Dec. 12, 1950 O. H. SCHMITT 2,533,288

TEMPERATURE STABILIZATION

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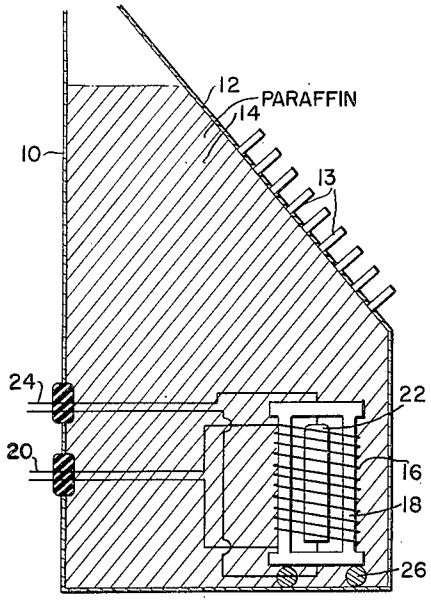


FIG. 1

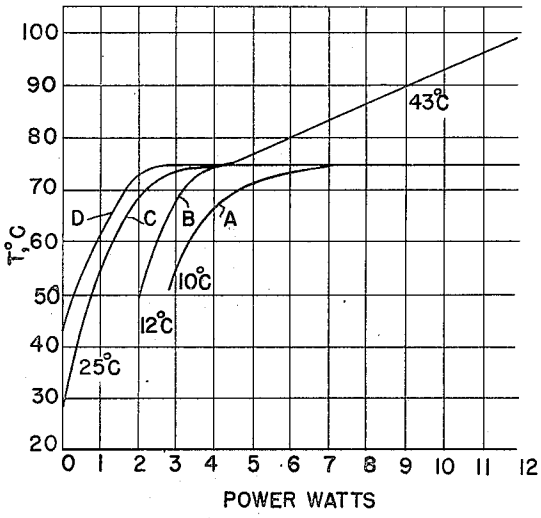


FIG. 3

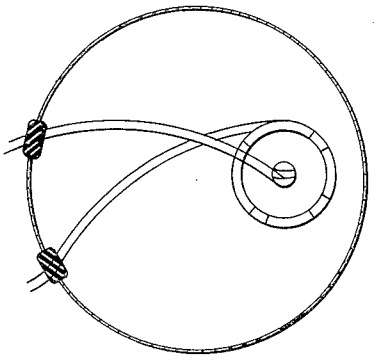


FIG. 2

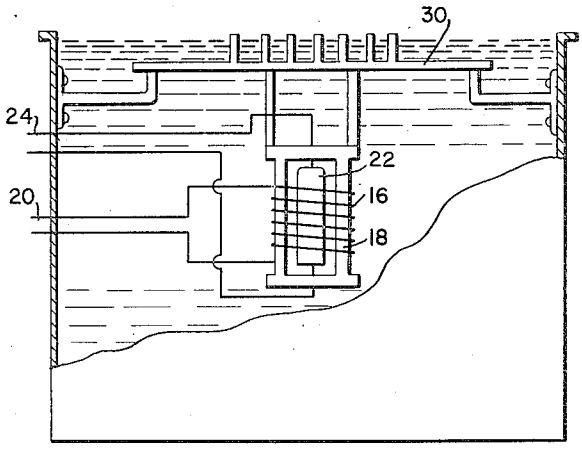


FIG. 4

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TEMPERATURE STABILIZATION

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7 Claims. (Cl. 236—1)

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This invention relates to temperature stabilization of devices generally, and more particularly of "thermistors" in electrical circuits.

Variations in the ambient temperature result in the lack of stability of electrical circuits which include "thermistors." It is, therefore, the object of this invention to provide means for maintaining "thermistor" units, and more broadly any device, at a constant temperature, although the ambient temperature of the entire apparatus might vary very widely.

In carrying out the object of the invention, the element to be kept at stable temperature is positioned adjacent a heating element and these two are surrounded with fusible material having low heat conductivity. A container may be provided having a special configuration to extend the range of ambient temperatures over which the apparatus is effective, and to make the temperature of the stabilized device more sharply defined.

In the drawings:

Fig. 1 is a side elevation, partly in section, of a preferred form of the apparatus;

Fig. 2 is a plan view omitting the top of the container;

Figure 3 is a graph showing performance of the apparatus, and

Figure 4 is a side elevation, partly in section, of another form of the invention.

In Figure 1, a metallic container 10 having preferably a sloping top 12 is filled nearly to its top with a solidified fusible material which in the preferred embodiment is paraffin. The solidifiable substance should fuse at a temperature which is substantially above the ambient temperature and about equal to the temperature at which the device being stabilized is desired to be maintained. An electrical heating coil 16 on a fenestrated frame 18 is connected to an external power source through leads 20. The unit 22 to be kept at stable temperature, which in this case is a "thermistor," is provided with leads 24 for connection in its external circuit. The "thermistor" and heater assembly are raised slightly from the bottom of container 10 by means of supports 26.

In operation, the heater fuses a small volume of the fusible material 14, for example the paraffin 14 surrounding the "thermistor." Convection currents cause the fused paraffin to rise toward sloping top 12 and to circulate. Should the ambient temperature outside container 10 rise appreciably, the height of the fused pool would increase and bring a larger volume of paraffin into

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a fluid state. Stability of temperature of the melted paraffin is maintained through changing areas of the solid paraffin in contact with the circulating melted paraffin to provide variable heat dissipation through conduction.

Should the ambient temperature outside the container 10 rise sufficiently, the melted paraffin would extend up to and along the sloping top 12. Since the latter is of metal and may and is preferably provided with fins 13, heat dissipation increases almost in direct ratio with the extent of the top surface of the paraffin pool.

In the same manner, temperature decreases outside the container diminish the volume of melted paraffin. Heat generated by the "thermistor" is dissipated without notably changing the temperature of the melted paraffin.

The temperature at which stabilization is effected is determined by the fusion temperature of the substance surrounding the heater and thermistor unit. While paraffin has been found very effective in maintaining the temperature of a thermistor element constant to better than one degree centigrade over a range of roughly 30° C. variation of the ambient temperature for a particular power input to the heater, other substances may obviously be substituted for paraffin to obtain stabilization at other temperatures.

In Figure 3 there are shown four curves illustrating the performance of the disclosed embodiment. As the ambient temperature decreases, it is necessary to increase the amount of power supplied to the heater to fuse a sufficient body of paraffin. Curves A, B and C which represent ambient temperatures of —10° C., 12° C. and 25° C. respectively, demonstrate that a degree of excess heater power does not change the temperature of the "thermistor" in the melted paraffin. Curve D which represents 43° C. ambient temperature attains temperature stabilization for a limited range of heater watts input, beyond which the temperature of the melted paraffin rises. This shows that all the paraffin has been melted and the area bounding the fused, circulating paraffin connot increase to dissipate the excess heat.

Other arrangements of heater and "thermistor" will achieve similar results. The container need not have a sloping top, although this is distinctly desirable, and need not be cylindrical. Indeed, a large block of fusible material as shown in Figure 4 of a size such that it will never all be melted may be used, and a heat absorbing surface 30, located therein so as to be contacted by the internal fused pool formed as the heat input of the embedded heat source increases. In

the illustrated embodiment shown in Figure 1, the container serves not only to contain the melted material but also as a heat radiator or absorber. It is evident that these functions may be separated as shown in Figure 4. It is only necessary that the heat removed from the fused pool be proportional to the size of the pool which is formed. Thus the unit 22 and heater 16 may be located within the mass of fused material as shown in Figure 4 and the heat absorbing surface also located therein so as to be enveloped to an increasing amount by the pool of fused material as the pool increases in size, thus removing more heat from the pool as it tends to increase, and hence stabilizing the temperature thereof. The heater may be in any suitable form and indeed need not even be electrical. The specific embodiment shown has been found particularly desirable in that the heater input is not critical and the temperature of the "thermistor" is maintained constant within close limits in spite of wide variations in ambient temperature.

While thermistors were the primary consideration resulting in this invention, it is obvious that other devices might be similarly temperature-stabilized.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to the specific embodiments herein except as defined by the appended claims.

What I claim is:

1. The method of maintaining temperature stability of a circuit element having a thermal coefficient of functional variation and which is subject to variable heat input or variable ambient temperature which comprises submerging said circuit element in a container in which there is a mass of fusible material having a relatively low heat conductivity when in the solid state and having a fusion point temperature which is appreciably above normal operating ambient temperature and not substantially exceeding the temperature at which the circuit element is desired to be stabilized, locating the circuit element with reference to the container wall so that any fused pool of material which is formed around and adjacent said circuit element in said mass will be bounded by an unfused portion of said material which is in contact with the container wall for radiation of heat therefrom and maintaining a source of heat adjacent said circuit element and within said mass.

2. Apparatus comprising a device having a thermal coefficient of functional variation and the temperature of which is to be stabilized, a heater, said device and heater being positioned in heat conducting relation to each other in a mass of fusible material which is in contact with the heater and device, said fusible material having a relatively low heat conductivity when in the solid state and having a fusion point temperature which is appreciably above normal operating ambient temperature, whereby a portion of said material adjacent said heater and device will be heated thereby to form a fused pool, the unfused portion of material serving to absorb and conduct heat from said fused pool, said fused pool increasing in volume in response to an increase in ambient temperature.

3. Apparatus comprising a circuit element having a thermal coefficient of functional variation and the temperature of which is to be stabilized, a heater, said circuit element and heater being positioned in heat conducting relation to each other in a mass of fusible material which is in contact with the heater and element, said fusible material having a relatively low heat conductivity when in the solid state and having a fusion point temperature which is appreciably above normal operating ambient temperature, whereby a portion of said material adjacent said heater and element will be heated thereby to form a fused pool, and a heat absorber positioned so as to be contacted by the fused pool of said fusible material, said heat absorber and said unfused portion of material serving to absorb and conduct heat from said fused pool.

4. The apparatus of claim 2 further characterized in that the heat absorber also constitutes the side wall of a container for the fusible material.

5. The apparatus of claim 2 further characterized in that the heat absorber also constitutes at least a part of the side wall of the container and has an upwardly and inwardly inclined surface.

6. The apparatus of claim 2 further characterized in that the fusible material is paraffin.

7. The apparatus of claim 4 further characterized in that the heat absorber constitutes a heat absorbing plate located within the mass of fusible material to be enveloped to an increasing amount by the pool of fusible material.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,054,409	Harrison	Feb. 25, 1913
1,432,864	Johnston	Oct. 24, 1922
1,874,909	Conklin	Aug. 30, 1932
2,025,534	Sheard	Dec. 24, 1935