

[54] **HERMETICALLY SEALED ELECTRICAL CONNECTOR**

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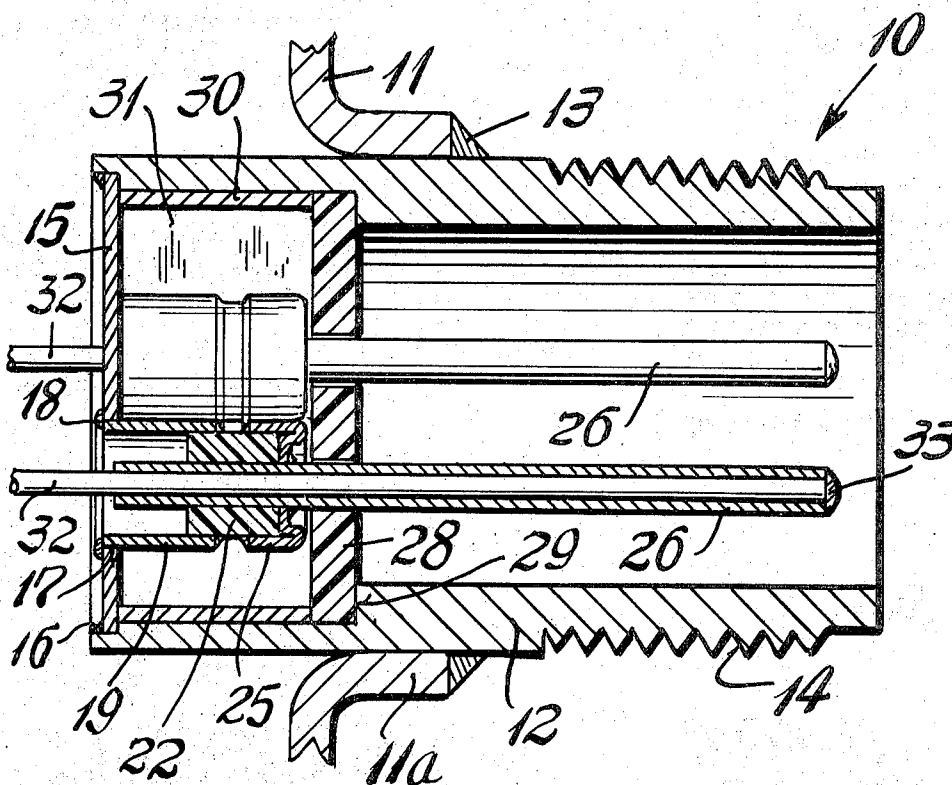
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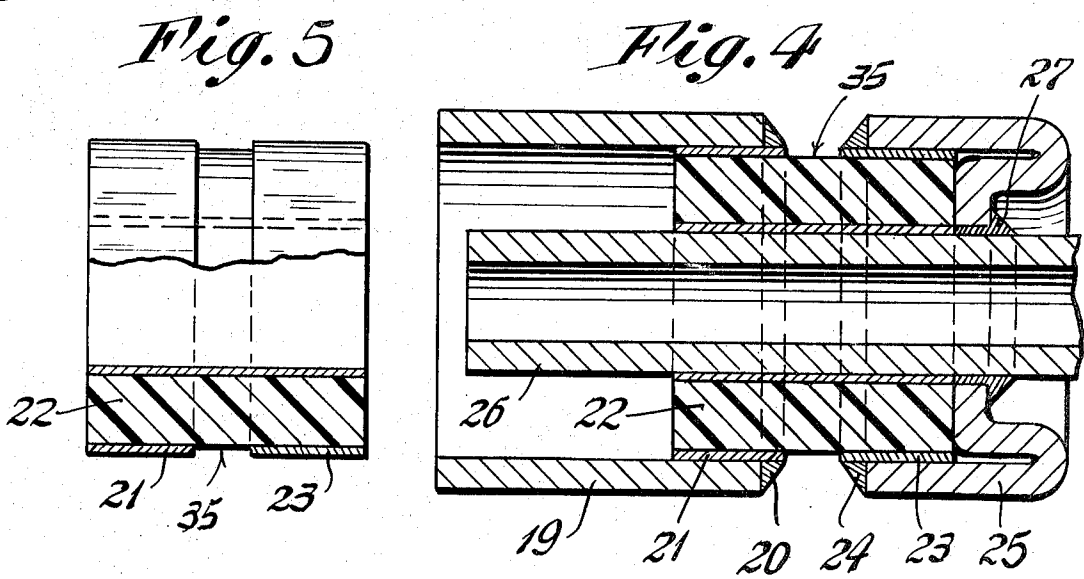
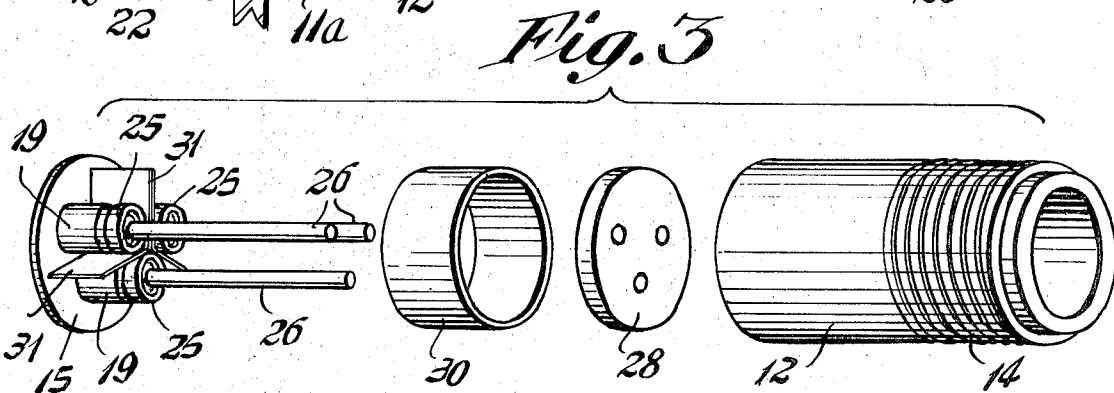
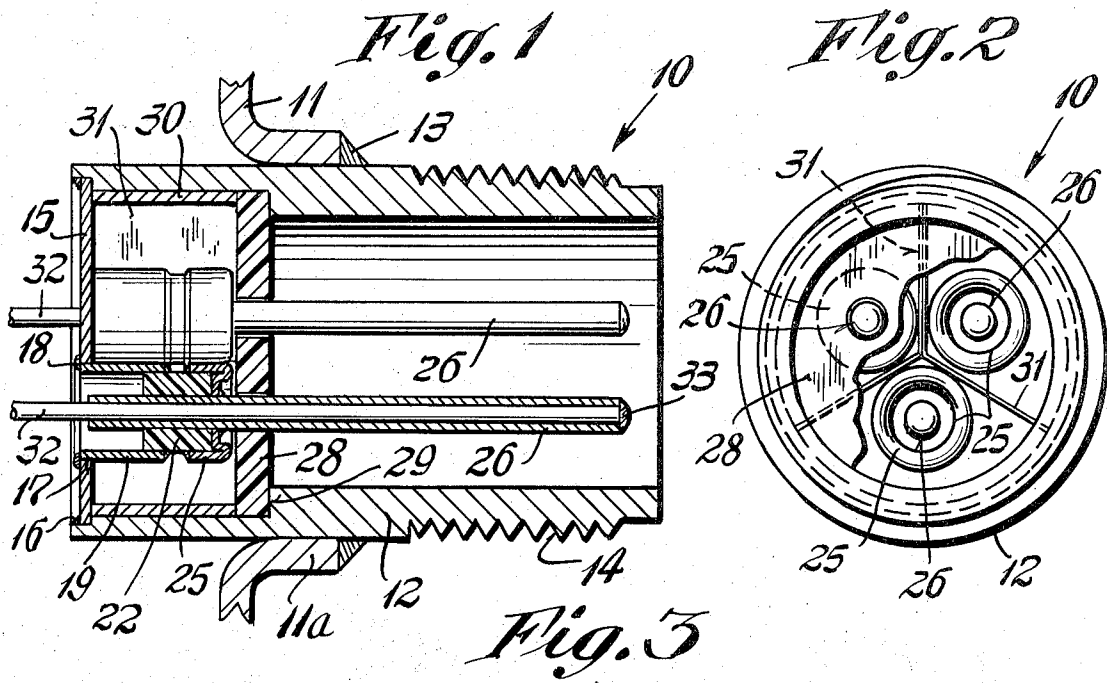
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ABSTRACT

An electrical connector for providing a leakproof releasable electrical connection through a wall even over a wide temperature range. The connector has at least one terminal with the terminal including a ceramic annulus having a sleeve secured at one end that is secured to a base of the connector and a cap secured on the other end with a closed tube to which the electrical connection is made extending through the annulus and being secured to the cap.

2 Claims, 5 Drawing Figures





HERMETICALLY SEALED ELECTRICAL CONNECTOR

In U.S. Pat. No. 3,346,836 assigned to the assignee of the present invention there is disclosed a fluid leak-proof electrical connector for providing electrical connections through a wall with the assurance that the connector will be leakproof over a wide temperature range and operating conditions. While such a connector has been found to be extremely satisfactory in operation, it has, however, been found to be somewhat difficult and expensive to manufacture and also to make each terminal with complete assurance that it is hermetically sealed.

It is accordingly an object of the present invention to provide an electrical connector which maintains a hermetic seal over a wide temperature range but yet which may be easily substituted for heretofore existing connectors to mate with other connectors of standard construction.

Another object of the present invention is to provide a hermetically sealed electrical connector that has terminals in which not only the terminals but also the complete connector may be assembled with greater assurance that it is leakproof than heretofore possible.

A further object of the present invention is to achieve the above objects with an electrical connector that is more economical and requires less skill to manufacture than heretofore known terminals.

In carrying out the present invention, the electrical connector has a tubular shell which is secured in an opening in a wall so as to be leakproof therewith and which carries an outer threaded periphery for releasable engagement with a mating standard connector. In the disclosed embodiment herein, the electrical connector is of the male type and includes one or more elongate cylindrical terminals positioned within the shell that mate with female terminals of the standard connector to provide electrical connection therewith.

Each terminal is formed with an insulating ceramic annulus having a sleeve secured at one end, a cap secured to its other end and a cylindrical tube is passed through the annulus to extend beyond thereby forming the male portion of the terminal. The tube is connected as by welding to the cap while the other end of the sleeve is secured to a base which in turn is secured to one end of the shell. Accordingly, when a connecting wire is passed into the interior of the tube and secured therein both mechanically and electrically by welding closed the exposed end of the tube, an electrical connection is made between the wire on one side of the wall and the terminal on the other side. Moreover, as the tube is only secured to the cap and as the cap and sleeve are spaced apart on the ceramic annulus, the gap on the periphery of the annulus therebetween serves to electrically insulate the tube from the remainder of the conductor.

Other features and advantages will hereinafter appear.

In the drawing:

FIG. 1 is a cross-section of an electrical connector made according to the present invention, approximately twice normal size.

FIG. 2 is an end view thereof, partly in section.

FIG. 3 is an exploded view of the parts forming the connector, somewhat enlarged.

FIG. 4 is an enlarged sectional detail of a portion of a terminal.

FIG. 5 is an enlarged view, partly in section, of a ceramic annulus that is incorporated into each terminal.

Referring to the drawing, the electrical connector of the present invention is generally indicated by the reference numeral 10 and is shown secured in an opening formed in a wall 11 which may be the wall of a container in which it is desired to provide electrical connection between the interior and exterior thereof in a manner which hermetically seals the container over an extremely wide temperature range, as for example, -65°F to $+1,000^{\circ}\text{F}$. While any form of fluid tight mechanical securement may be used, herein the container is shown as having an outwardly extending flange 11a which fits about the periphery of a shell 12 of the connector as by a welded joint 13. The shell is threaded as at 14 for enabling releasable connection with a mating electrical connector of standard construction (not shown). The end of the sleeve 12 within the interior of the wall 11 is closed by a disk shaped base 15 that is welded all around as at 16 to the adjacent portions of the shell. The base 15, as shown, supports terminals with there being in the present embodiment three terminals shown though, of course, it will be understood that a different number may be employed if desired. Preferably the terminals are arranged on the base according to a standard configuration in order to mate with standardized connectors. For each terminal, the base is formed with a through aperture 17 to which is secured all around as by welding 18, the end of a sleeve 19.

Referring to FIG. 4, the sleeve 19 has its other end secured as by welding 20 to a metalized portion 21 of an alumina ceramic annulus 22. The other end of the annulus 22 is also metalized as at 23 for enabling securement as by welding 24, a cap 25 having the shape shown. The annulus 22 is formed to have a through hole which is also metalized, through which a tube 26 extends with the latter being secured as by welding 27 to the cap 25 and down into the through hole of the ceramic annulus to provide a strong welded joint.

After each terminal has been formed and secured by welding 18 to the base 15 the connector 10 is assembled by initially positioning within the shell a terminal spacer 28 against a ledge 29 formed internally in the sleeve 12 and a sleeve spacer 30 positioned against the terminal spacer. Thin strips of insulating material 31 are preferably positioned between the terminals to minimize short circuiting therebetween with the material being mica, ceramic or other material that is capable of withstanding high temperature changes. The base, having the terminals secured thereto and the insulating strips, is then fitted against the other end of the sleeve spacer 30 and the welding 16 is effected to thereby form the unitary electrical connector 10.

In use, the connector 10 is secured in the hole in the wall 11 by the welding 13 and each terminal has a conducting wire 32 inserted through the corresponding hole in the base 15 into its tube 26 to substantially the end of the tube. A weld 33 secures the end of the conducting wire 32 to the exterior end of the tube 26 and also seals the end of the tube. Accordingly, the connector now provides an electrical path from each wire 32 to a tube 26 in a manner which is not only leakproof but is capable of withstanding temperature changes

over a wide range and is also quite resistant to deformation in use.

The shell 12, base 15 and sleeve spacer 30 are formed of stainless steel; the strip insulators 31 may be formed of mica or aluminous ceramic strips; and the sleeve 19, cap 25 and tube 26 may be formed of a high nickel content alloy such as nickel 200. The terminal spacer 28 is formed of the same electrically insulated material as the annulus 22 which is a hardened composition having a minimum of 94 percent alumina. The metalizing portions 21 and 23 on the annulus may be moly manganese that is nickel plated to assure that the welds 20 and 24 will have a receptive surface. The portions 21 and 23 are actually extremely thin but are depicted quite thick in the drawing for clarity of illustration.

It will be understood that in the absence of the metalizing portions 21 and 23 that the welds 20 and 24 would not "wet" the surface of the annulus 22 and hence would not form a weld. Thus the space or gap 35 between the two metalized portions of the annulus is not subjected to being welded and accordingly forms an electrical insulation portion between those parts connected to the wire 32 (cap 25 and tube 26) and the remainder of the connector.

The weld 13 may be formed of any material which is compatible with the wall 11 and shell 12 while the welds 20, 24 and 27 preferably use a brazing alloy consisting of gold nickel with the ratio being approximately 5 parts of gold to 1 part of nickel. The welds at 16, 18 and 33 are made using heli arc welding or its equivalent.

It will accordingly be appreciated that there has been disclosed an electrical connector which is capable of mating with other standard electrical connectors but yet which is capable of being durable and leakproof even over a wide temperature range. The connector includes a plurality of terminals with each terminal including an alumina ceramic annulus which not only serves to provide for physical support between the terminal and the connector body but also serves through a peripheral portion thereof to electrically insulate

each terminal from the remainder of the connector thereby assuring that each terminal will be electrically independent of the other terminals.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

We claim:

1. An electrical connector for providing a hermetically sealed leakproof electrical connection through a wall over a wide temperature range comprising a tubular shell secured to the wall to have an interior end portion located on one side of the wall and an open exterior end portion on the other side of the wall, a base closing the interior end portion of the shell and having at least one hole, a terminal secured to the base at the hole to project into the shell, said terminal including an electrically insulating ceramic annulus having a through hole, means securing one end portion of the annulus to the base, a cap welded to the other end portion of the annulus to form a sealed securement, a tube extending through the through hole of the annulus and the cap, means welding said tube only to the cap and the through hole of the annulus to form a sealed securement, means for securing a conducting wire in the tube, and in which the means securing the annulus to the base and the cap are formed of electrical conducting material and in which they are spaced apart on the annulus to provide an electrically insulating gap therebetween on the periphery of the annulus.

2. The invention as defined in claim 1 in which there are a plurality of terminals spaced about and connected to the base, and in which a spacer formed of electrically insulating material is located within the shell to abut against the interior of the shell interiorly of the base and beyond the cap of each terminal to provide mechanical support for the terminals by having an aperture through which a portion of the tube of each terminal extends with said aperture for each terminal being smaller than the bottom of the cap of its associated terminal.

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