

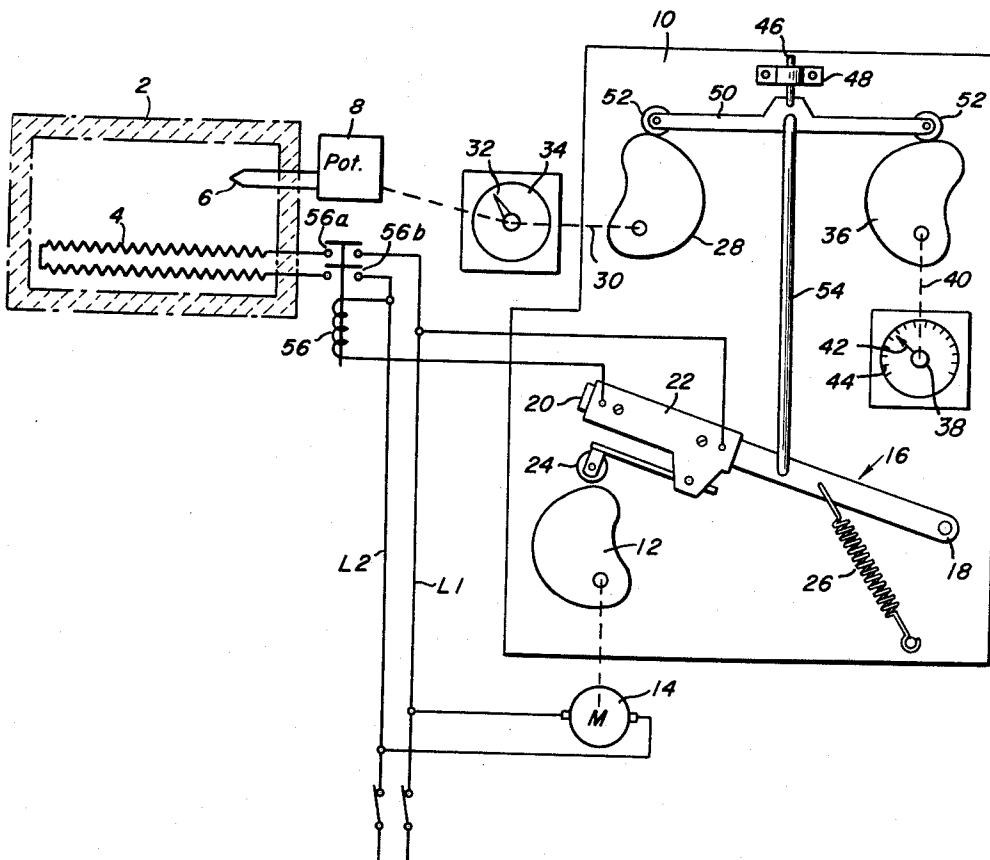
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FURNACE TEMPERATURE CONTROL SYSTEM

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3,062,447

**FURNACE TEMPERATURE CONTROL SYSTEM**  
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The present invention relates generally to furnace control systems and has as its primary object the provision of an improved temperature control for gas fired and electrically heated furnaces which is simple and economical in construction and maintenance, and accurate, sensitive and reliable in operation.

It is a further object of the invention to provide a temperature control system to be used in combination with a continuous balance potentiometer controller wherein the ratio of fuel or current "on time" to fuel or current "off time" is made a function of the deviation of temperature from the desired temperature.

These and other objects will become more apparent after referring to the following specification and attached drawing, in which the single figure is a diagrammatic illustration of the system of the invention.

Referring more particularly to the drawing, reference numeral 2 designates an electric furnace which is heated by an electrical heating element 4 and is provided with a thermocouple 6 connected with a Brown Instrument Company continuous-balance potentiometer controller 8.

Reference numeral 10 designates a vertical base plate on which is mounted a constantly rotating cam 12 connected with and driven by a constant speed motor 14. A lever arm 16 is pivotally mounted by one end 18 on the vertical base plate 10 with its free end 20 disposed adjacent the constantly rotating cam 12. A micro switch 22 having a cam-follower actuating arm 24 projecting therefrom is mounted on the end 20 of lever arm 16 with its actuating arm adjacent the periphery of cam 12. A tension spring 26 having one end anchored to the base plate 10 and its other end connected with the lever arm 16 constantly urges the end 20 of the lever arm and the micro switch carried thereby toward the cam 12 to engage the periphery of the cam with the actuating arm 24.

A balance cam 28 is mounted on the base plate 10 above the constantly rotating cam 12 and is connected with the potentiometer shaft 30 of the controller 8. A recording pen 32 also mounted on the shaft 30 functions to indicate and mark the actual temperature of the furnace on a circular chart 34. The shaft 30 of the controller is connected with and driven by the balance motor of the controller 8 in accordance with the actual furnace temperature. Thus the position of cam 28 is a function of the actual furnace temperature.

A manually adjustable cam 36 rotatable by means of a knob 38 is mounted on the base plate 10 spaced laterally from the cam 28 on a shaft 40. The shaft 40 also carries an indicator pointer 42 which is mounted for movement along a temperature scale 44. When the indicator pointer 42 is moved up-scale, the cam 36 is rotated clockwise at the same time and when the pointer is moved down-scale, the cam 36 is rotated in the counter clockwise direction.

A pivot pin 46 is slidably mounted in a fixed bearing in the form of a bracket 48 affixed to the vertical base plate 10 and carries a lever bar 50 pivotally mounted thereon. The bar 50 is mounted at a point intermediate its ends and extends over the cams 28 and 36. Cam follower rollers 52 are mounted in each end of the lever bar for contacting the cams 28 and 36. A rod 54 is pivoted at one end to the center of bar 50 and at its other end to the lever arm 16.

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In the operation of the system of the invention, the manually adjustable cam 36 is rotated by means of knob 38 until the indicator pointer 42 is positioned at the desired furnace temperature. If the actual furnace temperature is below that desired, the cam-follower actuating arm 24 of micro switch 22 rides the constantly rotating cam 12. As the arm 24 rides cam 12, the micro switch 22 is closed and a circuit is completed between lines L1 and L2 energizing a relay 56. When the relay 56 is energized its normally open contacts 56a and 56b are closed and a circuit is completed to the heating element 4 of furnace 2. (If the furnace is gas fired a solenoid valve (not shown) is energized for feeding gas to the furnace). When the actuating arm 24 is lifted from the cam 12, the micro switch 22 is opened, relay 56 is de-energized and contacts 56a and 56b are opened thus breaking the circuit to the furnace element 4.

The actuating arm 24 of the micro switch 22 is positioned so that it will ride the cam 12 during only a fraction of its revolution. This introduces the ratio of "on time" to "off time." It is necessary that the position of the micro switch and its actuating arm be determined by two factors, namely, the desired temperature and the actual temperature of the furnace. In other words, the ratio of "on time" to "off time" is a function of the deviation of temperature from the desired temperature. This relationship is achieved through the used of cams 28 and 36. For example, if the actual furnace temperature is increasing and the pen 32 is moving up-scale, cam 28 will be rotated clockwise. This movement will raise the bar 50 and rod 54 so that the lever arm 16 will be lifted and actuating arm 24 will be lifted from cam 12. It will be noted that as the temperature gradually rises, cam 28 which is driven by the balance motor of controller 8, is rotated very slowly and there will be a correspondingly slow upward movement of the micro switch and its actuating arm from the cam 12. The amount of time that the actuator arm 24 rides cam 12 will gradually decrease. In this manner the system of the invention will control the ratio of "on time" to "off time."

Conversely, if the actual furnace temperature is falling and the pen 32 is moving down-scale, cam 28 will be rotated in the counter-clockwise direction. Counter-clockwise rotation of the cam 28 will lower the bar 50 and the rod 54 so that lever arm 16 will be lowered and the actuating arm 24 will ride on the cam 12 closing micro switch 22 and energizing relay 56 so current will flow to the furnace element 4 as described above.

While one embodiment of my invention has been shown and described, it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for controlling the temperature of a furnace having a continuous-balance potentiometer controller including a potentiometer shaft, and means controlling the rotation of the potentiometer shaft in response to changes in furnace temperature, said apparatus comprising a cam adapted to be mounted on and rotatable with the potentiometer shaft, a manually adjustable cam adjacent said first mentioned cam, said manually adjustable cam being adapted to be positioned rotatively in accordance with a pre-selected furnace temperature, a bar resting on said cams jointly, said bar being adapted to be raised and lowered by rotation of either of said cams, a lever connected to said bar, a switch mounted on said lever, continuously operating means adapted to actuate said switch intermittently when said bar is lowered, and means controlled by said switch for controlling the supply of heat to said furnace.

2. Apparatus as defined by claim 1 including a shaft

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slidable vertically in a fixed bearing, said bar being pivoted to said slidable shaft.

3. Apparatus for controlling the temperature of a furnace comprising a first cam, means connected with said cam for rotating the same in response to changes in furnace temperature, a second manually adjustable cam adjacent said first cam, said manually adjustable cam being adapted to be positioned rotatively in accordance with a pre-selected furnace temperature, a bar resting on said cams jointly, said bar being adapted to be raised and lowered by rotation of either of said cams, a lever connected to said bar, a switch mounted on said lever, continuously operating means adapted to actuate said switch intermittently when said bar is lowered, and means

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controlled by said switch for controlling the supply of heat to said furnace.

4. Apparatus as defined by claim 3 including a shaft slidable vertically in a fixed bearing, said bar being pivoted to said slidable shaft.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |        |               |
|-----------|--------|---------------|
| 2,249,682 | Clark  | July 15, 1941 |
| 2,387,562 | Brunot | Oct. 23, 1945 |
| 2,549,461 | Haller | Apr. 17, 1951 |
| 2,702,843 | Taylor | Feb. 22, 1955 |
| 2,728,829 | Tuttle | Dec. 27, 1955 |