

Feb. 5, 1924.

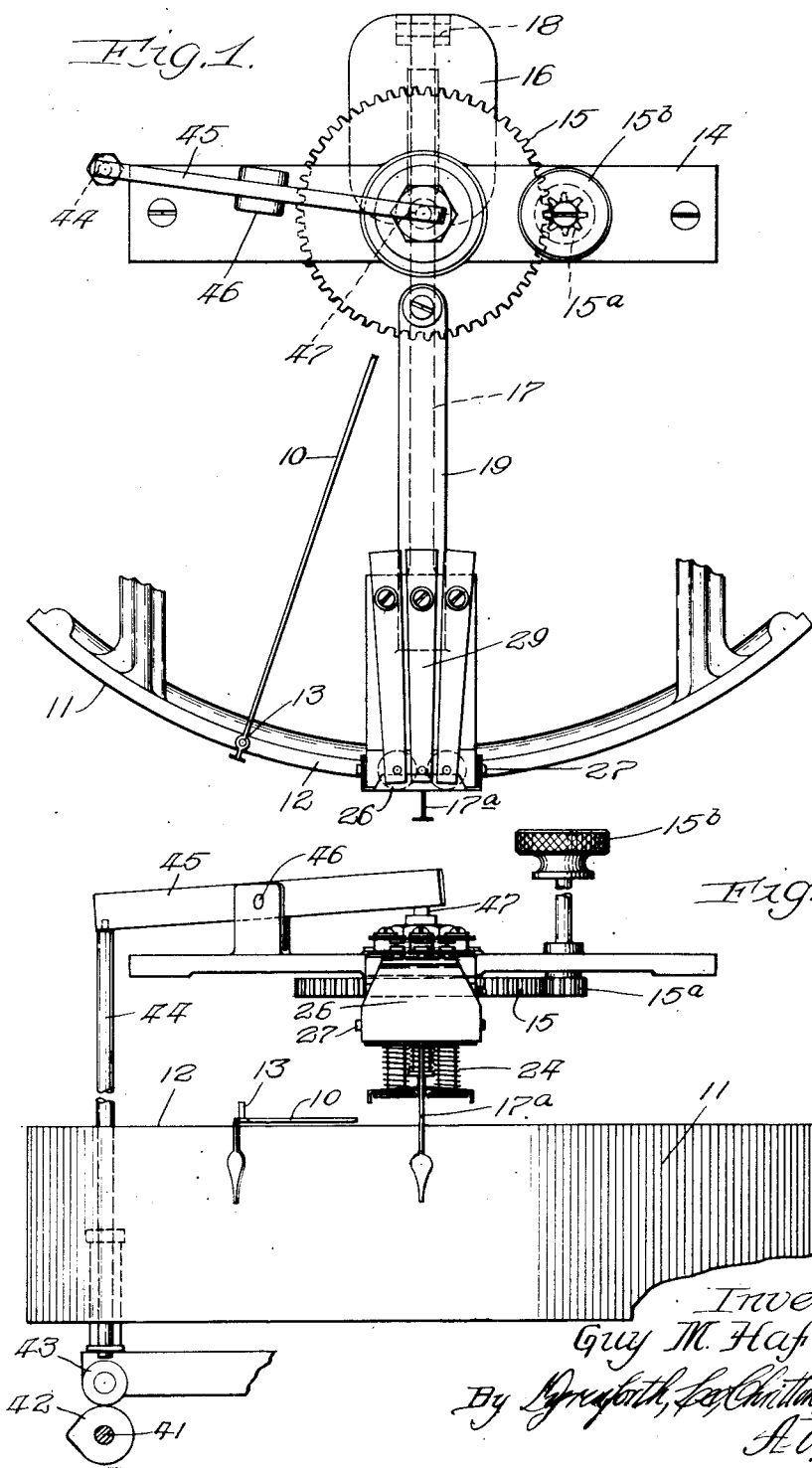
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G. M. HAVER

REGULATOR

Filed Sept. 14, 1921

2 Sheets-Sheet 1



Feb. 5 , 1924.

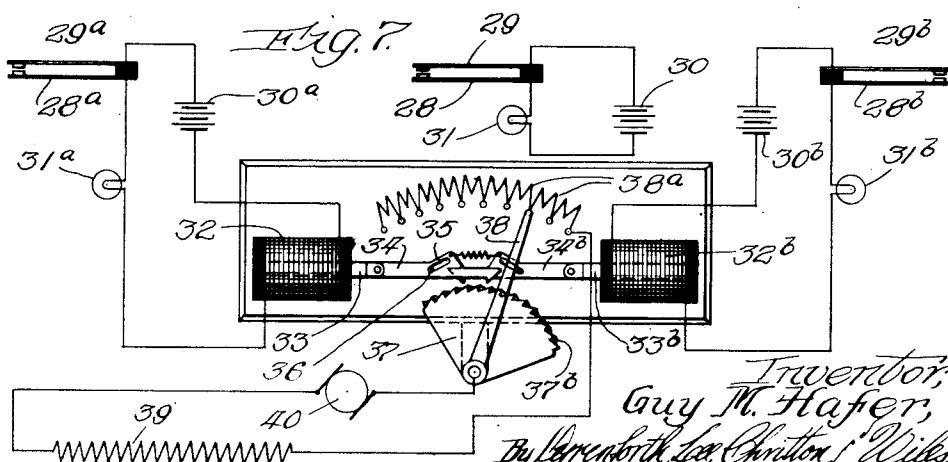
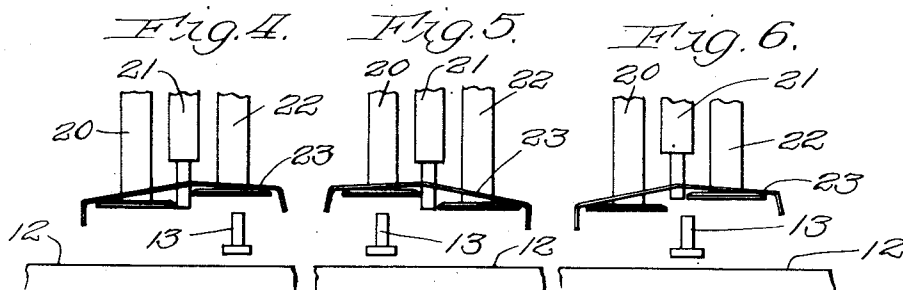
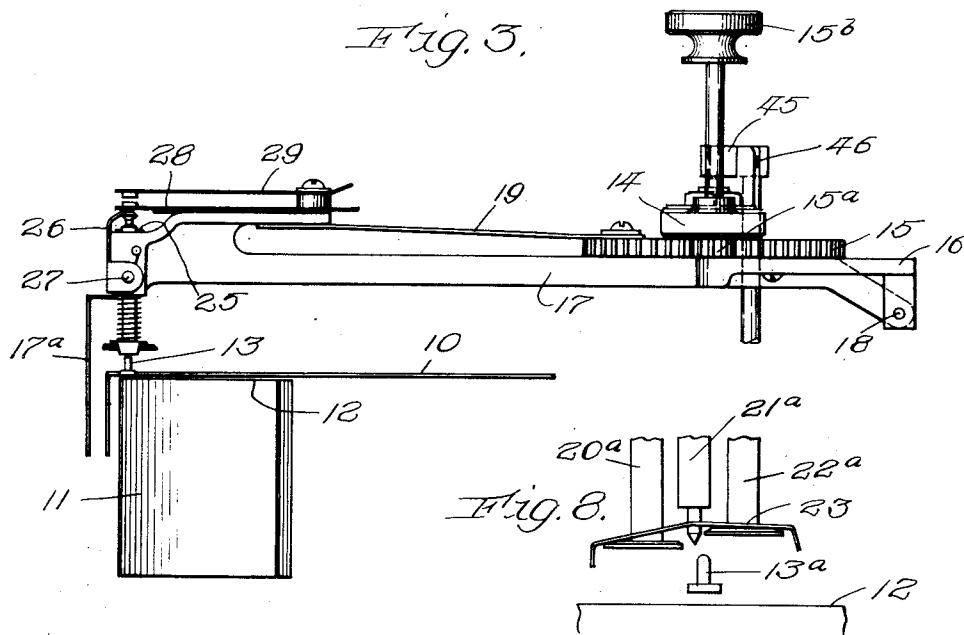
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

GUY M. HAFFER, OF DETROIT, MICHIGAN, ASSIGNOR TO HOSKINS MANUFACTURING COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

REGULATOR.

Application filed September 14, 1921. Serial No. 500,716.

To all whom it may concern:

Be it known that I, GUY M. HAFFER, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented a new and useful Improvement in Regulators, of which the following is a specification.

This invention relates to regulators and is particularly adapted to be used on furnaces and the like for automatically controlling the furnace-heating means so as to maintain the temperatures of the furnace nearly constant.

The invention is clearly set forth in the following specification and shown in the accompanying drawings, in which Figure 1 is a partial plan view of the regulating mechanism; Fig. 2 is a front elevation of the same; Fig. 3 is a side elevation of Figure 1; Figures 4, 5 and 6 are front elevations showing the operating plungers in various positions; Figure 7 is a diagrammatic view of the regulating mechanism, and Fig. 8 is a front elevation of a modified form of plunger mechanism.

This mechanism is illustrated as applied to a galvanometer having a needle 10 which oscillates over a scale 11 in a well-known manner. On the upper edge of the scale 11 is formed a smooth ledge 12 and a pin 13 is carried by the needle and swings above this ledge.

The main frame 14 of the galvanometer carries a gear 15 which is journaled thereon, the center of this gear corresponding to the axis of the needle 10. The gear 15 carries a lug 16 to which an arm 17 is pivotally connected by means of a pin 18. This arm is normally held in the raised position, as shown in Figure 3, by means of the flat spring 19.

The outer end of the arm 17 overlies the ledge 12 and has three plungers 20, 21 and 22 which are vertically slidable therein.

The lower ends of the plungers 20 and 22 are enlarged and retain a plate 23 through which they pass. Springs 24 serve to hold these plungers in their lowermost position, which is fixed by means of pins 25, as shown in Figure 3, which pass thru the upper ends of the plungers.

The upper ends of these plungers are also necked down and a flat metal spring 26 is hingedly mounted upon pins 27 at the outer end of the arm 17. The upper edge of the

spring 26 is so placed as to yield as any of these plungers are raised and falls into the neck portion so as to retain them in the raised position until it is released.

A pair of switch-contacts 28 and 29 are mounted so as to be insulated from each other and from the arm 17 and have their outer movable ends immediately over one of the plungers, so that as the plunger is raised they will be moved into engagement.

The central pair of contacts which are operable by the plunger 21 are shown in the center of Figure 7 and are connected to a source of current 30 and a lamp 31 in series therewith.

In this same figure, contacts 28^a and 29^a which are operable by the plunger 20 are placed in series with a suitable source of electric current 30^a, a lamp 31^a and a solenoid 32. This solenoid has a core 33 to which is pivotally connected a pawl 34 which has a slot 35 which is slidable over the stationary pin 36.

It will thus be seen that when the switch 28^a, 29^a is closed, current will flow thru the solenoid 32 in the core 33 and move the pawl 34. Owing to the angularity of the slot 35, the outer end of the pawl will be drawn downwardly and to the left and will engage a tooth of the ratchet 37, thereby moving the rheostat arm 38 to the left.

The contacts 28^b and 29^b, also shown in Figure 7, are likewise operable by means of the plunger 22. These contacts likewise are placed in series with a suitable source of current 30^b, a lamp 31^b and a solenoid 32^b. This solenoid has a core 33^b which is pivotally connected to a pawl 34^b which operates a ratchet 37^b which is connected to the ratchet 37 but which operates in the reverse direction.

It will thus be seen that when the plunger 22 is raised the switch 28^b, 29^b will be closed and the solenoid 32^b will be actuated to move the rheostat arm 38 one notch to the right.

The furnace (not shown) is heated by means of a resistance coil 39, as shown in Fig. 7, which is placed in series with any suitable source of current 40 and the rheostat which has been previously described. An electric pyrometer (not shown) is placed in the furnace and connected to the galvanometer in a well-known manner.

The shaft 41, as shown in Figure 2, is

driven at a uniform rate of speed by any suitable means and carries a cam 42 which periodically raises the cam follower 43 and the rod 44. This rod is connected to the outer end of a lever 45 which is pivotally mounted at 46 near its center. The opposite end of the lever 45 overlies a pin 47 which is slidably mounted so as to engage the arm 17.

The method of operation of this device is as follows:

When the electric furnace has been in operation for sometime so as to have reached nearly a stationary temperature, the arm 17 is turned so that its pointer 17^a indicates the temperature of the furnace which it is desired to maintain. This is done by means of a pinion 15^a which is turned by means of the thumb-nut 15^b.

The arm 17 is periodically depressed by means of the cam 42. Assuming that the pin 13 is beneath the plunger 22, as shown in Figure 4, as the arm 17 is lowered the plunger 22 will engage the pin 13, depressing it until it strikes the ledge 12. The other plungers 20 and 21 will then be further lowered while the plunger 22 is pushed up into engagement with the spring 26.

The contacts 28^b and 29^b are then forced into engagement, closing the circuit and actuating the solenoid 32^b. This will cause the rheostat arm 38 to be drawn to the right, thereby cutting out some of the resistance coils 38^a and increasing the current flowing thru the heating coil 39. The tendency will therefore be to increase the temperature of the furnace which in time will manifest itself by increasing the current flowing thru the pyrometer, thereby swinging the galvanometer needle 10 to the left, as shown in Figures 1, 2 and 4.

During the time that the switch 28^b, 29^b is closed the lamp 31^b will remain lighted, indicating that the plunger 22^b was actuated. This plunger corresponds to a temperature in the furnace which is below normal, while the plunger 21 corresponds to a normal temperature and 20 to a temperature above normal. These temperatures are indicated by different colored lights 31, 31^a and 31^b, so that the operator, who may be at some distance from the instrument, will know from the color of the light which plunger was the last one actuated and consequently will indicate to him whether the temperature of the furnace is normal or whether it is above or below normal.

As the temperature in the furnace increases, the pin may be moved to the position shown in Figure 5 and upon depressing the arm 17 the plunger 20 will be raised, thereby releasing any other plunger which may have been in a raised position. The solenoid 32 will then be actuated and the rheostat arm 38 will be moved to the left,

thereby decreasing the current flowing thru the heating coils 39, with the result that the temperature will again be brought nearer normal.

At certain points, as shown in Figure 6, the pin 13 may be immediately under two of the plungers, in which case they will both be raised. In this case, both of the lights 31 and 31^b will be lighted, indicating that both plungers have been actuated and that the temperature of the furnace is very nearly normal.

In Fig. 8 is shown a modification of the mechanism shown in Fig. 6 in which the central plunger 21 is securely held on the arm 17. The bottom of this plunger is beveled at both sides and the pin 13^b is rounded on top so as to cause the arm 17 to swing to one side or the other if the plunger strikes the pin. In this case, only two lighting circuits controlled as previously explained by the plungers 20^a and 22^a are used.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

What I claim as new, and desire to secure by Letters Patent, is—

1. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over which said pin oscillates, a member having a plurality of plungers slidably mounted therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate one of said plungers, an electric circuit having a switch which may be closed by one of said plungers as it is actuated, and means operable by said circuit for varying the temperature of said furnace.

2. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over which said pin oscillates, a member having a plurality of plungers slidably mounted therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate one of said plungers, an electric circuit having a switch which may be closed by one of said plungers as it is actuated, electric resistance coils for heating said furnace, and means operable by said circuit for varying the current passing thru said coils.

3. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over which said pin oscillates, a member having a plurality of plungers slidably mounted therein, said plungers overlying the path of said pin, means for periodically depress-

ing said member to cause said pin to actuate one of said plungers, an electric circuit having a switch which may be closed by one of said plungers as it is actuated, electric resistance coils for heating said furnace, a rheostat in series with said coils, a ratchet operably connected to said rheostat, and a solenoid in said circuit operably connected to said ratchet.

10 4. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over which said pin oscillates, a member having a plurality of plungers slidably mounted
15 therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate one of said plungers, an electric circuit having a switch which may be closed by said
20 plunger as it is actuated, and means operable by one of said circuits for lowering the temperature of the furnace and means operable by another of said circuits for raising the temperature of the furnace when
25 said circuits are selectively closed by their plungers.

5. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over
30 which said pin oscillates, a member having a plurality of plungers slidably mounted

therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate one of said plungers, a switch operable by
35 each plunger, an electric circuit connected to said switch, electric resistance coils for heating said furnace, a rheostat in series with said coils, and means operable by said circuit for moving said rheostat as the gal-
40 vanometer moves either way from a predetermined position.

6. In an electric pyrometer for furnaces, a galvanometer having an oscillating needle, a pin carried by said needle, a ledge over
45 which said pin oscillates, a member having a plurality of plungers slidably mounted therein, said plungers overlying the path of said pin, means for periodically depressing said member to cause said pin to actuate
50 one of said plungers, a switch operable by each plunger, an electric circuit connected to said switch, electric resistance coils for heating said furnace, a rheostat in series with said coils, means operable by said cir-
55 cuit for moving said rheostat as the galvanometer moves either way from a predetermined position, and a signal means in each of said circuits for indicating which circuit is actuated.

GUY M. HAFFER.