Dec. 14, 1965 R. EGGERS 3,223,875

ELECTRIC HEATING TUBE IN WHICH ENLARGED CONVOLUTIONS OF FILAMENT COIL ACT AS FILAMENT SUPPORTS

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Fig. 1

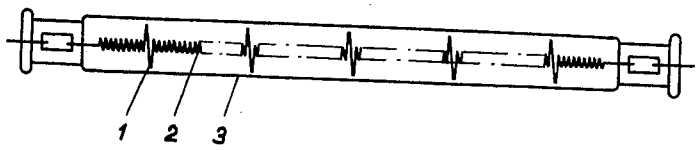


Fig. 2

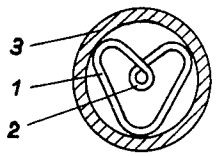
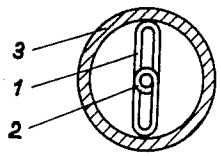


Fig. 3



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ELECTRIC HEATING TUBE IN WHICH ENLARGED CONVOLUTIONS OF FILAMENT COIL ACT AS FILAMENT SUPPORTS

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The present invention relates primarily to electric high intensity heating tubes.

Electric heating tubes are employed for many different purposes, for example, for drying and baking paints and enamels, for softening plastics, for baking, roasting, or grilling food, etc.

There is a prevailing tendency to attain the highest possible output of radiant heat with tubes of the smallest possible dimensions. Thus, for example, there are known heaters in which a helically wound coil of tungsten wire is mounted in a quartz tube with the axis of the helix extending in the longitudinal direction of the tube. It is, however, very difficult to maintain such a tungsten coil in a coaxial position within the tube. It has for this purpose been proposed prior to this invention to insert small plates of molybdenum into the coils to serve as supports. However, in order to attain a coil which will operate properly for a long time, it is necessary to preheat the coil at a very high temperature prior to the installation which renders the coil brittle. Since the subsequent insertion of the small molybdenum plates causes a slight deformation of the coil, this deformation often leads to breakage of the coil. The use of such small molybdenum plates for supporting the tungsten coil also has the disadvantage that a considerable drop in temperature occurs at the points of contact between the molybdenum plates and the incandescent coil, so that the coil will not produce heat uniformly over its length.

It is an object of the present invention to provide electric heating tubes of the highest possible heat output which overcome the above-mentioned disadvantages.

According to the present invention, the heating coil is designed so that a few of the windings of the coil, which are disposed at suitable distances from each other, rest upon the wall of the tubular enclosure and form supporting elements.

The heating tube according to the invention therefore contains a self-supporting heating coil which extends exactly coaxially with the quartz tube or other suitable tubular enclosure. The coil supports, are current-carrying integral components of the coil itself, and therefore radiate heat as the other portions of the coil. Thus the heat dissipation from the coil caused by the metal supporting plates of the known heating tubes is avoided. Since the supporting parts according to the invention are integral components of the coil, no deformations of the coil after initial shaping will occur. The coils according to the invention have the further advantage of being more easily inserted into the tubular enclosure since they cannot cause any binding or wedging. They are also superior to the known coils in having a much longer life.

The supporting parts which according to the invention are formed by the windings of the coil itself are preferably disposed at equal distances from each other and define angular supporting points. Thus, for example, the supporting parts may be of a triangular shape. The points of engagement of the heating coil with the quartz glass tube or similar enclosure are therefore extremely small so that any substantial drop in temperature of the heating coil at these points will be avoided. The heating wire tradiates heat uniformly substantially along its entire length.

The encasing tube may be partly provided with a light-reflecting coating. Thus, for example, a longitudinally extending reflecting strip may be deposited by metallization on the outside of the tube so that all rays emitted by the heating coil will be directed toward the other side of the heating tube where they are to be utilized.

In some applications of high-intensity heaters, light radiation is undesirable, for example, in kitchen apparatus. In order to filter out the undesirable wave lengths of the radiation, the encasing tube of the heater which consists of quartz or a special glass may be suitably colored, for example, ruby-red, black, or the like.

These and other objects, features, and advantages of the present invention will become further apparent from the following detailed description thereof, particularly when the same is read with reference to the accompanying drawings, in which,

FIGURE 1 shows a side view of an electric heating tube according to the invention;

FIGURE 2 shows a cross section thereof; while

FIGURE 3 shows a similar cross section of a heating tube according to a modification of the invention.

Referring to the drawings, and initially to FIGS. 1 and 2, the electric heater according to the invention consists of a heating coil 2 of tungsten wire which is enclosed within a vacuum-tight tube 3 of quartz or a similar heat-resistant material and extends therein in the axial direction. The ends of the heating coil 2 are connected to fused-in vacuum-tight leads 4 and the quartz tube 3 is evacuated. Heating coil 2 is wound so that at regular distances individual coil windings of the tungsten wire which is otherwise helically wound are bent outwardly so as to define, for example, a triangle, as shown in FIGURE 2, the outer circumference of which corresponds to or is slightly smaller than the inner diameter of the quartz tube so that the triangle is inscribed in a circle substantially identical with the circle formed by the cross section of the cavity in the tube 3. These substantially triangular windings of coil 2 form supporting parts 1 which maintain the coil in a central position within the quartz tube 3.

FIGURE 3 illustrates a modification of the coil 2, in which the regularly spaced windings 1 are bent into a flat elliptical shape 1' inscribed into the circular cross section of the tube cavity.

The encasing tube 3' shown in FIG. 3 is partly provided with a light reflecting coating 5. The coating is a longitudinally extending reflecting metal strip deposited on the outside of the tube 3' by metallizing. The rays emitted by the heating coil 2 are directed by the coating 5 toward the other side of the tube. The encasing tube 3' is colored ruby red to filter out most visible light radiation while passing radiant heat.

The two illustrated particular shapes of the supporting windings 1, 1' of the heating coil 2 are mere examples of some of the many suitable shapes in which the heating coil may be wound.

In order to produce the heating coils according to the invention, a tungsten wire or a wire of another suitable refractory material is wound upon a round wire core and the winding operation is interrupted at certain intervals. A winding which serves as a supporting part 1 is then wound over a die, for example, of triangular shape, whereupon winding is continued for the required distance on the round core until the next specially shaped winding is to be formed.

The completed coil is heated on the winding core to such a high temperature that no deformation will occur in service.

The present invention facilitates the production of heating tubes and other vacuum tubes in which filaments of a similar type may be used. The number of rejects

which occur during the production of these tubes is extremely small. The high-intensity heating tube according to the invention is therefore relatively inexpensive and it has the further advantage of radiating heat at a uniform temperature along its entire length. As already indicated, the invention is not limited to heating tubes but may also be applied to other incandescent or vacuum tubes which are intended for other purposes and in which the wire filament should be maintained in a well defined position.

Although my invention has been illustrated and described with reference to the preferred embodiments thereof, I wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. Electric heat-generating device comprising a hermetically sealed tubular enclosure having two ends, an inside wall, and an inside diameter, two conductors sealed through said ends, and an integral coiled filament extending approximately centrally within said enclosure and being connected at its ends to said conductors, said coiled filament including a main portion of smaller convolutions and at least a single larger convolution, said main portion having a substantially cylindrical shape and an outside diameter smaller than said inside diameter, said single larger convolution being shaped to provide

point-contacts with said inside wall and thus to position said filament.

2. In the device according to claim 1, said convolution, when viewed in plan, having the outline of a paper clip, and being adapted to engage said inside wall in two points.

3. In the device according to claim 1, said convolution, when viewed in plan, being substantially V-shaped, and being adapted to engage said inside wall in three points.

4. In the device according to claim 1, said convolution, when viewed in plan, being substantially of V-shape, said V forming a triangle, a circle bounding the triangle having a diameter slightly smaller than said inside enclosure diameter.

References Cited by the Examiner

UNITED STATES PATENTS

2,342,044	2/1944	Foote	313—279 X
2,523,033	9/1950	Leighton	313—279
2,859,368	11/1958	Biggs et al.	219—34 X
2,864,025	12/1958	Foote et al.	313—279
2,883,571	4/1959	Fridrick et al.	313—222
2,957,154	10/1960	Strokes	219—34

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