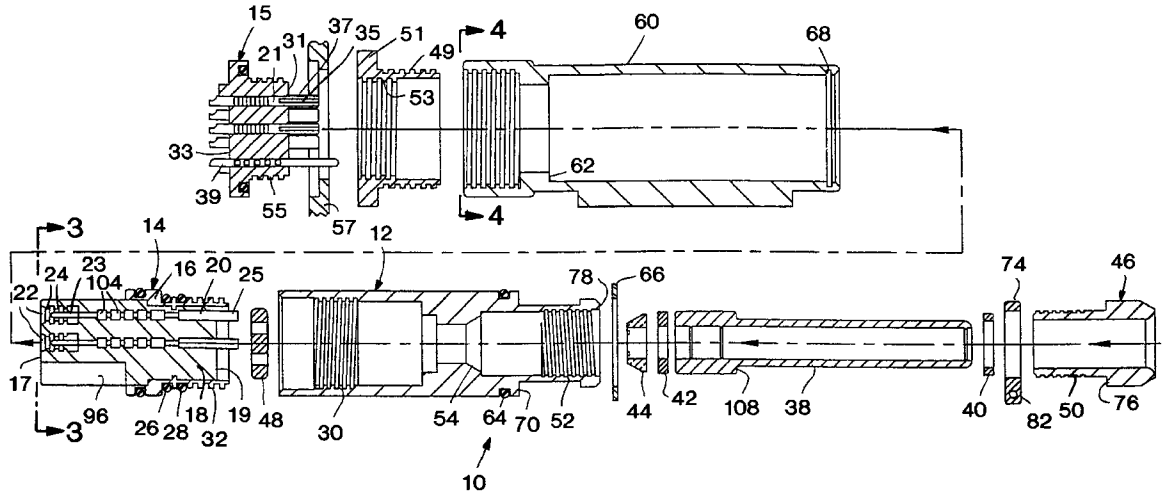
Assistant Examiner—Hae Moon Hyeon

[57] **ABSTRACT**

An electrical geophysical connector comprising an outer housing, a first connection member and a second connection member. First and second coacting electrical contacts are positioned in the first and second members, respectively. The first member includes a rigid outer shell and a resilient inner core bonded to the first electrical contacts. The first ends of the first contacts are positioned in cavities located in one end of the inner core and resilient seal rings are formed about the cavities for engaging and sealing the coacting engagement of the first and second contacts. A dust cap is rotatably mounted with a 360° rotation to the housing and the exterior of the housing is tri-lobed in cross section for ease of gripping.

2 Claims, 3 Drawing Sheets



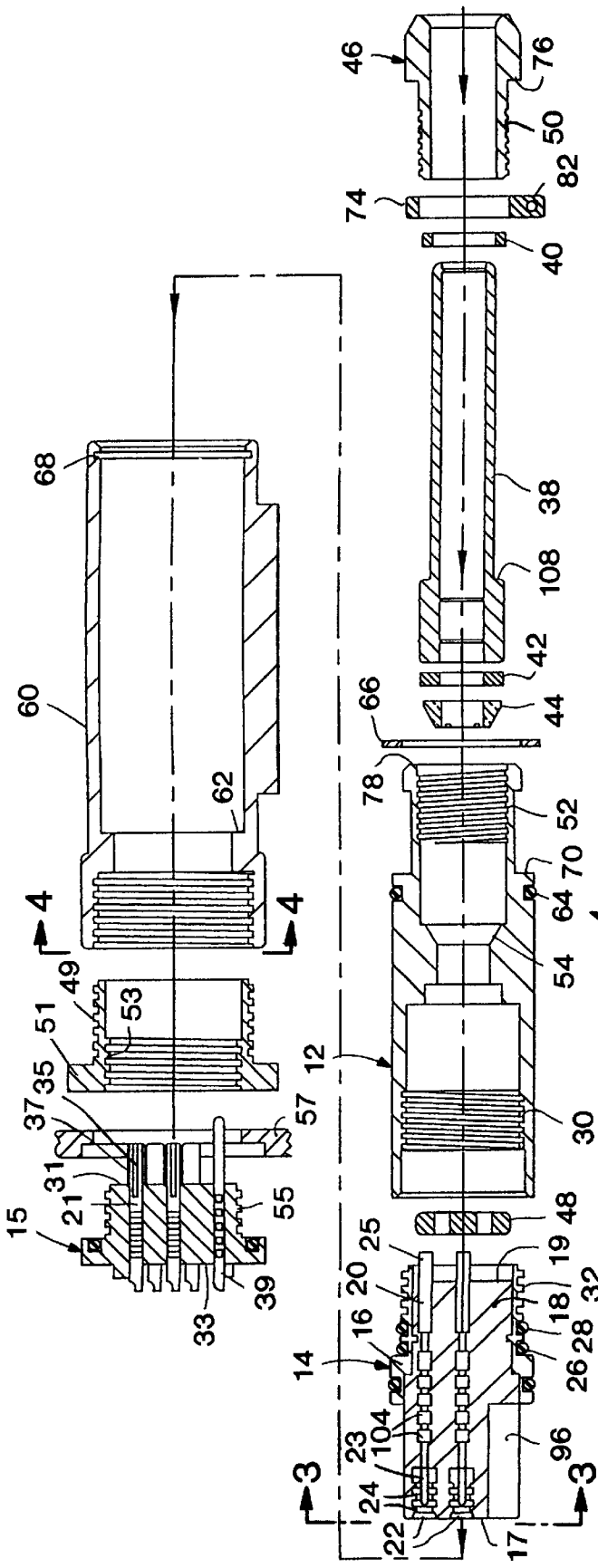

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FIG. 1

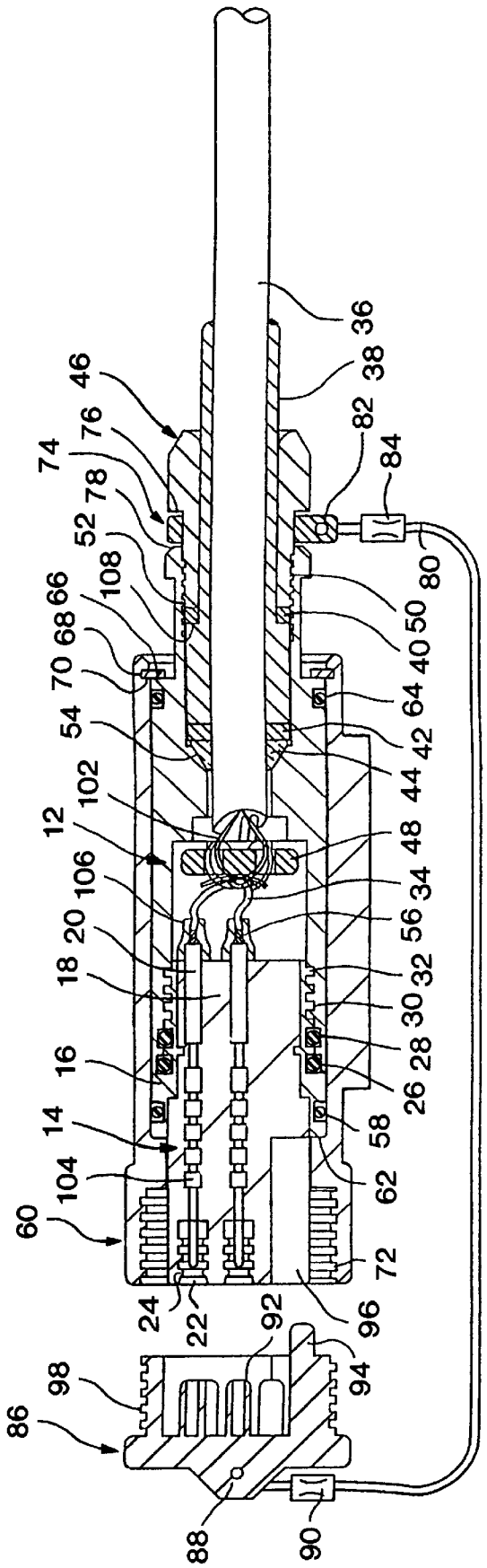
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FIG. 2

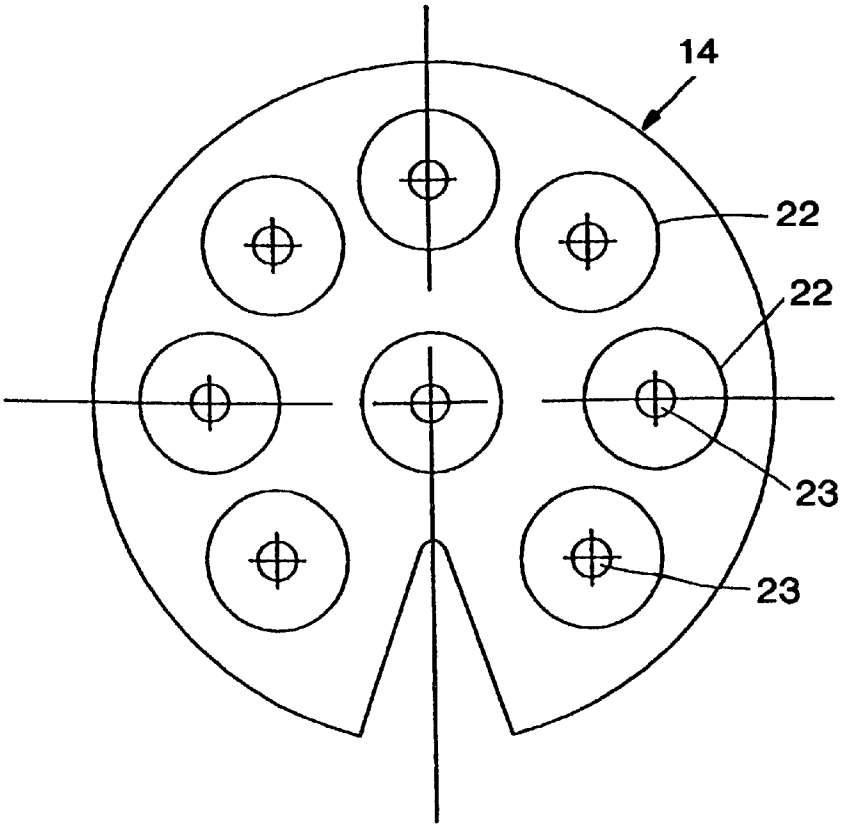

FIG. 3

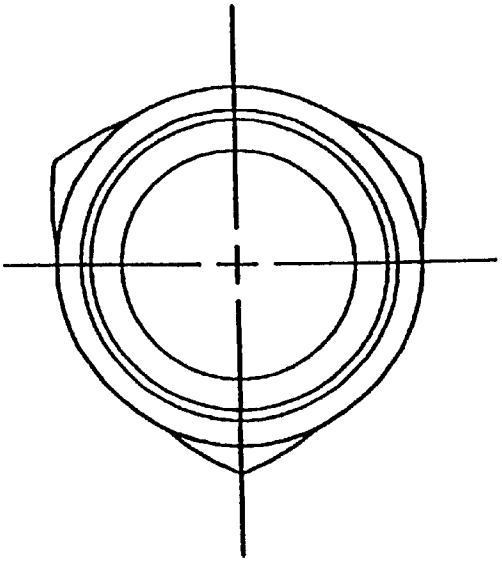

FIG. 4

REPAIRABLE ELECTRICAL GEOPHYSICAL CONNECTOR

FIELD OF THE INVENTION

This invention provides a means by which a geophysical connector can easily be disassembled in the field, new parts inserted and wired, and reassembled with a minimum of down time and cost. A connector of this design can be used in all environments, such as dry land or underwater, Arctic or desert locations.

BACKGROUND OF THE INVENTION

In seismic exploration, conditions dictate that electrical cables and attached connectors must withstand the rigors of hot, cold, dry and wet environments and be well constructed for years of field service. A long standing field problem has always been the routine repair and upkeep of the cables and connectors. Most generally, geophysical connectors which were to be used in a water environment were of the single molded type construction in order to maintain a waterproof sealed and moisture free assembly. However, a connector, such as this, ability to be repaired to its original condition is questionable. Single molded type connectors that are used in the wet environment, most generally, by its design have mating surfaces of a relatively soft elastomeric material which engage, face to face, with a relative hard mating member connector to provide a waterproof, moisture free assembly that maintains a minimum resistance path to all internal electrical conductive components. If a repaired cable with attached electrical connectors cannot meet this requirement, then the cable must be removed from service.

A single molded type of electrical connector construction usually has a one piece body member which is molded from soft elastomeric material. This body internally houses a plurality of pins, in a designed fixed pattern, within individual cavities that communicate with its mating, hard body, connector, sealing and excluding moisture from around the pins or socket. An electrical cable which has a plurality of electrical insulated conductors, that attach to the individual electrical pins, must also be molded within the body member. The outer jacket insulator of the electrical cable is generally an extruded soft, urethane material which satisfactorily forms a sealed bond between the electrical cable's outer insulating jacket and the body member that prevents and excludes moisture from entering within.

However, due to the extreme harsh handling that the cables and connectors are subjected to in the field, damage to the cables and connectors occur. Since the electrical pins are molded within the body member in a soft, relatively pliable material, over a period of time and continuous service, the pins are subjected to movement, when mating occurs, or they misalign eventually causing separation of the bonding material from around the pins. When this event eventually happens, it presents a passageway for moisture to enter within, increasing the possibility of devastating electrical leakage.

Another type of repairable electrical connector is shown in U.S. Pat. No. 5,470,248 in which rigid male and female members are joined together by a resiliently compressible coupling member.

SUMMARY

The present invention is directed to a sealed, field repairable electrical geophysical connector which overcomes many of the disadvantages, as described above, of the single molded construction as well as other types of connectors. The present invention can easily be disassembled if problems exist, repaired and reassembled in the field with a minimum of down time and used in any and all exploration environments.

A further object of the present invention is the provision of an electrical geophysical connector having an outer housing, a first connection member releasably secured in the housing and a second connection member releasably secured to the housing. First and second coacting electrical contacts are provided, one of which is male and the other of which is female, positioned in the first connection member and the second connection member, respectively. The first connection member includes a rigid, outer shell and an inner, resilient core bonded thereto having a first end including a plurality of cavities. The first contacts are positioned in and bonded to the inner core in which the first ends are positioned in one of the cavities and the second ends extend out of the second end of the core. A second connector member includes a rigid shell enclosing the second contacts whose ends extend out of the ends of the rigid shell. The inner core of the first connector forms a plurality of sealing rings around each of the cavities for sealing the coacting electrical contacts.

Yet a further object of the present invention is wherein the exterior of the outer housing is tri-lobed in cross section for ease of gripping.

Still a further object is wherein the first contacts are male pins and the second contacts are female receptacles.

Yet a still further object of the present invention is the provision of a dust cap releasably attached to the outer housing and connected to a line attached to an anchor which is 360° rotatable relative to the housing.

Other and further objects, features and advantages will be apparent from the following description of a presently preferred embodiment of the invention, given for the purpose of disclosure and taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view, in cross section, of the present invention in an exploded view,

FIG. **2** is an elevational cross section of one of the connector members of the present invention assembled with an attached disconnected dust cover,

FIG. **3** is a cross-sectional view taken along the line **3**—**3** of FIG. **1**, and

FIG. **4** is a cross-sectional view taken along the line **4**—**4** of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIGS. **1** and **2**, the reference numeral **10** generally indicates the geophysical connector of the present invention and generally includes an outer housing **60**, a first connector member **14** releasably securable in the housing **60**, and a second connector member **15** releasably securable to the housing **60**.

First and second coacting electrical contacts **20** and **21**, one of which is male and the other of which is female, are positioned in the first connector member **14** and the second connector member **15**, respectively. That is, for purposes of illustration, the first member **14** is shown as a male connector member having male electrical contacts, such as pins **20** and the second electrical connector **15** is shown as the

female connector having female electrical contacts such as receptacles **21**.

Obviously, the coacting electrical contacts in the connectors **14** and **15** could be reversed.

The first male connector member **14** includes a rigid outer shell such as an injection molded hard non-conductive glass filled urethane outer shell **16** and a resilient inner core **18** bonded to the outer shell **16** such as any suitable relatively soft non-conductive injection molded core, such as of a low durometer urethane material. The core **18** includes a first end **17** and a second end **19** and the first end **17** includes a plurality of cavities **22**. The first electrical contacts are pins **20** positioned in and bonded to the inner core **18** and include a plurality of outwardly extending annular rings **104** to improve the sealing capability, urethane to metal, and pins **20** retention within the male connector member **14**. The first contacts pins **20** include first ends **23** and second ends **25**. The first end **23** of the pins **20** are positioned in one of the cavities **22**. The second ends **25** of the first electrical contacts extend out of the second end **19** of the core **18** for attachment to an electrical cable.

The male connector member **14** is releasably secured to the housing **60** through a body member **12**. A threaded section **32** of the outer shell **16** is disposed at one end and adapted to mate with the internal threaded section **30** of the body **12** securing the two parts in rigid engagement. Two O rings **26** and **28** hermetically seal the male connector member **14** to the body member **12**.

Referring now to FIG. **1**, the second, or female, connector member **15** is comprised of a rigid shell having a first end **31** and a second end **33**. The second electrical contacts **21** are positioned in the connector **15** and include ends extending out of the first end **31** and the second end **33** of the rigid shell of the second connector **15**. One of the ends **35** of the receptacles **21** include an outer electrically non-conductive covering **37** and the ends **35** are adapted to be inserted into the cavities **22** of the male connector **14** to engage the ends **23** of the pins **20** to provide an electrical connection between the connectors **14** and **15**. It is to be noted that a plurality of internal sealing rings **24** are formed by the inner core **18** of the connector **14** around each of the cavities **22** for sealing the coacting electrical contacts **20** and **21**. The ends of the electrical receptacles **21** extending out of the end **33** of the connector **15** are suitably connected to an electrical cable. The receptacle **15** additionally includes a locator key **39** for engagement with a female locator key **96** (FIG. **3**) in the electrical connector **14** for correctly aligning and mating the electrical contacts **20** and **21**.

Referring now to FIG. **2**, the male connector member **14** is adapted to be connected to a plurality of electrical wires **34** from within an electrical cable **36** preferably by a hard wire connection such as soldering. A cable seal **38** is preferably formed of an injection moldable resiliently compressible material such as a thermoplastic rubber which seals against the outside of the cable **36**. A compression anchor spacer **42** is positioned and abuts the face of the cable seal **38**. A compression spacer **40** is positioned on the rear shoulder **108** of the cable seal **38**. Positioned directly ahead of compression anchor spacer **42** is a collapsible cable anchor **44**. Seal screw **46** has a plurality of external threads **50** which are adapted to mate with a plurality of internal threads **52** of the body member **12**. As the seal screw **46** is secured within the threaded engagement, pressure is exerted against compression spacer **40** which in turn compresses the cable seal **38**. The compression anchor spacer **42** is forced against the cable anchor **44** driving it into a tapered receiving counterbore **54** whereby cable anchor **44** having its diameter reduced in size bites into the outside of the electrical cable **36** virtually locking the cable **36** in a secured position relative to the body member **12**. Cable seal **38** which is captured between the compression spacer **40** and compression anchor spacer **42**, expands under compression, both internally sealing the jacket of the electrical cable **36** and externally sealing the entrance to the body member **12**.

The strain anchor **48** is a means to secure the cable stress member **102**, and cable conductor wires **34**. The cable stress member **102**, such as impregated KEVLAR, is most generally located within the center of the electrical cable **36**. When electrical cables, of long lengths, are subjected to tension there is a tendency for the electrical wires **34** to stretch and move internally breaking the electrical connections at the solder connection **56**. However, with stress member **102** and cable conductor wires **34** firmly attached to the strain anchor **48** damage is kept to a minimum. Shrink tubing **106** with internal adhesive that makes a positive seal between the electrical pin **20** and the outer insulation of the cable conductor wires **34**. Seal screw **46**, compression spacer **40**, compression anchor spacer **42**, cable anchor **44** and strain anchor **48** preferably are injection molded hard, rigid, non-conductive glass filled urethane material.

The assembled body member **12**, as shown in FIGS. **1** and **2**, is inserted into the housing **60** and is positioned to stop at shoulder **62**. O rings **58** and **64** are positioned in light engagement to prevent the internal area between the housing **60** and body member **12** from filling with fine sand or mud. Spiral lock ring **66** is inserted into an internally disposed groove **68** and engages shoulder **70** of the body member **12**. A plurality of internal threads **72** of housing **60** disposed at one end are adapted to mate with a plurality of external threads **49** of an adapter **51** (FIG. **1**) which in turn threadably engages the mating connector **15** by coacting threads **53** and **55** through a wall **57**. The housing **60**, as shown in FIG. **4**, has a three lobed arrangement to aid in gripping and turning during assembly or disassembly of the connector.

A wire rope anchor **74** is disposed between the shoulder **76** of the seal screw **46** and shoulder **78** of the body member **12**. The wire rope anchor **74** is free to rotate 360°. Attached to the wire rope anchor **74**, a stainless steel jacked wire rope **80** is inserted through the hole **82** of the wire rope anchor **74** and secured with a clamp **84**. Attached to the opposite end of the wire rope **80** is an injection molded dust cover **86** preferably a hard, rigid, glass filled urethane material. Wire rope **80** is secured to the dust cover **86** through hole **88** and secured with a clamp **90**.

Dust cover **86** has a plurality of mating pins **92** which engage the cavities **22** of the male connector member **14** for sealing purposes when the cable is not in service. A male key **94** on the dust cover **86** projects outwardly and engages the female key **96** on the male connector member **14** which orients and positions all mating pins **92**. A plurality of external threads **98** of the dust cover **86** engage and mate with a plurality of internal threads **72** of the housing **60**.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While a presently preferred embodiment of the invention has been given for the purpose of disclosure, numerous changes in the details of construction and arrangement of parts may be made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. An electrical geophysical connector, comprising,

an outer housing, a first connection member releasably secured in the housing, and a second connection member releasably secured to the housing,

first and second coacting electrical contacts, one of which is male and the other of which is female, positioned in first connection member and the second connection member, respectively,

said first connection member having a rigid outer shell and a resilient inner core bonded thereto and having first and second ends, said first end including a plurality of cavities,

said first contacts positioned in and bonded to the inner core and include first and second ends, the first ends of each of the first contacts positioned in one of the cavities, the second ends of the first contacts extending out of the second end of the core for attachment to an electrical cable,

said second connection member including a rigid shell having first and second ends, and said second contacts positioned in the second connection and having ends extending out of the first and second ends of the rigid shell of the second connector, respectively, one of the ends of the second contacts adapted to be inserted into the cavities of the first connection member and engage the first ends of the first contacts,

said inner core of the first connector forming a plurality of sealing rings around each of the cavities for sealing the coacting electrical contacts, and

wherein the exterior of the outer housing is tri-lobed in cross section for ease of gripping.

2. An electrical geophysical connector, comprising,

an outer housing, a first connection member releasably secured in the housing, and a second connection member releasably secured to the housing,

first and second coacting electrical contacts, one of which is male and the other of which is female, positioned in first connection member and the second connection member, respectively,

said first connection member having a rigid outer shell and a resilient inner core bonded thereto and having first and second ends, said first end including a plurality of cavities,

said first contacts positioned in and bonded to the inner core and include first and second ends, the first ends of each of the first contacts positioned in one of the cavities, the second ends of the first contacts extending out of the second end of the core for attachment to an electrical cable,

a body member sealably and releasably connected to the rigid outer shell and sealably and releasably connected to the outer housing and having a cavity enclosing the second ends of the first contacts,

a strain anchor positioned in the cavity for connection between the electrical cable and the second ends of the first contacts,

a cable seal and anchor releasably connected to the body member for sealably and releasably attaching to said electrical cable,

said second connection member including a rigid shell having first and second ends, and said second contacts positioned in the second connection and having ends extending out of the first and second ends of the rigid shell of the second connector, respectively, one of the ends of the second contacts adapted to be inserted into the cavities of the first connection member and engage the first ends of the first contacts, and

said inner core of the first connector forming a plurality of sealing rings around each of the cavities for sealing the coacting electrical contacts.

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