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[11] **3,753,206**

[45] **Aug. 14, 1973**

[54] **ELECTRICAL CONNECTOR WITH COAXIAL CONTACTS**

[75] Inventors: **Henry L. Busuttil,** Chatsworth; **Sol S. Kreisler,** Downey; **James R. McGibbeny,** Marina Del Rey; **Russell O. Pearson,** Redondo Beach, all of Calif.

[73] Assignee: **TRW Inc.,** Redondo Beach, Calif.

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[52] **U.S. Cl.** ..... **339/16 C,** 339/183, 339/117 R, 174/47

[51] **Int. Cl.** **H01r 3/04**

[58] **Field of Search** 339/15, 16, 182, 339/183, 117, 118; 279/277, 278; 174/47

[56] **References Cited**

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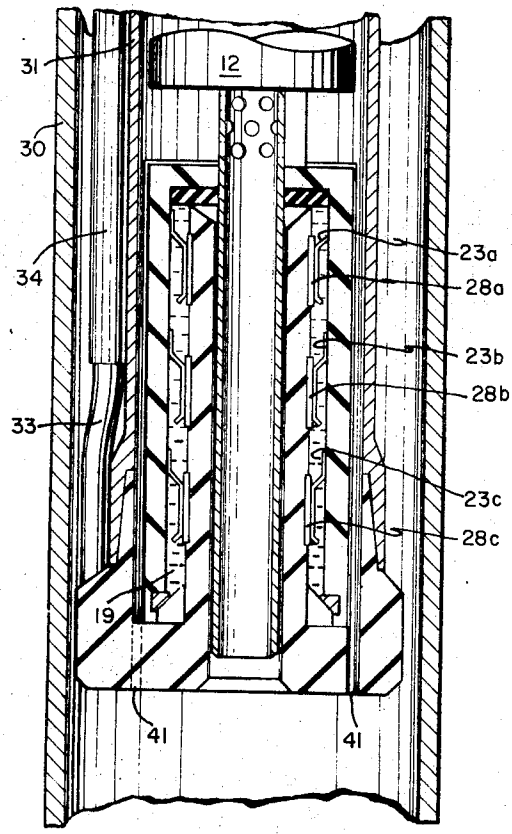
Primary Examiner—Marvin A. Champion
Assistant Examiner—Robert A. Hafer
Attorney—Daniel T. Anderson et al.

[57] **ABSTRACT**

An electrical connector especially suitable for subsea and oil well applications is disclosed. One member of the connector is movably associated with submergible equipment and as described for oil well applications includes a cylindrical shell with a center post depending within the shell permissive of acting as an alignment guide and a flow passage. The other member of the connector is permanently positioned subsurface on a subsea structure or within an oil well production tubing where it receives the one member. A tubular member carries a number of ring contacts that engage tubular contacts in the first member. To purge hostile fluids, a viscous dielectric grease is packed in the shell of the movable member and is partially expelled as the connector members are engaged. The configuration is particularly permissive of removing a downhole oil well pump without reeling in an electrical cable and of thereafter passing servicing tools through the subsurface member.

16 Claims, 6 Drawing Figures



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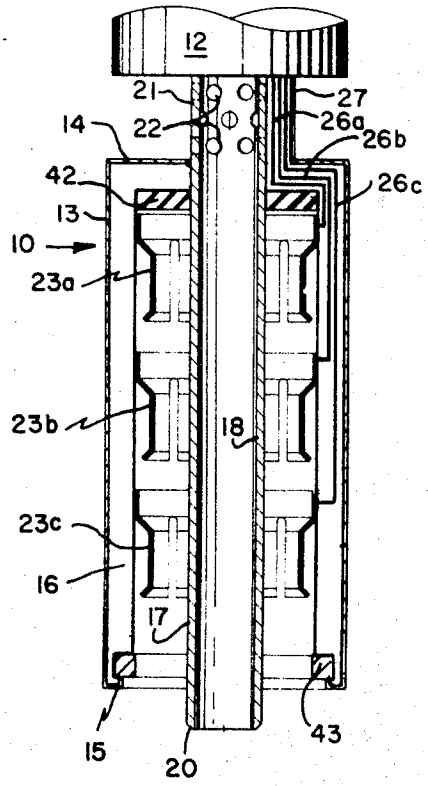

Fig. 1

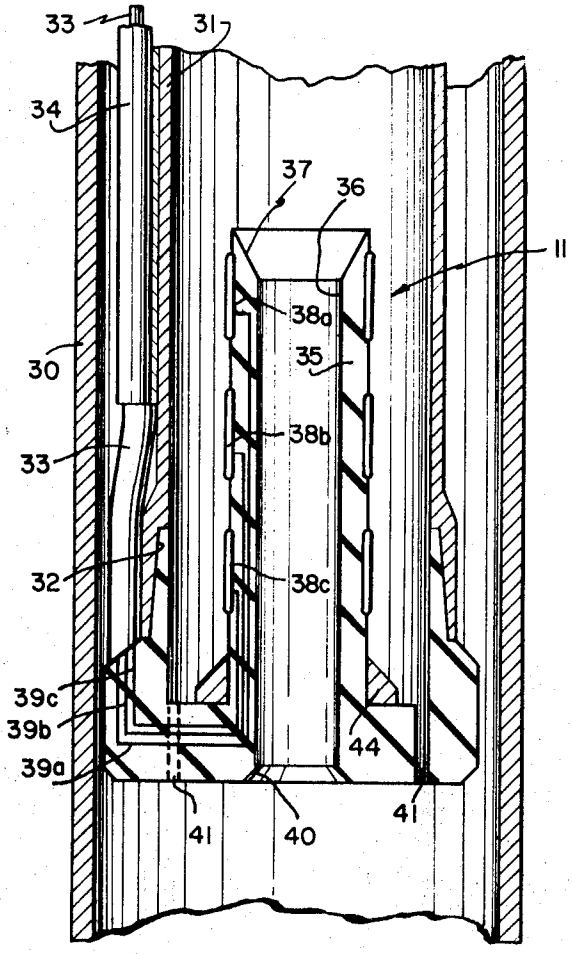

Fig. 2

Henry L. Busuttil
Sol S. Kreisler
James R. McGibbeny
Russell O. Pearson
INVENTORS

BY William B. Leach
ATTORNEY

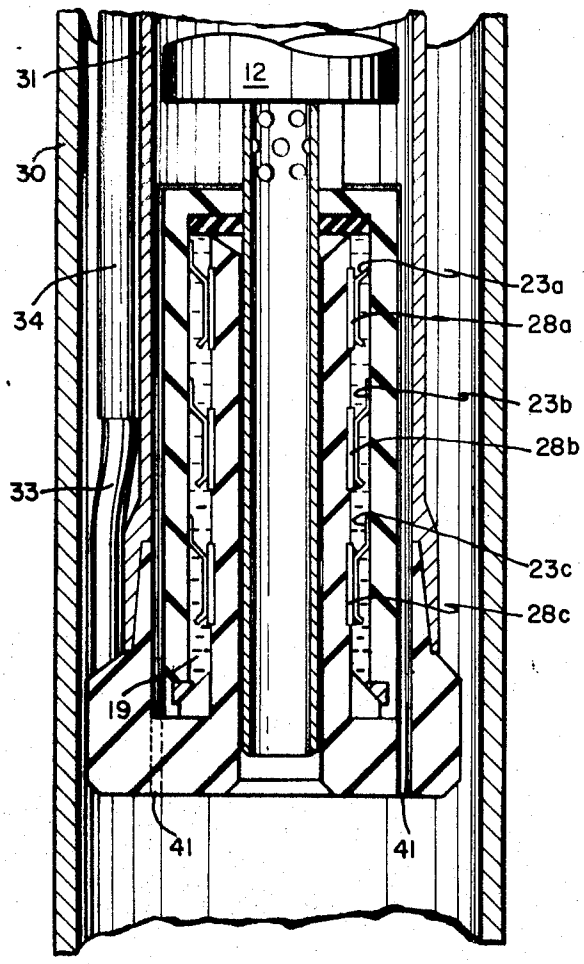

Fig. 3

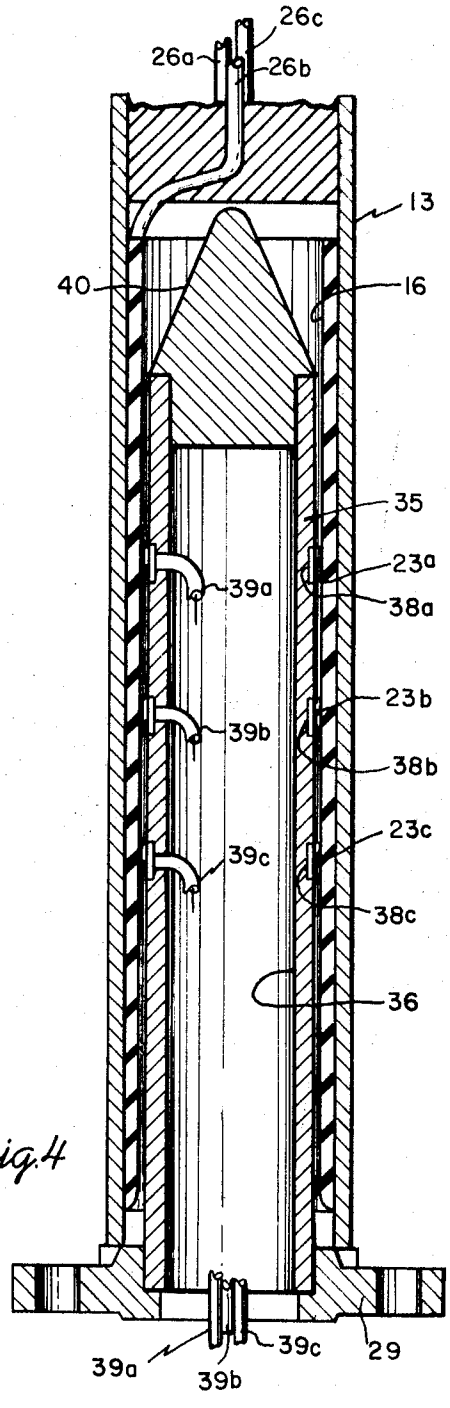

Fig. 4

Henry L. Busuttil
Sol S. Kreisler
James R. Mc Gibbeny
BY Russell O. Pearson
INVENTORS
William B. Leach
ATTORNEY

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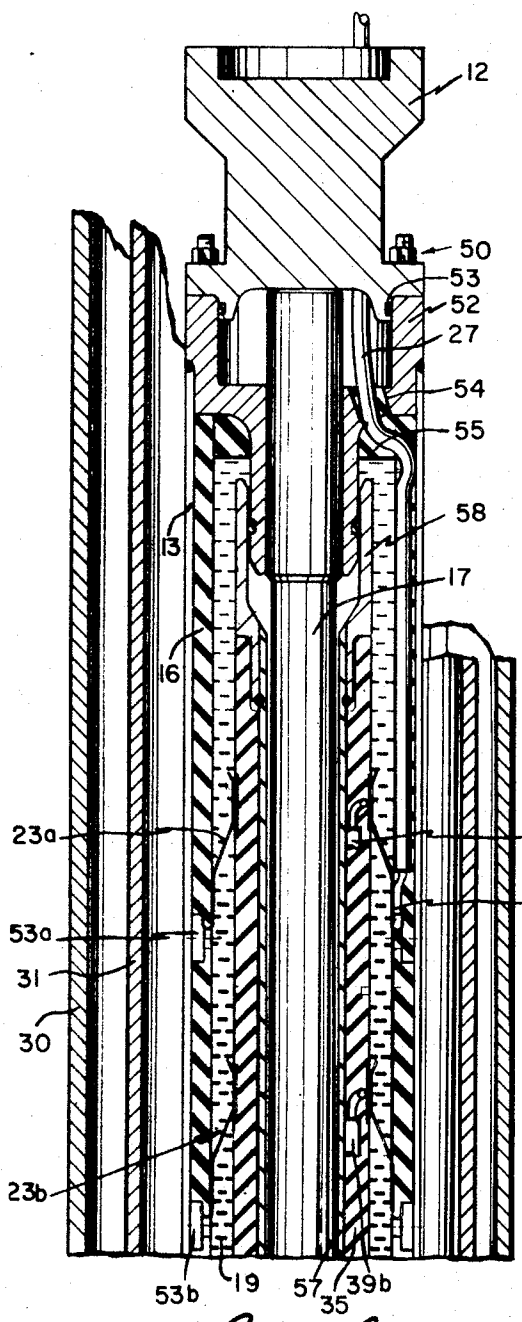

Fig. 5A

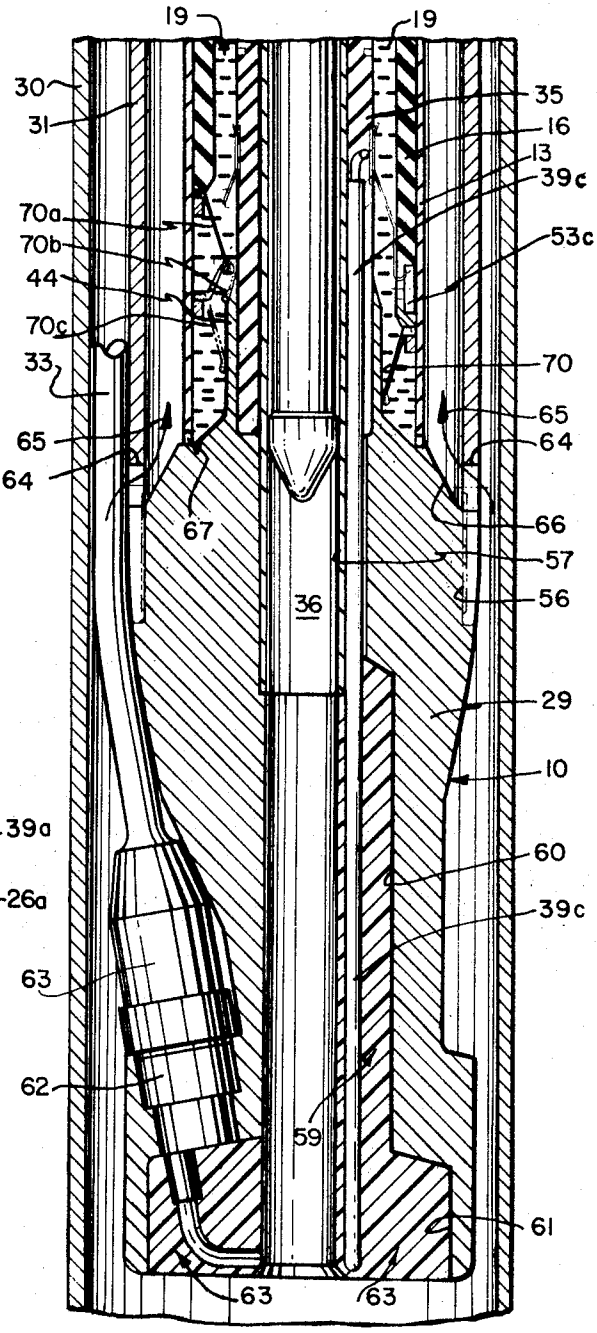

Fig. 5B

Henry L. Busuttil
Sol S. Kreisler
James R. Mc Gibbeny
Russell O. Pearson
INVENTORS
BY William B. Leach
ATTORNEY

ELECTRICAL CONNECTOR WITH COAXIAL CONTACTS

BACKGROUND OF THE INVENTION

The present invention relates generally to electrical connectors engagable in a hostile environment and more particularly to subsea and downhole oil well applications usually referred to as wet-connectors.

An electrical connector that may be safely engaged and disengaged under a fluid such as water is commonly known as a wet connector. A connector usable under water that must be engaged before immersing it in the water is known as a dry connector.

Providing for electrical contact in fluid and other hostile environments has been approached in various ways. One such approach that has been used is to provide connector members which mate with such close tolerances that the fluid will be expunged from the contact area. Connectors of this type are shown in the U.S. Pat. to Dietrich, No. 3,375,480; Cook, No. 3,546,657; Gimpel, No. 3,367,181; and Nelson, No. 3,375,480.

Another approach has been to use elastomeric material to either encase or enclose one or both of the pair of contacts for protection from the fluid and to cause one contact to pierce the protective material to permit contact and engagement. Reference may be made to such U.S. Pat. as Minto, No. 2,703,870; Chrystie, No. 2,858,518; Armstrong, No. 3,262,084; or Henderson, No. 3,398,392.

Connectors known to the applicants are disadvantaged by requirements such as close manufacturing tolerances, mechanical complexity and a restrictive number of contacts includable within space limitations. Many are also limited to low voltage and/or low power circuits.

Oil wells are drilled and operated on land and beneath the sea. For offshore wells, the wellhead assembly may be installed close to the ocean floor and in depths ranging up to several thousand feet. The wells themselves may be several thousand feet deep.

It is well known in the art to use electrical submergible pumps to raise the oil to the surface when there is an insufficient amount of natural pressure to do so. The submergible artificial lift pumps are installed far down in the well casing and are typically suspended from the end of the production tubing or liner. The liner carries or supports an electrical cable to provide power to the pump. When the pump needs to be changed, the past practice has been to withdraw the liner, section by section, thus, pulling the pump to the surface. This is a very time consuming procedure and is extremely costly for the subsea well situation wherein the specially designed and equipped ships required may rent for several thousand dollars per day.

It is therefore desirable to simplify the pump servicing as much as possible. One approach has been to insert and remove the pump by a steel cable which also carries an electrical cable. The cable tends to interfere with the use of standard well equipment such as storm chokes and requires special attention to sealing around the cable at the wellhead.

The present invention enables the use of an electrical cable that is permanently installed with the production tubing. The pump may be inserted and withdrawn from the production tubing by a load carrying cable. Electrical connection is automatically accomplished within the well, thus, the load cable may be removed so as not

to interfere with other standard well mechanisms. The connector is further compatible with well maintenance and service tools using through-flow-line techniques.

Other electrical connections are often required to be made in remote locations such as beneath the sea. These applications often require a simple, rugged connector that permits making the connection automatically and reliably.

Accordingly, it is an object of the present invention to provide an electrical connector which is not subject to these and other shortcomings and limitations of the prior art.

Another object of the present invention is to provide an electrical connector suitable for making an electrical contact in the presence of a hostile environment.

A further object of the present invention is to provide an electrical connector permissive of making an electrical connection in a subsea environment.

Still another object of the present invention is to provide an electrical connector having one member of which may be installed at the lower end of an oil well production tubing with connections to an electrical cable from the surface and the other member attached to a removable artificial lift pump to thereby furnish electrical power and signals to the pump and which further permits removal of the pump without disturbing the electrical cable.

Still a further object of the present invention is to provide an electrical connector for a removable oil well pump which is compatible with the use of standard storm chokes and with downhole service tool activities.

SUMMARY OF THE INVENTION

A direct contact type of electrical connector is provided having a first and second member. One of the members includes a generally open ended shell or housing having at least one electrical contact member therein. The second number has a like member of contacts structured to mate with the contact in the first member when the two members are brought into coaxial engagement. The shell of the one member is first filled with a dielectric viscous material which completely protects the contacts in the one member from the environment and upon engagement of the connector members is partially extruded from the first member and simultaneously purges the environment from the contact area of the second member. Thus, a very mechanically simple connector is provided for making electrical connection in environments such as salt water and oil and the like.

This arrangement further permits a plurality of contacts to be axially disposed within the mated connector members which has the advantage of maximizing the number of circuits which may be connected within a particular space requirement such as the diameter of an oil well casing. There may be provided a central post depending from within the shell or housing of the one member for engaging a mating element of the other connector member to thereby provide a mechanically simple and reliable means for guiding the two members into engagement.

As described and claimed the connector is particularly suitable for oil well applications in which a submergible pump is disposed within an oil well production tubing. One of the members such as the open end shell may be attached to the lower end of the pump and the other member permanently mounted at the lower

end of production tubing. The pump may then be lowered within the well until the electrical connection is made which is accomplished without special indexing, automatically, and reliably. The second member may be configured with a passageway therethrough so that when the pump is removed standard oil well servicing tools may be passed through the permanently attached connectors to positions below the production tubing.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram representing an example of a first of two members of an electrical connector constructed in accordance with the principles of the present invention;

FIG. 2 is a diagram representing the second of two members of an electrical connector for engagement with the first member shown in FIG. 1 and constructed in accordance with the principles of the present invention;

FIG. 3 is a diagram showing the first and second electrical connector members of FIGS. 1 and 2 in an engaged relationship;

FIG. 4 is another embodiment of the connector member shown in FIG. 3 which is particularly suited to subsea bulkhead applications; and

FIG. 5*a* and 5*b* show an alternative embodiment of the electrical connector shown in FIGS. 1 – 3 which is particularly suited for submergible oil pumps.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing in which like characters refer to like parts, and particularly to FIGS. 1 – 3, there is shown an electrical connector consisting of a first member **10** (FIG. 1) and a second member **11** (FIG 2). By way of example, the connector will be described as might be used in association with an artificial lift pump in an oil well casing. The first connector member is attached to the lower end of an artificial lift pump, a portion of which is indicated at **12.** The first connector member **10** includes a cylindrical housing **13** closed at one end **14** and opened at the lower or other end **15.** The cylindrical housing **13** may be of any material found suitable for specific environmental applications. Within the housing **13** and considered a part thereof is a housing liner **16** composed of non-conducting material such as plastic. The shell or housing **13** and liner **16** may, of course, be combined as a single structure of non-conducting material. For purposes of discussion, these two members may be referred to collectively as the housing. Within the housing **13** there is a central post **17** which depends from the closed end **14** of the housing **13** and extends coaxially therefrom toward the other end **15** of the housing **13.**

As shown in this embodiment, the central post **17** extends through the closed end **14** of the housing **13** for attachment to the pump **12** as by welding, thereby providing a means for attaching the first connector member **10** to the pump **12.** In some applications it is particularly useful to provide a tubular central post so as to provide a passageway **18** extending from an entrance end **20** of the central post **17** to an exit end **21** thereof where there is provided exit ports **22.** The advantages of such a configuration will become apparent as this discussion is further developed.

The first connector member **10** further includes within housing **13** one or more electrical contacts **23***a*, **23***b*, **23***c* which preferably are constructed in a substantially tubular form and have resilient characteristics such that the contacts will each be self biasing against a mating contact member. One means to do this is to provide slots in the contact material to form finger-like portions as shown in FIG. **1.** Each of these contacts is connected to an electrical conductor **26***a*, **26***b*, **26***c* which are each embedded in the insulating lining **16** of housing **13** and are carried by cable **27** into the pump **12.** As shown in FIG. **1,** the first connector member **10** includes provision for three separate electrical circuits which in accordance with the principles of this invention may be expanded or contracted to meet the needs of the specific applications, thus both single and multiple phase electrical power connections may be utilized as well as providing circuits for low voltage electrical signals. Such circuits may be added or deleted without increasing the diameter of the connector which is especially advantageous in such applications as oil wells where the diameter of the well casing is a strict limitation upon the design.

FIGS. **2** and **3** each show the second connector member **11** mounted within an oil well which includes a well casing **30.** A well liner or production tubing **31** is supported from the wellhead assembly structure near the surface of the well. The second connector member **11** is attached to the production tubing as at **32** which by way of example is a weld joint. An electrical cable **33** eminates from the wellhead assembly or other remote location and may be secured to the production tubing **31** by a clamp and cable guard **34.**

The second connector member **11** includes a tubular element **35** having several functions. The internal conduit **36** serves as a guide to bring the two members **10, 11** together. The central post **17** of the first connector member **10** is slidably received within the tubular element **35** of the second connector member **11.** To assist the alignment of the connector members, the upper end **37** of the tubular element may be beveled.

The tubular element **35** (FIG. **2**) also serves as a means to mount one or a plurality of electrical contacts **38***a*, **38***b*, **38***c* which in this example of the invention are in the form of flat rings that extend around the tubular element **35,** and when the two connector members are engaged the electrical contacts **23***a*, **23***b*, **23***c* of the first connector member and the ring contacts **38***a*, *38b*, **38***c* of the second connector member are biased into contact (FIG. **3**). In this example of the invention, the tubular member **35** is made of an insulator and the electrical leads **39***a*, **39***b*, **39***c* are embedded in the insulation; each lead is connected to or is an extension of the leads in the electrical cable **33.**

When the lower end **40** of the tubular member **35** is open as shown in FIG. **2,** it serves, in combination with the passageway **18** of the first connector member **10** of FIG. **1,** as a flow path (FIG. **3**) for oil to reach the pump intake ports (not shown) and subsequent pumping of the oil to the surface.

In application, and as used in an oil well, the second connector member **11** is affixed to the lower end of the production tubing. The first connector member is affixed to the pump. Prior to submerging the pump, the interior chamber of the first connector member **10** is completely filled with a dielectric fluid which is prefer-

ably sufficiently viscous to remain within the connector member regardless of its orientation.

As the pump and first connector are lowered into engagement with the second connector member, the dielectric fluid forces any foreign matter such as salt water from the area of the second connector contact. Drain openings **41** are provided in the second member **11** (FIGS. **2** and **3**) to allow expulsion of the salt water, and the like and to allow sand to settle downward after the pump operation is stopped, thereby preventing sand-locking of the movable connector member. The openings may be annular shaped with supporting webbs to thereby maximize the area of passage. As the two connector members are brought into full engagement, some dielectric material **19** (FIG. **3**) is forced out leaving the mated contacts in clear engagement and the cavities within the engaged connector fully protected from the environment (FIG. **3**). In this manner, protection is readily provided to prevent any shorting of the electrical circuits. The combination dielectric fluid or grease and the axial spacing of the contacts is especially useful for high power/high voltage circuits.

If further assurance for protecting the contacts from environmental conditions is desired, seals may be included. The first connector member **10** (FIG. **1**) is shown to include an upper seal **42** and a lower seal **43** which engage the seal shoulder **44** and the upper end **37** of tubular element **35** (FIG. **2**), respectively. These seals effectively provide a closed chamber containing the engaged contacts and dielectric material (FIG. **3**).

A connector as described may include a plurality of contacts for providing high voltage single or multiple phase power to the pump and for low voltage data and control signals. Such a plurality of contacts may be achieved in situations that limit the diameter of the connector; an oil well casing is a prime example. Although an oil well will usually dictate that the diameter of each contact be the same, there may be applications for which the contacts may have differing diameters.

Turning now to FIG. **4**, an alternative embodiment of the second connector member of FIG. **2** is shown. This embodiment would be suitable for making an electrical connection through a subsea bulkhead and the like. The tubular element **35** and the ring contacts **38***a*, **38***b*, **38***c* are constructed in the same manner as heretofore described. However, the internal conduit **36** of tubular element **35** has a closed upper end **40** which may further be conically shaped to assist in aligning the two connector members. The supporting structure **29** may be sealingly attached to a bulkhead or may be made an integral part thereof as by forming a hole in the bulkhead to receive the supporting structure **29** and mounting the support structure therein. Since flow-through capability is not required as in oil wells, the movable connector need not include the depending central post **17** of FIG. **1**. It can also be readily understood that tubular element **35** may be constructed as a solid element rather than tubular when flow-through is not required, thus upstanding ring-contact support element **35** may be either tubular or solid.

As here shown, tubular element **35** is of insulating material, thus the ring contacts **38***a*, **38***b*, **38***c* are each embedded therein and are directed through the supporting structure **29** for connection with an electrical circuit interior of the bulkhead.

Drawings **5A** and **5B**, when considered together, constitute an alternative embodiment of the electrical connector of FIGS. **1 – 3**, and is shown only in the engaged position similar to that of FIG. **3**. As in the foregoing figures, the connector is shown within an oil well casing **30** into which there is inserted a well liner **31** to which the second connector member is attached (FIG. **5B**). At the upper portion of FIG. **5A** there is a portion of an artificial lift pump **12**. The pump **12** and the connector may be attached by a stud and bolt arrangement **50** which facilitates rapid changes of pumps in the field. A collar **52** engages the central post **17** in a press fit and mates to the pump portion **12** where an O-ring seal **53** is provided. The housing **13** is welded to the collar **52**, both of which are metal to provide protective structural integrity.

The housing liner **16**, an insulator such as plastic, is formed with one or more longitudinal slots which receive the electrical conductors **26***a*, **26***b*, **26***c* and is further formed with an assembly cavity for each electrical contacts, shown at **53***a*, **53***b*, **53***c*, each in communication with a longitudinal slot thereby facilitating the attachment of the electrical conductors **26***a* – **26***c* to the tubular electrical contacts **23***a* – **23***b* each of which may be clipped into one of the assembly cavities **53***a* – **53***c*. The conductors and contacts are then potted in place by well known techniques thereby filling the assembly cavities and slots. Each conductor **26***a* – **26***c* passes through the collar **52** via an opening **54** and is potted in place by potting material indicated by numeral **55**.

Referring now to the second conductor member **10**, the supporting structure **29** is generally cylindrical in shape and includes a circumferential attachment area **56** which provides means for attaching the second connector member **10** to the well liner **31** as by threaded engagement or other fastening means.

The tubular element **35** of the second connector member is preferably of an insulator material and carries the ring-contacts **38***a* – **38***c* as in FIGS. **1 – 4**. In the embodiment of FIGS. **5A** and **5B**, the tubular element **35** further includes a metallic insert **57** and includes a metallic guide element **58** at the upper end which is generally funnel shaped to guide the central post **17** of the first connector member into proper axial alignment with the second connector member; both metallic pieces serve to provide durability in services.

For purposes of assembly, the diameter of internal conduit **36** is enlarged at one lower portion **60** by using an off-center bore operation and still a larger diameter at a second lower portion **61** which enables the attachment of each of the conductors **39***a* – **39***c* to their respective ring-contacts **38***a* – **38***c* and to one pin of a cable connector **62**. A mating cable connector **63** serves to terminate the electrical cable **33** and provide a cable disconnect. The conductors **39***a* – **39***c* are then embedded in a potting compound **59**. During the potting operation, a forming tool may be used to preserve and define the continuity of the internal passageway of conduit **36** through to the bottom of the second connector member.

In operation, the pump draws oil, and other matter, from below the second connector member (FIG. **5B**) through the annulus defined by the well casing and the second connector supporting structure **29**, then through one or more openings **64** in the well-liner **31** as indicated by arrows **65** and into the annulus defined by the internal diameter of the well-liner **31** and the housing **13** of the first connector member. The fluid is then admitted through ports in the pump (not shown).

Adjacent the well-liner openings **64**, the supporting structure of the second connector member includes a conical surface **66** which serves to prevent the build-up of sand and other particles when the pump is not operating.

As heretofore discussed, a dry, clean electrical contact is assured by the use of a viscous dielectric material **19** carried by the first connector member which purges the contact areas during the engagement of the two connector members **10, 11.** One or more expulsion openings **67** may be provided at the abuttment of the first member housing **13** onto the second members supporting structure **29.** These allow complete expulsion of excess dielectric material during the engaging process, allow for thermal expansion of the dielectric, and allow for changes in differential pressures.

A flexible wiper seal **70** may be included in applications wherein there is believed to be a danger of washing-out the dielectric material **19.** In the right hand portion of FIG. **5B**, the wiper seal **70** is shown as it would appear when the connector members **10, 11** are fully engaged. The left hand side of FIG. **5B** shows the wiper-seal in three positions **70***a*, **70***b*, **70***c* indicating its operation as the two connector members are moved toward engagement. Position **70***a* is prior to contact with the seal shoulder and seat **44.** The seal is generally in the form of a hollow truncated cone with the small diameter thereof selected to be larger than the outer diameter of the tubular element **35** and less than the largest diameter of the seal seat **44.** Thus, the seal **70** permits the dielectric above the seal to expand and contract without interfacing with foreign fluids, such as the oil being pumped, which may tend to wash away the dielectric material thereby endangering the security provided the electrical contacts.

There has been described various embodiments of the present invention which provides for the connection of electrical circuits in a hostile environment. Furthermore, connection is accomplished by axial force alone and is particularly suitable for remote operation applications. The connector is self-aligning, self-purging, is not affected by thermal or fluid pressure forces, is capable of swivel connection, and neither connector member has movable parts. The present invention also is permissive of providing an electrical connector for oil wells having at least one member stationary within the well and which is compatible with standard servicing tools and safety devices. Finally, the connector can accommodate a plurality of circuits without increasing the diameter of the connector, and, thus can accommodate alternating or direct current, single or multiple phase networks, and multiple circuits for various ranges of voltage and current.

What is claimed is:

1. An electrical connector comprising:

a. a first member having a tubular housing open at one end thereof;

b. a plurality of tubular electrical contacts mounted to said housing and axially spaced within said housing of said first member, thus forming annular cavities between said contacts, each of said tubular contacts having an engaging portion radially spaced inwardly from the inner walls of said first member;

c. a second member having an upstanding element having an outer surface substantially conforming in shape to the internal configuration of said plurality of contacts of said first member, the upstanding element of said second member and the tubular housing of said first member forming an annular cavity therebetween and extending to said one end of said first member when said members are in mating relationship;

d. each of said tubular contacts of said first member further having an axial passageway from the annular cavity above said tubular contact to the annular cavity below said tubular contact when said first and said second members are in mating relationship; and

e. a like plurality of ring-contacts mounted on and axially spaced along said upstanding element of said second member and each said ring-contact disposed to mate with one of said plurality of tubular contacts of said first member whereby the first and second members are brought into engagement to form a like plurality of electrical circuit connections whereby a viscous dielectric material placed in said first member will be partially extruded therefrom thereby purging and protecting said circuit connections from hostile environmental elements.

2. The electrical connector of claim **1** further comprising a viscous dielectric material substantially filling the interior of said first member characterized by a viscousity permissive of retention within said housing irrespective of the connector orientation and of the hostile environment and further permissive of sufficient extrusion from said housing to effect mating of said first and second members thereby to purge the contacts of the hostile environment upon mating of said members.

3. The electrical connector of claim **1** further comprising:

a. a central post depending axially from within said housing and radially spaced inwardly from each of said plurality of tubular contacts, and wherein;

b. said upstanding element of said second member is tubular and is characterized by an internal passage shaped for slideably receiving said central post of said first member.

4. The electrical connector of claim **3** wherein said second member further comprises:

a. a supporting structure affixed to the lower end of said upstanding element and extending radially therefrom, said structure being characterized by a portion thereof having an outer perimeter permissive of attachment to the end of a selected oil well production tubing member, and

b. means providing an electrical path from each of said like plurality of ring-contacts through said upstanding element and said supporting structure, whereby connection may be made to an electrical cable.

5. The electrical connector of claim **4** wherein said first member includes:

a. means for attaching the closed end of said housing to the lower end of an artificial lift pump such as are used in oil wells, and further comprising;

b. means forming an electrical path from each of said plurality of tubular contacts to selected connections in the artificial lift pump from which said first member depends.

6. The electrical connector of claim **5** wherein said central post of said first member is further characterized by:

a. a passageway formed therein and having at least one port in the lower end thereof and having at least one other port near the base of said post which exits proximate the exterior of the closed end of said housing; and wherein said second member is further characterized by;

b. said upstanding element of said second member having an entrance port at said one end thereof whereby fluid from the well may pass internally through said upstanding member and said central cylindrical post to a zone proximate the pump.

7. The electrical connector of claim **4** wherein the internal diameter of said upstanding element of said second member is further selected to accommodate the passing therethrough of oil well servicing tools.

8. The electrical connector of claim **4** further comprising;

one portion of a cable connector mounted in electrical communication with the exterior of said supporting structure and having each said electrical path terminably affixed to a contact element in said one portion of the cable connector, whereby said second connector member may be provided with a remote electrical circuit through a mating portion of a cable connector.

9. The electrical connector of claim **3** wherein said upstanding element of said second member is further characterized by a generally funnel shaped interior entrance to receive said central post and thereby guide said central post into coaxial alignment with said upstanding element.

10. The electrical connector of claim **3** wherein said upstanding element further comprises a tubular insert forming a liner within said upstanding element and extending throughout an axial length thereof which at least corresponds to the axial length traversed by said central post of said first connector member when said connector members are engaged, said tubular insert being comprised of a material to provide protection to the structural integrity of said upstanding element.

11. The electrical connector of claim **1** further comprising:

a seal-seat circumferentially adjoining said tubular element of said second connector member;

a resilient tubular sealing element affixed to said housing proximate the open end thereof, and having internal cross-sectional dimensions greater than the outer cross-sectional dimensions of said tubular element and less than the outer-cross-sectional dimensions of said seal seat, said seal-seat having an axial position selected to bring said sealing element and said seal-seat into engagement when said like plurality of electrical circuit connections are made.

12. The electrical connector of claim **11** wherein said resilient tubular sealing element is characterized by a form substantially in the shape of a hollow truncated cone having its base affixed to the internal wall of said housing of said first connector member and extending away from the closed end of said first connector member.

13. The electrical connector of claim **1** wherein said housing of said first connector member is further characterized by an outer shell comprised of material selected to provide protection to the structural integrity of said housing.

14. The electrical connector of claim **1** wherein:

a. said upstanding element of said second member being further characterized by a substantially conical upper end, and said second member further comprising;

b. a supporting structure, said upstanding element extending outwardly therefrom, and

c. means providing an electrical path from each of said like plurality of ring-contacts through said element and said supporting structure thereby providing a bulkhead type second connector member.

15. An electrical connector for an oil well electrically powered artificial lift pump having a first connector member attachable to the pump and a second connector member attachable to the lower end of the production tubing within the well, the connector comprising:

a. a first connector member having a cylindrical outer shell;

b. a dielectric tubular liner within said shell;

c. closure means for closing the upper end of said shell;

d. means associated with the closed end of said shell for attaching said first connector member to the pump;

e. a cylindrical central post coaxially depending from said closed end and protruding from within said shell;

f. a plurality of tubular electrical contacts spaced coaxially from one another and affixed to the interior of said dielectric liner, each said tubular contact having an engaging portion radially spaced inwardly from the inner walls of said dielectric tubular lines;

g. a like plurality of electrical conductors each attached to one of said plurality of tubular contacts and each terminating exteriorly of said shell for connection to circuits in the pump;

h. a second connector member having a substantially cylindrical elongated supporting structure characterized by a portion thereof having means for attaching said supporting structure to the production tubing;

i. a cylindrical tubular metallic insert upstanding from the upper end of said supporting structure, and coaxially aligned to mate with said central post of said first member, and characterized by an enlarged internal diameter at the upper end thereof, said supporting structure being further characterized by a longitudinal passageway therethrough aligned with the interior of said insert to thereby form a flow path from the top of the insert to the region below said supporting structure;

j. a layer of dielectric material extending substantially along the exterior of said insert;

k. a like plurality of electrical ring contacts axially spaced along said layer of dielectric material to mate with said tubular contacts of said first member, said dielectric tubular liner of said first member and said layer of dielectric material forming an annular cavity therebetween and extending to the open end of said first connector member when in a mating relationship, each said tubular contacts of said first member further having an axial passageway thereby when in a mating relationship; and

l. a like plurality of electrical conductors each attached to one of said ring-contacts and terminating exteriorally of said supporting structure for connection to an electrical cable extending from the

wall surface to said second connector member, whereby a pump having said first connector member may be lowered into the well and automatically make electrical connection with circuits connected through said second connector member.

16. The electrical connector of claim 14 further comprising a viscous dielectric material substantially filling the interior, the interior of said first connector member prior to engagement of said connector members and characterized by a viscosity permissive of self-retention therein and further permissive of sufficient extrusion from said first connector member to effect mating of said first and second members.

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