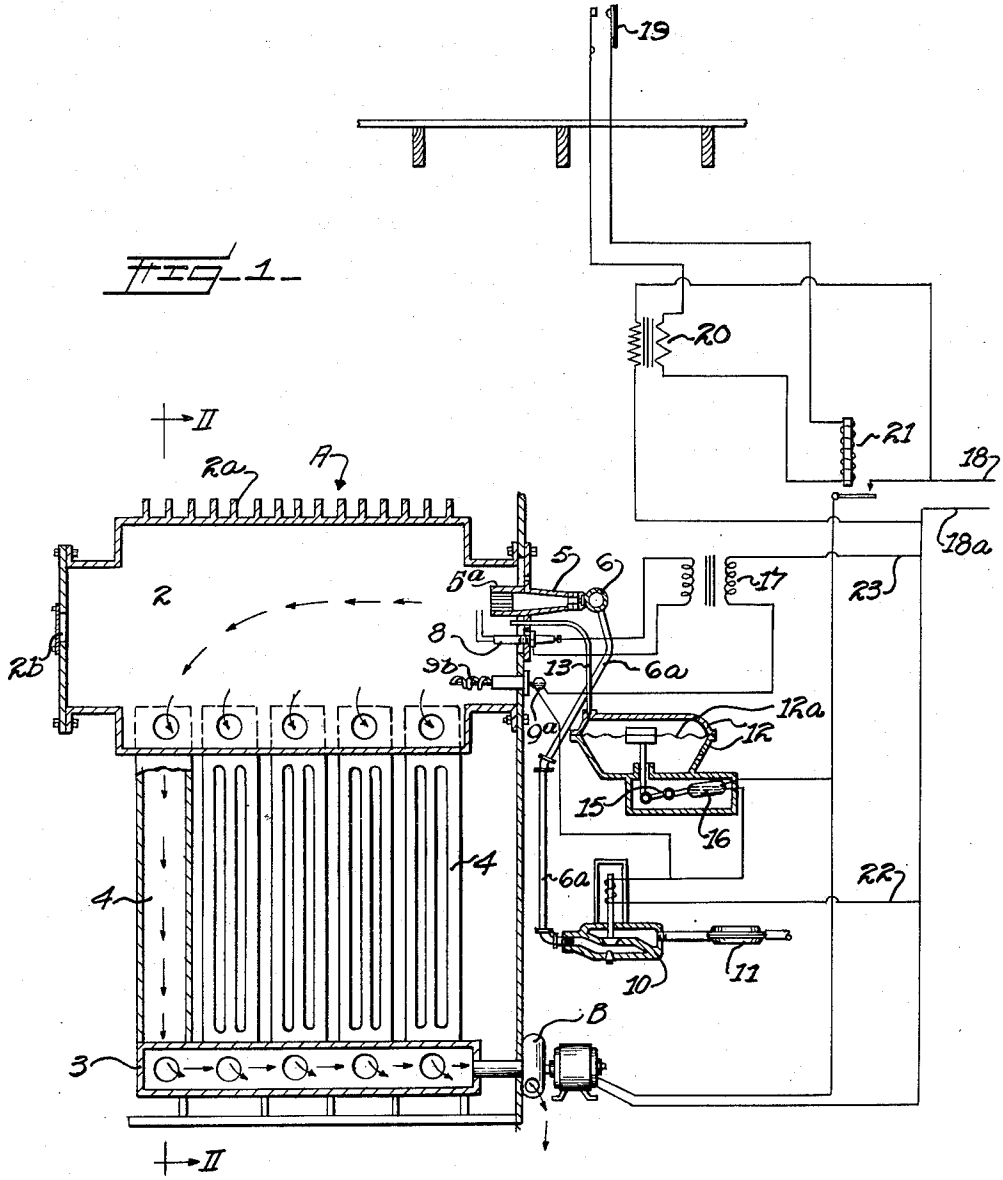
Oct. 14, 1941. M. J. DEWEY 2,259,299

HEATING APPARATUS

Filed April 18, 1938 2 Sheets-Sheet 1

Fig. 1.



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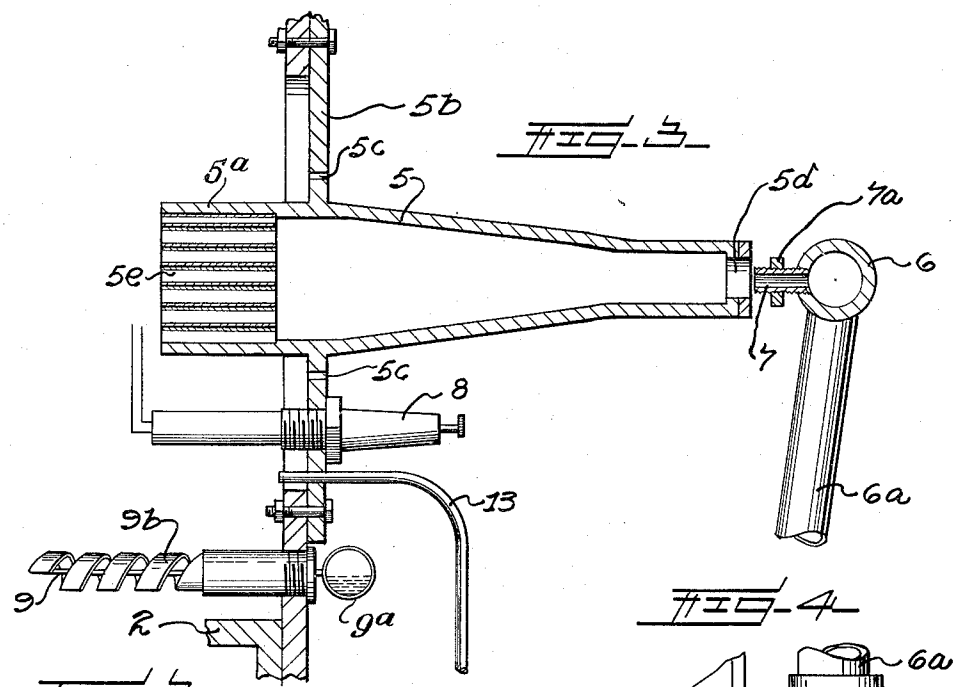

FIG. 3

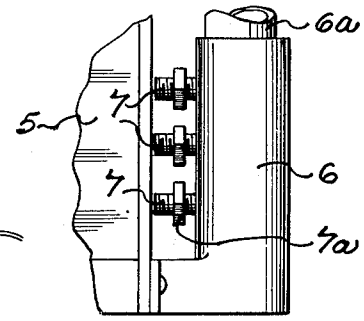

FIG. 4

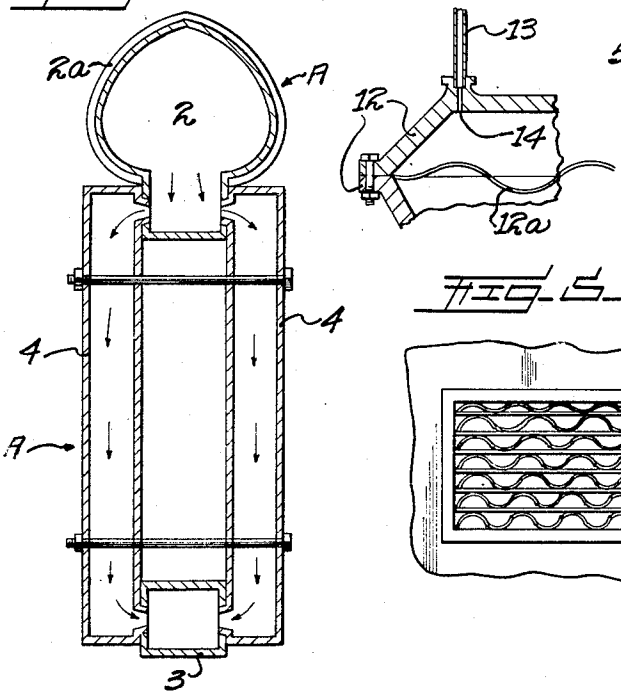

FIG. 2

FIG. 5

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HEATING APPARATUS

Maurice J. Dewey, Detroit, Mich.

Application April 18, 1938, Serial No. 202,679

3 Claims. (Cl. 158—28)

My invention relates to heating apparatus and control for the same, and an object is to secure safety, efficiency and accurate and reliable control.

I secure this object in the apparatus shown in the accompanying drawings in which:

Figure 1 is a sectional elevation of an apparatus embodying my invention, the control being shown diagrammatically;

Figure 2 is a section on the line II—II, Figure 1;

Figure 3 is a detail section, to an enlarged scale, of the burner and adjacent and cooperating parts;

Figure 4 is a detail plan view of a portion of the apparatus shown in Figure 3;

Figure 5 is a detail elevation showing the delivery end of the burner looking from the left of Figure 3.

This application may be considered a continuation in part of my copending application Serial Number 91,063.

A indicates the furnace as a whole, which I will assume for convenience in description is using gas as a fuel, including the horizontal cylindrical combustion chamber 2 at the top, and the horizontal manifold 3 at the bottom connected by parallel spaced tubular columns 4. The chamber 2 is preferably provided with heat-radiating ribs 2a.

5 is a tubular burner the casing 5a of which I have shown as rectangular in cross-section, smaller at its receiving end and gradually enlarging to its delivery end. Said casing is provided with an outwardly extending flange 5b by which it is secured to the end of the chamber 2 coaxially therewith and having its delivery end extending into said chamber. 5c indicates holes for the passage of air which may be formed through the flange 5b. 5d is an inlet aperture through which gaseous fuel is projected into the casing 5a. 5e indicates sheets of metal lying against each other throughout the breadth of the delivery opening from the casing 5a. These sheets are alternately corrugated and plane the corrugations running in the direction of the length of the casing.

6 is the fuel manifold and 6a is the supply pipe. 7 are small delivery nozzles leading from the manifold 6 coaxially with the openings or ports 5d in the casing 5a. These nozzles are smaller than said ports and are screw-threaded in their outer surfaces. 7a are discs upon the nozzles having interior screw-threads engaging the screw-threads of the nozzles 7. Said discs may be adjusted along said nozzles to vary the area of opening for air entering the ports 5d.

2b (Fig. 1) is an observation window in the chamber 2, through which the flame from the burner 5 may be observed. This opening is covered air-tight with a transparent substance.

B is an exhaust fan adapted to draw air from the interior of the furnace A. 8 is a sparking plug extending through the wall of the chamber 2, its lead wires extending into a position to produce an ignition spark for the burner 5. 9 is a rod extending through the wall of the chamber 2, and adapted to turn about its axis. 9a is a mercury switch on the outer end of the rod 9, and 9b is a bimetal thermostatic coil in the chamber 2 adapted to turn the rod 9 for a purpose hereinafter described.

10 is an electrically controlled valve in the gas supply pipe 6a. 11 is a pressure regulating valve in said pipe.

12 is an enclosure divided into upper and lower compartments by the weighted diaphragm 12a, the lower one of said chambers is open to the atmosphere and the upper one is connected to the interior of the chamber 2 by a pipe 13 through a small metering aperture 14 in the wall of the enclosure 12.

15 is a lever pivoted below the enclosure 12, having one arm connected at the center of the diaphragm 12a. 16 is a mercury switch secured upon the lever 15.

17 is a transformer, or sparking-coil, having its secondary winding connected to energize the leads of the plug 8 to produce an igniting spark to light the burner 5. 18—18a indicate the electric mains which operate the fan B.

19 is a room-thermostat. 20 is a transformer having its primary coil connected across the mains 18—18a.

21 is an electric switch adapted to make and break the circuit through the mains 18—18a.

The switch 21 is operated by a coil in the circuit of the secondary of the transformer 20 and the room-thermostat 19. 22 is a lead wire connected to the main 18a leading through the operating coil of the valve 10 and through the switch 16 to the extension of the main 18 beyond the switch 21. 23 is a lead wire passing through the primary of the transformer 17 and the switch 9a and connecting with the lead wire 22 between the valve 10 and the switch 16.

The operation of the above described apparatus is as follows:

When the switch of the room-thermostat 19 is open, the circuit through the mains 18—18a is

automatically broken at the switch 21. When the temperature of the room falls and the switch is closed by the room-thermostat 19, a current passes from the secondary of the transformer 20, through the coil of the switch 21, closing the same and completing the circuit through the mains 18—18a. This sets the fan B in operation drawing a vacuum in the furnace A. This vacuum is gradually communicated through the pipe 13 and metering aperture 14 to the upper compartment of the enclosure 12. In the apparatus shown this time is about six seconds. The preponderating pressure below the diaphragm raises the same, turning the lever 15 about its pivot and completing the circuit through the wire 22 and actuating coil of the valve 10, thus opening the gas supply to the burner 5. The closing of the switch 16 also completes the circuit through the lead wire 23 and primary coil of the transformer 17 causing an ignition spark to light the gas and air mixture at the delivery end of the burner 5.

The metering aperture 14 in the wall of the enclosure 12 is of such a size that the vacuum necessary to raise the diaphragm 12a shall not occur until after the termination of a predetermined time so that all residual gases in the furnace shall be removed before an igniting spark occurs and before new gas and air is admitted.

When the temperature in the chamber 2 rises, the thermostat 9b is actuated thereby and the switch 9a is turned to break the circuit through the transformer 17 and an igniting spark no longer occurs in the furnace. The switch 9a being in a branch from the wire 22 does not affect the current in the latter.

The motor B runs at a constant speed and the regulating valve 11 maintains a constant pressure of gas at the nozzles 7. By adjusting the discs 7a, the area of air passage to the burner may be adjusted so that a constant and uniform mixture of air and gas is maintained in the burner.

While a mercury switch has been above described any other suitable form of switch may be used.

The diaphragm's area is sufficient to supply abundant actuating force to the switch, and the action is directly controlled by the static pressure in the combustion chamber so that any change in said pressure due to an abnormal working or disarrangement of the apparatus is immediately and effectively responded to by the diaphragm and connected switch.

Should the vacuum in the combustion chamber be destroyed as, for instance, by an obstruction in the stack, or the breaking of a part, the diaphragm would fall and the gas supply and ignition would be discontinued.

Hitherto the regular operation has been interfered with by causes acting only momentarily, as when the ignition takes place after the vacuum has been formed, the flame heating and expanding the air, restoring the pressure and causing the diaphragm to fall which again rises when the effect of the impulsive pressure has passed, thus actuating the control. This action is automatically repeated and is called "hunting."

Also a gust of wind may obstruct the passage of the gases in the stack, or cause a down draft, which acts to restore the pressure and operate the control.

The metered passage between the combustion chamber and the diaphragm enclosure obviates these disadvantages as it slows down and obstructs these temporary impulses.

The weight upon the diaphragm accurately defines the degree of vacuum at which the control will be actuated.

The air is drawn in through passages directly communicating with the outer air and the gas is supplied under constant pressure through the burner.

I claim:

1. In a heating system, the combination of a combustion chamber, a burner communicating with a source of fuel supply and extending into the combustion chamber, an electrically operated ignition means located in said chamber adjacent the delivery end of the burner and included in an electric circuit, a valve controlling the flow of fuel to the burner, means for circulating air through the combustion chamber, a pressure operated device comprising a closed casing having a flexible diaphragm at one side thereof and communicating with the interior of the combustion chamber through the medium of a passage, the end of the passage communicating with the combustion chamber being so located with respect to the air stream circulated through the combustion chamber by the means aforesaid that a suction is created in the passage and the pressure in said casing is reduced to effect an operation of the diaphragm, and means operated by the diaphragm in response to the reduction in pressure aforesaid for closing the circuit to the ignition means and for opening said valve, said passage also having a restriction predetermined to insure operation of the air circulating means for a definite period before the diaphragm operates to close the circuit to the ignition means and to open said valve.

2. In a heating system, the combination of a combustion chamber, a burner communicating with a source of fuel supply and extending into the combustion chamber, an electrically operated ignition means located in said chamber adjacent the delivery end of the burner and included in an electric circuit, a valve controlling the flow of fuel to the burner, a pressure operated device comprising a closed casing having a flexible diaphragm at one side thereof and communicating with the interior of the combustion chamber through the medium of a passage, means for circulating air through the combustion chamber in a manner to create a suction in the passage and thereby provide differential pressures at opposite sides of the diaphragm to operate the latter, said passage communicating with the chamber at a point immediately adjacent the delivery end of the burner so as to insure evacuation of the products of combustion from the zone surrounding the burner before a suction is created in the passage by the air stream, and means operated by said diaphragm in response to the differential pressure created at opposite sides of the latter for closing the circuit to the ignition means and for opening said valve to supply fuel to the combustion chamber, said passage also being restricted to cause a predetermined delay in the operation of the diaphragm to open said valve and to close the circuit to the ignition means.

3. In a heating system, the combination of a combustion chamber, a burner communicating with a source of fuel supply and extending into the combustion chamber, an electrically operated igniter located in the combustion chamber

in proximity to the delivery end of the burner and included in an electric circuit, an electrically operated valve controlling the flow of fuel to the burner and also included in an electric circuit, a switch controlling both circuits, a closed casing having a flexible diaphragm at one side communicating with the combustion chamber through the medium of a passage, a blower having the discharge side communicating with the combustion chamber for drawing air from the combustion chamber in a manner to create a suction in said passage and thereby produce a differential pressure at opposite sides of the diaphragm to operate the latter, said passage being in communication with the combustion chamber at a point so located with respect to the delivery end of the burner that complete evacuation of any combustible gases that may be present in the chamber is accomplished by the time a suction is created in said passage, and means operated by the diaphragm in response to the movement of the latter caused by the suction in said passage for closing said switch to open the valve and to close the circuit to the igniter, said passage also being restricted to cause a predetermined delay in the movement of the diaphragm to operate said switch and to also prevent fluttering of the diaphragm by minor pressure variations in the combustion chamber.

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