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R. REICHMANN

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HIGH TEMPERATURE HEATING UNIT AND METHOD OF MAKING SAME

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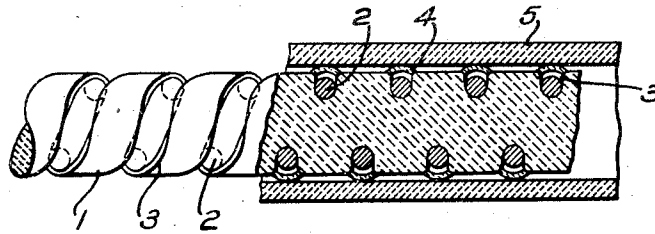


Fig. 1.

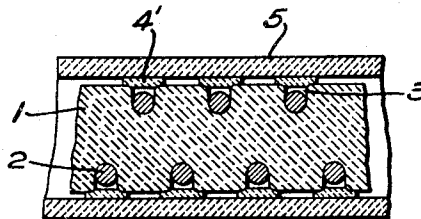


Fig. 2.

WITNESSES:

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HIGH TEMPERATURE HEATING UNIT AND
METHOD OF MAKING SAME

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Application April 30, 1940, Serial No. 332,508
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4 Claims. (Cl. 201—67)

This invention relates, generally, to electric heating units of the resistor type, and more specifically relates to such units built for high temperature operation even in an oxidizing atmosphere.

A heating unit, in accordance with my invention, comprises, as the resistance element, a suitably-formed wire or rod of a highly refractory metal, such as, for example, tungsten, molybdenum, and their alloys, and other similar metals capable of attaining very high temperatures without melting; the wires being, preferably, wound around a ceramic refractory carrier or support which has grooves in its outer portions in which the wire is disposed. To protect the wire from harmful influences, particularly from oxidation while in a highly heated condition, the heating wire or conductor is, as aforesaid, located in the outer groove of the carrier but to fully embed it, I close the groove by an additional ceramic layer, preferably fitting the groove, and fused to the main body of the carrier after the wire has been placed in the groove. The heater of my invention is completed by placing the aforesaid structure within a snugly-fitting ceramic tube, but, in some instances, coating the completed inner wire carrier with a gas-tight glaze or enamel before inserting it into the tube.

It is an object of my invention to provide a heating unit of the general type described which will protect the resistor wire from oxidation.

It is a further object of my invention to provide a support and protection for a high temperature heating wire, which will not, after some use, rupture as by fine fissures occurring therein, which afford access of air to the highly heated metal wire.

It is an additional object of my invention to provide a heating resistor for operation at very high temperatures, such as, for example, temperatures of 1400° C. and above, in which the heating unit has a comparatively long, useful life and may be made of highly refractory metals, such as, for example, tungsten, molybdenum, their alloys, or other highly refractory materials having similar properties but which, at high temperatures, are extraordinarily sensitive to oxidation. The subject matter of my invention is schematically shown in the drawing in which Fig. 1 comprises a fragmentary cross sectional view longitudinally of the unit with parts broken away and parts shown in elevation for clarity of illustration; and Fig. 2 is a fragmentary sectional view of a modification.

In accordance with the general principles of

my invention, the member which carries the resistor wire comprises a wire carrier or support 1 for supporting a heating resistor material in the form of a resistor wire 2 which is placed in a groove or indentation 3 in the outer portion of the carrier 1, the lateral boundaries of the groove extending beyond the wire 2 by a small amount. The groove 2 is preferably a helix running along the length of the carrier 1 and the wire resistor 2 is formed to fit therein.

The groove 3 is closed by a suitable closure 4 which fits the top of the groove so that the wire 2 is embedded in the resistor carrier. The unit produced in the manner thus far described may be then set into a ceramic tube 5, whose smaller diameter is only slightly greater than the larger diameter of the unit so that a snug fit obtains. The manner in which the unit described may be produced is subject to variations, thus, for example, it is preferred to use a substance for the closure 4 which is the same as that of the heating carrier 1. This substance may be of well known high temperature insulating refractories, such as sillimanite, sintered emery, mullite, or other similar refractories generally comprising silicates or oxides of metals. The groove may be closed by first forming a plastic thread of the ceramic material and then winding it over the tops of the groove. The thread may be given a form when it is produced which is particularly suitable for its function for closing the groove.

In the drawing, two forms of threads are shown. Thus the closure 4 is a thread which fits across the top edges of the groove, while the closure 4' is a thread which has a thickened portion which protrudes slightly into the groove 3 with the lateral projections of the protruding portion abutting the sides of the groove, and the main body lying on the surface of the carrier 1. The thread for closing the groove may be secured to the carrier by firing after it is put on, or by heating of the resistance wire itself to the necessary temperatures for fusing the plastic mass. Preferably, it is desirable to cover the outer surface of the resulting unit with a thin glaze or enamel to further render it gas impervious.

In accordance with the teachings of my co-pending application Serial No. 273,891, filed May 16, 1939, the groove in the carrier should be dimensioned in such manner that its cross sectional area is somewhat larger than that of the heating wire disposed in it, but should not be more than 20% greater, and preferably less, and suitable terminals may be provided. The aforesaid application has, since the filing of the in-

stant application, matured into Patent No. 2,208,342, granted July 16, 1940.

I claim as my invention:

1. A heating unit comprising a tubular ceramic member having an outer convoluted groove, a non-metallic refractory closure for said groove, shaped to substantially match the top of said groove, a high-temperature refractory metal in said groove having an original cross-sectional area which is less than that of said groove when closed by said closure, said refractory metal being of the type which swells through heat-treatment at high temperatures to fill said groove as closed by said closure.
2. A high-temperature heating unit comprising, a tubular ceramic body of cylindrical form, a helical groove on the outside of said body, a helical non-metallic refractory closure closing said groove, said closure substantially matching said groove, a high-temperature metallic refractory heating element swelled in said groove through heating at high temperatures, and a snug-fitting gas-tight non-metallic refractory outer cover around said body and closure.
3. A high-temperature heating unit comprising, a tubular ceramic body of cylindrical form, a helical groove on the outside of said body, a helical non-metallic refractory closure closing said groove, said closure substantially matching said groove, a high-temperature metallic refractory heating element swelled in said groove through heating at high temperatures, a glaze over said body and closure, and a snug-fitting, gas-tight, non-metallic refractory outer cover around said body and closure.
4. In the making of an electrical resistor unit by utilizing a non-metallic refractory member having an outer convoluted groove and a high-temperature metallic refractory resistor material of the type which has an increased cross-sectional area after suitable heat-treatment; the method which comprises disposing said resistor material in said groove, closing said groove with a ceramic closure in such a manner that the cross-sectional area of said groove is larger than that of said resistor material therein, and heating said member, resistor material and closure, to gas-tightly fuse said closure to said member and to swell said resistor material in said groove, glazing the resulting structure, and then fitting a gas-tight, non-metallic refractory cover over it.

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