United States Patent

Eck

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[54] **DIRECTIONAL INFRARED HEATING ELEMENT**

[72] Inventor: **Richard H. Eck,** 352 Pines Lake Drive East, Wayne, N.J. 07470

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[52] **U.S. Cl.** **219/553,** 219/354, 219/355, 219/548, 313/275, 338/234, 338/268

[51] **Int. Cl.**.....**H05b 3/44**

[58] **Field of Search**.....219/339, 342, 343, 347–358, 219/377, 552, 553, 546, 548; 313/275, 271; 338/234–237, 267, 268, 270, 315, 301

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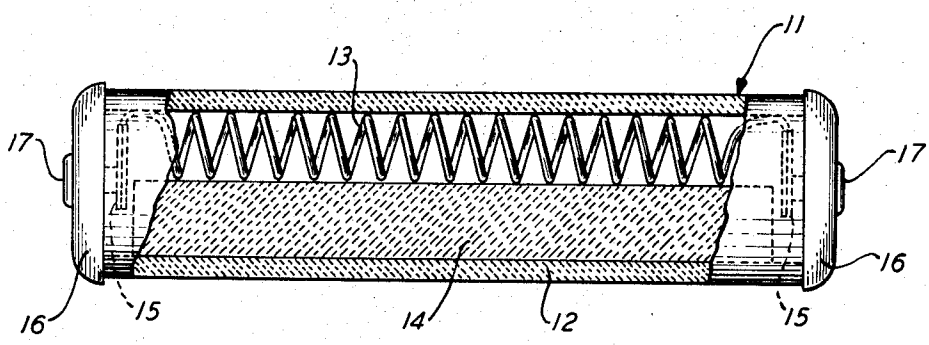
Primary Examiner—A. Bartis

Attorney—Popper, Bain, Bobis & Gilfillan

[57] **ABSTRACT**

A radiant heater that provides uniform directional disposition of heat includes an elongated cylindrical tubular enclosure of heat resistant vitreous material pervious to infrared radiation, such as VYCOR. A preformed semicylindrical elongated support rod extends longitudinally in the enclosure and provides an uninterrupted generally flat support surface extending diametrically across the enclosure. A single helical resistance element of Kanthal is disposed in the portion of the enclosure not occupied by the support rod. The resistance element extends longitudinally of the support rod and enclosure and is in tangential and direct contact with the flat surface of the support. The support rod is formed of a compressed fibrous material having a low coefficient of thermal conductivity, such as a fibrous aluminum oxide and silicon dioxide composition known as FIBERFRAX.

2 Claims, 2 Drawing Figures



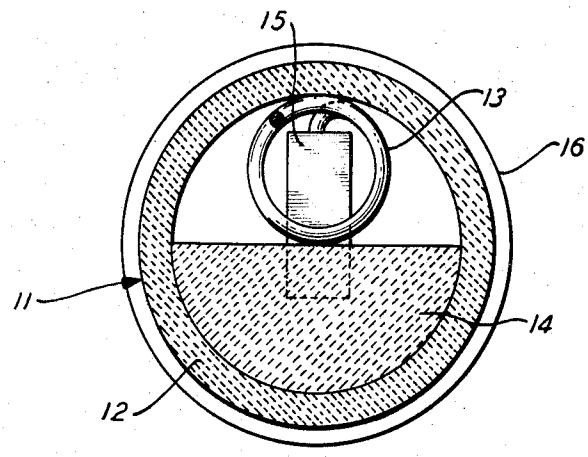


FIG. 1

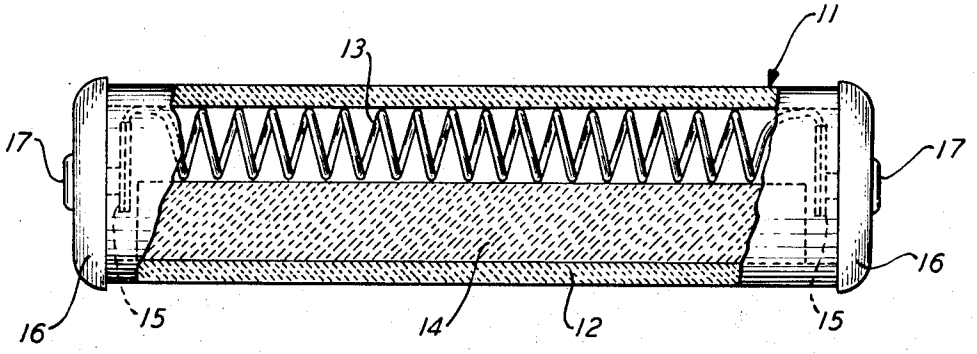
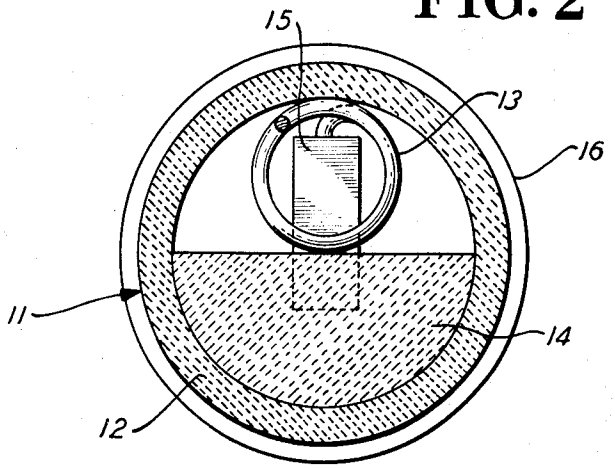


FIG. 2



INVENTOR
Richard H. Eck
BY
Popper, Bain Bobis & Gilfillan
ATTORNEYS

DIRECTIONAL INFRARED HEATING ELEMENT

BACKGROUND OF INVENTION

1. Field of Invention

This invention relates generally to heaters, and specifically to electrical resistance heaters in which the resistance is disposed in a tubular body.

2. Prior Art

Electrical resistance heaters, consisting of a helix of resistance wire disposed in a vitreous tube are well known and in wide general use. In order for such heaters to have a relatively long life, they must be provided with a rather costly tubular housing that is highly resistant to deterioration at high temperatures. At high temperatures, the unsupported resistance wires soon collapse. When the wires start to collapse, however slightly, deterioration to a further degree may follow rapidly. Due to the loss of symmetry, the wires develop "hot spots" i.e., some areas of the tube become hotter than others, and the wires further collapse until there is a burn-out. While high heat yields are sought, the larger the diameter helix, the more rapidly the failure. Consequently, if the heater is to be used, it becomes uneconomical unless cost is no factor, or unless lower heat yields are acceptable, in which case smaller diameter helix can be utilized.

A still further disadvantage of conventional heaters is the fact that they radiate 360°, when a more limited radiation is usually required. Such wastefulness is attempted to be overcome by the use of external reflectors, but these soon become soiled and lose their efficiency. Likewise, films of gold applied to the tube at limited areas soon deteriorate, and lose their efficiency to restrict the field of heat radiation.

Until the present invention, the only solution to these problems has been a smaller, less efficient helix of resistance wire and the frequent cleaner replacement of the reflector.

SUMMARY OF THE INVENTION

It has been found that a heater can be provided which does not develop hot-spots, uses smaller helix sizes, has a relatively long life, a high useful heat yield, and may have a radiation area restricted to a useful zone. This can be accomplished by providing a backing strip or rod that serves as a support for the resistance wire helix; this backing strip is inserted into the tube; it has a low coefficient of thermal conduction. Depending on its configuration, the radiation area is controlled, and the collapse of the helix is prevented, so that hot spots do not develop.

DRAWINGS

These objects and advantages as well as other objects and advantages may be attained by the device shown by way of illustration in the drawings in which:

FIG. 1 is a vertical sectional view of the heater;

FIG. 2 is a vertical sectional view of the heater in FIG. 1.

PREFERRED EMBODIMENT

Referring now to the drawings in detail, the heater **11** provides a vitreous silica tube enclosure **12**. As an example, this tube may have an internal diameter of one-half inch and an outer diameter of five-eights of an inch. Quartz or high temperature glass are suitable materials.

A helix **13** of resistance wire is prepared with a helix diameter of one-quarter of an inch; the wire may be two-hundredths of an inch in diameter.

A semicylindrical rod **14** of fibrous refractory material is inserted in the tube **12** with the helix **13**. The rod is made of material which has a low coefficient of thermal conductivity. Asbestos rods have been found to be unsatisfactory because they melt and collapse. FIBERFRAX (The Carborundum Corporation) has been found to be ideally suitable. The material is generally available in sheet form and may be easily cut to the desired configuration. It is made from a molten mixture principally of aluminum oxide and silicon dioxide (with small amounts of boron, and zirconium), is poured through a blast of steam, and this results in the formation of fibers which are approximately 1 ½ inch long and 10 microns in diameter. This material is compressed into sheets. Other refractory materials may also be used.

For the vitreous tube 12 VYCOR (Corning Glass) may be used or the vitreous silica tubes provided by Thermal-American, Montvale, N.J. For the resistance wire, an alloy of aluminum, cobalt, chromium, and iron may be used, such as KANTHAL (Kanthal Corp., Stamford, Conn.).

The ends of the helix **13** may be provided with terminals **15** which are welded onto them. Caps **16** are then provided for each end of the tube, with the terminals attached to contacts **17** which protrude from the end of the tube. The rod **14**, being semicylindrical, as shown in FIG. **2**, has a flat surface, and the resistance **13** is shown in tangential contact with this flat surface. Thus, the resistance **13** is free to radiate out of the tubular enclosure **12** along its entire external surface except at the points of tangential contact.

The rod **14** being of fibrous, refractory material, rather than being made of the dense ceramic material, as is well known in the prior art, and further having a low coefficient of thermal conduction, will not cause the heater **11** to develop hot spots, as mentioned in the summary, and will not store appreciable amounts of thermal energy.

I claim

1. A heater comprising:

a. an elongated, substantially cylindrical tubular enclosure,

b. the tubular enclosure made of heat resistant material which is pervious to infra red radiation,

c. a preformed semicylindrical, elongated support for a resistance extending longitudinally in the enclosure,

d. The support providing an uninterrupted generally flat support surface extending substantially diametrically across the tubular enclosure for receiving and supporting a resistance and being formed of a material which:

A. has a low coefficient of thermal conduction,

B. is fibrous and compressed,

e. a single helical resistance disposed in a portion of the remainder of the enclosure not occupied by the support and extending longitudinally of the support and the enclosure,

f. the resistance in generally tangential and direct contact with the flat surface of the support,

g. the entire surface of the resistance, except at the points of tangential contact, being free to radiate through the tubular enclosure.

2. The device according to claim 1 in which the support comprises fibrous aluminum oxide and silicon dioxide.

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