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REGULATING MEANS FOR GAS BURNING HEATING APPARATUS

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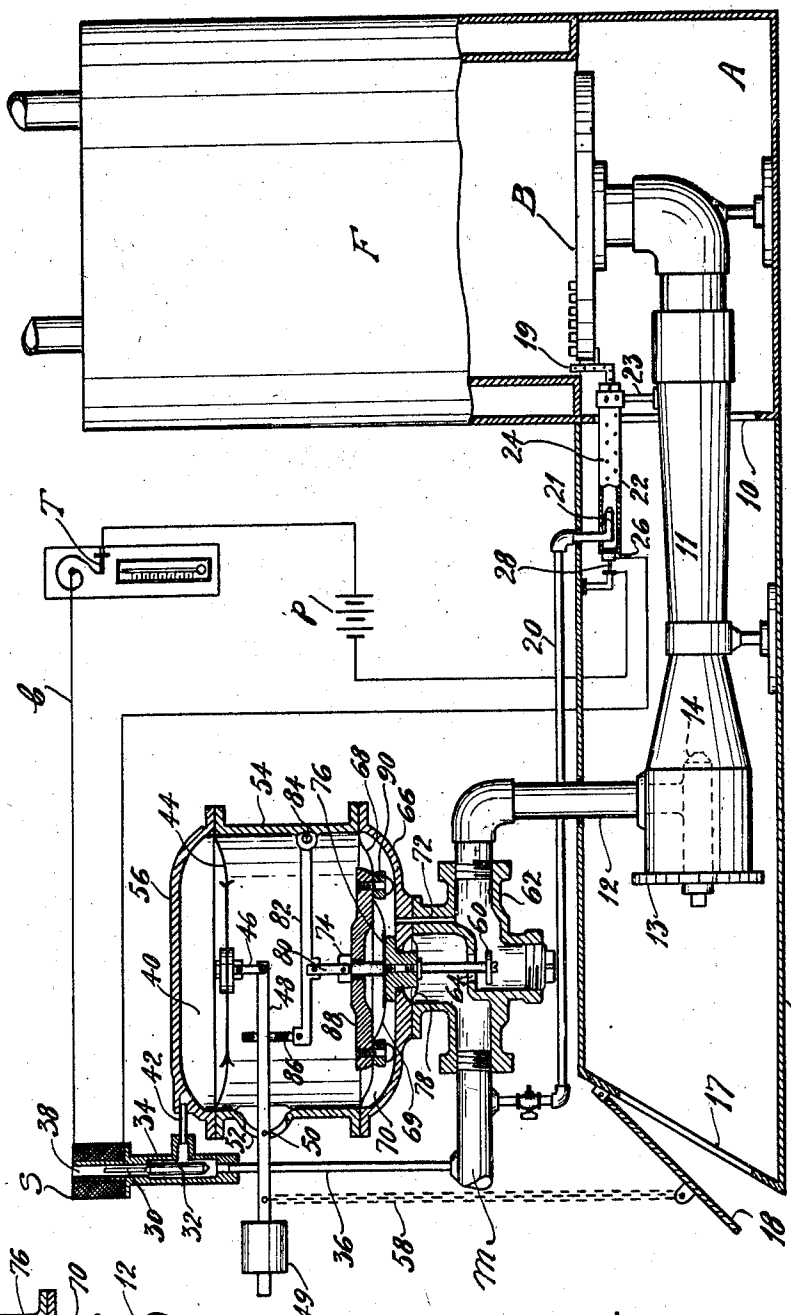


FIG 1

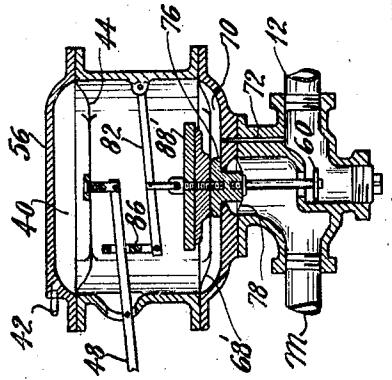


FIG 2

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REGULATING MEANS FOR GAS-BURNING HEATING APPARATUS

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This invention relates to improvements in regulating means for gas burning heating apparatus and more particularly to means for shutting off the flow of gas to the burner at predetermined times. It is an object of the invention to provide, in combination with a pressure regulator, a mechanism for automatically closing the regulator valve when the ignition pilot ceases to burn or there is no call for heat. Another object is to provide, in combination with a pressure regulator, a mechanism for closing not only the regulator valve but also a secondary air damper when there is no call for heat or the ignition pilot ceases to burn. Other objects will more fully appear hereinafter.

Referring to the drawings wherein the preferred form of the invention is shown:

Fig. 1 is a more or less diagrammatic view of an apparatus embodying the invention, and

Fig. 2 is a sectional view of a modified form of regulator valve controlling means.

In the drawings, there is conventionally illustrated a heating furnace F fired by any suitable type of gas burner B which is supported in any suitable manner above the floor of an air box A having a side opening 10 for the inflow of secondary air for combustion. A mixing tube 11 of any approved type supplies a mixture of gas and air to the burner. Gas is supplied to the mixing tube by a pipe 12, the air for mixing with the gas being controlled by a shutter 13 at the front of the tube. At the delivery end of the gas pipe 12 is a suitable nozzle 14 as will be readily understood.

The mixing tube 11 is located within a casing 16 which at one end is in direct communication with the air box A of the furnace and which at its other end has an opening 17 adapted to be closed by a damper 18. By closing the damper when the burner is temporarily shut off useless cooling of the hot burner parts and the furnace itself by air entering through the opening 17 is prevented.

Positioned alongside the burner B is an ignition pilot 19 which receives gas from a pipe 20, having a discharge nozzle 21 which discharges into a thermal tube 22 of which the pilot is an extension. This tube at its forward end is rigidly supported by a bracket 23 or any other suitable support. The tube 22 may be made of brass and is provided with one or more longitudinally extending rows of jet openings 24, which also extend up to the pilot tip. Some of the gas delivered into the thermal tube 22 for passage to the pilot passes through the side jet openings 24 in the tube and pilot and when the pilot is burning at its tip the flame will be propagated to the jets of gas issuing from said openings and heat the thermal tube 22.

Secured to the front end of the thermal tube 22 and insulated therefrom is a switch contact 26. Normally spaced from contact 26 when the thermal tube 22 is cold is a second contact 28 suitably secured to and insulated from the top of the casing 16. As long as the thermal tube is kept hot, it will expand sufficiently to close the switch constituted by the contacts 26 and 28. The switch is shown as closed.

In series with the switch formed by the contacts 26 and 28 which switch will hereinafter be referred to as the pilot switch, is a second switch generally indicated by letter T and also a solenoid indicated by letter S. The switch T is part of a room thermostat or the like. When both of said switches are closed, the circuit to the solenoid is closed and will be energized by a battery P in the circuit C.

The solenoid has as its movable core an iron stem 30 of a two-way-seating valve 32 mounted in a chambered non-magnetizable valve body 34 having a three-way passage therein. Leading from a gas supply main M and delivering into the chamber of the body 34 is a pipe 36. When the solenoid is de-energized, the valve 32 drops by gravity and seats against the gas inlet passage to close off the entry of gas from pipe 36 into the valve chamber or body 34. When the valve 32 is seated as aforesaid, the valve chamber is open to the atmosphere by way of a passage 38 wherein the valve stem of said valve operates.

Leading from the valve chamber to a pressure chamber 40 is a pipe 42, the bottom wall

of the pressure chamber being a flexible diaphragm 44. When the solenoid S is energized to lift the valve 32 from its lower or gas inlet seat, the pressure of the gas in the supply main M is made effective in the pressure chamber 40. When the solenoid lifts the valve 32 from said inlet seat the upper part of the valve closes the vent opening 38 and consequently gas cannot escape from the pressure chamber by way of the passage 38 to the atmosphere. When the solenoid is again de-energized valve 32 as already explained drops to close off the admission of gas from the pipe 36 and in so closing opens the vent 38 whereupon the gas within the chamber 40 will be vented to the atmosphere by way of the pipe 42 and the vent passage 38 in the valve body, as will now be readily understood.

It will now be seen that the solenoid is controlled by two switches, namely, the pilot switch and the thermostat switch T. If either one of these switches is open the solenoid cannot of course be energized. This is the preferred arrangement but it will be readily appreciated that the thermostat switch T may be omitted from the circuit without disturbing the control exercised by the pilot switch and vice versa. Moreover pressure chamber 40 broadly considered is a motor the actuation of which is controlled by means under the control of temperature-controlled means.

Anchored to the aforesaid pressure-chamber diaphragm 44 by a jointed connection 46 is a lever 48 which is pivoted between its end as at 50 to a lug 52 projecting from a casing 54 across the top of which the diaphragm 44 is secured by the cover or cap 56 which forms the top of the pressure chamber 40. A chain 58 or other suitable linkage connects the previously mentioned air damper 18 with the free end of the lever 48. When the gas pressure in the supply main M is effective in the pressure chamber 40, the diaphragm 44 presses down on the lever 48 as a result of which the damper 18 opens. Conversely, where the pressure chamber is open to the atmosphere the damper 18 of its own weight or assisted by such additional weight 49 on the lever 48 as may be necessary to counterbalance the diaphragm and other parts operatively connected thereto, will close the air passage 17 into the casing 16.

Interposed between the main line supply pipe M and the delivery pipe 12 is a pressure regulator the valve of which is indicated at 60 and the valve chamber or body at 62. The valve body is of the conventional type wherein the valve 60 is adapted to close a main flow passage 64. Secured to or formed as part of the valve body 62 is a bowl 66 across the top of which is a flexible diaphragm 68. The diaphragm 68 and the bowl 66 together constitute a pressure chamber 70 which is continually open by way of a passage 72 in the valve body to the fluid pressure at the delivery side of the valve 60. The stem of the valve 60 or an extension thereof is tightly secured to the center of the diaphragm in any suitable manner and projects therebeyond, finally terminating in a head 74. As is common practice in pressure regulators, the valve stem is connected to a piston-like body 76, the bottom of which is subject to the main-line pressure in the supply main M for counterbalancing the weight of the valve. To more effectively prevent leakage by the body 76 into the pressure chamber 70 from the supply main M, a flexible seal 78 is positioned across the opening wherein the body 76 is reciprocable. This seal is suitably secured to the bottom of the movable body 76 to move therewith.

The head 74 of the valve stem extension is connected by a link 80 or other suitable joint to a lever 82, one end of which is pivoted as at 84 to the previously mentioned casing 54 and the other end of which is connected with the previously mentioned lever 48 by a lost motion connection 86 shown in the present instance as a link having a slot therein. When the diaphragm 44 of the pressure chamber 40 is made subject to the main line gas pressure, the lever 48 becomes operatively disengaged from the regulator valve 60 through the lost motion connection 86 in such a manner that the valve may assume an open position as shown in the drawings. When, however, the chamber 40 is open to the atmosphere in the manner previously described, the lever 48 will take up the lost motion in the connection 86 and will lift the valve 60 sufficiently far to close the flow passage 64. As previously described, the combined weight of the damper 18 and the lever weight 49 is such as to close the damper 18 and to elevate the diaphragm 44 when it is not subject to fluid pressure. The casing 54, it may be mentioned, is open to the atmosphere.

When the valve 60 is open, the fluid pressure at the delivery side of the valve is effective on the diaphragm 68 and when such pressure reaches a given value the diaphragm is free to rise to close the valve 60. In the preferred form of the invention the diaphragm 68 is loaded by a weight 88 through an opening in the center of which the valve stem extension freely passes. When the valve 60 is open, the weight of the valve, including those parts secured to the valve stem, is supported on the diaphragm weight 88 through the valve stem head or shoulder 74 resting on the weight. The load acting in opposition to the pressure at the outlet side of the valve is therefore not only the weight 88 but also the weight of the valve and parts fixedly connected with the stem of the valve 60. When the outlet pressure is not sufficient to lift the

load on the diaphragm the burden of the load is taken by the bottom of the bowl 66.

When the lever system previously described closes the valve 60 it does so without lifting the weight 88, there being sufficient clearance between the bottom of the weight and the top of the piston-like body 76 to which the central part of the diaphragm 68 is secured to prevent the body 76 from abutting the weight. For preventing the leakage of gas from the pressure chamber 70 through the center opening in the weight 88, a flexible seal 69, which is conveniently the central portion of the diaphragm 68, bridges the space between the confines of the ring 90. It will of course be understood that the area of the seal 69 is not sufficient to permit the gas pressure effective in the chamber 70 to actuate the valve 60 independently of the diaphragm 68.

In the construction shown in Fig. 2, the valve 62 and weight 88′, which loads the diaphragm 68′ corresponding to the diaphragm 68 in Fig. 1, are immovably connected and consequently the lever system must also lift the load on the diaphragm in lifting the valve to close it. The lever system however is the same in both cases. To counterbalance the additional weight (the weight 88′) which must be lifted by the lever system the weight 49 must of course be correspondingly heavier.

It will now be seen that the present invention provides, in combination with a pressure regulator and a gas burner, a mechanism which normally keeps the regulator valve closed and which must be positively actuated, before the regulator can function. By making use of the main-line-supply pressure for actuating the motor which controls the lever system with which the regulator valve is connected, the apparatus as a whole is very much simplified and there is the important advantage that regardless of other conditions which must be present before the regulator can function, the regulator valve will not open when the main line pressure is insufficient to counterbalance the loading normally tending to keep the valve closed.

What is claimed is:

1. In a controlling system for burners, the combination, with a valve in a supply line from which fuel is supplied to the burner and a diaphragm normally subject to the fuel pressure at the delivery side of said valve for closing the valve when the fuel pressure at the delivery side of the valve exceeds a given value, of means including an air damper for the burner tending to close the valve, a motor actuable to oppose the valve-closing tendency of said means, and means under the control of a thermal element for controlling the actuation of the motor.

2. In a controlling system for burners, the combination, with a valve in a supply line from which fuel is supplied to the burner and a diaphragm normally subject to the fuel pressure at the delivery side of said valve for closing the valve when the fuel pressure at the delivery side of the valve exceeds a given value, of means including an air damper for the burner tending to close the valve, a diaphragm connected with said means and adapted when actuated to oppose the valve-closing tendency of said means, and a valve under the control of a thermal element for controlling the admission of motive fluid to the last mentioned diaphragm.

3. The combination with a valve in a fluid supply line and a diaphragm normally subject to the fluid pressure at the delivery side of said valve for closing the valve when such pressure exceeds a given value, of means independent of the diaphragm normally tending to close said valve, a diaphragm connected with said means and adapted when actuated to oppose the valve-closing tendency of said means, a valve for admitting supply-line pressure to the last mentioned diaphragm, and means under the control of a thermal element for controlling the operation of the last-mentioned valve.

4. In a controlling system for burners, the combination, with a valve in the supply line from which fuel is supplied to the burner and a diaphragm normally subject to the fuel pressure at the delivery side of the burner for closing the valve when the fuel pressure at the delivery side of the valve exceeds a given value, and a damper tending to close by gravity to prevent the flow of air to the burner, of means coupling the damper and valve for simultaneous closing, and a motor actuable by fluid pressure at the inlet side of said valve for opening the damper and operatively disconnecting it from the valve.

5. In a controlling system for burners, the combination, with a valve in the supply line from which fuel is supplied to the burner and a diaphragm normally subject to the fuel pressure at the delivery side of the burner for closing the valve when fuel pressure at the delivery side of the valve exceeds a given value, of a damper for controlling the admission of air to the burner, means including a lost-motion connection coupling the damper and valve for simultaneous closing, and means operable on the last-mentioned means for opening the damper far enough to bring the lost-motion connection into play.

6. The combination, with a valve for controlling the flow of fluid under pressure and a pressure chamber open to the pressure at the delivery side of said valve and beyond the top of which the stem of the valve projects after passing through the chamber, the top of the chamber being a flexible diaphragm, of a weight resting on the diaphragm, means limiting the downward movement of the weight, means associated with the valve stem for supporting the valve from the weight, the

valve when so supported and when the weight is at its downward limit of movement being in open position, and means for moving the valve independently of the weight to close the valve.

7. The combination, with a valve for controlling the flow of fluid under pressure and a pressure chamber open to the pressure at the delivery side of said valve and beyond the top of which the stem of the valve projects after passing through the chamber, the top of the chamber being a flexible diaphragm, of a weight resting on the diaphragm, means limiting the downward movement of the weight, means associated with the valve stem for supporting the valve from the weight, the valve when so supported and when the weight is at its downward limit of movement being in open position, means independent of the diaphragm normally tending to close the valve, and means operable to oppose the valve closing tendency of the last-mentioned means.

8. The combination, with a valve for controlling the flow of fluid under pressure and a pressure chamber open to the pressure at the delivery side of said valve and beyond the top of which the stem of the valve projects after passing through the chamber, the top of the chamber being a flexible diaphragm, of a weight resting on the diaphragm, means for limiting the downward movement of the weight, means associated with the valve stem for supporting the valve from the weight, the valve when so supported and when the weight is at its downward limit of movement being in open position, means independent of the diaphragm normally tending to close said valve, a second pressure-chamber having a diaphragm connected to the last-mentioned means for movement therewith, and means for controlling the actuation of the last-mentioned diaphragm in opposition to the valve-closing tendency of the last-mentioned means.

9. The combination, with a valve for controlling the flow of fluid under pressure and a pressure chamber open to the pressure at the delivery side of said valve and beyond the top of which the stem of the valve projects after passing through the chamber, the top of the chamber being a flexible diaphragm, of a weight resting on the diaphragm, means limiting the downward movement of the weight, means associated with the valve stem for supporting the valve from the weight, the valve when so supported and when the weight is at its downward limit of movement being in open position, a second pressure chamber having a diaphragm forming a wall thereof, means acting in opposition to the fluid pressure applied to the last-mentioned diaphragm for removing the burden of the valve from said weight, a lost-motion coupling between the last-mentioned means and the valve stem, and means for controlling the admission of fluid pressure into said second pressure chamber.

10. In combination, with a valve for controlling the flow of fluid under pressure and a pressure chamber open to the pressure at the delivery side of said valve and beyond the top of which the stem of the valve projects after passing through the chamber, the top of the chamber being a flexible diaphragm, of a weight resting on the diaphragm, means limiting the downward movement of the weight, means associated with the valve stem for supporting the valve from the weight, the valve when so supported and when the weight is at its downward limit of movement being in open position, means tending to remove the burden of the valve from said weight, and means operable to maintain the burden of the valve on said weight.

11. In a combined pressure regulator and cut-off mechanism, the combination with a diaphragm and its chamber and a valve casing provided with a passage extended from the delivery side of said casing to said diaphragm chamber and a valve in said casing normally movable with said diaphragm to permit the latter to regulate the pressure at the delivery side of the casing, of a valve stem for said valve extended through said diaphragm, a flexible seal carried by said diaphragm and secured to said valve stem, and means coupled to the extended end of the valve stem for actuating said valve independently of said diaphragm.

12. In a combined pressure regulator and cut-off mechanism, the combination with a diaphragm and its chamber and a valve casing provided with a passage extended from the delivery side of said casing to said diaphragm chamber and a valve in said casing normally movable with said diaphragm to permit the latter to regulate the pressure at the delivery side of the casing, of a plate carried by said diaphagm, a valve stem for said valve extended through said plate and adapted to be suspended from said plate, a flexible seal secured to the under side of said plate and secured to said valve stem, and means coupled to the extended end of the valve stem for actuating said valve independently of said diaphragm.

13. The combination with a pressure regulator embodying a diaphragm and its chamber and a valve casing provided with a passage extended from the delivery side of said casing to said diaphragm chamber and a valve in said casing normally movable with said diaphragm to permit the latter to regulate the pressure at the delivery side of the casing, of means tending to close said valve, a pressure chamber having a diaphragm, means coupling said diaphragm to said means, and means for making fluid pressure effective in said pressure chamber where-

by the diaphragm thereof may oppose the valve-closing tendency of said means.

14. The combination with a pressure regulator embodying a casing, a valve in the casing and a diaphragm movable in response to pressure at the outlet side of the valve, of a lever connected to said valve for movement therewith, a pressure chamber having an element movable in response to fluid pressure therein, a lever connected to said element for movement therewith, means actuable to admit fluid under pressure to said chamber, and a lost-motion connection between said levers.

15. In a combined pressure regulator and cut-off mechanism, the combination with a valve for controlling the flow of fluid through a conduit and a diaphragm normally subject to the fluid pressure prevailing at the outlet side of said valve and adapted to close the valve when said fluid pressure exceeds a predetermined degree, of a member adapted to be moved in one direction by the fluid pressure at the inlet side of said valve and adapted to be moved in the opposite direction by a continuously acting means, means for controlling the admission of said fluid pressure to said member, and means including a lost-motion connection for coupling said valve to said member, said connection permitting said diaphragm to control said valve as long as the fluid pressure effective on said member is sufficient to counteract said continuously acting means.

16. In a combined pressure regulator and cut-off mechanism, the combination with a valve for controlling the flow of fluid through a conduit and a diaphragm open to the pressure prevailing at the outlet side of the valve for closing the valve when the outlet pressure exceeds a predetermined degree, of a weighted means connected to said valve by means including a lost-motion connection and normally tending to take the slack out of said connection and close said valve, and means controlled by the fluid pressure prevailing at the inlet side of said valve for opposing the valve-closing tendency of said means.

In testimony whereof I affix my signature.

NELSON T. BRANCHE.