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ELECTRIC HEATER ASSEMBLY

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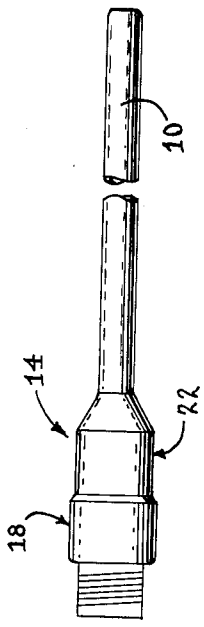

Fig. 1

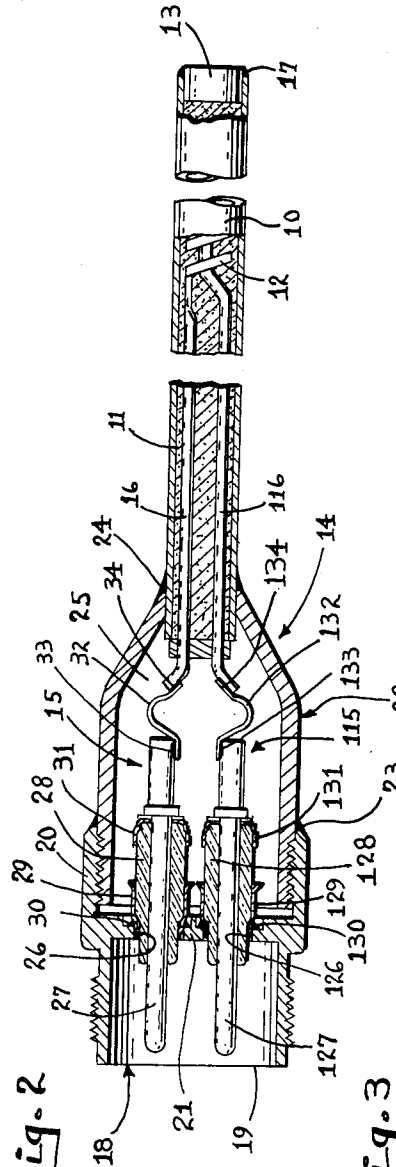

Fig. 2

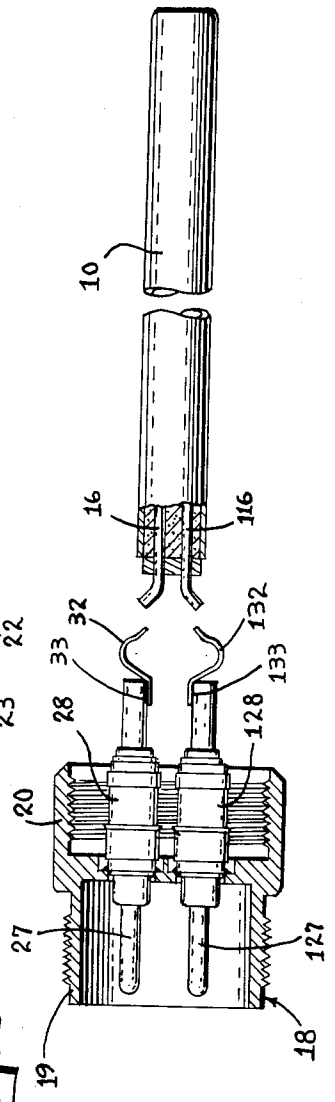

Fig. 3

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ELECTRIC HEATER ASSEMBLY

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The present invention relates to electric resistance heaters, more particularly to electric resistance heaters of the type which are hermetically sealed to prevent communication of fluids and the like between the interior and exterior thereof, and the principal object of the invention is to provide new and improved heaters of the character described.

In the manufacture of certain kinds of hermetically sealed electric resistance heaters, a problem arises because of differential expansion and contraction of various heater assembly parts, either during the manufacturing process or during use of the heater assembly. As a result of such differential expansion and/or contraction, the current conductive means which carries electrical energy from a source exteriorly of the heater to the heat generating resistor element within the heater is frequently damaged.

Under certain circumstances, the current conductive means may be tensioned so greatly that it is pulled apart, thus destroying the electrical continuity of the heater. This is especially true when the current conductive means is formed of two or more parts which are welded or otherwise secured together. More frequently, however, the current conductive means is subjected to compressive forces which caused it to buckle. As a result of such buckling, the current conductive means is displaced from its desired position with a resulting loss in dielectric clearance between adjoining heater parts. This loss in dielectric clearance frequently causes short circuiting and resultant destruction of the heater.

The present invention eliminates the problem hereinbefore mentioned in heaters of the type contemplated. Other advantages will readily become apparent from a study of the following description and from the drawing appended hereto.

In the drawing accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which the invention may assume, and in this drawing:

FIGURE 1 is a broken elevational view of an electric resistance heating element embodying the invention,

FIGURE 2 is a broken, enlarged, longitudinal sectional view of the heater seen in FIGURE 1, and

FIGURE 3 is a view similar to FIGURE 2 but showing the heater during an intermediate stage of manufacture.

With reference to FIGURES 1 and 2, the heater chosen to illustrate the present invention comprises an elongated, tubular metallic sheath **10** filled with electric insulating material in which is embedded a coiled resistor conductor **12**. One end of the sheath is closed by welding a plug or the like **13** therein. The opposite end of the sheath, through which electrical energy is conducted to the resistor **12**, is closed by an enlarged, hollow, closure assembly **14**. As will later be described in detail, this closure assembly is welded to the adjoining sheath end to provide a hermetically sealed, unitary structure therewith.

Means are provided for conducting electrical energy from the exterior of the closure assembly, through its hollow interior, and to the coiled resistor within the interior of the sheath. At the present time, such means comprises a pair of current conductors **15**, **115** in spaced, side-by-side relation each having its right end (in the position of parts shown) electrically connected with a respective end of the coiled resistor **12** and its left end extending through a wall of the closure assembly for connection to a source of electrical energy.

The sheath **10** and its associated parts are well known

in the art; accordingly it should suffice to disclose that this portion of the assembly is formed by disposing the coiled resistor **12**, which has a terminal conductor pin or the like **16**, **116** secured to respective ends thereof, within the sheath whereby the resistor **12** is spaced from the ends of the sheath and whereby the pins **16**, **116** project beyond one end of the sheath in spaced, side-by-side relation. The sheath is then filled with a suitable material **11** such as powdered magnesium oxide or filled in whole or in part by bushings formed of the same or similar material. The sheath is then subjected to a swaging operation or the like which reduces its transverse size so as to compact the material **11** to rock-like hardness. This swaging operation anchors the resistor **12** and the pins **16**, **116** in position within the sheath to provide a unitary assembly as is well known to those skilled in the art.

Part of the material **11** may then be removed from the right end (in the position of parts shown) of the sheath **10** and the metal plug **13** then inserted therein. The plug and the sheath may then be circumferentially welded together at **17** to hermetically close this sheath end.

Returning now to the closure assembly **14**, the latter comprises a tubular body **18** presently having an externally threaded portion **19** and an internally threaded portion **20** spaced axially of portion **19**. A transverse wall **21**, spaced intermediate the ends of the tubular body, blocks off its interior as shown.

Presently threaded into portion **20** of body **18** is one end of a sleeve **22**. The other end of the sleeve is reduced in size to closely fit the exterior of the sheath **10**. Sleeve **22** is adapted to be circumferentially welded to body **18** at **23** and to sheath **10** at **24** to provide leak-proof joints thereat. From the foregoing, it will be seen that the closure assembly **14** (comprising body **18** and sleeve **22**) cooperates with the left end of the sheath **10** to provide an internal cavity **25** in which the projecting ends of the terminal conductor pins **16**, **116** are disposed.

Wall **21**, it will be seen, in part defines a wall of the cavity **25** and is provided with a pair of spaced apertures **26**, **126**. Extending through respective apertures **26**, **126** for ultimate connection to a source of electrical energy are respective conductors **27**, **127** which form a part of respective current conductors **15**, **115** hereinbefore mentioned. Any suitable means may be provided for securing respective conductors **27**, **127** to wall **21** in hermetically sealed, electrically insulated relation. Since the same construction is employed to connect both conductors to the wall, a description of the construction as applied to conductor **27** alone should suffice for both.

Conductor **27** presently extends through and is herein shown hermetically sealed to an elongated dielectric sleeve **28** which may be formed of ceramic or other rigid, temperature resistant, non-electrical conductive material. An apertured, cup-shaped member **29** is suitably bonded to the exterior of an intermediate portion of sleeve **28** and member **29** is brazed or the like at **30** to the portion of wall **21** margining aperture **26**. A member **31** similar to member **29**, may be seated over the right-hand end of sleeve **28** and may be welded, crimped, or otherwise secured to the adjoining portion of the conductor **27**.

As seen in FIGURE 2, the right-hand ends of conductors **27**, **127** are adapted to be disposed within cavity **25** adjacent to but spaced from respective terminal pins **16**, **116**. The means provided for bridging the gap between conductor **27** and pin **16** presently comprises a flexible electrical conductor member **32** which forms an expansile-contractile portion or extension of the conductor **27** and which may be welded or otherwise secured to conductor **27** at **33** and to pin **16** at **34**. An identical construction employing a member **132** is employed to connect conductor **127** and pin **116** as will be apparent.

At the present time, member **32** comprises a flexible metallic strip formed to provide a loop. It will readily

be understood that member **32**, being flexible, provides a lost-motion connection which will absorb relative movement between respective ends of the current conductor **15** of which it forms the intermediate part. Obviously, member **32** could be formed to provide a plurality of loops or perhaps formed to a helical configuration. It might also be formed of, for example, a flexible wire instead of the strip illustrated. Any other suitable construction may be employed so long as it provides a yieldable, current conductive junction between respective ends of the current conductor **15**. It might also be mentioned that member **32** might, if desired, be formed as an integral part of either pin **16** or conductor **27** instead of being a separate member as herein disclosed.

As illustrated in FIGURE 3, assembly of the foregoing will be as follows: The completed heater, with the terminal pins **16, 116** projecting from one end thereof, will first be assembled with the completed body **18** by welding members **32, 132** to respective terminal pins **16, 116**. Members **32, 132**, it will be understood, preferably having been earlier welded to respective conductors **27, 127**. Sleeve **22** will then be slid over the heater sheath and threaded into portion **20** of the body **18**. Next, sleeve **22** will be welded to body **18** at **23** as heretofore disclosed and thereafter, the sleeve will be welded to the heater sheath **10** at **24** to thus form a structurally integral, hermetically sealed assembly between the heater sheath **10**, the body **18** and the sleeve **22**.

It will be understood that during the making of weld **23**, sleeve **22** will become quite hot and will therefore expand in length. This expansion in length will be followed by a corresponding contraction when the sleeve cools; however, since the sleeve is welded to the sheath **10** at **24** following the making of weld **23**, the contraction of the sleeve will draw body **18** toward the adjoining end of the sheath. Since conductors **27, 127** are anchored to the body **18** and the terminal pins **16, 116** are anchored to the sheath **10** (by virtue of being embedded in the compacted material **11**), the conductors and the terminal pins will be drawn toward each other. Were it not for the lost motion connection provided by the flexible members **32, 132**, the terminal pins, being weaker than the conductors **27, 127**, would buckle and possible short out either against each other or against the sleeve **22**.

In the event weld **24** is made prior to making weld **23**, expansion of the sleeve **22** will tend to move the conductors **27, 127** away from the terminal pins thus tending to rupture the welded joint therebetween. Here again, however the flexible members **32, 132** will absorb the motion harmlessly.

In view of the foregoing it will be apparent to those skilled in the art that I have accomplished at least the

principal object of my invention and it will also be apparent to those skilled in the art that the embodiment herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiment is illustrative only, and that my invention is not limited thereto.

I claim:

A sealed electric heater assembly, comprising a tubular metal sheath hermetically sealed at one end and having its other end open, a resistance conductor within said sheath and having a pair of terminals accessible at said open sheath end, granular refractory material compacted within said sheath and embedding said resistance conductor, a tubular metal body having an interior transverse wall intermediate its ends and having external screw threads at one end and internal screw threads at its other end, a pair of current conductive posts extending in hermetically sealed relation through respective openings in said wall, each having one end part accessible from the externally threaded end of said body for connection to a source of current and an opposite end part extending from the internally threaded end of said body, a metal sleeve having a large end externally threaded and fitting the internal threads of said tubular body and a weld to hermetically seal such threaded connection, said sleeve having a small end enclosing and hermetically welded to the open end of said sheath, said sleeve combining with said tubular body to form a closed hermetically sealed chamber into which said resistance conductor terminals and said current conductive posts extend with respective ends in spaced relation, and a pair of metal connectors, each electrically and mechanically connected to ends of respective terminals and posts and bridging the space therebetween, each metal connector having a looped portion freely disposed within said sealed chamber to absorb movement of said posts and said terminals caused by differential expansion and contraction of various heater parts.

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