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METHOD OF TREATING THE HEAT-RESPONSIVE ELEMENTS OF THERMOSTATS

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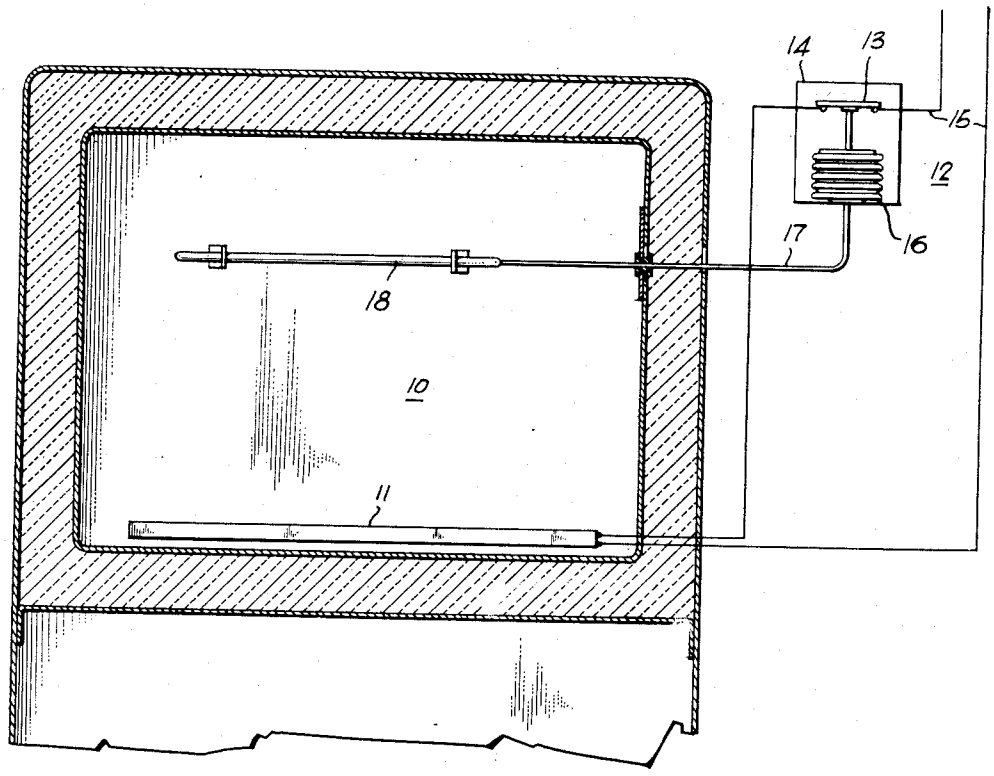


FIG. 1.

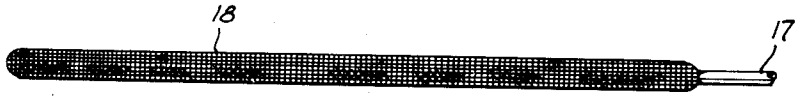


FIG. 2.

WITNESSES:
R. J. Ridge
Andrew L. Cook

INVENTOR
EARL K. CLARK &
GEORGE E. PRICE
BY W. A. Steiger
ATTORNEY

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METHOD OF TREATING THE HEAT-RESPONSIVE ELEMENTS OF THERMOSTATS

Earl K. Clark and George E. Price, Mansfield, Ohio, assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

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4 Claims. (Cl. 148—6)

Our invention relates to thermostat structures of the expansible or volatile-fluid type and has for an object to provide an improved method of treating the heat-responsive elements of apparatus of this kind.

A further object of the invention is to provide more sensitive thermostatic apparatus of the type set forth which may be readily produced in large, substantially uniform quantities.

A still further object of the invention is to improve the heat-absorbing and heat-radiating properties of the heat-responsive elements of fluid-type thermostats.

These and other objects are effected by our invention as will be apparent from the following description and claims taken in accordance with the accompanying drawing, forming a part of this application, in which:

Fig. 1 is a diagrammatic view of an oven, the temperature of which is controlled by a thermostat constructed and treated in accordance with our invention; and,

Fig. 2 is an enlarged view of the bulb or heat-responsive element of the thermostat.

In the drawing, a heat insulated oven space is diagrammatically shown at 10 and heated by an element 11 which we have shown of the electrically-energized type. A thermostat of the expansible fluid type is shown generally at 12 and includes a switch 13 arranged within a casing 14 exteriorly of the oven and controlling a circuit 15, the latter including the heating element 11. The circuit 15 is connected to a suitable source of electrical energy (not shown) as is well understood.

Operation of the switch 13 is effected by an expansible and contractible element 16, such as, for example, a bellows. The bellows is connected by a relatively small tube 17, commonly referred to as a capillary tube, to a bulb or reservoir 18 arranged in heat transfer relation with the heated air in the oven space 10. A suitable expansible liquid is contained in the bellows 16, tube 17 and bulb 18, which liquid retains its liquidity at temperatures up to 650° F. and which expands and contracts as its temperature is increased and decreased, respectively.

As the operation of the apparatus referred to heretofore is well understood in the art, no description thereof is deemed necessary. Fluid-type thermostats which have been employed heretofore for controlling ovens of electric ranges have not been sufficiently sensitive to meet requirements now imposed by certain utilities and testing laboratories. These prior art thermostats have, in general, been unable to maintain oven temperatures within a 40° F. amplitude, the figure which now represents the maximum amplitude permitted by such utilities or testing laboratories. The thermostats provided heretofore have their fluid-containing bulbs formed of copper or other metal, and, when new, have such low heat-absorbing and heat-radiating capacities that a relatively large differential obtains between the oven air temperature and fluid temperature. In other words, changes in the temperature of the fluid lag behind temperature changes in the oven air so that the temperature differential of the oven air is higher than the figure now required. A further disadvantage of these prior thermostats is that the heat-absorption capacity of the thermostat changes with use or as the surface of the bulb becomes oxidized. This change in heat-absorbing capacity usually necessitates a visit of the service man, after a period of use, for adjustment of the thermostat.

In accordance with our invention, we treat the bulb of the thermostat prior to its application to the apparatus to be controlled, so that the heat-absorbing and radiating qualities of the bulb are materially increased and so that substantially no change in these qualities obtains during extended use of the thermostat. We first etch the surface of the bulb for materially increasing its area and then blacken by an oxidation reaction the etched or matted surface of the bulb. Preferably, the smooth metal bulb is cleaned in a vapor degreaser for removing oil or grease spots and the bulb is then acid etched by dipping for two to five minutes in a solution of four parts muriatic acid, one part nitric acid and one part water. We have found that the suface of the bulb may be increased to 300% of its original surface when so treated. The bulb is then rinsed in clear water and may be blackened or oxidized by dipping from ten to thirty seconds in a poly-sulphide and water solution. During the latter step the bulb should be dipped just long enough for obtaining a blackened surface, as an excessive time in this dip may cause flaking. After the oxidizing process, the bulb is rinsed in clean water and then suitably dried.

While we prefer to employ the described method of roughening the bulb for increasing its surface area, it will be understood that this step may be effected other than by an acid etching operation. For example, the bulb may be roughened for increasing its surface area by sand-blasting or other mechanical means. The finally treated and blackened bulb 18 is shown in Fig. 2.

We have found that the maximum temperature amplitudes in ovens controlled by thermostats treated in accordance with our invention have been materially reduced to a value of the order of 27° F. when measured with a bare thermocouple disposed at the center of the range oven. Furthermore, we have found that the heat-absorbing and heat-radiating capacity of the bulbs so treated does not vary materially when in service, so that adjustment or calibration of the thermostat after a period of use is not necessary.

From the foregoing it will be apparent that we have provided improved thermostatic apparatus of the fluid type wherein the sensitivity is materially increased and wherein variations in operation after an extended period of use are obviated. Furthermore, the operation of the heat-responsive element, when produced in large quantities, is uniform, so that the original adjustment of the thermostatic structure is more readily effected. We consider this an important feature of our invention as, in the past, the heat-absorbing and radiating capacities of untreated bulbs have varied so widely that the proper calibration of the thermostat could only be obtained after many and widely different adjustments. The non-uniformity of the bulbs employed heretofore has, therefore, increased the factory cost of producing uniform thermostats of the fluid type and has been the cause of frequent servicing necessary to maintain the thermostats in proper adjustment.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and we desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What we claim is:

1. The method of making a thermostat of the fluid type for a heated appliance, which thermostat embodies a thermostatic bulb formed of a metal which progressively oxidizes in said appliance over an extended period of time so that its heat-absorbing property increases during such period, said bulb containing a temperature-responsive fluid, which method includes the step of providing the bulb, prior to the assembly of the thermostat for use in the heated appliance, with a dark coating having a high heat-absorbing property which is not substantially altered during use in the heated appliance.

2. The method of making a thermostat of the fluid type for a heated appliance, which thermostat embodies a thermostatic bulb formed of a metal which progressively oxidizes in said appliance over an extended period of time so that its heat-absorbing property increases during such period, said bulb containing a temperature-responsive fluid, which method includes the step of applying an oxidizing solution to the bulb, prior to the assembly of the thermostat for use in the heated appliance, to provide a predetermined coating of a compound of said metal on the bulb which compound has a high heat-absorbing property that is not substantially altered during use in the heated appliance.

3. The method as claimed in claim 2 wherein the oxidizing solution comprises a sulphide.

4. The method of making a thermostat of the fluid type for a heated appliance, which thermostat embodies a thermostatic bulb formed of copper, said bulb containing a temperature-responsive fluid, which method includes the step of applying a sulphide solution to the bulb prior to the assembly of the thermostat in the heated appliance to provide a coating on the bulb whose heat-absorbing property is relatively high and is not substantially altered during use in the heated appliance.

EARL K. CLARK.
GEORGE E. PRICE.