

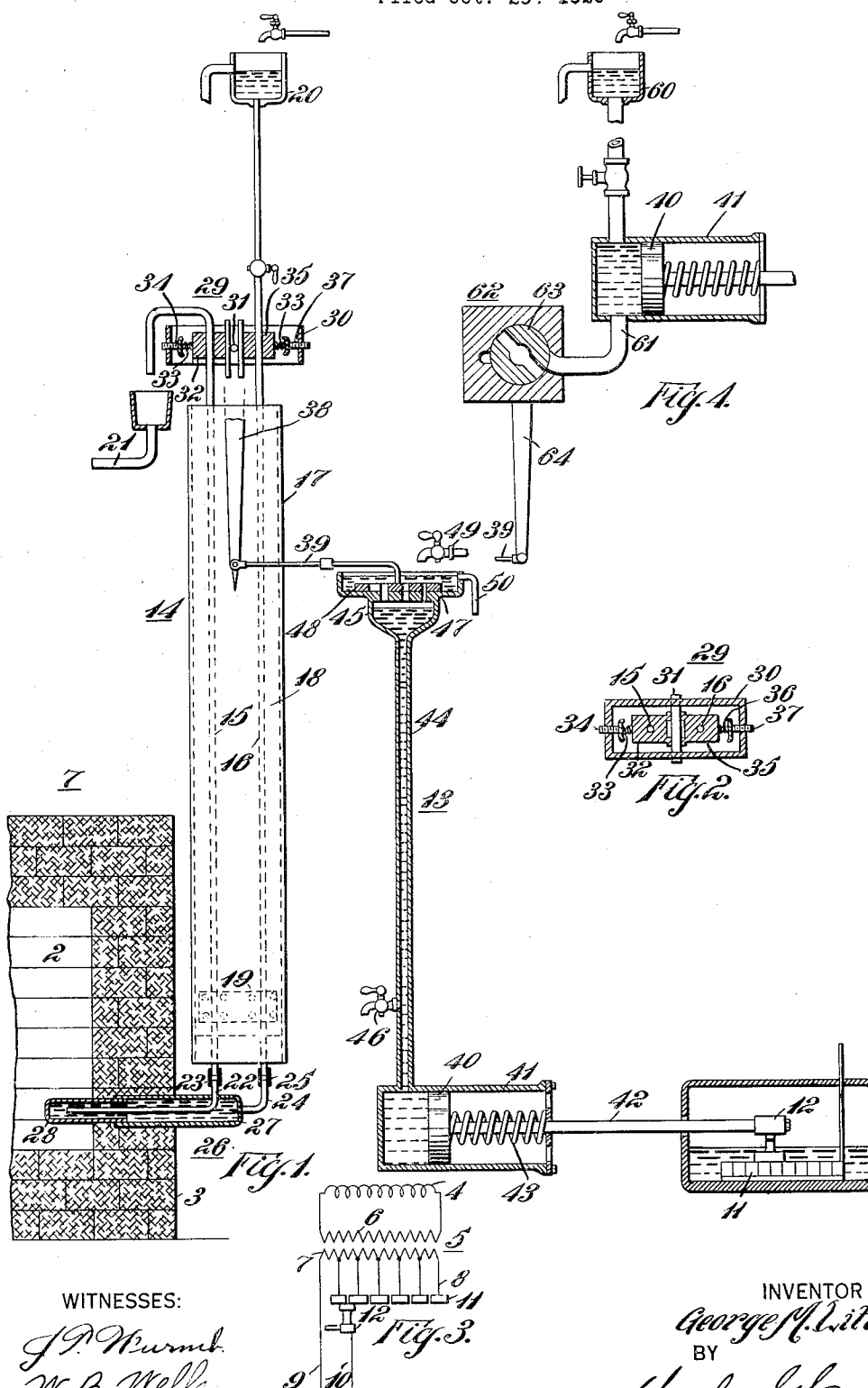
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FURNACE REGULATOR SYSTEM

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FURNACE-REGULATOR SYSTEM.

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To all whom it may concern:

Be it known that I, GEORGE M. LITTLE, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Furnace-Regulator Systems, of which the following is a specification.

My invention relates to regulator systems and, particularly, to regulator systems for governing the operation of electric furnaces.

One object of my invention is to provide a furnace-regulator system that shall embody two members having relative elongation in accordance with variations in furnace temperature, and that shall utilize such relative elongation between the members for controlling the current input to the furnace.

In an electric furnace and, particularly, in an electric furnace of the resistor type, trouble is often encountered in so controlling the power input as to maintain the furnace temperature within certain predetermined limits.

In a regulator system constructed in accordance with my invention, two tubes, preferably composed of aluminum, are mounted in parallel relation, and one of them is heated in accordance with the furnace temperature. A fluid system, which has a constant head and which passes through the furnace, is so connected to the two tubes as to effect relative elongation between the two tubes in accordance with variations of furnace temperature. Such relative elongation between the tubes is utilized for operating a controller to govern the current input to the furnace.

In the accompanying drawing,

Figure 1 is a diagrammatic view of a furnace-regulator system constructed in accordance with my invention;

Fig. 2 is a plan view of the two tubes and the means connected thereto for measuring the relative elongation between them;

Fig. 3 is a diagrammatic view of the transformer connections for the furnace; and

Fig. 4 is a diagrammatic view of a modification of the regulator system shown in Fig. 1.

Referring to the drawing, an electric furnace 1, of the resistor type, comprises a

heating chamber 2, which is surrounded by walls 3 of any suitable refractory and heat-insulating material. A resistor 4, of any suitable type, is connected to a transformer 5 and is located, in any convenient manner, within the chamber 2.

The transformer 5 comprises a secondary winding 6, which is directly connected to the resistor 4, and a primary winding 7, which is provided with a plurality of taps 8. One terminal of the primary winding 7 is directly connected to one side of a supply circuit comprising conductors 9 and 10. The taps 8 are adapted to be connected to the other side of the supply circuit through controller segments 11 and a brush member 12 which passes over the segments 11. The brush member 12 and the segments 11 constitute a portion of a controller for governing the current input to the furnace.

The brush member 12 is preferably operated by a fluid device 13, and the latter is controlled by a thermal device 14. The thermal device 14 comprises two tubes 15 and 16, which are preferably composed of aluminum and are mounted within a suitable box 17. The tubes 15 are surrounded by any suitable heat-insulating material, such as asbestos 18, and are held together, near the bottom, by a clamp 19. The clamp 19 is preferably composed of some heat-insulating material and not only serves to hold the tubes 15 and 16 within the box 17, but also to prevent relative movement between the tubes at one end thereof in order that the relative elongation between such tubes may be readily measured. The tube 16 is connected to any suitable source of constant fluid pressure 20, and the tube 15 is so bent as to empty into any convenient drain 21.

The lower end of the aluminum tube 15 is connected to an L-shaped iron tube 22 by means of a coupling 23, which is preferably composed of rubber. The lower end of the aluminum tube 16 is connected to an L-shaped iron tube 24 by means of a rubber coupling 25. The iron tube 24 is directly connected to one end of a cylinder 26. The iron tube 22 enters the cylinder 26 near one end thereof and ends near the opposite end of the cylinder. The cylinder 26 comprises a portion 27 which extends partly through

the wall of the furnace and is preferably composed of iron or steel. A second portion 28 of the cylinder 26, which is composed of copper, extends into the chamber 2 of the furnace and is preferably thread-connected to the portion 27 of the cylinder.

The upper ends of the aluminum tubes 15 and 16 are held together by means of a bracket 29. The bracket 29 comprises a frame 30, which surrounds the two tubes 15 and 16, and a roller 31 which is mounted in the frame 30 between the two tubes. A block 32 is mounted on the tube 15 and is held in engagement with the roller 31 by means of a spring member 33 and an adjustable screw 34. A similar block 35, which is mounted on the tube 16, is held in engagement with the roller 31 by means of a spring member 36 and the screw member 37. Preferably, the surface of each of the blocks 32 and 35, which engage the roller 31, are grooved, as shown in Fig. 2 of the drawing.

The roller 31 is provided with an elongated portion or pointer 38, which is flattened and also bent at right angles to the portion which engages the blocks 32 and 35. An arm 39 is connected near the lower end of the elongated portion or pointer 38 for operating the fluid device 13.

The thermal device above described serves to measure variations in the temperature of the furnace 1. A uniform stream of water or fluid from the source of supply 20 is conveyed, through the aluminum tube 16, the iron tube 24, the cylinder 26, the furnace, the iron tube 22 and the aluminum tube 15, to the drain 21. Accordingly, the aluminum tube 15 is heated in accordance with the temperature of the furnace, and, consequently, there is relative elongation between the two tubes 15 and 16. Relative movement between the two tubes is prevented at one end by means of the clamping member 19. However, relative elongation between the tubes is permitted and such elongation is measured by the rotative movement of the roller 31. Such relative elongation between the tubes is indicated by the movement of the pointer 38 and is utilized for controlling the fluid device 13. The fluid device, as will be hereinafter set forth, controls the current input to the furnace.

The fluid device 13 comprises a piston 40, which operates within the cylinder 41 and is connected, by a piston rod 42, to the brush member 12. The brush member 12 and the contact segments 11 are preferably enclosed or encased, as shown in Fig. 1 of the drawing. A spring member 43 is mounted on the piston rod 42 between the cylinder head and the piston 40 for biasing the piston and brush member to the extreme position, where a minimum amount of current is supplied to the furnace.

A vertical tube 44, having an enlarged

head portion 45, is connected to the cylinder 41, near one end thereof, and serves to supply variable fluid pressure for operating the piston 40. The tube 44 is provided with an outlet 46 adjacent to the cylinder 41, for a purpose to be hereinafter set forth. The head portion 45 of the tube 44 supports a valve 47 which serves to admit any amount of suitable fluid to the tube 44 for operating the piston 40. The gate member 48 of the valve is directly connected to the pointer 38 by means of the arm 39. A source of fluid pressure 49 is provided for supplying fluid above the valve 47, and an outlet 50 is provided above such valve in order to maintain a constant head on it. The outlet 46, which is connected to the tube 44, serves to permit the slow release of the fluid pressure in the tube 44.

Assuming the valve 47 to be in the position shown for supplying fluid pressure through the tube 44 to the cylinder 41, the fluid pressure operates the brush member 12 toward the left, as shown upon the drawing. Such movement of the brush member 12 increases the number of active turns of the transformer which is included in circuit with the resistor 4, and, consequently, increases the current input to the furnace.

When the temperature of the furnace is increased above a predetermined point, the aluminum tube 15 is so elongated as to effect rotation of the roller 31 in a clockwise direction. Such rotation of the roller member operates the valve 47 for preventing further fluid pressure being supplied to the cylinder 41. Thereupon, the outlet 46, which is connected to the tube 44, slowly removes the fluid pressure from the cylinder 41, and the spring member 43 effects movement of the piston 40 and the brush member 41 toward the left, as shown in Fig. 1 of the drawing. Consequently, the number of active transformer turns is reduced to lower the current input to the furnace. When the temperature of the furnace is reduced below a predetermined limit, the thermal device 14 operates the valve 47 for again supplying fluid pressure to the cylinder 41. The current input to the furnace is increased and the above cycle of operations is again repeated.

Referring to Fig. 4, a modification of my invention is shown, where a considerable portion of the fluid device 13 is eliminated. By reason of the similarity of the two regulators, like parts will be indicated by corresponding reference characters.

The cylinder 41 is directly connected to a source of constant fluid pressure 60 and is provided with an outlet 61, which is controlled by a valve 62. The valve 62 comprises a plug 63 which controls the release of the fluid pressure from the cylinder 41. In the position shown in Fig. 4, the valve 62 is so set as to maintain the fluid pressure in

the cylinder 41. Upon a small movement of the valve plug 63 in a counter-clockwise direction, the outlet 61 is directly connected, through the valve 62, to any suitable drain (not shown). The valve plug 63 is directly connected to a link 64, which is operated by the arm 39. The operation of the regulator shown in Fig. 4 is similar to the operation of the regulator shown in Fig. 1, and further description thereof is deemed unnecessary.

In the regulator system above described, an efficient and reliable thermal device is provided for indicating any minute variation in the temperature of the furnace, and such thermal device is utilized for efficiently controlling the current input to the furnace and so maintains the furnace temperature substantially constant. The thermal device is so constructed as to permit the ready replacement or repair of any parts thereof.

Modifications in the system and in the arrangement and location of parts may be made within the spirit and scope of my invention, and such modifications are intended to be covered by the appended claims.

I claim as my invention:—

1. In a furnace-regulator system, the combination with a pair of tubes, and means for effecting relative elongation between said tubes in accordance with the temperature of the furnace, of means controlled by the relative elongation between said tubes for regulating the temperature of the furnace.

2. In a regulator system, the combination with an electric furnace, a conduit for conveying a fluid through said furnace, tubes connected to the respective ends of said conduit and disposed in parallel relation, and a source of fluid supply connected to one of said tubes, of a roller located between said tubes and operated in accordance with the relative elongation between the tubes, and means controlled by said roller for governing the temperature of the furnace.

3. In a regulator system for an electric furnace, the combination with a pair of tubes, and means for effecting relative elongation between said tubes in accordance with the temperature of the furnace, of means controlled in accordance with the relative elongation between said tubes for governing the current supplied to the furnace.

4. In a regulator system for an electric furnace, the combination comprising a controller for governing the current supplied to the furnace, a fluid system passing through said furnace, and means governed by said fluid system for operating the controller to maintain the temperature of the furnace substantially constant.

5. In a regulator system for an electric furnace, the combination comprising a fluid system passing through the furnace, a con-

troller, and mechanical means operated in accordance with the difference in the temperature of the fluid entering and leaving the furnace for governing the operation of said controller to maintain the temperature of the furnace substantially constant.

6. In a regulator system for an electric furnace, the combination with two members and means for effecting relative elongation between said members in accordance with the temperature of the furnace, of means comprising a roller located between said members and rotated in accordance with the relative elongation between said members for controlling the current input to the furnace.

7. In a regulator system for an electric furnace, the combination with two members, and means for effecting relative elongation of said members in accordance with the temperature of the furnace, of a roller located between said members and rotated in accordance with the relative elongation between said members, means comprising a controller for governing the current supplied to the furnace, and mechanical connecting means between said roller and the controller for operating the controller to maintain the furnace temperature substantially constant.

8. In a regulator system for an electric furnace, the combination with a pair of members located in parallel relation, and means for effecting relative movement of said members in accordance with the temperature of the furnace, of a controller for governing the amount of current supplied to the furnace, and means for mechanically connecting said controller to said tubes to be operated in accordance with the relative elongation between such tubes.

9. In a regulator system for an electric furnace, the combination comprising a fluid system having a fluid heated in accordance with the furnace temperature, said fluid system having two tubes located in parallel relation and respectively heated in accordance with the temperature of the fluid before and after being heated by the furnace, and means operated in accordance with the relative elongation of said tubes for controlling the current input to the furnace.

10. In a regulator system for an electric furnace, the combination comprising a pair of tubes, means for effecting relative elongation of said tubes in accordance with the variation in furnace temperature, a controller for governing the current input to the furnace, and means controlled by the relative elongation of said tubes for operating said controller.

11. In a regulator system for an electric furnace, the combination comprising a pair of members having relative elongation in accordance with the variations in furnace

temperature, and means comprising a roller operated by said members for governing the input to the furnace to maintain its temperature substantially constant.

- 5 12. In a regulator system for an electric furnace, the combination comprising a pair of members having relative elongation in accordance with the variations in furnace

temperature, and means operated by said members for governing the input to the 10 furnace to maintain its temperature substantially constant.

In testimony whereof, I have hereunto subscribed my name this 26th day of October 1920.

GEORGE M. LITTLE