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ELECTRIC HEATER ASSEMBLY

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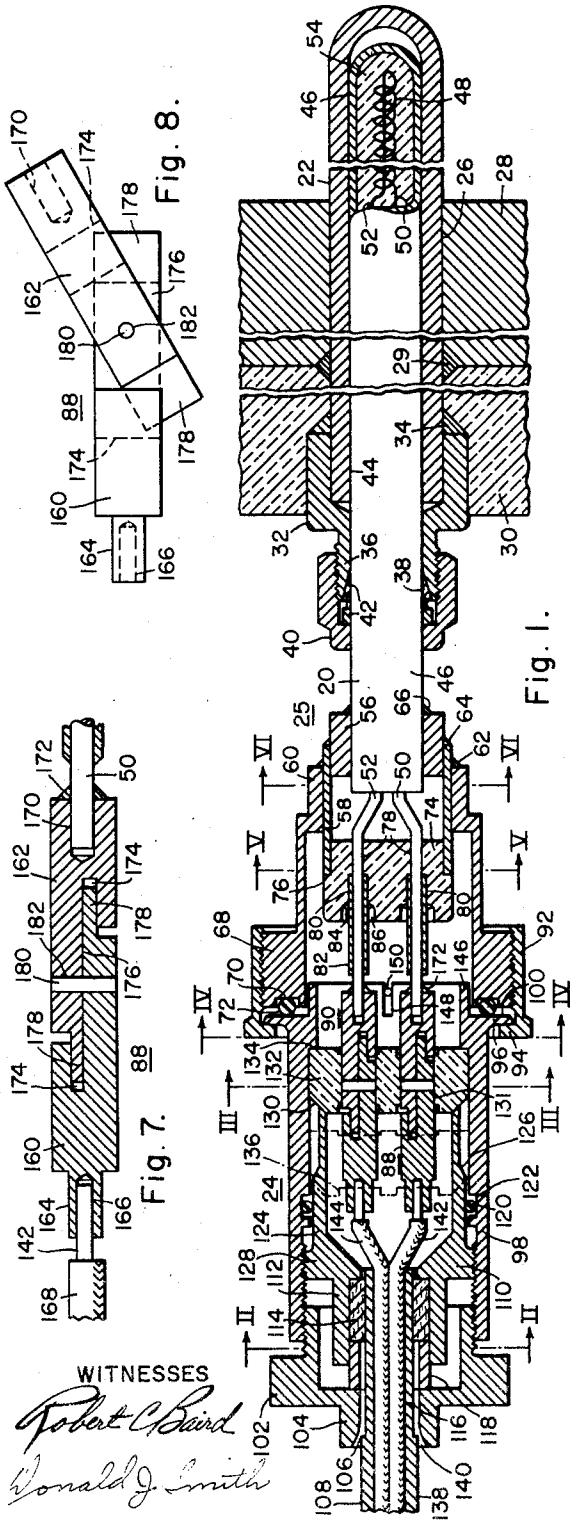


Fig. 1.

Fig. 8.

Fig. 7.

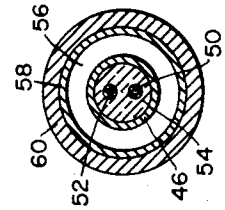


Fig. 6.

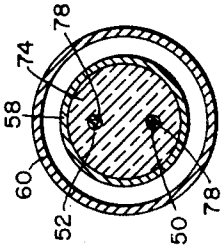


Fig. 5.

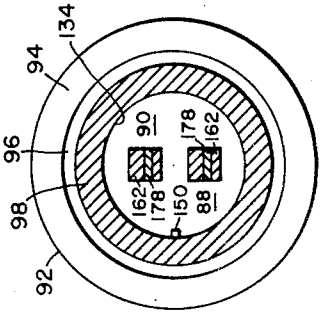


Fig. 4.

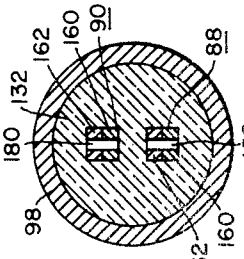


Fig. 3.

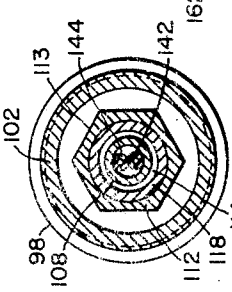


Fig. 2.

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ELECTRIC HEATER ASSEMBLY

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16 Claims. (Cl. 219—38)

The present invention relates to a replaceable electric heater assembly and more particularly to means for sealing the same and for detachably coupling the electrical contacts thereof.

There are many applications wherein it is necessary to provide a sealed vessel or other container with a suitable heating means in order to increase or maintain the temperature of the material contained within the vessel. In the case of sealed or pressurized vessels, it is frequently desirable to remove the heating elements for repair or replacement without opening the vessel. Consequently, such heating elements are frequently inserted into the interior of the vessel through suitably formed apertures in the wall of the vessel.

Prior heating elements of the character described frequently had to be sealed within the vessel by means of brazing or welding to prevent leakage and thus could not be readily removed from the vessel wall in the event of leakage or other failure of the heating element. In the event of failure of the heating element, the material contained within the vessel frequently was contaminated with insulating material or other components associated with the heating element. The difficulty or sometimes the impossibility of removing and replacing prior heating elements of this nature from the vessel wall compelled their operation at a relatively low wattage density in order to minimize burnouts or other failures in the heating elements and to furnish an acceptable heater life. These prior heating elements often suffered from the additional disadvantage that in many cases no adequate means was provided for preventing escape of pressurized and frequently hazardous fluids from the vessel by way of the heater in the event of failure thereof. Prior heating elements have not been provided with adequate means for sealing the electrical connections thereof for use in corrosive atmospheres or against the release of such pressurized fluids and at the same time for providing quick detachability of the connections. Therefore in those heaters which were adapted for removability, considerable time was expended in attaching and detaching the electrical contacts thereof with the source of electrical operating potential.

In contemplation of the foregoing discussion, it is an object of the invention to provide a novel and efficient replaceable heating element.

Other objects of the invention are to provide novel means for sealing a replaceable heating element and for preventing leakage of the vessel contents in the event of failure of the heating element.

A further object of the invention is to provide a novel arrangement for quickly and efficiently inserting and removing a heating element relative to the wall of a sealed vessel.

Still other objects of the invention are to provide means for quickly coupling and decoupling the electrical contacts of said heating element relative to a source of

operating potential and for conveniently providing a fluid tight housing for said means.

A further object of the invention is to provide an efficient and readily replaceable sealed heating element in combination with means for reentrantly inserting the element through a wall of a vessel.

These and other objects, features and advantages of the invention will be elaborated upon in greater detail during the ensuing description of illustrative forms of the invention, with the description being taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a longitudinal sectional view of a replaceable heating element and coupling therefor constructed in accordance with the invention and shown in connection with reentrant means for inserting the heating element through the wall of a sealed vessel;

Fig. 2 is a cross-sectional view of the coupling means of Fig. 1, which view is taken along reference lines II—II of Fig. 1;

Fig. 3 is a cross-sectional view of the coupling means of Fig. 1, with the view being taken along reference lines III—III thereof;

Fig. 4 is still another cross-sectional view of the coupling means of Fig. 1, which view is taken along reference lines IV—IV of Fig. 1;

Fig. 5 is another cross-sectional view taken along lines V—V of the coupling means of Fig. 1;

Fig. 6 is still another cross-sectional view of Fig. 1 taken along lines VI—VI thereof;

Fig. 7 is an enlarged longitudinal sectional view of one of the detachable electrical contacts of Fig. 1; and

Fig. 8 is a top plan view of the detachable electrical contact of Fig. 7 shown herein in a position prior to joining the components thereof.

According to the invention, a hermetically sealed heating element is adapted for insertion into a hermetically sealed reentrant thimble therefor and means are provided for sealing the thimble to the wall of a sealed vessel and for detachably sealing the thimble to the hermetically sealed casing of the replaceable heating element. Additional means are provided for imparting a quick-detachable feature to a means for electrically coupling the heating element to a source of operating potential therefor and for detachbly sealing a housing surrounding the electrical coupling to the casing of the hermetically sealed heating element. With this arrangement of the invention the electrical contacts of the heating element are positively coupled to the source of operating potential but nevertheless are readily detachable to permit removal or replacement of the hermetically sealed heating element. When in its operating position, the replaceable heating element, the aforesaid reentrant thimble, and the sealed detachable electrical coupling are completely sealed to form an integral enclosure comprising these components so that in the event of a leak or failure in the reentrant thimble or of a double leak or failure in the reentrant thimble and in the hermetically sealed heating element inserted therein, escape of fluid, through the heating element or the reentrant thimble from a pressurized vessel in which the replaceable heating elements are employed is prevented.

Referring now more particularly to the drawings, the exemplary form of the invention illustrated therein comprises a hermetically sealed replaceable heating element 20 including an end sealing arrangement 25, a reentrant thimble 22, and a sealed casing 24 for enclosing a detachable electrical coupling. The reentrant thimble 22 extends through a channel 26 formed in the wall 28 of a sealed vessel and extends through suitable thermal insulation 30, if such material is employed. The reentrant thimble is secured against longitudinal movement in the channel 26 and is rigidly secured to the wall 28 of

the vessel by means of an annular sealing weld 29. Adjacent the outward end of the reentrant thimble 22, a cup-shaped sealing cap 32 is inserted thereover and is secured to the exterior surface of the reentrant thimble by an annular sealing weld 34. To the outer end of the sealing cap 32 an outwardly extending tubular projection 36 is secured or is formed integrally therewith. The projection 36 is threaded exteriorly and is provided with an interiorly disposed conical surface 38 for purposes presently to be explained. A cup-shaped sealing member 40 is threadedly engaged with the tubular extension 36 of the sealing cap 32 and suitable sealing means is inserted between the member 40 and the projection 36 for sealing the outward end of the reentrant thimble 22 and associated components thereof to the hermetically sealed replaceable heating element 20. One form of such sealing means includes a pair of wedge-shaped annular sealing rings 42 whose surfaces adjacent the tapered portions thereof tightly engage the heating element 20 in a known manner upon tightening down the cup-shaped member 40. The sealing rings 42 are preferably fabricated from a metal such as stainless steel in order to provide a rigid metal-to-metal fluid tight seal between the reentrant thimble assembly 22 and the heating element 20.

The replaceable heating element 20 is adapted for insertion into the central channel 44 of the reentrant thimble assembly 22 and therefore the heating element comprises an elongated cylindrical casing member 46 extending substantially along the interior length of the reentrant thimble assembly 22 and protruding a short distance outwardly therefrom. Positioned within the casing member 46 in order to lie interiorly of the wall 28 of the vessel is a heating coil 48 coupled by means of conductors 50 and 52 to the sealed casing arrangement 24, which is presently to be described in greater detail. The heating coil 48 and the conductors 50 and 52 are embedded in suitable electrically insulating material 54 which, when used in conjunction with a high temperature sealed vessel, is formed from a ceramic material such as magnesium oxide or aluminum oxide. The insulating material 54 extends along substantially the entire interior length of the casing 46.

The outward end of the casing 46 is provided with means sealed thereto for enclosing and hermetically sealing the conductors 50 and 52 at points adjacent to their emergence from the casing member 46. In this example of the invention the hermetically sealing means comprises a relatively short annular sleeve member 56, a relatively thinner connecting sleeve 58 and the coupling member 60. The annular member, the connecting sleeve and the coupling member are in turn inserted and hermetically sealed one to another, and the annular member is hermetically sealed to the sealed casing 46 of the heating element 20, as by the annular sealing welds 62, 64, and 66 respectively. The coupling member 60 is provided with a radially projecting portion 68, the outward surface of which is threaded for the purpose of engaging the sealed casing structure 24, presently to be described. The radial projection 68 further is provided with a groove 70 formed on the end surface of the radial projection for receiving a resilient O-ring 72 to aid in sealing the casing 24 in a manner to be elaborated upon in greater detail.

A ceramic insulating member 74, in this example fabricated from aluminum oxide, is partially inserted into the intermediate sleeve 58 and positioned thereat by means of an annular shoulder 76 formed on the outer periphery of the insulating member 74. The insulating member is hermetically sealed to the sleeve 58 and a pair of apertures 78 are formed in the insulating member 74, through which apertures the conductors 50 and 52 extend respectively. Each of the apertures 78 is provided with an intermediately disposed widened portion 80 into which portions a pair of metallic sleeves 82 are inserted individually. The metallic sleeves 82 are fabricated desirably from nickel and thus are adapted to be hermetically sealed to the insulating member 74 by means of portions 84 of silver brazing material fused into the recesses 86 provided in the ceramic insulating member 74 and individually surrounding the metallic sleeves 82 when inserted in the aforesaid apertures 78. The metallic sleeves 82 preferably are hermetically sealed to the ceramic insulating member prior to assembly thereof to the heating element 22 with the result that upon inserting the insulating member into the inner sleeve 58 and the conductors 50 and 52 through the apertures of the insulating member, the latter can be conveniently and hermetically sealed to the conductors 50 and 52 simply by brazing or soldering the nickel sleeves 82 to the conductors 50 and 52, respectively.

The sealed casing 24, which is presently to be described and which encloses a pair of detachable electrical contacts indicated generally by the reference characters 88 and 90, is sealed to the radially extending portion 68 of the coupling member 60 by means of a coupling nut 92 threadedly engaged therewith. The coupling nut 92 is provided with an inwardly extending flange 94 which engages a complementary, outwardly extending flange 96 of an outer cylindrical casing section or housing 98 of the sealed casing 24. The end surface 100 of the housing flange 96 is machined for sealing engagement thereof with the sealing O-ring 72. Adjacent the other end of the housing 98 the interior portion thereof is threaded for engagement with an exteriorly threaded cable sealing nut 102. The latter part is provided with a tubular extension 104 having a central opening of sufficient diameter to permit the passage of a shoulder 106, which in this case is formed on the outer surface of a desirably resilient, impervious, electric cable sheath 108, for purposes presently to be exemplified.

Mounted coaxially within the housing section 98 is a generally cylindrical sealing member 110 which is provided with a reduced tubular extension 112. Inserted into the tubular extension 112 is a resilient sealing ring 114 arranged to fit relatively closely with the interior of the tubular extension 112 and with the exterior surface of a reduced portion 116 formed upon the cable sheath 108. An annular compressional member 118 is positioned between the sealing ring 114 and the inward extremity of the tubular extension 104 of the cable sealing nut 102 and is further arranged to fit relatively closely within the tubular extension 112 of the sealing member 110. Accordingly, upon tightening the cable sealing nut 102 the abutting engagement thereof with the compressive ring 118 compresses the sealing ring 114 to form a seal between the impervious cable sheath 108 and the inner sealing member 110, in order to seal the housing 24 and associated components thereof to the electric cable.

The sealing member 110 is in turn sealed to the housing 98 through the intervention of a sealing O-ring 120 disposed in an annular groove 122 formed in the inner surface of the housing 98. When positioned in this manner the O-ring 120 is adapted for sealing engagement with a thickened portion 124 of the wall of the sealing member 110. The aforesaid wall is necked down gradually, as indicated by the reference character 126, to form an inclined or camming surface thereof in order to facilitate engagement of the thickened wall portion 124 with the sealing O-ring 120. Engagement of the aforesaid thickened wall portion is affected by threading the sealing member 110 into the housing 98. In furtherance of this purpose the sealing member 110 is further provided with an annular shoulder 128, the radial, outward periphery of which is threaded for engagement with the interior threaded portion of the housing 98. Moreover, the tubular extension 112 of the sealing member 110 is provided with an outward hexagonal configuration 113, as better shown in Fig. 2 of the drawings, or some other wrenching surface, for use in conjunction with a suitable

tool for threading and adjusting the sealing member **110** relative to the housing **98**.

The other end of the cylindrical sealing member **110** is beveled inwardly for engagement with a complementarily disposed beveled portion **130** formed upon an electrical insulator **132**, through suitable apertures **131** of which the elongated detachable electrical contacts **88** and **90** extend. The contacts are slidably mounted relative to the aforesaid aperture for purposes hereinafter explained more fully. The insulator **132** is slidably mounted relative to the interior surface of the housing **98** but is positioned longitudinally thereof by engagement with the beveled end of the sealing member **110** and with an inwardly extending annular shoulder **134** disposed on the inward surface of the housing **98** adjacent the flanged end thereof. The beveled end portion of the sealing member **110** serves the additional function of preventing distortion thereof upon engagement of the thickened wall portion **124** of the sealing member **110** with the sealing O-ring **120**.

The detachable electrical contacts **88** and **90**, for purposes of the invention, can each be provided in form of a severable pair of electrical contacting members which are maintained in alignment and consequently in electrical contact therebetween by insertion of each pair of contacting members, when engaged, through an associated one of the aforesaid apertures **131** in the insulator **132**. When thus positioned, suitable means are provided for securing the components of each of the electrical contacts **88** and **90**, which means can be provided in the form of that presently to be described or in the form of any known means adaptable for this purpose. The insulator **132** and the associated housing **98** are then moved to a position relative to the contacts **88** and **90** whereat the aforesaid joining means is enclosed within the apertures **131** of the insulator in order to positively prevent disengagement of the electrical contacts **88** and **90** during operation of the heating element.

When it is desired to disengage the electrical contacts **88** and **90** and to disengage the casing structure **24** from the hermetically sealed casing **25** associated with the end of the heating element casing **46**, in a manner presently to be described, means are provided for exactly positioning the insulator **132** at a position indicated by the dashed lines **136** whereat the means coupling each of the detachable electrical contacts **88** and **90** is exposed for convenient removal thereof. At this position of the insulator a portion of each of the electrical contacts is still inserted within the respective apertures **131** of the insulator in order that convenient reassembly of the casing **24**, the hermetic sealing arrangement **25** and the electrical contacts **88** and **90** conveniently can be made. The partial insertion of each of the contacts, of course, serves as a means for guiding the contacts through the apertures **131** during movement of the insulator **132** and the casing **24** relative to the detachable contacts **88** and **90**.

One arrangement for so positioning the insulator **132** relative to the electrical contacts includes the employment of the aforesaid cable casing shoulder **106** to limit the outward or leftward movement of the casing **24** relative to an electrical cable **138**, which is secured to the electrical contacts **88** and **90** in a manner presently to be described. In furtherance of this purpose, a channel **140** extending coaxially through the tubular extension **104** of the cable sealing nut **102** and through the compressional ring **118** is provided for sufficient diameter to permit passage of the aforesaid cable casing shoulder **106**. Therefore, upon loosening the cable sealing nut **102** and disengaging the coupling nut **92**, and release of the compressive stress imparted to the resilient sealing ring **114**, the sealing ring is then free to move along the reduced portion **116** of the cable casing **108** until the outward side of the sealing ring engages the cable casing shoulder **106**. At this latter position of engagement, the

insulator **132** has been moved relative to the contacts **88** and **90** to the position indicated by the dashed lines **136** by engagement of the housing ribs **134** therewith and by unitary movement of the casing **24** to the left as aforesaid. When the sealed casing **24** is withdrawn in this fashion, the mechanical connection of the cable conductors **142** and **144** with the heater conductors **50** and **52**, respectively, by means of the as yet undetached electrical contacts **88** and **90** maintains the latter of course in the same position relative to the heating element **20** and the electric cable **138**.

Upon recoupling the housing **98** to the coupling member **60**, a coaxially extending, tubular projection **146** secured to the flanged end of the housing **98** serves as a guide for coaxially aligning the housing **98** with the coupling member **60** secured to the hermetic heater sealing arrangement **25** in order to reassemble the coupling nut **92** thereto. The tubular housing extension **146** is provided with a slot **148** which functions in conjunction with a pin **150** mounted on the inward surface of the coupling member **60** for preventing rotation of the housing **98** relative to the coupling member **60** and consequent distortion or twisting of the contacts **88** and **90** and the conductors **142**, **144** and **50**, **52**.

As better shown in Figs. 7 and 8 of the drawings, one form of detachable electrical contact **88** or **90** arranged according to the invention and alluded to generally heretofore includes a pair of contact coupling members **160** and **162** of complementary configuration. The coupling member **160** is provided with a necked-down portion or reduced extension **164** thereof having a central recess **166** disposed substantially along the length of the extension **164**. The cable conductor **142** is inserted into the recess **166**, with a portion of the insulation **168** thereof being removed for this purpose. The extension **164** is then crimped or pressed about the end of the conductor **142** when inserted therein, in order to cause the extension **164** to frictionally engage the conductor.

The other coupling member **162** is provided with a conductor receiving recess **170** extending a short distance into the outward end of the coupling member **162**. The end of the heating element conductor **50** is inserted into the recess **170** and the latter conductor is secured to the coupling member **162**, and electrical contact therewith is ensured, by soldering or brazing the conductor **50** to the coupling member as indicated by the annularly disposed, fused material **172**. Obviously, the contact **88** or **90** can be made up of identical coupling members which both can take the form of coupling members **160** or **162**.

Each of the coupling members **160** and **162** is formed with a slot **174** and an elongated electrical contacting surface **176** and with a tab member **178** desirably adjoining the contacting surface **176** and adapted for insertion into the slot **174** of the complementary coupling member. The coupling member **160** is provided further with an upstanding pin **180** disposed substantially centrally of the contacting surface **176** and rigidly secured to the coupling member **160**. For engaging the pin **180**, the coupling member **162** is formed with an aperture **182** likewise centrally disposed relative to its aforesaid contacting surface and extending through the coupling member desirably at right angles to the contacting surface. As better shown in Fig. 8 of the drawings, the coupling member **162** is assembled relative to the coupling member **160** by disaligning the coupling member **162** relative to the member **160** and inserting the pin **180** of the coupling member **160** into the aforesaid aperture **182** of the coupling member **162**. The coupling members **160** and **162** are then pressed into engagement at their contacting surfaces **176**, respectively, and the coupling member **162** is rotated into longitudinal alignment with the coupling member **160** by pivoting the coupling member **162** about the pin **180** and thereby inserting the tab members **178** of the coupling members **160** and **162**

respectively into the associated slots **174** of the coupling members. To aid this insertion the lateral edges of the tabs **178** desirably are beveled or rounded-off slightly as shown in Fig. 4. In this manner a secure electrical joint is formed between the coupling members **160** and **162** by insertion and engagement of the associated tabs **178** thereof in the slots **174** of the complementary coupling member. Since a frictional engagement between the tabs **178** and the slots **174** is contemplated, it is evident that the leverage, which is afforded by pivoting the coupling member **162** about the pin **180**, further facilitates the insertion. When thus engaged, the coupling members **160** and **162** forming the electrical contact **88** or **90** (Figs. 1, 3 and 4) present a uniform cross-sectional configuration along substantially the entire length thereof such that the insulator **132** can be moved along the length of the contacts **88** and **90** during the operations of coupling and decoupling the sealed casing **24** relative to the hermetically sealing arrangement **25** which is secured to the heating element **20**. When the sealed casing **24** is coupled thus to the replaceable heating element **20** and its associated components as illustrated in Fig. 1 of the drawings, the insulator **132** substantially surrounds the contacting surfaces **176** of the coupling members **160** and **162** of each of the contacts **88** and **90** in order thereby to maintain longitudinal alignment of the coupling members and to prevent positively the severability thereof during operation of the heating element.

From the foregoing it will be apparent that a novel and efficient replaceable heating element has been disclosed herein. The heating element and its associated components, including the detachable electrical contacting means therefor, are all adapted for convenient sealing or pressurizing. At the same time the heating element is adapted for ready insertion or removal relative to a sealed or pressurized vessel, or the like, for replacement or repair of the element. Although the replaceable heating element can be quickly detached from its source of electrical operating potential, the element can be quickly and effectively sealed, including the electrical contacting means therefor, against the escape of pressurized, high temperature or other hazardous materials being processed within the vessel.

It will be appreciated that the embodiments of the invention exemplified in the foregoing description are presented for the purpose of illustrating the invention and therefore are not limitative in nature. Accordingly, numerous modifications of the invention will occur to those skilled in the art without departing from the spirit and scope of the invention. Moreover, it is to be understood that certain features of the invention can be utilized without a corresponding use of other features.

We claim as our invention:

1. A replaceable heating element assembly comprising a reentrant thimble extending through a vessel wall and rigidly secured and sealed thereto, an electric heating element inserted into said thimble, an impervious casing surrounding said heating element, means for detachably sealing said reentrant thimble to said casing, means for detachably and electrically connecting said heating element to a source of electric potential, and a detachable sealed housing enclosing said electrical connecting means and sealed to said casing.

2. A replaceable heating element assembly comprising a reentrant thimble extending through a vessel wall and rigidly secured and sealed thereto, an electric heating element inserted into said thimble, an impervious casing member surrounding said heating element, a pair of detachable electrical contacts for coupling said heating element to a source of electric potential, a hermetically sealed enclosure joined to said casing and to the conductors of said element, a sealed housing enclosing said contacts, and means for detachably joining and sealing said housing to said enclosure.

3. A replaceable heating element assembly comprising an electric heating element, an elongated, open-ended impervious casing member surrounding said heating element, a pair of elongated detachable electrical contacts for coupling said heating element to a source of operating potential, means joined to the open end of said casing and to the conductors of said element for sealing said casing and said conductors, a sealed housing enclosing said contacts and detachably joined and sealed to said sealing means, an electrical insulator having apertures through which said contacts are inserted, respectively, said insulator being arranged for sliding movement thereof relative to said contacts, and means for mounting said insulating member interiorly of said housing.

4. A replaceable heating element assembly comprising a heating element, an impervious casing surrounding said heating element, a pair of elongated detachable electrical contacts for coupling said heating element to a source of operating potential, said contacts each being formed from complementary coupling members, means for detachably joining said coupling members, a housing enclosing said contacts and detachably joined to said casing, an electrical insulator having apertures through which said contacts respectively are inserted, said insulator being arranged for sliding movement thereof relative to said contacts, and means for mounting said insulator interiorly of said housing at a position whereat said insulator at least partially surrounds said coupling member joining means when said housing is joined to said casing.

5. A replaceable heating element assembly comprising a heating element, an impervious casing surrounding said heating element, a pair of elongated detachable electrical contacts for coupling said heating element to a source of operating potential, said contacts each being formed from complementary coupling members, means for detachably joining said coupling members, a movable housing enclosing said contacts and detachably joined to said casing, an electrical insulator having apertures through which said contacts respectively are inserted, said insulator being arranged for sliding movement thereof relative to said contacts, means for mounting said insulator interiorly of said housing at a position whereat said insulator at least partially surrounds said coupling member joining means when said housing is joined to said casing, and means for limiting the movement of said housing and said insulator to prevent removal of said contacts from said insulator apertures when said housing is detached from said casing.

6. A detachable electric coupling arranged for electrically connecting a means for utilizing electric current to a source of potential, said coupling comprising alignable electric contacting means arranged to connect conductors of said source and said utilizing means, said contacting means being disengageable only when disposed out of alignment; a housing for enclosing said contacting means and detachably secured to said current utilizing means; an insulating member having at least one aperture extending therethrough, said contacting means being insertable in said aperture, said housing being arranged for longitudinal movement relative to said contacting means to a position whereat said insulating member maintains alignment of said contacting means by insertion thereof into said aperture; and means for mounting said insulating member interiorly of said housing.

7. In combination with an electric cable and means for utilizing electric current, at least one detachable, elongated, electrical contact arranged electrically to connect conductors of said cable and said utilizing means respectively; a housing for enclosing said contact; means for detachably securing said housing to said cable and to said utilizing means, said housing being arranged for longitudinal movement relative to said contact when detached from one of said utilizing means and said cable; an insulating member having an aperture extending there-

through, said contact being inserted loosely through said aperture and being supported therein by said insulating member; means for mounting said insulating member interiorly of said housing for movement of said insulating member with said housing; a sheath surrounding said cable, said sheath having a reduced portion adjacent the end of said cable, said reduced portion forming a shoulder on the outer surface of said cable at a position such that said shoulder limits the longitudinal movement of said housing and said insulating member to maintain at least partial insertion of said contact in said aperture.

8. A detachable electric coupling arranged for electrically connecting a means for utilizing electric current to a source of potential, said coupling comprising at least one detachable, elongated, electrical contact arranged electrically to connect conductors of said source and said utilizing means, respectively, said detachable contact including a pair of alignable complementary, pivoted coupling members and means for securing electrical contact therebetween only when pivoted to an aligned position; a housing for enclosing said contact; means for detachably securing said housing to said current utilizing means, said housing being arranged for longitudinal movement relative to said contact when detached from said utilizing means; an insulating member having an aperture extending therethrough, said contact being slidably mounted in said aperture; and means for mounting said insulating member interiorly of said housing, said housing and said insulating member being movable to a position whereat insertion of said coupling member securing means within the aperture of said insulating member prevents pivoting of said coupling members from said aligned position.

9. A detachable electric connector comprising a pair of complementary coupling members, a pivot pin secured to one of said members and inserted into a hole in the other of said members, and means for pressing said coupling members laterally into engagement when said other member is pivoted about said pin to the coupling position relative to said one member.

10. A replaceable heater assembly comprising, a pressure vessel having an opening in one wall, an elongated tubular pressure thimble inserted in said opening and having a closed inner end and an open outer end located outside said vessel, said thimble being rigidly secured and sealed to said vessel at said opening, an elongated electric heating element having an impervious tubular sheath receiving an elongated resistance heater and adapted to be received in said thimble, said resistance heater being rigidly secured in said sheath and having terminal ends projecting outwardly of the outer open ends of said sheath and said thimble, the inner end of said sheath being closed, releasable means located outside the vessel for sealing said sheath to said thimble, and means for permanently sealing the terminal ends of said resistance heater to said sheath.

11. A replaceable heating element assembly comprising a reentrant thimble extending through a vessel wall and rigidly secured and sealed thereto, an electric heating element inserted into said thimble, an impervious casing surrounding said heating element, means for detachably sealing said reentrant thimble to said casing, means for detachably and electrically connecting said heating element to a source of electric potential, a detachable sealed housing enclosing said electrical connecting means and sealed to said casing, and additional means for detachably joining and sealing said housing to a source cable.

12. A replaceable heating element assembly comprising a reentrant thimble extending through a vessel wall and rigidly secured and sealed thereto, an electric heating element inserted into said thimble, an impervious casing member surrounding said heating element, a pair of detachable electrical contacts for coupling said heating element to a source of electric potential, a hermetically sealed enclosure joined to said casing and to the conductors of said element, a sealed housing enclosing said contacts, means for detachably joining and sealing said housing to said enclosure, and additional means for detachably joining and sealing said housing to a source cable.

13. A detachable electric coupling arranged for electrically connecting a means for utilizing electric current to a source of potential; said coupling comprising at least one detachable, elongated, electrical contact arranged to connect conductors of said source and said utilizing means respectively, said contact including a pair of complementary pivoted coupling members; means for securing electrical contact therebetween when coupled; an insulating member having an aperture extending therethrough, said contact being slidably mounted in said aperture; means for movably mounting said insulating member; and said insulating member being movable to a position whereat said insulating member surrounds both said coupling members to prevent pivoting thereof when electrical contact is secured between said coupling members.

14. A detachable electric connector comprising a pair of complementary coupling members, a pivot pin secured to one of said coupling members and inserted into a hole in the other of said members, at least one of said members terminating in a tab extending transversely of said pivot pin and insertable into a complementary slot formed in the other member and likewise disposed transversely of said pin.

15. A detachable electric connector comprising a pair of complementary coupling members, a pivot pin secured to one of said coupling members and inserted into a hole in the other of said members, at least one of said members terminating in a tab extending transversely of said pivot pin and insertable into a complementary slot formed in the other member and likewise disposed transversely of said pin, the opposing sides of said slot in the plane of said tab being open to permit pivotal movement of said tab and coupling member in either direction from said slot.

16. A detachable electric connector comprising a pair of alignable complementary coupling members, a pivot pin secured to one of said members and inserted into a hole in the other of said members, means for pressing said coupling members laterally into engagement when said other member is pivoted about said pin to an aligned coupling position relative to said one member, and means for maintaining said coupling members in said aligned coupling position.

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