April 12, 1932. J. C. BOGLE 1,853,196

GAS BURNER CONTROL SYSTEM

Original Filed March 21, 1927

Fig. 1.

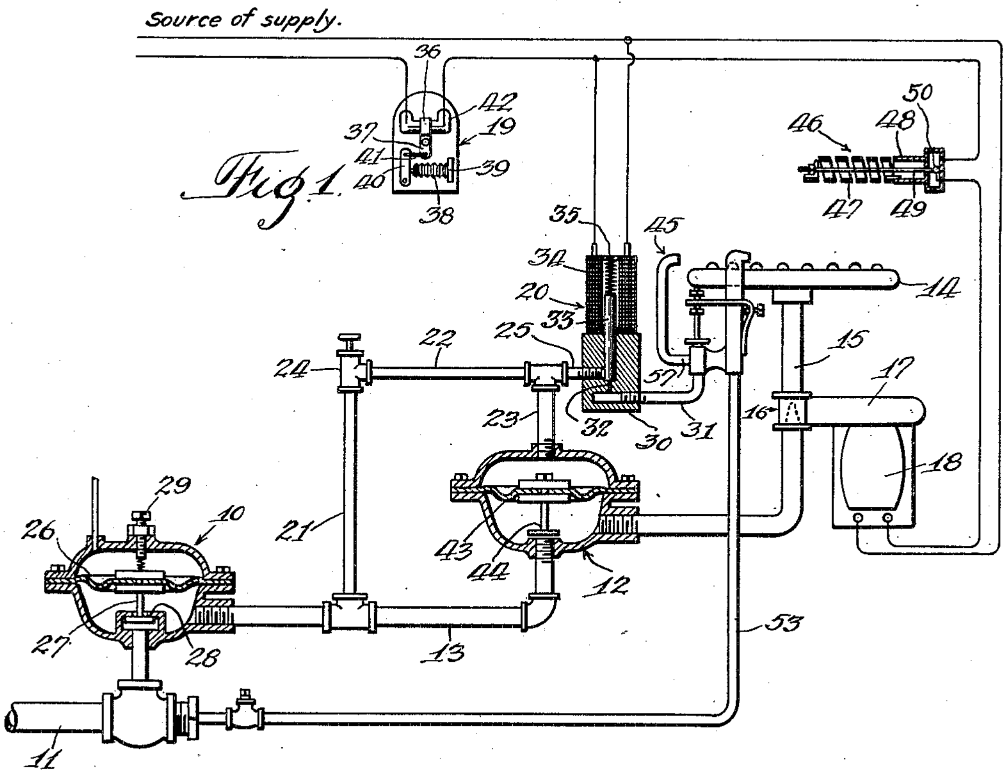
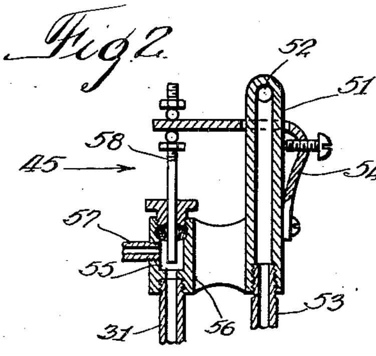


Fig. 2.



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UNITED STATES PATENT OFFICE

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GAS BURNER CONTROL SYSTEM

Original application Serial No. 176,859, filed March 21, 1927. Divided and this application filed December 11, 1928. Serial No. 325,172. Renewed April 9, 1931.

This application is a division of application Ser. No. 176,859 filed Mar. 21, 1927 for gas burner control system by the applicant of this application.

This invention relates to a control system for gas burners and has special reference to a safety control system for a gas-fired boiler, or other appliances or apparatus employing gas for its operation.

Hereinafter this invention will be illustrated and described in connection with an automatic heating system, although it is to be understood that this system may be employed wherever it is desirable to promote a substantially even temperature, to provide a periodic supply or demand, or any other instance wherein gas is permitted to flow to a burner at intervals.

Automatic heating systems are equipped with controls responsive to variations of temperature in a room or other enclosure to be heated; for example, such a control may comprise a wall thermostat capable of directing the generation of heat for assuring against substantial variations in the room temperature. Other forms of controls for automatic heating systems are those directing the specific limits of temperature to be obtained in the boiler or furnace. These latter instruments may include a water thermostat on a hot water heating boiler, a pressure switch on a stem or vapor boiler, or an air thermostat upon a warm air furnace.

Any of the above enumerated controls, or several thereof, may be so arranged in the present system as to govern the sequence of operation of the various devices in order that gas may be fed to the burners when desirable. In order to avoid complications of the drawings and disclosure, the several embodiments of this invention are primarily controlled by a simple room thermostat.

This invention is further enhanced by safety controls which operate to shut down the system in the event of failure of those controls previously recited to promote or sustain desirable conditions of combustion within the boiler or furnace.

Moreover, in order to illustrate the further usefulness of the control system, the invention has been incorporated in an automatic heating system wherein the burner is supplied with a mixture of gas and air under pressure.

Other objects will be apparent from the description and the drawings forming a part of this specification to which reference may now be had for a more complete understanding of the characteristic features of this invention, in which drawings:

Figure 1 is a more or less diagrammatic view of a gas burner control system incorporating an arrangement whereby the burner is supplied with a mixture of gas and air under pressure; and

Fig. 2 is a vertical sectional view of the ignition device in the control system.

Referring more particularly to the drawings, the control system comprises a reducing valve 10 which is directly connected to the main supply of gas 11. It is usual for gas to be supplied for domestic use at about six to eight ounces of pressure. The reducing valve 10 reduces this line pressure to any desired pressure, in this instance to about two ounces, which latter pressure is substantially constant. The gas under reduced pressure is directed to the lower chamber of a relay or snap valve 12 through a conduit 13, and thence to the main burner 14 through a conduit 15. In order that a mixture of gas and air under pressure in the burner be obtained, this system incorporates means for forcing air unto the gas supply line to mix with the gas. In order to accomplish this result an ordinary gas and air mixer 16 is disposed in the conduit 15 and receives a supply of air under pressure from any source of supply such as a fan 17 operated by an electric motor 18. After the gas passes through the gas and air mixer 16 it is directed to the burner 14.

The gas from the reducing valve 10 to the main burner is regulated by means of a thermostatic control 19 and a magnetic valve 20, the pressure being built up in the upper chamber of the snap valve 12 to shut off the supply of gas to the main burner when the switch 19 closes the valve 20 and the pressure being reduced in the snap valve 12 to permit

a flow of gas to the burner 14 by means of the thermostatic switch 19 opening the valve 20. A portion of the gas leaving the reducing valve 10 is by-passed to the upper chamber of the snap valve 12 through conduits 21, 22, and 23, a throttling valve 24 being positioned between conduits 21 and 22. The magnetic valve 20 is connected to a T-fitting through conduit 25 and communicates with conduits 21 and 22.

The various devices of the control system will now be specifically described whereafter their operation in the system will be related. The reducing valve 10 is of the usual type having upper and lower chambers separated by means of a diaphragm 26, said diaphragm having a valve 27 secured thereto and extending into the lower chamber to seat against a suitable valve seat 28. An adjustable screw 29 is provided in the upper chamber for asserting a proper pressure upon the diaphragm 26 so that any desired pressure may be obtained within the lower chamber. It is desirable, although not essential to the operation of the system, to provide such a reducing valve since the pressure in the main line is not always constant and a considerable quantity of gas is withdrawn at certain times; for example, during meal times, and lesser quantities at other times.

The electromagnetically operated valve 20 comprises a base member 30 which is drilled to provide inlet and outlet ports and valve chambers. The conduit 25 enters the inlet port formed at one side of the base 30, while a conduit 31 is connected to the outlet port formed in the opposite side and below said inlet port. A main port 32 connects the inlet and outlet openings, the port 32 being controlled by the movement of an iron plunger 33 which is vertically reciprocable in an upstanding tubular member 34, which latter is suitably secured to the metal base member 30 and rises substantially centrally therefrom, as shown. A coil spring 35 is secured between the top of the tubular portion 34 and the upper end of the plunger 33 whereby the plunger is maintained in position to close the main port 32 when the valve is de-energized. The tubular portion 34 comprises an electromagnetic coil of the usual construction. In the operation of this device the coil is energized and the electromagnetic lines thread through the plunger 21, and the latter is raised against the action of the spring 23 whereby the degree of opening of the main port 20 is controlled.

A more thorough understanding of the construction and operation of this valve may be had by reference to a copending application filed November 27, 1925, bearing Serial No. 71,860.

The magnetic coil is electrically connected to the room thermostatically operated switch 19 which controls the energization and de-energization of the electro-magnetic coil. The room switch 19 may be of any usual type but for the purpose of a specific illustration and means for a better understanding, the device has been shown in the drawings as comprising a mounting base of a suitable insulating material to which is secured a bracket 36 having a downwardly extending portion 37. A thermostatic element 38 of an expansible and contractible bellows type is supported by an extension 39 mounted on the insulating base. The other side of the bellows contacts with an actuating arm member 40 which latter occupies a substantially vertical position and is pivoted at its lower end to the insulating base. The upper end of the arm 40 is adjustably connected by means of a link 41 to the lower extension of the bracket 37, which bracket suitably supports a mercury contactor tube 42 of the usual type having a body of mercury and a pair of spaced cooperating electrodes disposed therein.

The bracket 36 is tiltably mounted on the insulating base and is actuated into its various positions by means of the bellows 38 which latter is provided with a highly volatile fluid, thus rendering the bellows sensitive to the slightest temperature change. The bellows 38 either contract or expand to move arm 40, which latter being linked to the extension 37 causes the mercury tube to tilt in positions whereby the mercury contactor will be caused either to bridge the electrodes and to close the electrical circuit therethrough or to flow in the opposite direction wherein the electrical circuit is opened.

For a better understanding of the elements of this device and the operation of the same, reference may be had to a co-pending application, Serial No. 739,006 filed September 22, 1924, and assigned to my assignee.

The relay or snap valve 12 comprises upper and lower chambers separated by means of a diaphragm 43, the diaphragm in turn having mounted thereon a valve stem and head 44 for engagement with a valve seat provided at the inlet for the gas from the snap valve 10. In the operation of the snap valve 12 and when the desired pressure is obtained in the upper chamber, this pressure will force the diaphragm to seat the valve and to shut off the supply of gas from the conduit 13 to the burner. When there is no pressure in the upper chamber, or the pressure therein is reduced sufficiently, the diaphragm permits the valve member to unseat and to cause a flow of gas through the conduit 13 into the lower chamber, and thence to the burner.

In the operation of the system thus far described, when the room in which the thermostatically controlled member 19 is positioned, has reached a pre-determined temperature, the change in temperature will cause the bellows 38 to tilt the contactor tube to a position wherein the mercury will bridge the elec-

trodes and close an electrical circuit therethrough which in turn will cause the plunger 33 to rise and permit a flow of gas through the conduit 31. The throttling valve 24 is so regulated that when the magnetic valve 20 is open more gas is capable of passing through the latter than can escape through the throttling valve; therefore, the pressure built up in the upper chamber of the snap valve 12 is reduced to open the valve and to permit a flow of gas to the burner 14.

The gas to the burner is ignited by a pilot light 45 and after a predetermined interval, that is, when sufficient heat has been obtained in the boiler, a stack switch 46 is actuated to complete a circuit through the motor 18 which in turn operates the fan 17 to cause air to mix with the gas in the conduit. Because of the time elapsing between the operation of the stack switch 46 and the thermostatic switch 19, gas entering the burner is allowed a sufficient time to be ignited. However, upon the opening of the electrical circuit in the room thermostat switch 19, the magnetic valve 20 will become de-energized at the same time in which the circuit is broken through the motor 18.

The stack switch 46 comprises a helical bi-metallic element 47 disposed adjacent the end of the tube 48 and in axial alignment therewith. One end of the helical bi-metallic element is secured to the tube 48 and the other end is secured to a rod 49 extending through both the tubing and a casing on which the tube 48 is mounted. A mercury tube contactor 50 having a pair of electrodes and a body of mercury disposed therein is mounted on the end of the rod 49. In the operation of the stack switch, when the helical bi-metallic element 47 is heated, one end thereof being fixed to the stationary tube 48, the other end being free will rotate to cause a rotation of the rod 49 which in turn tilts the contactor 50 and causes the mercury therein either to bridge the electrodes and make an electrical circuit therethrough, or to break the electrical circuit therethrough. The operation of this device is more clearly illustrated and described in my co-pending application filed December 17, 1925 and bearing Serial No. 75,895, to which reference may be had for a more detailed description of the structure and operation thereof.

In the wiring of the apparatus of this embodiment, one side of the line from the source of supply is connected to one of the electrodes of the room thermostatic switch 19, the other electrode being connected to one side of the electromagnetically controlled valve 20 and one of the electrodes of the contactor of the stack switch 46. The other side of the valve 20 is connected to the other side of the line and the other electrode of the contactor 50 is connected through the motor 18 to the last mentioned side of the line, thus both the valve 20 and the stack switch 46 are connected in series with the switch 19. When an electrical circuit is completed through the room switch 19 the valve 20 is opened to relieve the pressure in the upper chamber of the snap valve 12 and thereby to permit a supply of gas through the lower chamber of the snap valve 12 to the burner where it is ignited. The hot gases from the burner actuate the helical bi-metallic element 47 whereby an electrical circuit is completed through the stack switch to operate the motor to cause a mixture of gas and air under pressure to flow to the burner. Upon obtaining a desired temperature in the room the thermostatic switch 19 terminates the operation of the motor and shuts off the gas to the burner simultaneously, in the manner previously described.

Referring now to Fig. 2 of the drawings, the outlet conduit 31 from the magnetic valve 20 is connected to the safety pilot 45 which latter will now be described. The safety pilot comprises an elongated tubular member 51 having an aperture 52 at its upper end through which gas is permitted to escape in order to ignite the main burner 14. Gas is supplied through conduit 53 to the lower portion of the tubular member 51, said tubular member being of a relatively high co-efficiency of expansion. A spring member 54 is suitably attached at one of its ends to the tubular member 51 and is perforated to permit the tube member 51 to pass therethrough. The free end of the spring member 54 extends at right angles to the tubular member and has secured at its outer end a valve stem 58 which latter projects downwardly through a packing gland to a point adjacent a seat 55 in a valve housing 56. The valve stem 58 has a lower co-efficiency of expansion than that of the tubular member 51. The conduit 31 is connected to the valve 56 at a point below the seat 55. Conduit 57 is connected to the valve housing 56 at a point above the seat 55 and communicates with the port provided between the packing gland and the seat 55, said conduit 57 extending upwardly and adjacent to the main burner 14 where gas emitted therefrom is ignited by the burner.

In the operation of the safety pilot the valve stem 58 is normally open as the pilot light 55 is constantly ignited. Heat proceeding from the flame which emerges from the pilot port will cause the tubular member 51 to expand more than the valve stem, thereby providing a spaced relation between it and its seat; however, should the pilot light be extinguished the tubular member 51 will contract faster and to a greater degree than the valve stem 58, thereby causing the latter to seat and shut off the supply of gas through the conduit 31. This is the effect which it ordinarily produces by reason of the room

thermostat 19 operating to close the magnetic valve 20, the magnetic valve, of course, building up a pressure in the upper chamber of the snap valve 12 to cut off the supply of gas through conduits 13 and 15 to the burner 14.

It is to be understood that a plurality of safety pilots may be employed to operate a plurality of burners and that these pilots may be arranged in series one with the other whereby the failure of any or all pilots may result in the complete termination of the control system. This invention then is not to be limited to the specific structure shown and described since various modifications of the system may be known to those skilled in the art without departing from the spirit and scope of this invention, and, therefore, the same is to be limited only by the scope of the appended claims and by the prior art.

I claim:

1. A control system for a boiler or furnace having a burner for receiving a mixture of gas and air under pressure comprising a valve, a main gas supply, a gas pressure operated device supplied with gas from the main supply and controlling said valve, thermostatically controlled means for controlling the amount of pressure in said device to regulate the supply of gas from said main supply to said burner, and a thermally operated switch connected in series with said thermostatically controlled means and actuated by the heat from said burner for controlling the supply of air to said burner.

2. A control system for a boiler or furnace having a burner for receiving a mixture of gas and air under pressure comprising a valve having chambers therein, one of said chambers being connected to said gas burner and being supplied with gas from the main supply, electrically operated means for controlling the amount of pressure in the other of said chambers to regulate the supply of gas from said first mentioned chamber to said burner, a main control switch for controlling the energization of said electrically operated means, and a thermally operated switch connected in series with said main control switch and actuated by the heat from said burner for controlling the supply of air to said burner.

3. A control system for a boiler or furnace having a burner for receiving a mixture of fuel and air under pressure, comprising means for controlling the admission of fuel to the burner in accordance with requirements for the operation thereof, ignition means for igniting the fuel supplied to the burner, means for supplying air to the burner under pressure for combustion purposes, and means responsive to the establishment of combustion at the burner for bringing said air supplying means into operation.

4. A control system for a boiler or furnace having a burner for receiving a mixture of fuel and air under pressure, comprising thermostatic means responsive to the temperature of the space to be heated for controlling the supply of fuel to the burner, ignition means for igniting the fuel supplied to the burner, means for supplying air under pressure to the burner for combustion purposes, and thermostatic means influenced by the heat generated at the burner for bringing said air supplying means into operation upon establishment of combustion at the burner.

5. A control system for a boiler or furnace having a burner for receiving a mixture of gas and air under pressure, comprising a gas supply conduit extending to the burner, a valve in said conduit, a gas pressure operated device for controlling said valve, a connection from said gas supply conduit to said device, means governed in accordance with the output requirements of the burner for controlling the gas pressure in said device, ignition means for igniting the gas supplied to the burner, means for supplying air under pressure to the burner for combustion purposes, and means responsive to the establishment of combustion at the burner for bringing said air supplying means into operation.

6. A control system for a boiler or furnace having a burner for receiving a mixture of fuel and air under pressure, comprising a fuel supply conduit extending to the burner, electrically operated means for controlling the flow of fuel through said conduit, a main control switch for controlling the energization of said electrically operated means, ignition means for igniting the fuel supplied to the burner, electrically operated means for supplying air under pressure to the burner for combustion purposes, a thermostatic device influenced by the heat generated by combustion of fuel at the burner, and a switch actuated by said thermostatic device for effecting energization of said last-mentioned electrically operated means upon establishment of such combustion.

In witness whereof I have hereunto subscribed my name.

JOHN C. BOGLE.