July 26, 1927. 1,636,770

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THERMOSTATIC PILOT CONTROL SYSTEM FOR BURNERS

Filed April 14, 1926 2 Sheets-Sheet 1

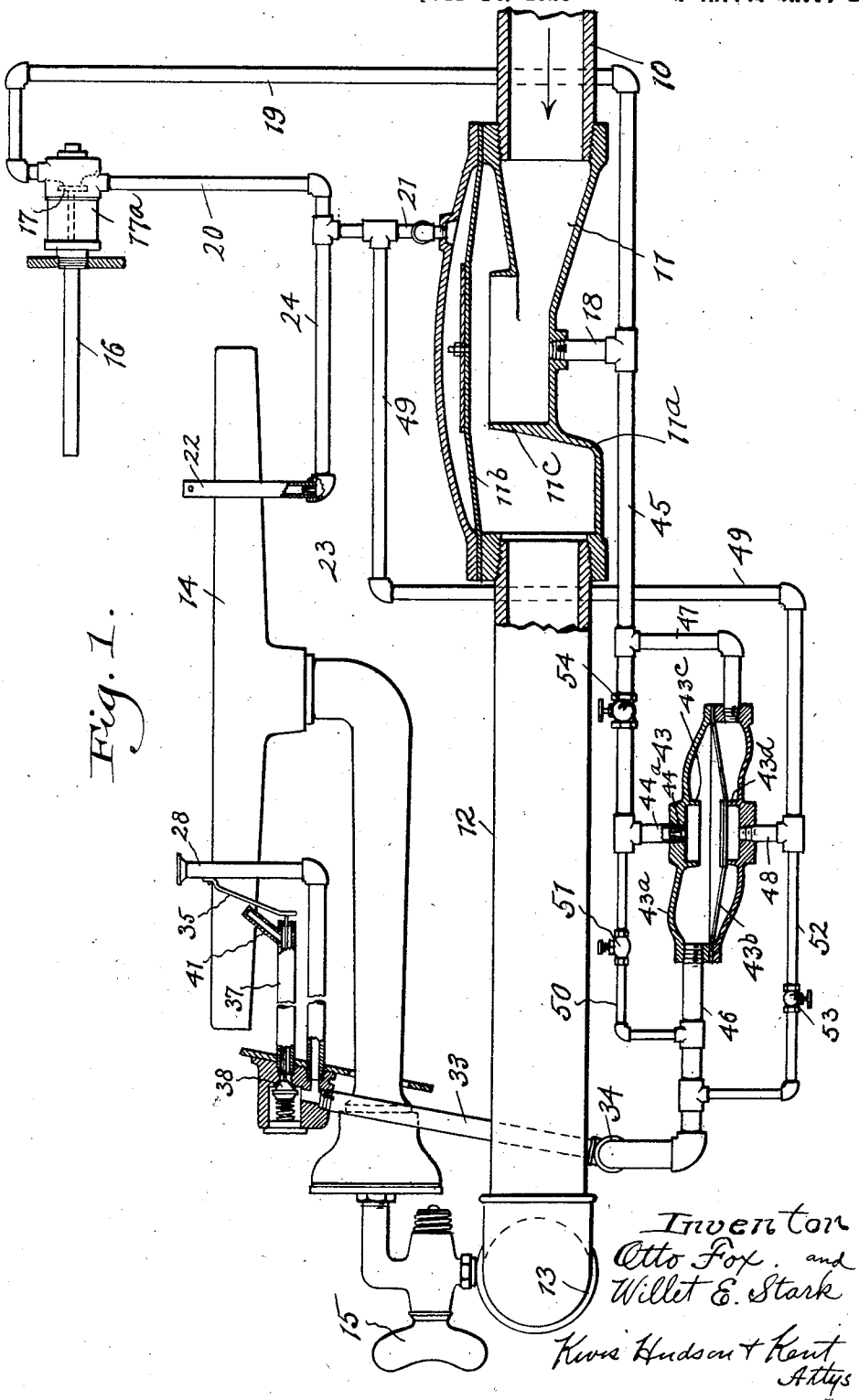



Fig. 1.

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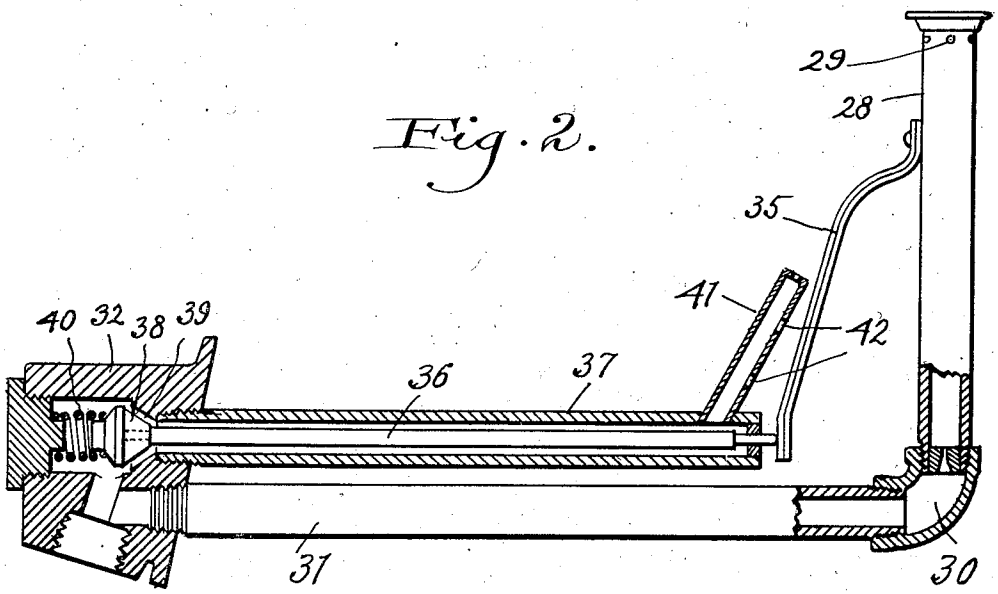
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Fig. 2.



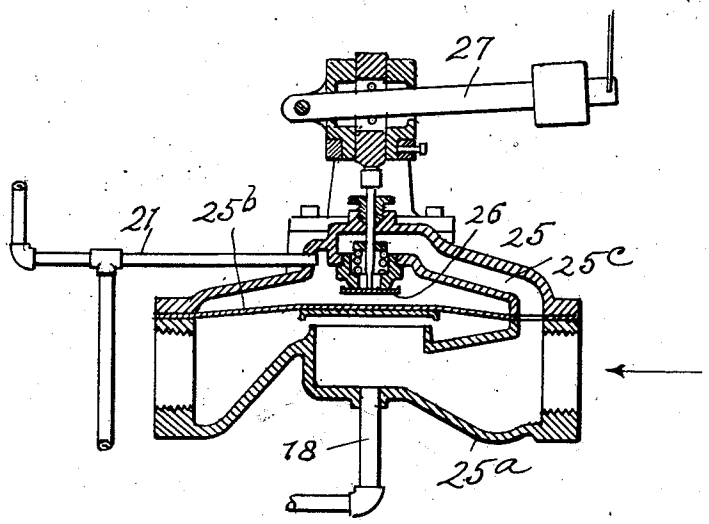




Fig. 3.

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Patented July 26, 1927. 1,636,770

# UNITED STATES PATENT OFFICE.

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## THERMOSTATIC PILOT-CONTROL SYSTEM FOR BURNERS.

Application filed April 14, 1926. Serial No. 101,886.

This invention relates to a thermostatic pilot control for gas burners and has for its object to provide an improved and highly efficient system for preventing the flow of gas to the main and pilot burners in the event that the flame at any one or more of the pilot burners becomes extinguished.

In accordance with our invention and in its preferred embodiment, a main control valve is employed preferably a diaphragm valve which is actuated automatically through the medium of a thermostat or other control device such as a steam regulator to control the flow of gas to the main burner or burners and in addition, we provide an auxiliary valve which is preferably also a diaphragm valve and which is actuated through the medium of a pilot thermostat and of a valve associated therewith for controlling the main valve in such a way as to prevent the latter being opened if the flame at the pilot burner should, for any reason, be extinguished.

The invention may be further briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings:

Fig. 1 is a more or less conventional representation of a system embodying my invention, parts being in elevation and parts being in section;

Fig. 2 is an enlarged view partly in elevation and partly in section of the pilot burner and control mechanism associated directly therewith; and

Fig. 3 is a sectional view through the main diaphragm valve showing the adaptation for a main control somewhat different than that illustrated in Fig. 1.

Referring now to the drawings, 10 represents the main gas supply pipe from which gas is supplied through an automatically controlled valve 11, on the outlet side of which is a pipe 12 connected to a manifold 13 to which any number of main gas burners 14 may be connected, each separately controllable through the usual hand operated valve 15. The main valve 11 is preferably a diaphragm valve and comprises a chamber $11^a$ and a diaphragm $11^b$ which is adapted by a change in gas pressures on opposite sides thereof, to move into and out of engagement with the seat $11^c$. This diaphragm is adapted to be lifted from its seat $11^c$ when the pressure above the diaphragm becomes less than the pressure beneath it so as to permit gas to flow to the main burners 14, but when the pressures on opposite sides of the diaphragm are equalized by the supply of gas into the portion of the chamber above the diaphragm, the latter will drop onto the seat and prevent the flow of gas to the main burners until the pressures are again unbalanced by reducing the pressure above the diaphragm.

In the normal operation of the system the flow of gas to the upper part of the chamber is controlled automatically by a valve actuated in any of the usual ways as by a thermostat or steam pressure regulator. When a thermostat is used it may be of the type which controls the temperature of the water in the storage tank or it may control it indirectly as when utilized in the control of room temperature in which event the valve may be actuated by a motor in turn controlled by the thermostat.

In Fig. 1 we have shown a thermostat 16 of the first named type adapted to actuate a valve 17 which, when opened permits gas to flow to the upper part of the chamber $11^a$ so as to seat the diaphragm $11^b$. In this instance a gas supply pipe 18 is connected to the lower part of the main control valve 11 and this is connected by a pipe 19 to the intake side of the chamber $17^a$ of the thermostat controlled valve 17. The outlet side of this chamber has connected to it a pipe 20 in turn connected to a pipe 21 communicating with the upper part of the chamber $11^a$ of the main control valve 11. It will be seen that when the thermostat 16 opens or permits valve 17 to open gas will flow from the lower side chamber of the main control valve 11 through pipes 18, 19, through valve 17 and pipes 20 and 21 to the upper side of the chamber of the main control valve thus equalizing the pressures on opposite sides of the diaphragm and permitting it to drop by gravity onto the seat $11^c$ so as to shut off the flow of gas to the main burner or burners. When the temperature in the storage tank falls to a predeter-

mined point the thermostat closes or permits the closure of the valve 17, shutting off the supply of gas to the upper part of the chamber of the main control valve. The pressure of the upper part of the chamber is then reduced through the medium of an escapement burner 22 having a small orifice 23 and connected by pipe 24 to pipe 21 leading to the upper part of the chamber of the main control valve. In consequence on the closing of the thermostat controlled valve 17, the pressure above the diaphragm is reduced and the diaphragm is lifted permitting gas again to flow to the main burner or burners 14.

In Fig. 3 a main control valve 25 is shown having a chamber $25^a$ and a diaphragm $25^b$ which is operated similarly to that shown in Fig. 1 but the flow of gas to the upper part of the chamber $25^a$ is controlled in a somewhat different manner. In this instance, the gas which is admitted to the upper part of chamber $25^a$ to seat the diaphragm, is supplied through a passageway $25^c$ formed in the valve chamber $25^a$, the lower end of this passageway connecting with the intake side of the valve 25. The upper end of this passageway is adapted to be placed in communication with the upper part of the valve chamber $25^a$ by a small valve 26 arranged in the upper part of the chamber. The opening and closing of this valve is controlled by a weighted lever 27 which can be connected to a steam pressure regulator or to a motor controlled by a thermostat actuated by room temperature; in this instance the valve 26 is opened by the lowering of the weighted lever and is closed by a small spring when the weighted lever is elevated but the valve 26 can be constructed and operated otherwise if desired.

In Fig. 3 the upper part of the valve chamber $25^a$ has connected to it the pipe 21 leading to the escapement burner 22, as shown in Fig. 1, and the lower part of the chamber $25^a$ has connected to it a gas supply pipe 18 as in the construction first described.

Coming now to the parts or features more directly involving my invention, the pilot burner which is associated with the main burner in Fig. 1 is shown at 28. As there may be any number of main burners 14 so there may also be any number of pilot burners 28, one associated with each main burner if desired. By reference particularly to Fig. 2 it will be seen that the pilot burner is provided at the top with a series of orifices 29 and is provided at the bottom with a restricted orifice 30. Gas is normally supplied to the pilot burner by a pipe 31 connected to a chamber 32. This in turn is connected by a pipe 33 to a pilot burner manifold 34 to which the different pilots are connected if more than one pilot is employed.

By referring again to Fig. 2 it will be noted that associated with each pilot 28 is a thermostat 35 which in this instance is attached directly to the pilot a short distance below the burner openings 29. The lower end of the thermostat abuts against a rod 36 which extends freely through a pipe 37 connected to the chamber 32. The rod 36 also extends into the chamber 32 and at its inner end is provided with a valve 38 adapted to engage a seat 39 which is formed in chamber 32 and toward which the valve is urged by spring 40. The arrangement is such that the thermostat 35 when heated will allow the valve 38 to be seated so as to close off communication between chamber 32 and pipe 37, but when the thermostat is cooled it unseats the valve against the pressure of spring 40 and allows gas to flow from the chamber 32 through pipe 37 as well as through the pipe 31 leading to the pilot burner.

At the outer end of the pipe 37 there is a gas outlet pipe 41 having a series of orifices 42, the area of which is greater than that of the orifice 30 leading to the pilot burner and in fact greater than the aggregate area of the orifices 30 of all the pilot burners assuming that there may be more than one. The function of the thermostat and of the arrangement illustrated in Figs. 1 and 2 in connection with the pilot burner will be explained presently.

Gas is adapted to be supplied to the pilot manifold 34 and thereby to the different pilot burners from the pipe 18 which, as previously explained, is connected to the lower side of the chamber of the main control valve 11 shown in Fig. 1 or main control valve 25 of Fig. 3. The pipe 18 leading to the lower side of the chamber of the main control valve is simply a convenient point of connection for the supply pipe for the pilot burners but a connection with any other point on the intake side of the main control valve or on the intake side of the diaphragm $11^b$ thereof will do as well.

It is an important feature of my invention that there is arranged between the pilot manifold 34 and the pipe 18 a special automatic valve 43 which is preferably a diaphragm valve composed of a casing or chamber $43^a$ and a diaphragm $43^b$ having an upper seat $43^c$ and a lower seat $43^d$.

Two pipe connections are made with chamber $43^a$ on each side of the diaphragm $43^b$. The connections on the upper side consist of a pipe 44 connected to a pipe 45 in turn connected to supply pipe 18 communicating with the lower side of the chamber of the main control valve, as already explained, the other connection to the upper side of the chamber being a pipe 46 leading to the pilot manifold 34. It may be here stated that normally the diaphragm is down or in engagement with the lower seat 43, in which event gas passes

continually from pipe 18 and pipes 45, 44 the upper part of the chamber $43^a$ and pipe 46 to the pilot manifold 34.

The two pipe connections with the lower part of the chamber $43^a$ includes a pipe 47 extending from the gas supply pipe 45, the other connection being a pipe 48 connected to a pipe 49 which in turn is connected to pipe 21 leading to the upper side of the chamber of the main control valve.

The apparatus is completed by two small by-pass pipes one consisting of by-pass 50 between the gas supply pipe 45 leading to the upper part of the chamber $43^a$ and the outlet pipe 46 extending therefrom. This by-pass pipe 50 is provided with a cock 51 which is preferably a small push-button cock. The other by-pass pipe 52 is between pipe 49 and pipe 46, this by-pass pipe being provided with an ordinary cock 53. There is preferably provided also a cock 54 in gas supply pipe 45 between pipes 44 and 47, as shown in Fig. 1. The cocks 51 and 53 are normally closed.

The system operates as follows:

During normal operation gas flows continuously from the lower part of the main control valve and through the upper part of the auxiliary diaphragm valve to the pilot burner or burners 28. During this normal operation the auxiliary valve controlled by thermostat 35 is closed since the thermostat is heated by the flame at the pilot burner. In consequence no gas passes through the pipe or tube 37. During such normal operation the flow of gas to the main burner or burners is controlled in the customary way by the thermostat or steam regulator, the latter controlling the valve which permits or stops flow of gas above the diaphragm of the main control valve so as to permit the diaphragm to be seated or unseated.

If while the gas is shut off from the main burner or burners, the flame at the pilot burner 28 or any one of the series of pilot burners should be extinguished the thermostat 35 associated with the particular pilot burner in question cools off and as it cools it unseats or opens valve 38 permitting a free flow of gas through pipe 37 and orifices 42. As before stated, these ports are so proportioned that they are much larger than the combined area of the orifices of all the pilot burners connected to manifold 34. The opening of valve 38, therefore, results in an increased amount of gas immediately passing through the entire pilot line and produces a decided drop in pressure in the upper part of the chamber of the auxiliary diaphragm valve 43. Since the pressure above diaphragm $43^b$ is reduced it becomes overbalanced by the pressure below the diaphragm and causes the diaphragm to raise and to be seated on the upper valve seat $43^c$.

The raising of the diaphragm shuts off the flow of gas to all pilot burners and additionally it permits gas to flow through pipe 47 and through the lower part of the chamber of the valve 43 and by pipes 48, 49 and 21 to the upper part of the chamber of the main control valve.

Now if the supply of gas through pipes 19 and 20 to pipe 21 is cut off by the action of the steam regulator or thermostat the diaphragm of the main valve is unable to rise as the pressure above it is maintained by the flow of gas through the auxiliary diaphragm valve and pipes 48 and 49. Thus the flow of gas to the main burners and to the pilot burners is shut off and during this time the flow of gas through escapement burner is restricted to the very small amount that will pass through the orifice 23, this being practically a negligible amount.

Let it be assumed that the house owner desires to relight the burners 14. Push button 51 which is provided to permit relighting with safety is depressed and gas flows through the small line 50 to pilot manifold 34 and to the pilot burner or burners. The gas may now be lighted at the ports 42.

During this time the diaphragm $43^b$ of the auxiliary diaphragm valve will remain seated against the upper valve seat $43^c$ since the ports 14 are so large in comparison with the passage through push-button valve 51 that sufficient gas pressure would be unable to build up in the upper part of the chamber of the auxiliary diaphragm valve to cause the diaphragm to drop onto the seat $43^d$. However, as soon as the thermostat 35 becomes heated enough to permit valve 38 to close sufficient pressure will accumulate in the upper part of the chamber of the auxiliary diaphragm valve by way of by-pass pipe 50 and pipe 46 to cause the diaphragm $43^b$ to be lowered on the seat $43^d$ this being true because the flow of gas is restricted by the orifice or orifices 30 of the pilot burner bodies.

The flow of gas through pipes 49, 48 and 21 to the upper part of the chamber of the main valve 11 is now stopped permitting the gas pressure in the upper chamber of valve 15 to be relieved through escapement burner 22. Diaphragm $11^b$ is now raised by gas pressure beneath permitting gas to flow to burner or burners 14.

Push button valve 51 is normally held shut by a spring, and as soon as the diaphragm $43^b$ of the auxiliary diaphragm valve has dropped onto seat $43^d$, the push button may be released and the pilot or pilots will be fed in the normal manner through pipes 45, 44, upper part of the chamber of the auxiliary diaphragm valve and pipe 46 to pilot manifold 34 and hence to the pilots.

Inasmuch as the push button valve 51 is generally operated by one hand and the pilot or pilots are lit with the other, it is

obvious that when this system is applied to large boilers it would be difficult for one person to operate the push button valve and light all the pilot burners. Accordingly by-pass 52 and cock 53 with its small orifice are provided to facilitate the lighting of such boilers.

In the latter case the operator will open cock 53 instead of the push button cock 51 thus permitting a small amount of gas to flow through cock 53 to pilot manifold 34 and pilots including the orifices 42, this gas of course being fed through pipe 48 leading from the lower part of the chamber of the auxiliary diaphragm valve 43. The pilots may now be lighted and push button cock 51 may be opened to increase the flow of gas and hence the heat of the pilots. As soon as the pilots are heated and the valves 38 close thus restricting the flow of gas through the pilots, pressure accumulates in the upper part of the chamber of auxiliary diaphragm valve 43 causing the diaphragm $43^b$ to be seated on the lower seat $43^d$ thus stopping the flow of gas through the lower part of the chamber of auxiliary diaphragm valve but there is a sufficient flow of gas through by-pass pipe 52 into pipe 49 to prevent the lifting of the diaphragm of the main shut-off valve until cock 53 is closed and when this cock is closed the system will operate normally.

The lower end of pipe 44 which normally supplies gas to the upper part of the chamber of the auxiliary control valve 43 is preferably provided with an orifice $44^a$, this orifice being comparatively large. When the pilot is burning in the normal manner the flow of gas is so small that this orifice has no throttling effect but when the flame is extinguished the increased flow of gas through the orifice causes it to reduce the pressure on top of the diaphragm $43^b$ much more rapidly than would be the case if the full area of piping 44 were available for the flow of gas. The apparatus will function without this orifice but not as quickly as desired, the principal effect of the orifice being therefore to accelerate the action of the pilot.

Having thus described our invention what we claim is:

1. In a thermostatic pilot control system for burners, a main burner, a pipe for supplying gas thereto, a pilot burner having a thermostat, a valve associated with the thermostat and adapted to be opened when the thermostat cools by the extinguishment of the flame of the pilot burner, a main control valve, and means whereby the opening of the first mentioned valve prevents opening of the main control valve.

2. In a thermostatic pilot control system for burners, a main burner, a pilot burner, a main control valve, a thermostat associated with the pilot burner, a valve adapted to be operated thereby and a third valve controlled by the second mentioned valve and serving to prevent the opening of the main control valve when the flame is extinguished at the pilot burner.

3. In a thermostatic pilot control system for gas burners, a main burner, a pilot burner, an automatic main control valve of the pressure actuated type, a thermostat associated with the pilot burner, a valve controlled thereby, a third valve which is controlled by the second mentioned valve and serving to cause pressure to be applied to the main valve so as to prevent the opening thereof when the flame is extinguished at the pilot burner.

4. In a thermostatic pilot control system for burners, a main burner, a pilot burner, a gas supply pipe, a main control valve for controlling the supply of gas to the main burner, means comprising a diaphragm valve for controlling the supply of gas to the pilot burner and for preventing the opening of the main control valve and means operated by the thermostat for controlling said diaphragm valve.

5. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat associated therewith, a main control valve of the diaphragm type for controlling the flow of gas to the main burner, means comprising an auxiliary control valve of the diaphragm type for controlling the flow of gas to the pilot burner and for controlling the flow of gas to the main control valve to prevent the opening thereof and means operated by the thermostat for controlling said auxiliary control valve.

6. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat, a main control valve of the diaphragm type for controlling the flow of gas to the main burner, means comprising an auxiliary control valve of the diaphragm type for controlling the flow of gas to the pilot burner and the flow of gas to one side of the diaphragm of the main control valve, and means comprising a valve operated by the thermostat for controlling the auxiliary control valve.

7. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat associated therewith, a gas supply pipe, a main control valve of the diaphragm type for controlling the flow of gas to the main burner, means comprising an auxiliary control valve of the diaphragm type for controlling flow of gas to the pilot burner and also the supply of gas to one side of the diaphragm of the main control valve, and means comprising a normally closed valve associated with the thermostat

and adapted to be opened through the movement of the thermostat when the flame at the pilot burner is extinguished for controlling the auxiliary control valve.

8. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat, a gas supply pipe, a main control valve of the diaphragm type for controlling the flow of gas to the main burner, means comprising an auxiliary control valve of the diaphragm type for controlling the flow of gas to the pilot burner, a normally closed valve associated with the thermostat and adapted to be opened through the movement of the thermostat when the flame at the pilot burner is extinguished, and means by which a drop in gas pressure produced by the opening of the thermostatically controlled valve operates to control the auxiliary control valve.

9. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat associated therewith, a gas supply pipe, a main control valve of the diaphragm type for controlling the flow of gas to the main burner, and means comprising a normally closed valve associated with the thermostat and adapted to be opened through the movement of the thermostat when the flame of the pilot burner is extinguished for controlling the main control valve.

10. In a thermostatic pilot control system for burners, a main burner, a pilot burner having a thermostat associated therewith, a gas supply pipe, a main control valve for controlling the flow of gas to the main burner, means comprising a normally closed valve associated with the thermostat and adapted to be opened through the movement of the thermostat when the flame at the pilot burner is extinguished, and means whereby the reduction in gas pressure caused by the opening of said normally closed valve effects the closing of the main control valve.

11. A pilot control valve of the type described comprising a pilot burner, and a thermostat associated with the pilot burner, adapted to open a normally closed valve upon the extinguishment of the pilot flame to reduce the pressure in a gas supply line.

12. A pilot control valve of the type described comprising a member adapted to be secured to a gas supply pipe, a pilot burner carried by said member, a thermostat associated with said pilot burner, and a normally closed valve mounted in said member, the extinguishment of the flame of the pilot burner causing the opening of said valve to thereby reduce the pressure within the gas supply pipe.

In testimony whereof, we hereunto affix our signatures.

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WILLET E. STARK.