June 4, 1929. W. E. DUERSTEN 1,715,824

ELECTRICAL RESISTANCE UNIT

Filed Aug. 29, 1924

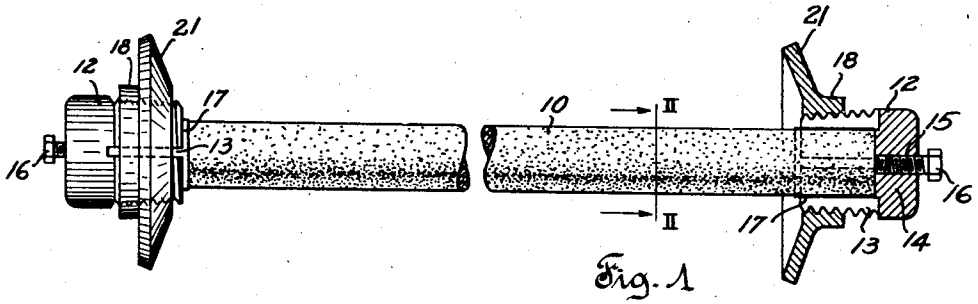


Fig. 1

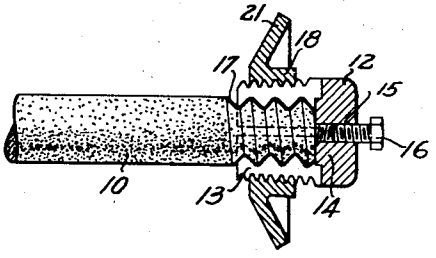


Fig. 3

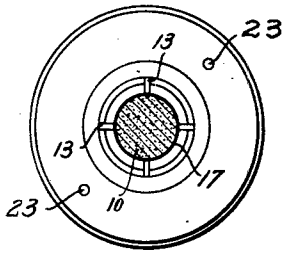


Fig. 2

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UNITED STATES PATENT OFFICE.

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ELECTRICAL RESISTANCE UNIT.

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The present invention relates in general to electrically conductive elements of the type known as resistance units, especially such a unit as is capable of producing in a commercial manner a relatively high degree of heat on the passage of an electrical current through the unit, and also of maintaining itself in an efficient manner during a commercially satisfactory life; and the invention is more particularly concerned with the production of such a resistance element provided with terminals of a character especially adapted to withstand high temperatures while connecting the unit in circuit in a mechanically and electrically efficient and generally satisfactory manner.

The problem of producing a commercially satisfactory terminal in connection with a relatively inexpensive and efficient electrical resistance element adapted to produce and withstand relatively high temperatures, has been a considerable one in the past, especially in connection with resistance heating elements of what is known in the art as the generally non-metallic class which have the characteristic of being able to produce and maintain relatively high temperatures with a very small degree of expansion. One certain type of commercially satisfactory resistor of this general class has been produced and has gone into extended use, this resistor being constituted to a considerable extent of silicon carbide, with or without the addition of one or more modifying substances; and the present invention finds considerable utility in connection with this type of resistance element.

A great defect in connection with prior art devices of this character has been the failure to produce and maintain sufficiently intimate contact between the metallic conductive terminal and the body of the resistor and to satisfactorily dissipate to the air or other surrounding medium, the heat of the terminal; for as the resistor becomes heated, there is a tendency toward oxidation or burning or pitting of the metallic terminal with consequent final destruction thereof, due to the formation of minute arcs between the resistor and the terminal, with a consequent considerable increase in the resistance at the terminal. This results in a decrease in the effective voltage on the normal heat producing portion of the resistor and, hence, an undesirable decrease in the total heating effect of the resistor.

The present invention contemplates the provision of an electrical resistance unit, especially such as is adapted for producing and maintaining relatively high temperatures, the invention being more particularly concerned with such a resistance element constituted to a considerable extent of silicon carbide as an essential ingredient, and wherein means are provided for forming an efficient electrical connection between the body of the resistance element and a line terminal and also constituting means for supporting the resistance element, the general result including the provision of a relatively inexpensive and efficient resistance unit adapted to produce the desired heating effect and satisfactorily maintain itself under severe operating conditions.

It is an object of this invention to provide an improved electrical resistance unit embodying a terminal or connection element of improved design and construction and adapted to withstand a considerable degree of heat while maintaining an efficient electrical connection and mechanical support for the resistance unit.

It is a further object of this invention to provide an improved electrical resistance unit embodying a resistance element essentially constituted to a considerable degree of silicon carbide or the like, and likewise embodying one or more electrically conductive terminals attached to the resistance element, the unit as a whole constituting an inexpensive and efficient resistance unit well adapted for producing and maintaining itself under high temperatures.

It is a further object of this invention to provide a terminal of improved design and construction for electrical resistance elements, more particularly of the heat generating type, which constitutes an efficient electrical connection and mechanical support for the resistance element.

These and other objects and advantages are obtained by the present invention, various novel features of which will be apparent from the description and drawings, disclosing embodiments of the invention, and will be more particularly pointed out in the claims.

In the accompanying drawings:

Figure 1 is a view in elevation, partly in

section, of a resistance element embodying features of the present invention.

Figure 2 is a sectional view in the plane of the line II—II of Figure 1.

Figure 3 is a broken sectional view showing a modification of a feature of the invention disclosed in Figure 1.

In accordance with the disclosure of the accompanying drawings, 10 indicates a resistance element more particularly of the non-metallic type and essentially constituted to a considerable degree of silicon carbide. The ends of the element 10 are provided with metallic terminals or connectors embodying features of the present invention. As indicated, the terminal includes a hollow element or cap 12 having a central bore, the tubular wall of the bored portion being provided with external threads and longitudinally slotted at a plurality of points, as indicated at 13, to provide spaced flexible fingers. The substantially closed end portion 14 of the cap 12 has a central or axial threaded aperture 15 in which a line or circuit attaching screw 16 may be secured, the line terminal, whether it be a circuit wire or bar or a connecting clip of the terminal of a heating appliance, being adapted to be secured beneath the head of the screw and in intimate contact with the end of the cap 14.

The bored portion of the cap 12 constitutes a flexible or contractile sleeve the bore of which is of such size as to readily receive and fit fairly closely over the end of the resistance element 10 with a preliminary conductive coating 17 applied thereto. This coating may be in the form of one or more turns or layers of strip or sheet metal, preferably aluminum foil, wrapped about the end of the bar, or it may be in the form of a dense coating of aluminum or Monel metal deposited in the form of minute particles a portion of which may impregnate the surface portion of the resistance element. In any case, the conductive coating 17 is of such a character that it is or may be forced into intimate engagement with the terminal portion of the resistance element which is of a somewhat porous structure. With the end of the resistance element and its conductive coating inserted into the bore of the sleeve of the cap, a locking or clamping device or collar 18 is applied to the exterior of the sleeve for the purpose of clamping the latter firmly upon and in intimate contact with the resistance element.

The desired locking or clamping effect is preferably secured by having the outer threaded wall of the sleeve portion of the cap 12 somewhat tapered toward its inner end, that is, toward the middle of the resistance element, and providing a clamping element or nut 18 having an internal thread tapered to correspond to the taper of the cap, the clamping element being threaded onto the outer wall of the cap from the inner end thereof. As this clamping or locking element is threaded or forced onto the sleeve of the cap 12 from the inner end thereof, it has the effect of pinching or contracting the spaced portions or fingers of the tubular portion 12, formed by the slots 13, into firm and rigid frictional engagement with the terminal portion of the resistance element directly or with the conductive coating, where the latter is applied to such terminal portion.

The inner end of the threaded clamping element 18 is provided with an integral flange 21 substantially perpendicular, or preferably slightly inclined from a perpendicular, to the axis of the resistance element and cap, as indicated. This flange 21 is preferably provided with spaced apertures 23 or the like which may serve for engagement by a tool for forcing the locking or clamping element into operative position on the tubular portion of the cap 12. As shown at the right in Figure 1, this flange extends toward the middle of the resistance element, while at the left in this figure, the flange 21 extends away from the middle of the resistance element. In either case, the flange constitutes a shield for protecting the heated portion of the resistance element from accidental contact with external objects, and also a heat conducting shield which dissipates heat from the body portion of the cap, and thus assists in preventing over-heating of the end and body portion of the terminal. The cap 12 and the clamping element 18 with its integral flange-like shield may be of any material having the desired conductivity and which does not readily oxidize at the normal operating temperatures of the terminal; and the radiating surface of the terminal as a whole should be such as to keep its operating temperature below a red heat.

In the modification shown in Figure 3, the end of the resistance element 10 is provided with corrugations, preferably in the form of screw threads, and the bore of the terminal cap 12 is provided with internal threads for engagement with the threads formed on the end of the resistance element, permitting screwing the cap to operative position on the terminal portion of the resistance element. The other features may be the same as shown in Figure 1. The pitch of the threads formed on the end of the resistance element may be opposite to that of the threads formed on the exterior of the terminal cap, to assist in locking the cap on the end of the resistance element as the clamping element 18 is forced into operative position on the threaded outer surface of the sleeve portion of the cap. A conductive coating 17 of the type described in connection with Figure 1 is likewise applied to the corrugated or threaded end of the resistance element prior to disposing the latter in operative position within the bore of the terminal cap 12. The corrugations or

threads on the resistance element and the bore of the cap 12 have the added function of providing additional surface contact between the terminal portion of the resistance element and the terminal cap 12 and the intermediate conductive coating 17. The resistance element is preferably formed from a mixture containing silicon carbide as an essential element, with or without one or more metallic modifying substances, and molded and baked and burnt or fired at a high temperature to produce a heat-hardened resistance element of the desired mechanical and electrical characteristics.

With a conductive coating of the character described applied to the end of the resistance element and the latter disposed within the bore of the sleeve-like portion of terminal cap 12 and the cap clamped or locked in operative position, an efficient mechanical and electrical connection of the parts is secured. With the complete resistance unit operatively connected to a supply line through the connection screws 16, the effect of a high degree of heat produced in the resistance element may be to weld or alloy or intimately unite the metallic coating 17 to the associated parts of the resistance unit. In general, the electrical and mechanical connection secured as hereinabove described is of a very efficient character, even while the resistance unit is operating at relatively high temperature.

It should be understood that the invention claimed is not limited to the exact details of construction and design shown and described herein, for it will be apparent that obvious modifications will occur to persons skilled in this particular art.

It is claimed and desired to secure by Letters Patent:

1. An electrical resistance heating unit, comprising a self-sustaining resistance heating element capable of producing and maintaining itself at high operating temperatures, a conductive terminal for said heating element comprising an externally tapered and threaded contractile sleeve portion at one end surrounding a terminal portion of said heating element and a substantially rigid portion at the other end, and an internally tapered and threaded clamping collar surrounding and adjustable upon said contractile sleeve portion and adapted to force and hold said sleeve in intimate engagement with said terminal portion of the heating element, said clamping collar being provided adjacent its inner end with an external flange-like shield inclined away from said inner end.

2. An electrical resistance heating unit, comprisng a self-sustaining resistance heating element capable of producing and maintaining itself at high operating temperatures and having a terminal portion of corrugated or irregular surface outline, a conductive terminal having a contractible sleeve-like portion of correspondingly irregular outline to intimately engage with said terminal portion of the heating element when the latter is disposed within said sleeve, and annular clamping means cooperative with the exterior of said sleeve for causing said sleeve to forcibly grip and intimately engage said terminal portion of the heating element, said clamping means having at its end nearest the center of the heating element and inclined away therefrom a flange-like shield adapted to dissipate heat from the body portion of said conductive terminal.

3. An electrical resistance heating unit, comprising a self-sustaining resistance heating element capable of producing and maintaining itself at high operating temperatures and having a terminal portion provided with screw threads, a conductive terminal having a contractible sleeve-like portion surrounding said terminal portion of the heating element, said conductive terminal being provided with screw threads in cooperative intimate engagement with the screw threads on said terminal portion of the heating element, and annular clamping means cooperative with the exterior of said sleeve for causing said sleeve to forcibly grip and intimately engage said terminal portion of the heating element, said clamping means having at its end nearest the center of the heating element and inclined away therefrom a flange-like shield adapted to dissipate heat from the body portion of said conductive terminal.

In witness whereof I affix my signature hereto.

WILLIAM E. DUERSTEN.