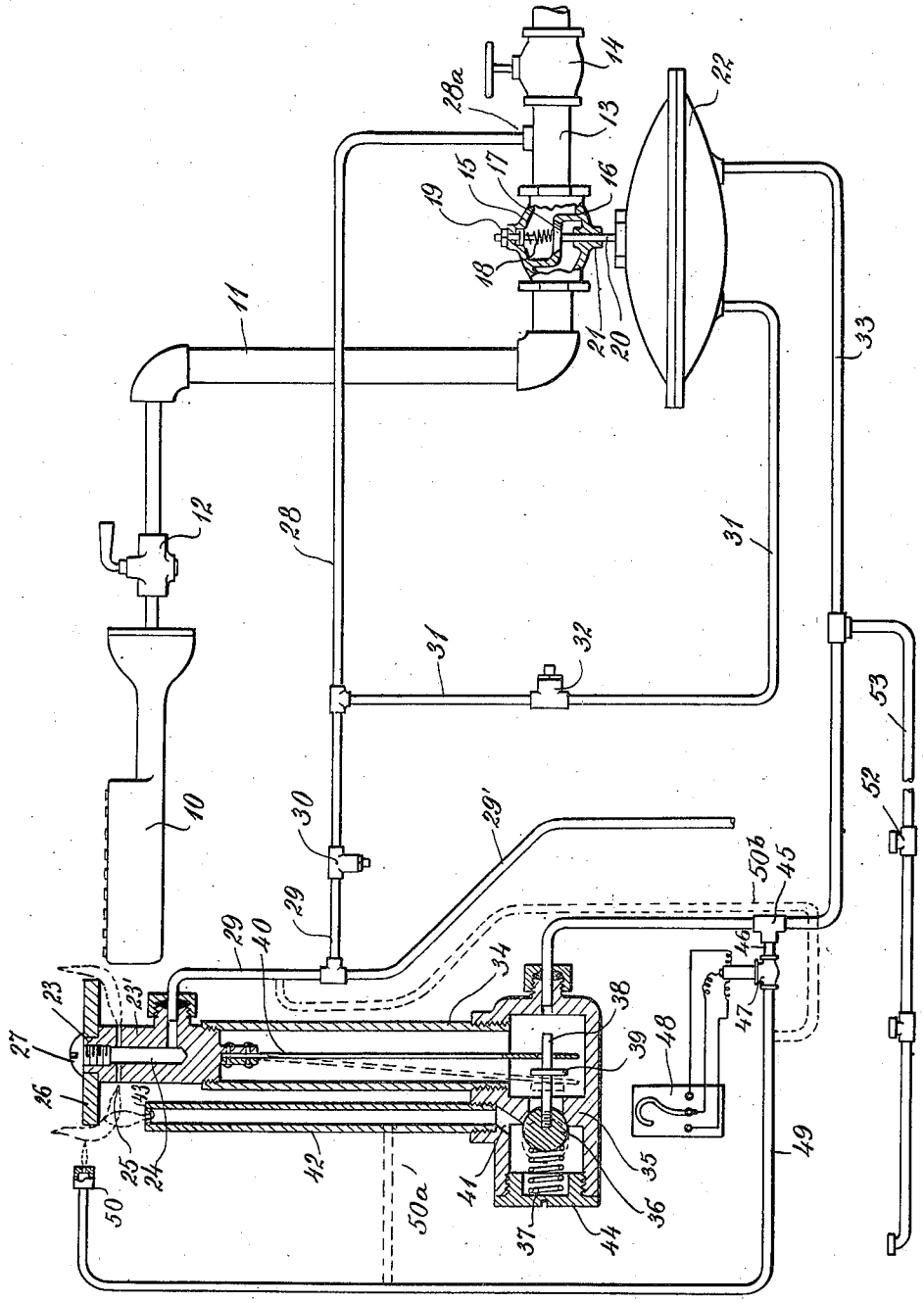
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THERMOSTATIC CONTROL DEVICE

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THERMOSTATIC CONTROL DEVICE.

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This invention relates to thermostatic control devices and has to do more particularly with a control device to be used in connection with a pilot burner by which a main heating burner may be lighted under proper conditions, the control device being operative to prevent the flow of fuel to the main burner under all conditions whenever the pilot burner is extinguished.

Heating burners are frequently provided with control mechanism operated by thermostatic devices, clock-work or the like arranged to control a valve through which fuel is supplied to the burners, and as the flow of fuel to the burners is intermittent and dependent on the temperature in an oven chamber, for example, these main burners are extinguished from time to time and must be provided with pilot burners, so that when the flow of fuel commences after an interval, the burners may be at once lighted. Failure to light the main burners as soon as fuel flow begins might lead to serious consequences, but since the pilot burners, which are intended to burn continuously so as to perform this function, may accidentally be extinguished, safety requires the use of control devices with the pilot burner arranged to prevent the flow of fuel to the main burners whenever the pilot burners are out.

The present invention is directed to the provision of a control device to be used in connection with a pilot burner to perform the functions above stated, and this control device is arranged and constructed so that it is particularly useful in conjunction with others, each associated with a main burner, and all the devices operating to control the flow of fuel through a single valve to the several main burners. The device is also constructed so that it may be used in connection with a manually or automatically operated control device, brought into action to vary the heating effect of the main burners.

The device of the present invention includes a valve controlling the flow of fuel to the main heating burners, and opened and closed by pressure-responsive means, as, for instance, a diaphragm. Fuel supplied under pressure is conducted from the main supply line from a point in front of the control valve to the pilot light, a part of this fuel being passed through a chamber on one side of the diaphragm to a secondary burner controlled by a thermostatic valve which opens and closes in response to the temperature generated by the pilot light. The arrangement of the parts is such that if the pilot light becomes extinguished for any reason, the thermostatic valve controlling the flow of fuel to the secondary burner will open and this will result in the escape of fuel through the line in which the diaphragm chamber is connected. The pressure on the diaphragm normally serving to maintain the latter in a position to hold the main supply valve open will begin to decrease, until eventually the pressure will fall to a point at which the diaphragm is ineffective, and the main fuel supply valve closes, thus shutting off the fuel supply to the main burners.

In one type of installation, a bank of heater burners is employed, each provided with its individual pilot burner and control device and all the heater burners being supplied with fuel through a single diaphragm-controlled valve. In such an installation, the escape of fuel unignited from one or more main burners resulting from the extinguishment of the associated pilot burners would probably result seriously but with the present control device, the supply of fuel to all the heater burners can be cut off if a single pilot burner is out. In addition, the present device operates to shut off the supply of fuel in the event that the pressure of the supply falls below the point of safety.

Further advantages of the new control device include its easy operation, since the system is entirely automatic and the burners may be put into operation simply by turning on the usual main valve and then lighting each pilot burner. The device is also capable of use without modification in connection with separate control devices arranged to operate in accordance with temperature variations, lapse of time, etc.

For a better understanding of the invention, reference may be made to the accompanying drawing, the single figure of which illustrates diagrammatically a system for use in connection with a single main heater burner, the connections for other burners being indicated.

In this drawing, the system illustrated is for use in connection with gas burners and includes a main heater burner 10 of any suitable type receiving gas from a supply

line 11 in which is a shut-off cock 12. The line 11 leads to a main supply line 13 in which is a shut-off cock 14 and a valve 15 controls the flow of gas to the supply line 11. In a multiple installation with a bank of burners, each burner receives gas through a line 11 from the main supply line, the flow of gas to all the burners being controlled by a single valve 15.

The valve 15 contains a seat 16 with which co-operates a movable member 17 engaged by a spring 18 tending to hold the member 17 on the seat to close the valve. An adjustment screw 19 of the usual type may be provided to permit the regulation of the action of the spring 18. The member 17 has a stem 20 extending through an opening in the wall of the valve housing and through sealed joint 21 into a chamber 22 formed in two halves between which is mounted a diaphragm of suitable impervious material. The stem 20 bears against the upper face of the diaphragm and when sufficient pressure is exerted on the under surface of the diaphragm, it is bulged up and forces the movable valve member off its seat against the action of spring 18, and opens the valve, permitting the flow of gas to the burners 10.

Associated with the burner 10 is a pilot burner generally designated 23. As illustrated it comprises a body 23′ having a passage 24 through it, which communicates at one end of the body with jet openings 25 extending through the side walls of the body. The end of the body carries a disc 26 held in place by a screw 27 threaded into the body, the plate providing a shield for the flames and directing them outwardly. In the drawing the pilot burner is shown on an enlarged scale with reference to the main burner 10 but in actual practice the pilot burner is relatively small and is placed near the main burner in such position that the flames from the jet openings 25 will ignite gas flowing from the main burner.

Gas is supplied to the passage 24 through lines 28, 29 the latter being suitably connected at one end to the body 23′ and line 28 leading to a connection 28ª in the main supply line 13 at a point in advance of the control valve 15, so that gas is continuously supplied to the pilot burner when the system is in operation regardless of the condition of valve 15. In the line 28 is a needle valve 30 by which the flow of gas to the pilot burner is initially adjusted in accordance with local gas pressure. Leading from the line 28 is a branch line 31, provided with a needle valve 32 to adjust the flow therethrough, this line leading to the part of chamber 22 beneath the diaphragm. From this part of the chamber a line 33 leads to a housing 34, in one end of which is mounted the body 23′ of the pilot burner.

The housing 34 is gas-tight and contains a valve seat 35 with which cooperates a ball 36 held against the seat by a spring 37 when the system is in operation and the pilot burning. A stem 38 carried by the ball extends beyond the seat into the housing and is provided with a shoulder 39. A thermostatic strip 40 of any suitable type is secured rigidly at one end to the body 23′ and the free end of the strip has an opening through which the stem 38 projects. Beyond the valve seat 35, is a passage 41 through the wall of the housing, and a burner tube 42 having an orifice 43 is mounted on the housing and receives gas through the passage. The tube 42 is a secondary burner and it terminates near the jet openings 25 so that gas ecaping therefrom is ignited by the pilot jets. The spring 37 holding the ball on its seat bears at one end against a cap 44 which may be adjusted to vary the tension on the spring.

The construction of the parts and their adjustment is such that when the system is to be put into operation, the cocks 12 and 14 are opened, and gas flowing through line 28 escapes from the jet openings 25 and is ignited by the operator. At this time, the diaphragm is in the down position and valve 15 is closed preventing the flow of gas to the main heater burner 10. The thermostatic strip 40 being cold has flexed to the dotted line position illustrated and holds the ball 36 off its seat so that gas supplied through branch line 31, the lower half of chamber 22 and line 33 to housing 34, escapes past the ball valve to the secondary burner tube 42, and is ignited at the orifice 43 by the ignited pilot burner. So long as gas flowing into the lower part of the diaphragm chamber is free to escape therefrom, no pressure is built up beneath the diaphragm and the main supply valve 15 remains closed and no gas flows to the main burner 10.

The heat generated by the jets at 25, however, soon heats the disc 26 and body 23′ and the heat is conducted to the thermostatic strip causing it to bend to the full line position illustrated. It now releases ball 36 and the latter is forced upon its seat by the spring 37. As soon as this occurs, gas pressure begins to build up within the lower part of the diaphragm chamber tending to bulge the diaphragm upward and when the pressure reaches a selected value, the diaphragm moves upwardly and unseats the movable valve member 17 against the action of spring 18. Gas is now supplied to the main burner 10 and is at once ignited by the pilot burner jets.

The present control device may be readily employed in conjunction with a thermostatic controller, a time mechanism, or some similar device so that under selected conditions, the burner 10 is extinguished. For example, the burner 10 may heat a liquid

tank and a thermostatic device may be employed to shut off the burner when the temperature of the liquid exceeds a selected value. After the burner has thus been extinguished, a drop in the temperature of the liquid will cause gas again to be supplied to the burner. This gas is ignited by the pilot and heating again begins. But occasionally the pilot light may become extinguished, and if after this occurs, gas is supplied to the burner 10 after the latter has been out for an interval, this gas will escape unconsumed and as the main burner normally has a relatively high rate of consumption, such quantities of gas escaping may result in explosions, aside from the loss of fuel.

Such consequences are prevented by the use of the present pilot burner control device because as soon as the pilot burner goes out, the body 23′ and the strip 40 rapidly cool and the strip moves to a position which forces the ball 36 from its seat. Gas now escapes from the burner 42 and the escaping gas causes a reduction in pressure in the lower half of the diaphragm chamber 22, resulting in the downward movement of the diaphragm and the seating of valve member 17 under the influence of spring 18. When this occurs, all further gas flow to the burner 10 is prevented, until the pilot is again lighted by the operator and normal conditions restored. The escape of gas unconsumed from the secondary burner tube 42 is unimportant, since this burner receives gas at a very low rate, as for example, less than one cubic foot per hour.

It will be noted that in this control device, the secondary burner 42 burns only when the main burner 10 is about to be started, and as soon as the strip 40 reaches the selected temperature the supply of gas to burner 42 is shut off. The burner 42 is not again brought into action until the pilot light is extinguished and strip 40 cools down. When this occurs, gas flows to burner 42 but escapes unignited.

The manner in which the present device is used in connection with a thermostatic controller or the like is illustrated in the drawing. For this purpose, the line 33 is provided with a T 45 to which is connected a line 46 leading to a valve 47. This valve may be of the manually operated type controllable from a distance as by pull chains, or it may be of any suitable automatic type. For example the valve 47 may be remotely controlled and operated electrically as by means of a thermostat 48. Such devices are sold in numerous commercial forms and are arranged to cause valve 47 to open at a selected temperature and to close at some other temperature. Leading from valve 47 is a line 49, which may lead the gas to any convenient point. The line may terminate in a burner tip 50, for example, placed near enough to the pilot burner so that the gas escaping from the tip is ignited by the pilot flames, or else the line may lead to the burner 42 or be connected to the line 29, as indicated on the drawing in dotted lines at 50^a and 50^b.

With this arrangement, if no more heat is required, valve 47 is operated either automatically or manually to open line 49 and gas escapes from the lower side of the diaphragm chamber 22, resulting in a reduction in pressure eventuating in the seating of valve member 18 and the shutting off of gas to burner 10. When heat is needed, valve 47 is closed, pressure in diaphragm chamber 22 builds up, valve disc 18 is unseated and gas supplied to burner 10 to be ignited by the pilot. In the event that the pilot is extinguished when valve 47 is opened, the gas escaping through orifices 43 and 50 will do no harm as both orifices are very small and permit only an insignificant gas flow.

The present device is also capable of use in controlling a bank of burners similar to 10, each having its own pilot light and bleeder and all the bleeders acting to govern the gas flow through a single main valve. For this purpose, the several main burners 10 receive gas from branches of line 11, the gas to all these burners being supplied through a single valve 15. A branch line 29′ connected to line 29 supplies gas to the several pilot burners and associated with each burner is a secondary burner similar to 42, all the secondary burners receiving gas as indicated at 52 through a line 53 connected to line 33. With this arrangement, to start the system, the cock 12 on each burner is opened, the main cock 14 is also opened, and each pilot burner is lighted. So long as the strip 40 associated with each pilot is cold, the secondary burners 42 will receive gas, and so long as one of these burners is being supplied, pressure will not build up in the diaphragm chamber sufficient to open the valve 15. When all the pilots and their strips are heated to the selected temperature, all the ball valves will be closed and pressure in the diaphragm chamber will build up, open valve 15 and cause gas to be supplied to all the main burners. If thereafter a single pilot burner is extinguished, the pressure in the diaphragm chamber will diminish and valve 15 will be closed until the pilot burner which is extinguished is again lighted by the attendant. Similarly operation of the valve 47 will shut off or supply gas to all the burners 10, the valve exercising its control through the diaphragm.

It will be seen that the present device provides a single control mechanism arranged and constructed with a minimum of work-

ing parts, and provides a high degree of safety in operation. The system consumes only a small amount of gas and operates to supply gas to the main burners only when all conditions are right. For example, in the event of low gas pressure, the supply valve 15 remains closed, and if a pilot valve 36 becomes stuck in open position or leaky, the flow of gas to the main burners is prevented. Furthermore the system is extremely simple to put into operation, since the attendant has merely to turn on the main cock 14, and light each pilot. From then on, the system is automatic in action and requires attention only when the flow of gas to the main burners is shut off, due to the extinguishment of a pilot burner or to some other cause.

I claim:

1. A controller for regulating the supply of fuel to a main burner provided with a pilot burner, which comprises the combination of a valve normally closed by spring pressure for controlling the flow of fuel under pressure to the main burner, a diaphragm exposed to the pressure of the fuel and operative when the pressure exceeds a selected value to open the valve against the resistance of the spring, and means responsive to the temperature at the pilot burner for controlling the action of the diaphragm by varying the pressure exerted upon it.

2. A controller for regulating the supply of fuel to a main burner provided with a pilot burner, which comprises the combination of a valve for controlling the flow of fuel under pressure to the main burner, a spring normally holding the valve closed, a diaphragm exposed on one face only to the pressure of the fuel and operable by said pressure to open the valve against the resistance of the spring, and a thermostatic device responsive to the temperature at the pilot burner for controlling the action of the diaphragm by varying the pressure exerted upon it, this device being operable upon extinguishment of the pilot light to prevent the accumulation of pressure on the diaphragm.

3. A controller for regulating the supply of fuel to a main burner provided with a pilot burner, which comprises the combination of a valve normally closed by spring pressure for controlling the flow of fuel to the main burner, an imperforate diaphragm directly exposed to the pressure of the fuel and operative to maintain the valve open so long as the pressure exerted upon it exceeds a selected value, a chamber in which said diaphragm is mounted, an outlet from the chamber, a thermostatic device responsive to the temperature at the pilot burner for opening and closing said outlet and thereby controlling the action of the diaphragm, and a second temperature-responsive means effective to control the action of the diaphragm by opening and closing the said outlet and thereby controlling the pressure to which the diaphragm is exposed.

4. A controller for regulating the supply of fuel to a main burner provided with a pilot burner, which comprises the combination of a main fuel supply line, a valve normally closed by spring pressure for controlling the flow of fuel through said line to the main burner, a branch connection from the main line in front of said valve and leading to the pilot burner, a diaphragm chamber containing a diaphragm operatively connected to the valve, said diaphragm being exposed to the pressure of fuel taken from the branch leading to the pilot burner and being effective to maintain the valve open when the pressure to which it is exposed exceeds a selected value, an outlet from the diaphragm chamber by which the fuel therein exerting pressure on the diaphragm may escape, and a thermostatic device responsive to the temperature at a pilot burner for the main burner for controlling the outlet.

5. The combination of a main burner, a valve normally closed by spring pressure for controlling the flow of fuel to the main burner, a diaphagm chamber containing a diaphragm directly exposed to the pressure of the fuel and operatively connected to the valve, this diaphragm being effective to hold the valve open when the pressure to which it is exposed exceeds a selected value, an outlet from the diaphragm chamber by which the fuel therein exerting pressure on the diaphragm may escape a pilot burner for the main burner, a thermostatic device responsive to the temperature at the pilot burner for controlling the outlet, and a secondary burner in which the fuel escaping from the diaphragm chamber is consumed.

6. The combination of a main burner, a line for supplying fuel thereto, a valve normally closed by spring pressure for controlling the flow of fuel through the line to the burner, a diaphragm chamber, a branch line connecting the main supply line and the chamber, a diaphragm within the chamber exposed on the face only to the pressure of the fuel and operatively connected to the valve, this diaphragm being effective to hold the valve open when the pressure to which it is exposed exceeds a selected value, a pair of outlets from the diaphragm chamber by which the fuel therein exerting pressure on the diaphragm may escape, and a device responsive to the temperature at a pilot burner for the main burner for controlling one of these outlets.

7. The combination of a main burner, a line for supplying fuel thereto, a valve normally closed by spring pressure for control-

ling the flow of fuel through the line to the burner, a diaphragm chamber, a branch line connecting the main supply line and the chamber, a diaphragm within the chamber exposed to the pressure of the fuel and operatively connected to the valve, this diaphragm being effective to hold the valve open when the pressure to which it is exposed exceeds a selected value, a pair of outlets from the diaphragm chamber by which the fuel therein exerting pressure on the diaphragm may escape, means for controlling these outlets independently, and burners in which the fuel escaping from the diaphragm chamber is consumed, the said means being operative when the pilot is extinguished to permit the escape of fuel under pressure acting on the diaphragm and thereby permitting the valve to be closed by its spring.

8. In a heating device, the combination of a main fuel supply line, a main burner connected to the line, a pilot burner adjacent the main burner and connected to the line, a valve in the line normally closed in part by spring pressure and in part by the pressure of the fuel in the main line, said valve controlling the flow of fuel to the main burner only, a diaphragm chamber, a branch line leading from the main fuel supply line to said chamber, a diaphragm in this chamber having one face exposed to the pressure of the fuel and operatively connected to the valve to open the latter, and means responsive to the temperature developed at the pilot burner for controlling the action of the diaphragm by varying the pressure exerted upon it.

9. In a heating device, the combination of a main fuel supply line, a main burner connected to the line, a pilot burner adjacent the main burner and connected to the line, a valve in the line normally closed by spring pressure for controlling the flow of fuel to the main burner only, a diaphragm chamber connected to the main fuel supply line by a branch connection, a diaphragm in this chamber having one face exposed to the pressure of the fuel and operatively connected to the valve to open the latter, an outlet from the diaphragm chamber permitting the escape of fuel under pressure therefrom, a valve controlling this outlet, and a thermostatic device responsive to the temperature at the pilot burner for actuating the valve, the said device being operable upon extinguishment of the pilot for opening the valve to permit the escape of fuel from the diaphragm chamber through the outlet.

10. In a heating device, the combination of a main fuel supply line, a main burner connected to the line, a pilot burner adjacent the main burner and connected to the line, a valve in the line normally closed by spring pressure for controlling the flow of fuel to the main burner only, a diaphragm chamber connected to the main fuel supply line through a branch connection, a diaphragm in this chamber having one face exposed to the pressure of the fuel and operatively connected to the valve to open the latter, an outlet from the diaphragm chamber, a valve controlling this outlet, means responsive to the temperature at the pilot burner for actuating the valve to open and close the outlet, and a secondary burner connected to the outlet in which the fuel escaping from the diaphragm chamber is consumed.

11. In a heating device, the combination of a main fuel supply line, a main burner connected to the line, a pilot burner adjacent the main burner and connected to the line, a valve in the line normally closed by spring pressure for controlling the flow of fuel to the main burner only, a diaphragm chamber connected to the main fuel supply line, by a branch connection, a diaphragm in this chamber having one face exposed to the pressure of the fuel and operatively connected to the valve to open the latter, a pair of outlets from that part of the diaphragm chamber receiving fuel under pressure, valves controlling these outlets, means for actuating the valves independently, a secondary burner connected to one of the outlets in which the fuel escaping from the diaphragm chamber is consumed, and a connection leading from the other outlet to the pilot burner.

12. The combination of a main fuel supply line, a main burner supplied with fuel therefrom, a valve normally closed by spring pressure and controlling the supply of fuel to said burner, a diaphragm chamber receiving fuel under pressure from said main line through a branch connection, a diaphragm in said chamber one face of which is exposed to the pressure of the fuel received through the branch line, an operative connection between the diaphragm and the valve whereby the distortion of the diaphragm operates to open said valve, a pair of outlets from the diaphragm chamber through which the fuel may escape and relieve pressure exerted against said diaphragm to open said main line valve, a pilot burner for the main burner, a temperature-responsive device exposed to the temperature developed by the pilot and operable to control one of said outlets, and a second temperature-responsive device operating to control the other of said outlets.

13. The combination of a main fuel supply line, a main burner supplied with fuel therefrom, a valve normally closed by spring pressure and controlling the supply of fuel to said burner, a diaphragm chamber receiving fuel under pressure from said main line through a branch connection, a diaphragm in said chamber one face of which is exposed

to the pressure of the fuel received through the branch line, an operative connection between the diaphragm and the valve whereby the distortion of the diaphragm operates to open said valve, a pair of outlets from the diaphragm chamber through which the fuel may escape and relieve pressure exerted against said diaphragm to open said main line valve, a pilot burner for the main burner, a temperature-responsive device exposed to the temperature developed by the pilot and operable to control one of said outlets, a second temperature-responsive device operating to control the other of said outlets, and a secondary burner in which the fuel escaping from the said diaphragm chamber through said outlet is consumed.

14. The combination of a main fuel supply line, a valve in the said line for controlling the flow of fuel thereto, a main burner supplied with fuel from said line through said valve, a pilot burner for the main burner, a diaphragm chamber, a diaphragm within the chamber operatively connected to said main line valve, a connection between the main fuel supply line and the chamber whereby fuel under pressure is led into the diaphragm chamber in contact with one face of said diaphragm, a temperature-responsive device exposed to the temperature generated by said pilot for controlling the pressure exerted on said diaphragm in said chamber, and a second temperature-responsive device remote from said pilot for independently controlling the pressure exerted within said chamber upon said diaphragm.

15. The combination of a main burner, a fuel line for supplying fuel thereto, a valve in the line for controlling the flow of fuel to the main burner, a diaphragm chamber, a diaphragm in said chamber operatively connected to said valve, a branch connection between the chamber and the main line in advance of said main valve for supplying fuel to said chamber in contact with one face only of said diaphragm, a pilot burner, a secondary burner disposed adjacent said pilot burner, a temperature-responsive device exposed to the temperature generated by the pilot, an outlet line leading from that part of the diaphragm chamber into which fuel is introduced to said secondary burner, and a valve controlling the supply of fuel to the secondary burner through said outlet line and actuated by said temperature-responsive device.

16. In a heating device, the combination of a main burner, means actuated by the pressure of the fuel for permitting the flow of fuel to said main burner, a pilot burner for the main burner, an element responsive to the temperature developed by the pilot, a fuel outlet line through which fuel may flow to bring about a reduction of pressure to render said pressure-actuated means ineffective, a valve controlling the flow through said outlet line, said valve being actuated by said temperature-responsive element, a secondary burner to which fuel flowing through said outlet line is supplied through said valve, a second temperature-responsive device for controlling flow of fuel through said outlet line, and another secondary burner to which fuel from said outlet line is supplied under the control of said temperature-responsive device.

In testimony whereof I affix my signature.

EDWARD L. FONSECA.