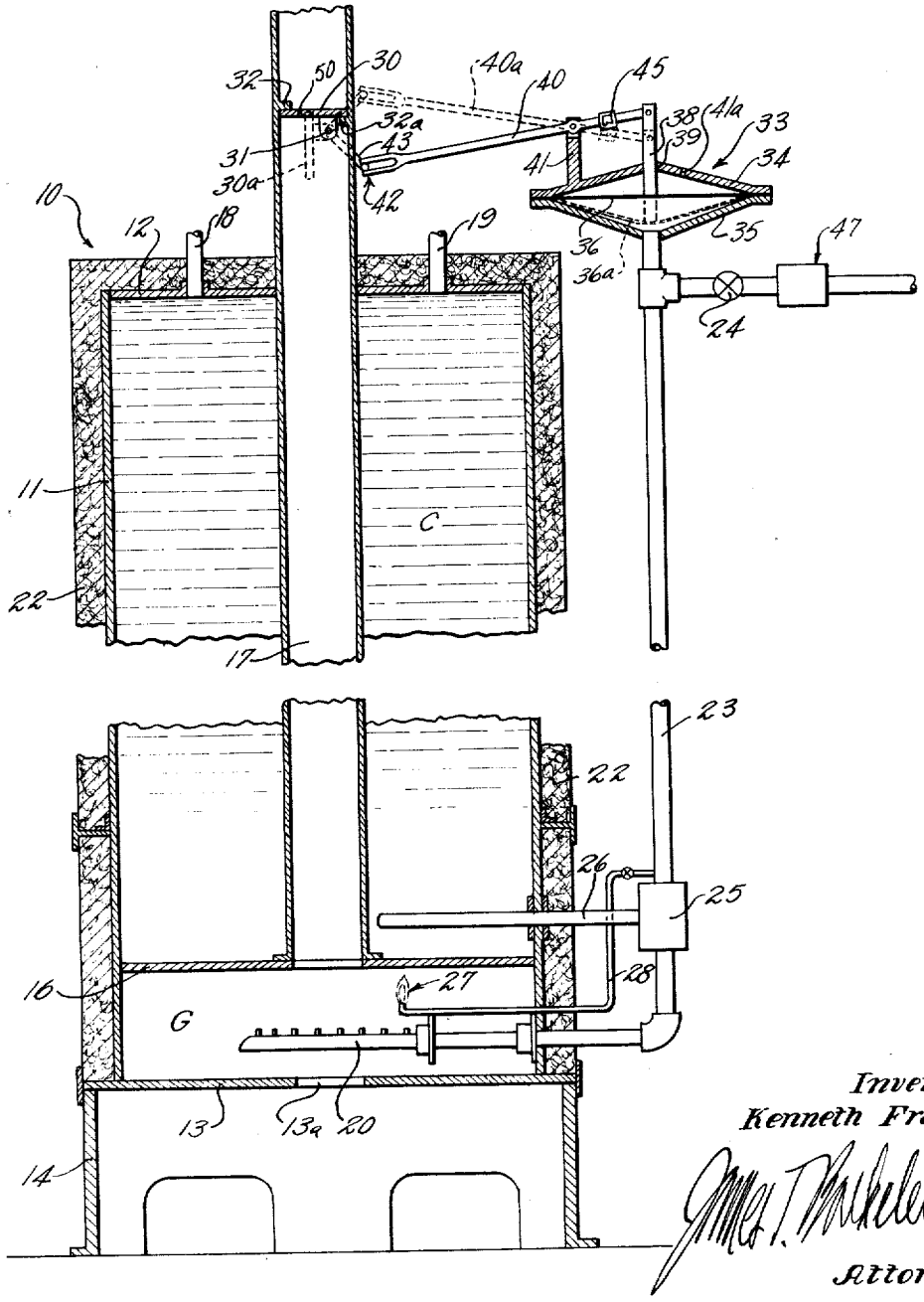
July 7, 1931. K. FRASER 1,813,395

DAMPER CONTROL SYSTEM

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DAMPER CONTROL SYSTEM

Application filed February 13, 1929. Serial No. 339,540.

This invention relates generally to control systems for heaters, boilers and the like, and is particularly concerned with a system for damper regulation in a device of this character, whereby the damper is controlled in accordance with the combustion taking place in the apparatus. The invention is broadly applicable to the control of various types of apparatus of the character mentioned and is adapted with particular advantage to use in common types of water heaters, and in connection with which the invention is hereinafter described. It will be understood, however, that the invention is not necessarily limited to use in the present preferred embodiment, and that it may be adapted to air or draft control in other apparatus of this general nature.

This type of heater hereinafter described may be characterized generally as comprising a water containing compartment in tubular formation, a combustion chamber at the bottom of the liquid compartment, and a flue communicating with the combustion chamber and extending through the liquid containing compartment of the heater, the water being heated through the walls of the combustion chamber and also by contact with the flue through which the hot gases flow. Delivery of fuel to the burner in the combustion chamber is regulated by means of a thermostat controlled valve in the feed line, the valve in turn being regulated in accordance with the temperature of the water in the heater, the manner of operation of the thermostat valve being such that the water is maintained, within certain limits, substantially at a predetermined temperature. Thus under normal conditions, the heater serves to provide a constantly available supply of hot water. Due to the fact that there are long periods of time at which no demand is made on the heater, it is necessary that the heat losses from the hot water be kept at a low minimum to economize in fuel consumption, and for this purpose the heater is heavily lagged or insulated to prevent the loss of heat to the atmosphere. In the usual heater, however, the flue is open at all times with the result that there is a constant draft therethrough and at times when the burner is not operating. The cool air passing through the flue and the combustion chamber tends to cool the heating walls of the water chamber, with the result that heat is constantly conducted from the liquid to said walls, and thence carried by convection in the air currents and out through the flue. This causes a substantial and continuous loss of heat from the water with the result that the thermostat controlled valve is frequently shutting on and off with resultant high fuel consumption in maintaining the water at the desired temperature.

A purpose of the present invention is to prevent such heat losses, and in so doing there is provided a damper in the flue beyond the heating extent thereof, and a control system for said damper, the control being such that when the burner is inoperative, the damper remains closed and thus serves to retain hot gases previously liberated in the combustion chamber and in the flue, and also to retain the heat constantly supplied by the pilot flame in the combustion chamber. The damper is automatically controlled in accordance with the flow of fuel to the burner, to the end that when the thermostat controlled valve opens to permit increased flow of fuel to the burner, the damper is simultaneously caused to open to permit sufficient draft for combustion. Heretofore it has been practiced to control the damper by direct connection with the burner regulating valve or through a mechanism actuated by the burner valve, with the result that the control system is somewhat complicated due to the number of working parts. The present system of damper control, however, is independent of direct connection with the thermostat valve, and instead enables the damper to be controlled by a simple connection with a pressure actuated device placed in the feed line, said device in turn being actuated in accordance with the flow of fuel to the burner.

The various features and advantages of the invention will be understood most clearly from the following detailed description of a typical embodiment thereof, reference being had throughout the description to the accom-

panying drawing which represents a sectional view of a typical form of heater equipped with the present damper control system.

Referring to the drawing, the heater, generally indicated at 10, is seen to embody the vertical shell 11 provided with top and bottom end closures 12 and 13 respectively, the latter resting on the base support 14 and having a draft opening 13*a*. Within the shell and spaced above the bottom plate 13 is a partition plate 16, the chamber G between plates 13 and 16 being termed the combustion chamber. The flue 17 extends axially through the shell and opens at its lower end into the combustion chamber, the flue serving to conduct the hot gases upward through the heater when the burner is in operation. The annular space between the flue and shell 11 provides a water containing compartment C, pipes 18 and 19 serving respectively as inlet and outlet for chamber C. Heat is supplied to the combustion chamber G by the burner 20, the heat being conducted from the hot gases to the water in chamber C, both through partition 16 and through the walls of the flue 17. To prevent heat losses to the atmosphere from chamber C, the heater is thoroughly insulated with suitable lagging 22. In other types of heaters to which the invention may be applied, the flue may extend upward to one side of the water chamber, or it may extend annularly around and enclose the chamber.

Fuel is delivered to the burner through the gas line 23, there being a manually adjustable valve 24 in the feed line and by means of which the proper amount of fuel required by the burner may be regulated. After valve 24 is once adjusted to allow for the delivery of maximum amount of fuel required by the burner, no further adjustment of this valve becomes necessary. Intermittent delivery of fuel to the burner is controlled by means of valve 25, which in turn is regulated by the thermostat 26 terminating in the water chamber C and actuated in accordance with the water temperature. It may be stated that the thermostat controlled valve 25 may be either a gradual or snap acting type, that is, it may open or close gradually as the water temperature varies, or the valve may snap to open or closed positions when the water reaches certain predetermined temperatures. The function of the thermostat valve is to cause the burner 20 to operate until the water in chamber C reaches a predetermined high temperature, at which point the thermostat closes the valve until the water temperature drops a predetermined degree, either due to the replacement of the hot by cold water or by heat losses from the apparatus, the valve then opening to deliver more fuel to the burner in order to maintain the desired water temperature. The gas is ignited at the burner by means of the usual pilot flame 27 fed through an auxiliary line 28.

It is customary in heaters of this type to permit an unobstructed draft through the flue at all times, and to rely solely upon the lagging 22 for preventing heat losses from the hot water bodies. It will be seen however, that when the burner is not in operation and cool air currents are permitted to circulate within the combustion chamber and upward through the flue, the heating walls of the water chamber become rapidly cooled by the air currents. The result is that heat from the water is continuously conducted to the cool walls of the combustion chamber and flue, from which the heat is carried out of the apparatus by convection in the air currents. This loss of heat has been found to be a material factor in decreasing the thermal efficiency of the heater.

To prevent such heat losses I have provided a damper 30 in the upper interior of the flue, the damper being carried on a horizontal rod 31 pivotally mounted in the flue, stops 32 and 32*a* being provided to limit the turning of the damper from a horizontal position in one direction. The damper is operatively connected to a suitable pressure actuated device, generally indicated at 33, and communicating with the feed line 23 at a point intermediate valves 24 and 25. Although the pressure actuated device may be of any suitable type, I have, as a typical illustration, shown it to comprise a flexible diaphragm 36 confined between body portions 34 and 35. A vertically movable pin 38 extends through a central opening 39 in the valve body and is secured at its lower end to the diaphragm, the pin being pivotally connected to lever arm 40 which is fulcrumed on the body support 41. An opening 41*a* is provided in the body above the diaphragm in order to allow atmospheric pressure on the upper face of the diaphragm. The lever arm has a sliding pivotal connection at 42 with arm 43, the latter being attached to rod 31 in a manner such that turning movement of the arm causes the damper to move pivotally with the rod. The sensitivity of the diaphragm to pressure changes in the feed line may be regulated by means of the counterweight 45 on the lever rod.

In the operation of the damper control system, it is assumed that with the thermostat valve first closed, at which time the pressure in line 23 between valves 24 and 25 retains the diaphragm 36 in its normal position shown, a sufficient drop in the water temperature occurs to cause valve 25 to open. The adjustment valve 24 then serves essentially as a throttle valve since it permits no more than the proper amount of fuel to be delivered to the burner. It may be stated that in order to maintain a constant pressure

at valve 24, a constant pressure regulating device, conventionally shown at 47, may be installed in the feed line. Thus when the thermostat valve opens, a certain amount of depression takes place in the feed line between the burner and valve 24, this depression being sufficient to cause the atmospheric pressure on top the diaphragm to move the latter downward to the dotted line position 36a. As a result of this movement of the diaphragm, lever 40 is moved to the dotted line position 40a and the damper swung to open position 38. Similarly, when the water in chamber C reaches the desired temperature, valve 25 closes and the pressure in the feed line assumes its normal value causing the diaphragm to return to its normal position and the damper to close. And as previously stated, the thermostat valve may be either gradual or snap acting so that the damper is capable of being positioned intermediate its wide open and closed positions or the damper may be actuated positively from one position to the other. In the present type of heater, it is preferable that the thermostat be snap acting. The damper is thus actuated in accordance with the depression below normal existing in line 23, or in other words, in accordance with the amount of fuel being delivered to the burner.

It will be noted that at the time previous to the closing of the thermostat valve and the damper, the combustion chamber and flue contain hot gases, and the damper upon closing, serves to keep these gases within the heater to obvious advantage. Furthermore, since at this time there is no substantial draft through the flue, the heat from the pilot flame is also kept within the apparatus to prevent cooling of the heating walls of the water chamber. A slight amount of draft may be had for the pilot flame by providing a small opening 50 in the damper. An additional advantage exists in the present control system in that should the pilot flame be extinguished and the thermostat subsequently opened, the unburnt gas, instead of being allowed to escape into the room where the heater may be used, is conducted out through the flue.

It will be understood the drawing and description are to be considered merely as illustrative of and not restrictive on the broader claims appended hereto for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

I claim:

1. In heating apparatus of the character described, the combination embodying a main burner, a feed line for delivering fuel to said burner, a burner adjustment valve in said line, a thermostat controlled valve, said thermostat controlled valve regulating the gas supply to said main burner, between the burner and said adjustment valve, a control member associated with the heater, and pressure actuated means independent of said valves, communicating with the feed line between said valves and operatively connected to said control member, whereby said member is actuated by virtue of pressure changes in the feed line.

2. A heating device embodying a combustion chamber, a burner in said chamber and a feed line for supplying fuel to the burner, a draft passage communicating with said chamber and a damper in the draft passage, a burner adjustment valve in said line, a thermostat controlled valve between the burner and said adjustment valve, and means for controlling said damper in accordance with the pressure in the feed line between said valves.

3. A heating device embodying a combustion chamber, a burner in said chamber and a feed line for supplying fuel to the burner, a draft passage communicating with said chamber and a damper in the draft passage, a burner adjustment valve in said line, a thermostat controlled valve between the burner and said adjustment valve, and a pressure controlled device in said line between the thermostat and adjustment valves, said pressure controlled device being operatively connected to the damper.

4. A heater embodying a combustion chamber, a liquid containing compartment, a burner in said combustion chamber and a feed line for supplying fuel to the burner, a flue communicating with said chamber and a damper in said flue, a thermostat controlled valve in the feed line and automatically regulated in accordance with the liquid temperature in said compartment, and automatic pressure controlled means communicating with said feed line at the high pressure side of said valve and operatively connected to said damper, whereby the damper is regulated in accordance with the fuel delivered to the burner by said thermostat valve.

5. A heater embodying a combustion chamber, a liquid containing chamber, a burner in said combustion chamber and a feed line for supplying fuel to the burner, a flue communicating with said chamber and a damper in said flue, a burner adjustment valve in the feed line, a thermostat controlled valve between the burner and said adjustment valve and automatically regulated in accordance with the temperature in said liquid chamber, and pressure operated means communicating said line between the thermostat and adjustment valves, said pressure operated means being operatively connected to the damper.

6. A heater embodying a vertically extending liquid containing compartment in tubular formation, a combustion chamber at the lower end of said compartment, a flue extending from said chamber axially through the liq-

uid containing compartment, a damper within the upper end of said flue, a burner in said chamber and a feed line for supplying fuel to the burner, a burner adjustment valve in the feed line, a thermostat controlled valve between the burner and said adjustment valve and automatically regulated in accordance with the temperature in said liquid compartment, and pressure operated means communicating said line between the thermostat and adjustment valves, said pressure operated means being operatively connected to the damper.

7. A heater embodying a vertically extending liquid containing compartment in tubular formation, a combustion chamber at the lower end of said compartment, a flue extending from said chamber axially through the liquid containing compartment, a damper within the upper end of said flue, a burner in said chamber and a feed line for supplying fuel to the burner, a burner adjustment valve in the feed line, a thermostat controlled valve between the burner and said adjustment valve and automatically regulated in accordance with the temperature in said liquid compartment, a pressure responsive diaphragm in said line between the thermostat and adjustment valves, and means operatively connecting said diaphragm with the damper.

In witness that I claim the foregoing I have hereunto subscribed my name this 5 day of February, 1929.

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uid containing compartment, a damper within the upper end of said flue, a burner in said chamber and a feed line for supplying fuel to the burner, a burner adjustment valve in the feed line, a thermostat controlled valve between the burner and said adjustment valve and automatically regulated in accordance with the temperature in said liquid compartment, and pressure operated means communicating said line between the thermostat and adjustment valves, said pressure operated means being operatively connected to the damper.

7. A heater embodying a vertically extending liquid containing compartment in tubular formation, a combustion chamber at the lower end of said compartment, a flue extending from said chamber axially through the liquid containing compartment, a damper within the upper end of said flue, a burner in said chamber and a feed line for supplying fuel to the burner, a burner adjustment valve in the feed line, a thermostat controlled valve between the burner and said adjustment valve and automatically regulated in accordance with the temperature in said liquid compartment, a pressure responsive diaphragm in said line between the thermostat and adjustment valves, and means operatively connecting said diaphragm with the damper.

In witness that I claim the foregoing I have hereunto subscribed my name this 5 day of February, 1929.

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CERTIFICATE OF CORRECTION.

Patent No. 1,813,395. **Granted July 7, 1931, to**

KENNETH FRASER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, lines 63 to 65, claim 1, strike out ", said thermostat controlled valve regulating the gas supply to said main burner," and line 66, after "valve," insert said thermostat controlled valve regulating the gas supply to said main burner,; page 3, line 123, claim 5, and page 4, line 10, claim 6, before the word "said" insert the word with; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of September, A. D. 1931.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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