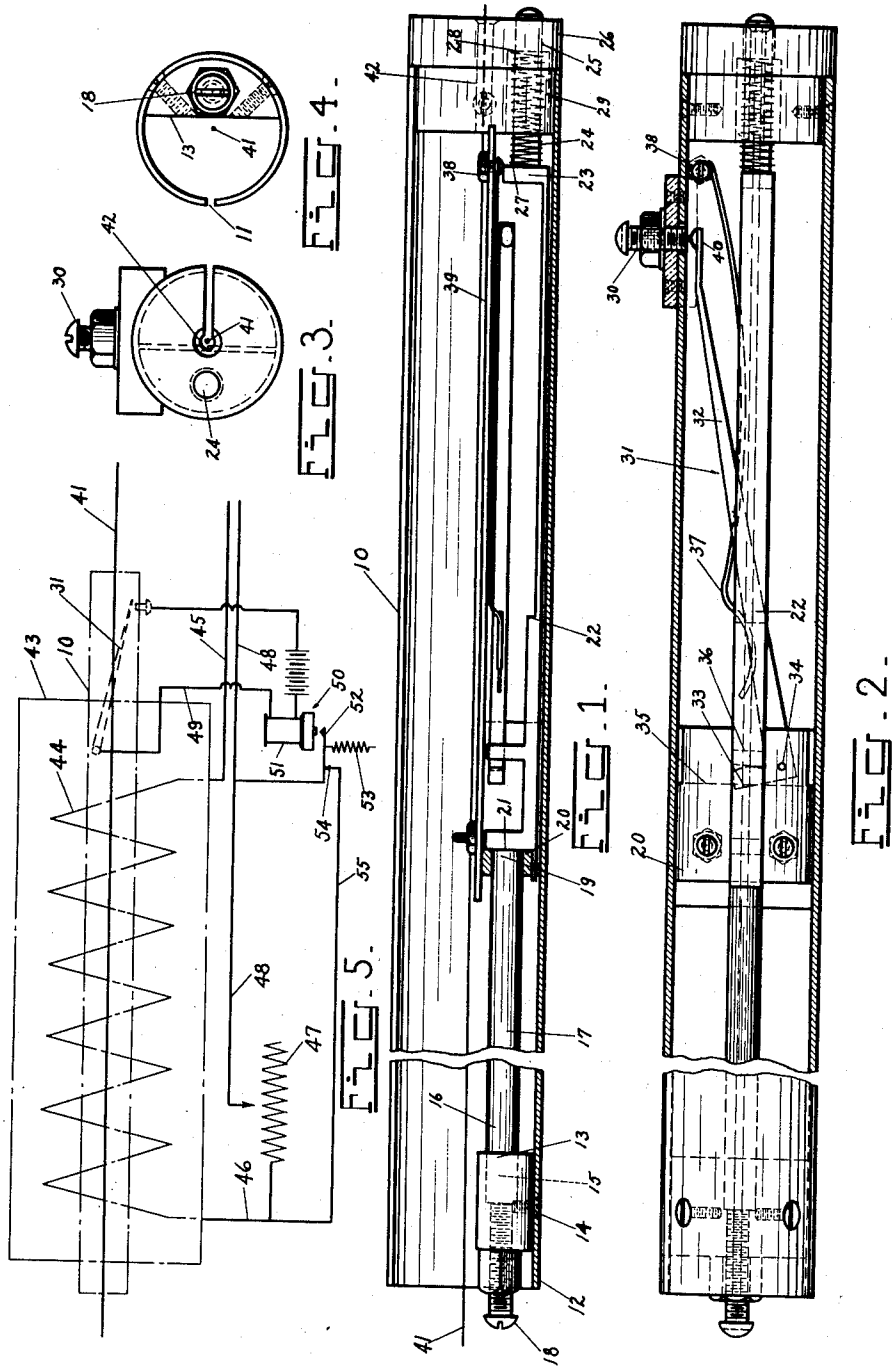
Jan. 2, 1934. E. ROMANELLI 1,942,002

AUTOMATIC TEMPERATURE CONTROL DEVICE

Filed Feb. 27, 1928



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Patented Jan. 2, 1934 1,942,002

UNITED STATES PATENT OFFICE

1,942,002

AUTOMATIC TEMPERATURE CONTROL DEVICE

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Application February 27, 1928. Serial No. 257,289

2 Claims. (Cl. 200—137)

This invention relates to a temperature control device and more particularly to a high temperature regulator for use in connection with gas or electric furnaces.

In the treatment of certain metals as, for example, the heating of tungsten wire, the baking of electrodes for electrical devices or in the annealing of glass parts it is important to provide a furnace which will maintain a uniform temperature throughout the heat treatment. Ordinarily the temperature of a gas furnace, for example, is subject to variation by reason of the variation in the density or combustible properties of the gas, it being evident that gas of a non-uniform character will give more or less B. t. u's. depending upon the constituents of the gas. In an electric furnace, the temperature is often inconsistent, inasmuch as a fixed voltage is difficult to maintain.

It is an object of the present invention, therefore, to provide a device for automatically controlling the temperature of a furnace by a regulation of the source of heat supply.

Another object of the invention is to provide a simple and effective device which may be applied to the active parts of a furnace so as to accurately control the temperature thereof.

Another object of the invention is to provide a heat control element which may be adjusted and regulated for maintaining a furnace at a given uniform temperature.

Another object of the invention is to provide a temperature control device wherein the device operates by reason of a differential between two elements of different coefficients of expansion.

Other objects and advantages of the invention will be understood from the following description and the accompanying drawing in which:

Fig. 1 is a side elevational view of a device embodying the present invention, part of the casing being broken away to more clearly show the interior structure;

Fig. 2 is a view of the underside of the device shown in Fig. 1 with the casing broken away;

Fig. 3 is a view of the right end of the device shown in Fig. 2;

Fig. 4 is a view of the left end of the device shown in Fig. 2; and,

Fig. 5 shows diagrammatically a furnace having the present invention applied thereto and includes a circuit for controlling the heat source.

A practical embodiment of the invention may consist of a tubular member 10 in the form of a cylinder having a longitudinal slot 11. The end 12 of the tube is provided with a stop-member 13 secured in the inner wall of the tube 10 by screws 14. The said stop-member is provided with an aperture 15 to receive an end 16 of a refractory rod 17, an adjustment screw 18 being provided for purposes to be presently described.

An opposite end 19 of the rod 17 is disposed in a guide-block 20 and normally in contact with an end 21 of a slide-member 22. The opposite end 23 of the slide-member 22 is provided with a guide-rod 24 passing through an aperture 25 in an end-piece or block 26 secured to the casing 10. The slide-member 22 is normally urged to engage with the end 19 of the rod 17 by reason of a helical spring 27 disposed between the end 23 and an end 28 of an aperture 29 in the end-piece 26.

At one side of the tubular member 10 is provided a stationary contact member 30 in the form of a set screw, one end of which projects through the tubular member for engagement with a movable contact member 31. The said member 31 consists of a long arm 32 and a short arm 33 and is pivoted at 34 in the guide block 20, the said block being provided with a slot 35 to allow for the movement of the arm 33. The arm 33 is normally maintained in contact with a projection 36 integral with the slide member 22 by a tension member or spring 37 secured at 38 to a plate 39, the said plate being suitably fastened to the guide-block 20 and the end-piece 26. The spring 37 is not, however, sufficiently strong enough to move the lever 31 in opposition to the helical spring 27 which exerts a thrust upon the slide member 22 and consequently normally maintains the lever 31 with its contact end 40 in engagement with the contact 30. The device is, however, set by an adjustment of the screw 18 to hold the contact end 40 away from the contact 30 as will hereinafter be more clearly explained.

The present device operates to control mechanism for regulating the temperature of a furnace by an actuation of the lever 31 to or from the contact 30. This is effected by positioning the present device in the furnace and as the tube 10 heats or reaches a predetermined temperature, it will, by reason of its greater coefficient of expansion than the refractory rod 17, cause the projection 36 on the slide-member 22 to engage the contact lever member 31. By reason of the short arm 33 and the long arm 32 of the contact lever, the degree of movement of the contact portion of the lever is greatly magnified, thus a slight expansion of the tube 10 results in a slight movement of the projection 36 to actuate the lever 31.

By a movement of the contact lever in accord-

ance with the variation of temperature within the device, a flow of electrical energy may be controlled with a subsequent operation of means for controlling the source of heat and regulating the temperature of the furnace.

The present device is constructed for the control of the temperature of a furnace for treating a wire 41 which may be passed through the tubular member 10 and an aperture 42 in the end-piece 26. As shown in Fig. 5, an insulating casing 43 constituting a portion of the furnace is indicated in dotted lines as well as a heating coil 44, having one conductor 45 connected with a suitable source of electrical energy (not shown) and the opposite end connected with a conductor 46 leading to a resistance element 47. The resistance element may be of a variable type provided with a lead 48 connected with the said source of electrical energy. Normally electrical energy will flow through the coil 44 to heat the same and elevate the temperature of the furnace.

For the purpose of controlling the temperature imparted to the furnace by the coil 44, the present device is positioned within the heating element as shown in dotted lines in Fig. 5 and the set screw 18 is adjusted and a force is applied to the slide member 22 through the rod 17 in opposition to the force exerted by the spring 27, thus allowing the tension member 37 to move the contact end 40 of the lever 31 away from the contact 30. When this adjustment is made, electrical energy will flow through the coil 44 to heat the furnace. The contact lever 31 is, however, connected at one end with a conductor 49 leading to a relay 50 comprising a coil 51 and a movable armature 52. The armature is normally held to engage a contact 54 by means of a spring 53. The said contact 54 is connected to a lead wire 55 which is connected to lead wire 46 thus electrical energy will flow through the coil 44 when the device is set as above described.

As the furnace heats beyond a predetermined amount, determined by the setting of the device, the metallic casing will expand and elongate and owing to the smaller expansion in the rod 17 a differential in forces is created and the force upon the spring 27 will be relieved, causing the said spring to overcome the force applied by the tension member 37 and permitting the contact 40 to engage the contact 30. When this occurs the relay is energized causing the contact 54 to be broken and the flow of energy directed through the resistance 47 which may be set for a predetermined value to lower the temperature of the furnace. When the furnace temperature drops a contraction of the metallic parts of the regulator device occurs and the slide member is moved with a consequent movement of the contact lever to bring its end 40 against contact 30 and the resistance 47 is short circuited and a full flow of current is applied to the coil 44.

The present device has, in practice, been found sufficiently sensitive to maintain a temperature of an electric furnace at 850° C. with a variation in temperature of less than two degrees plus or minus.

Although the present device is shown and described as applied to an electric furnace it is obvious that the invention has a wider application. For example, it may be used in connection with a gas furnace and the solenoid 50 utilized to actuate valve control mechanism for regulating the supply of fuel in accordance with the furnace temperature desired. This modification and the construction for accomplishing the same will be evident to those skilled in the art.

By reason of the present device a furnace may be easily and conveniently controlled. The casing or tube 10 which encloses the operative elements acts as a measure of the degree of heat and inasmuch as this portion of the device is in the active or effective part of the furnace an accurate and delicate control of the temperature is possible.

The use of an expansible element and a substantially non-expansible element makes it possible to obtain a fine adjustment of the device so that the movable contact element may be adjusted to a fine degree and a temperature regulation obtained within exceedingly narrow limits.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A thermostatic switch for an electrical circuit comprising a tubular expansible element, a slidable member within said element, a pivoted member having a short arm and a long arm, a stationary contact member, a pivoted member and said stationary contact member in said circuit, means for normally holding said long arm engaged with said contact member to close said circuit, and means for releasing said first mentioned means upon an elevation of the temperature of said expansible element and means for disengaging said long arm with said contact member.

2. A thermostatic switch for an electrical circuit comprising an expansible element arranged for disposition in a heat zone, a pivoted member having a short arm and a long arm, a contact member, a pivoted member and said contact member in said circuit, a refractory member engaging said short arm to hold said long arm to engage it with said contact member and means operable upon an elongation of said expansible element for disengaging said long arm and said contact member.

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