March 5, 1946. G. L. PEARSON 2,396,196

CONTROLLABLE RESISTOR

Filed May 15, 1943

FIG. 1

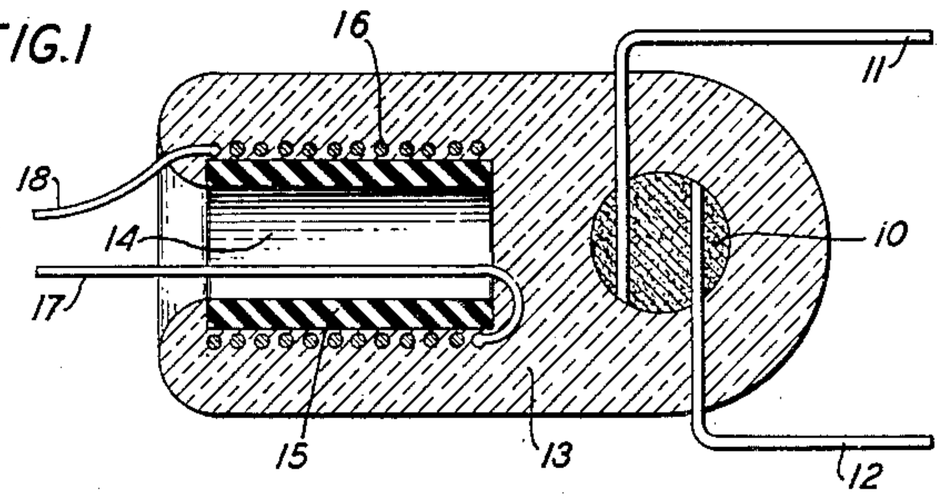


FIG. 2

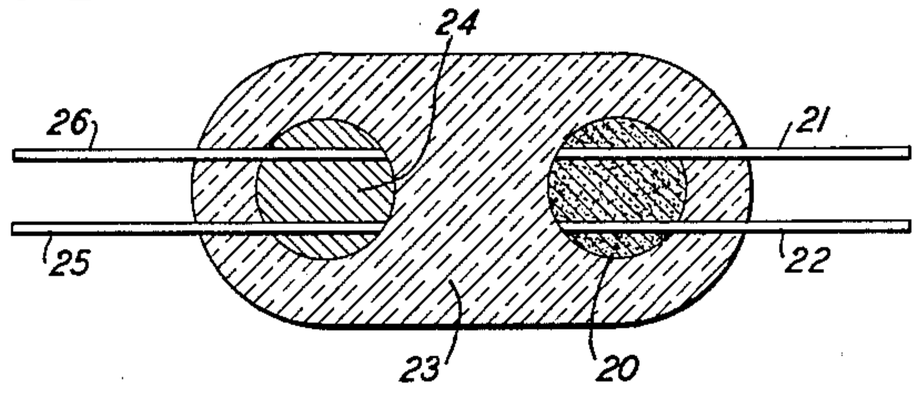
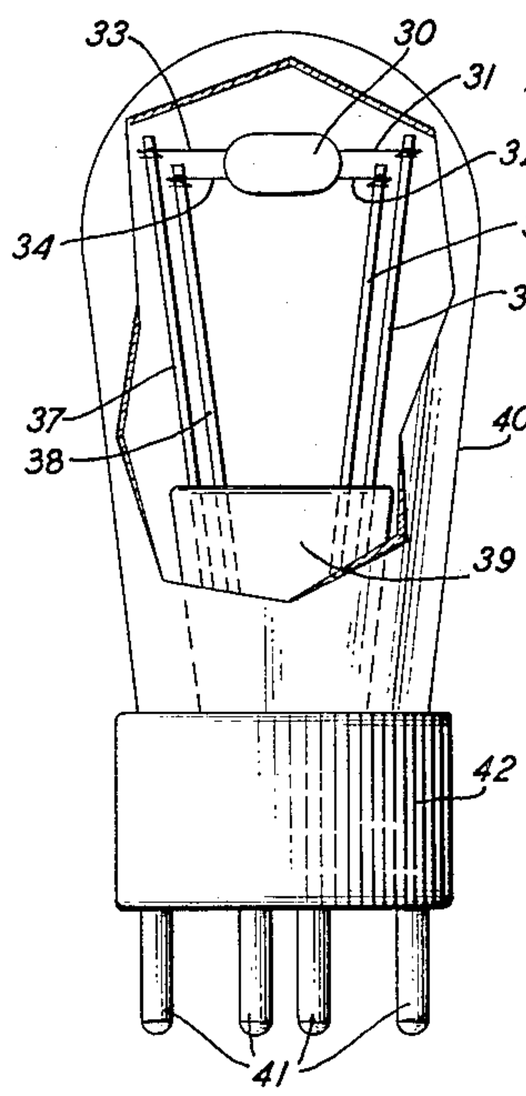


FIG. 3



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CONTROLLABLE RESISTOR

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2 Claims. (Cl. 219—20)

The invention herein disclosed is concerned with resistors and more particularly with resistor devices including a high resistance-temperature coefficient element and means for controlling the temperature of said element.

Resistors having a high temperature coefficient of resistance, i. e., those in which the resistance varies greatly with changes in temperature have for convenience of terminology been called "thermistors." In so far as the term may be used in this specification and the accompanying claims, such a resistor is intended.

Thermistors have been classified as directly heated and as indirectly heated. In the directly heated thermistor the primary variation in temperature with its consequent change in resistance is due to the variation in the electric power passing through a body of thermistor material. The indirectly heated thermistor comprises a body of thermistor material through which flows a current to be controlled, with separate means, usually electrical, for controlling the temperature of said body. This invention deals with improvements in the construction of indirectly heated thermistors.

An object of this invention is to construct an indirectly heated thermistor in which the heater portion is capable of carrying relatively large amounts of power and in which the effect of this power on the thermistor body is delayed.

A feature of this invention resides in a thermistor device in which both the thermistor body and the heater are embedded in an elongated insulating body with the thermistor longitudinally spaced from the heater means.

Other and further objects and features of this invention will be more clearly and fully understood from the following description of exemplary modifications of the invention taken in connection with the appended drawing in which:

Fig. 1 is a sectional view showing one embodiment of the invention;

Fig. 2 is another sectional view showing a further embodiment of the invention; and

Fig. 3 is an elevational view with parts broken away to show how the resistor device of this invention may be mounted in a protective envelope.

The device shown in Fig. 1 comprises a bead thermistor 10 having leads 11 and 12 projecting therefrom, the bead 10 and portions of the leads 11 and 12 adjacent thereto being embedded in one end of an elongated body 13 of insulating material. Embedded in the other end of the elongated body 13 is the heater 14. This heater comprises a tube 15 of insulating material such as aluminum oxide, a coil 16 of resistance wire wound on said tube and leads 17 and 18 connected to said coil.

A resistor device of the kind shown in Fig. 1 may be made by placing a thermistor 10 and a heater 14 in spaced relation within a cylinder of insulating material, such as glass, and then applying sufficient heat to the assembly to melt the glass and allow it to shrink around the thermistor and heater. The end of the tube 15 should preferably be left open to allow the air to be pumped therefrom if the device is mounted in an evacuated envelope. If it is desired to have the leads 11 and 12 oriented as shown in Fig. 1, it may be necessary to provide orifices or slots in the cylinder to insure proper location of the elements in the completed device. The thermistor body 10 may comprise one or more of the oxides of manganese, nickel, cobalt or copper, or other suitable thermistor material. The coil 16 may be made of any suitable resistance wire such as a well-known alloy of nickel and chromium.

The modification illustrated in Fig. 2 comprises a bead 20 of thermistor material having leads 21 and 22 extending therefrom. This thermistor element may be similar to that shown in Fig. 1. The element 20 is embedded in one end of the elongated body 23 of insulating material. The heater in this modification may comprise a bead or body 24 of resistance material having leads 25 and 26 projecting therefrom. This heater as in the case of Fig. 1 is embedded in the body 23 in longitudinally spaced relation to the thermistor 20. The bead 24 may be made of graphite, or some other form of carbon or like suitable material, held together with a binder of glass or the like. The proportions of conducting to insulating material in this bead should be adjusted so that the resistance is comparable to that of the heater in Fig. 1. The resistance-temperature coefficient of this material should also be relatively low, for example, about the same as that of the aforementioned nickel-chromium alloy used in the heater of the Fig. 1 modification.

Either of the devices of Fig. 1 or 2 may be mounted in a protective envelope 40 as illustrated in Fig. 3. The thermistor device, designated as 30 and having leads 31, 32, 33 and 34 extending therefrom, may be mounted by securing these leads respectively to support conductors 35, 36, 37 and 38. The support conductors may be secured in a conventional manner in the press 39 of the envelope 40. External connection may be made by way of pins 41 secured in the base 42

and connected to the support conductors in a well-known manner. The envelope 40 may be evacuated or may be filled with a suitable gas such as helium, nitrogen, etc.

Although this invention has been disclosed by means of illustrative embodiments thereof, it should be understood that it is not limited thereby but by the scope of the appended claims only.

What is claimed is:

1. An indirectly heated resistor device comprising a tube of insulating material, a coil of heater wire on said tube, an elongated body of insulating material covering said tube and coil except for one end which is left open, a portion of said body extending beyond the closed end of said tube, a small, high resistance-temperature coefficient resistor embedded in the extended portion of said body, and connecting leads attached to the heater and to the resistor and extending outside of said body.

2. An indirectly heated resistor device comprising a tube of aluminum oxide, a coil of heater wire wound on said tube, an elongated body of glass covering said tube and coil except for one end of the tube which is left open, a portion of said body extending beyond the closed end of said tube, a resistor comprising a small body of high resistance-temperature coefficient, semi-conductive material embedded in the extended portion of said body, and connecting leads attached to the heater coil and to the resistor and extending outside of said body.

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