

March 3, 1970

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3,498,732

HEATER

Filed Dec. 18, 1967

2 Sheets-Sheet 1

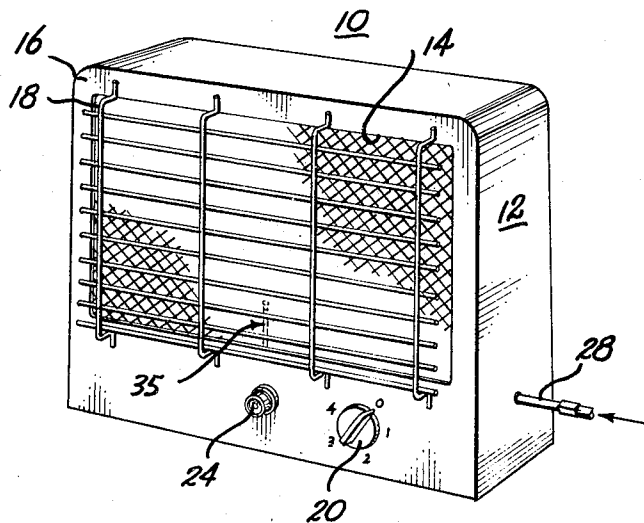


Fig. 1.

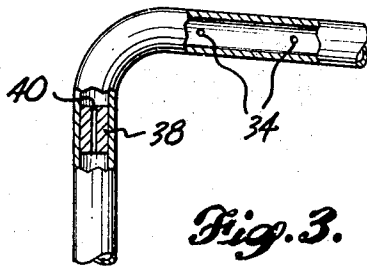


Fig. 3.

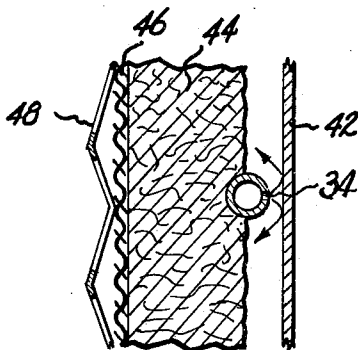
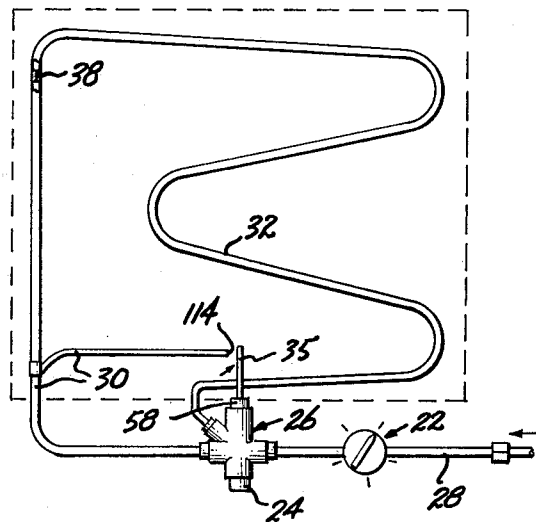


Fig. 4.

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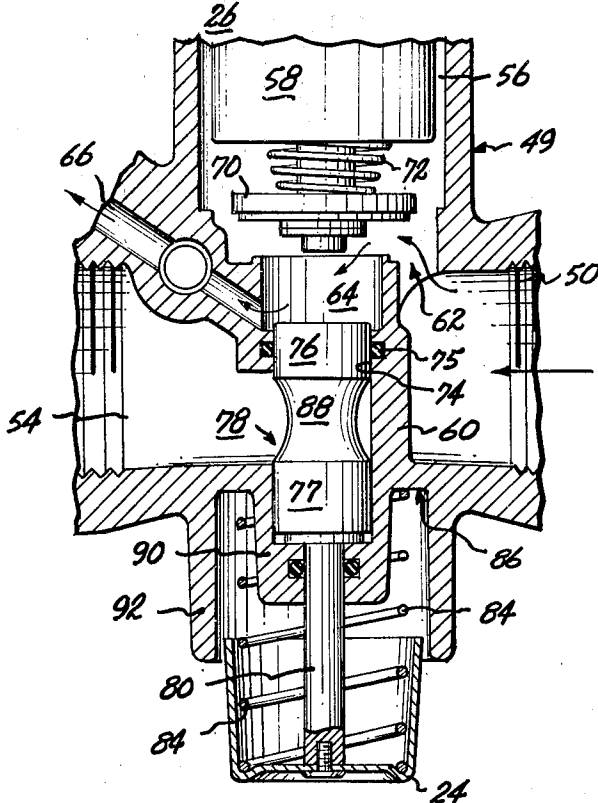
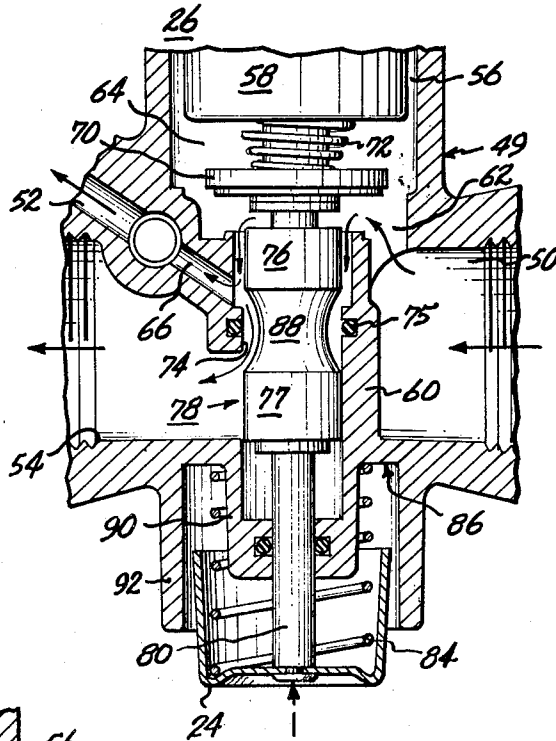
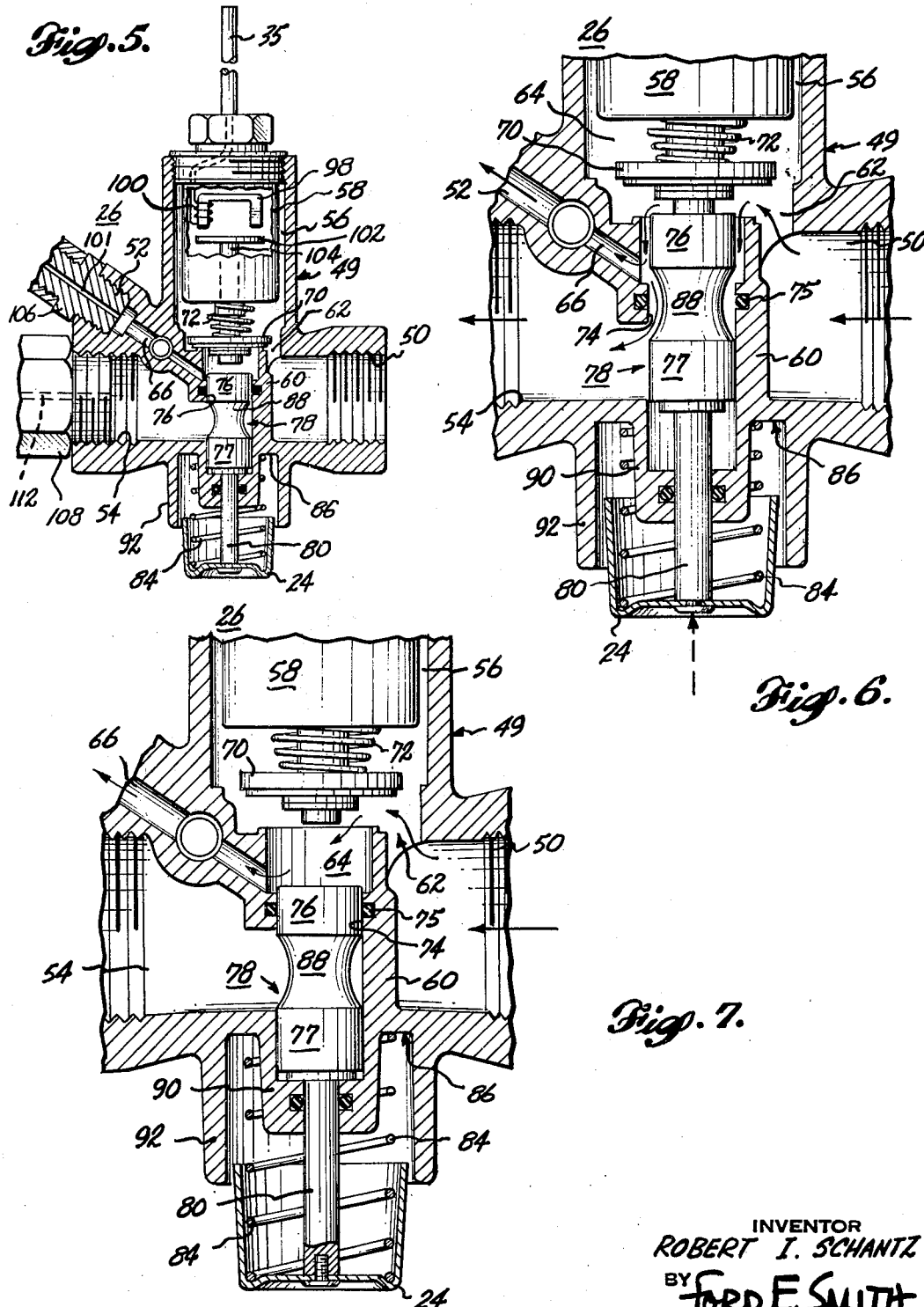
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HEATER

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2 Sheets-Sheet 2



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3,498,732
HEATER

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Filed Dec. 18, 1967, Ser. No. 691,456

Int. Cl. F23n 5/00

U.S. Cl. 431—80

6 Claims

ABSTRACT OF THE DISCLOSURE

A catalytic gaseous space heater has a closed-loop, perforated gas distribution conduit extending between two outlets of a control valve. During initiation of burning, the conduit is oppositely supplied with gas. A pilot flame near one end of the conduit heats a thermo-couple valve control. Upon excitation of the valve control and the relief of manual pressure, the gas supply to one end of the conduit terminates, the pilot flame is extinguished, and the heater operates on gas from a single outlet.

BACKGROUND

Catalytic heaters operating on the principle of flameless combustion of carbon compounds containing gaseous vapors are, of course, known. In such heaters the catalyst which may be platinum or rhodium or palladium on asbestos fiber in the form of a felt or fabric which is disposed in a flat plane usually against a reticulated member and backed by a diffusing pad of glass wool or the like. A chamber encloses the assembly in which there also is a distribution conduit from which the gas exits and diffuses through to the asbestos face where it is combusted. It is customary for the distribution conduit to be under the control of a reciprocating, spring-biased-to-close valve. Such a system usually includes a thermo-electric, magnetic assembly for maintaining the distribution valve element open against its bias so long as heat is available. The heat effective on the thermo-couple is commonly a pilot flame also supplied through the control valve. This flame burns visibly all during operation of the heater but this is undesirable and has been found unnecessary.

It has been an object of this invention to supply gas and so distribute and diffuse it that a broad field, flameless combustion can be maintained, but dispensing with the usual pilot flame except upon a brief period during ignition of the gas heater when its operation is started. Put another way, this invention has for a main object the provision of a completely flameless catalytic heater which is capable of rapid ignition, safe operation by reason of complete combustion without dangerous carbon monoxide production, a high degree of control over the heat output, especially at lower levels and the provision of a two-outlet valve, one of which outlets may be closed once combustion has been established.

These and other objects will become apparent during the course of the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of a catalytic heater constructed in accordance with the teachings of the present invention;

FIGURE 2 is a front elevation view showing the gas distribution tubing and the starter or main control valves of the heater shown in FIGURE 1;

FIGURE 3 is a fragmentary front elevation view, partly in section, showing a portion of the gas distribution tubing;

FIGURE 4 is a fragmentary, cross sectional view showing a portion of the interior structure of the heater; and

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FIGURES 5-7 are cross sectional views showing the main valve of the heater in its at-rest, starting and operating conditions, respectively.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGURES 1-4, a catalytic heater 10, constructed according to the present invention, is seen to comprise a casing 12 having an enlarged window opening 14 in the front panel 16 thereof covered by a protective grill 18. Through suitable openings in the front panel 16 protrudes rotary knob 20 for control valve 22 and pushbutton 24 for the starter or pilot valve 26. Valves 22 and 26 are mounted within casing 12 and gas inlet tube 28 extends to and past the control valve 22 and is connected to the inlet side of starter valve 26. A closed loop gas distribution tube 32 is connected at each end to passages on the outlet side of starter valve 26. Pilot tube 30 extends from loop 32 to adjacent valve 22. As best shown in FIGURE 4, the gas distribution tube 32 has a series of spaced preferably rearwardly-facing, gas outlet orifices 34. The pilot tube 30 terminates at the outlet 114 adjacent probe 36 of thermo-couple 58 mounted on starter valve 26.

Insert plug 38 is disposed within the gas distribution tube 32 to cut off the flame on pilot 114 when button 24 is released. As shown in FIGURE 3, the insert 38 comprises a cylindrical plug having a minute orifice 40 extending axially therethrough. If plug 38 were eliminated there could be a gas flow to the pilot 114 even though gas flow at passage 54 is blocked.

Referring to FIGURE 4, the gas distribution tubing loop 32 is shown disposed adjacent the rear wall 42 of heater casing 12 with the orifices 34 in the tubing facing rearwardly. A gas pervious sheet of material 44, such as glass wool, is sandwiched between the tubing and a foraminous catalytic fabric 46 (such as asbestos cloth including a metal catalyst, such as platinum, palladium or rhodium, incorporated therewith). The wool sheet 44 functions to uniformly diffuse and distribute gas to the catalytic fabric 46, and also serves an insulating function in the heater.

A relatively coarse or large mesh screen 48 extends over the forward surface of the catalyst 46 and protects as well as holds it in place.

Referring to FIGURES 5-7, the starter valve 26 comprises casing 49 having an inlet port 50, a main outlet port 52, a pilot outlet port 54 and a chamber 56 housing a thermally-responsive electromagnetic assembly 58. A partition structure 60 separates the inlet port 50 from the main and pilot outlet ports 52, 54. A passage 62 communicates between the inlet port 50 and a first or main opening 64 which, in turn, communicates with the main outlet port 52 via passage 66. The main opening 64 is normally covered by a main valve closure 70 seated thereon and maintained in such seated position by spring 72 disposed between the closure 70 and the electromagnetic assembly 58.

A second or pilot opening 74, smaller than the main opening 64, is disposed between the main opening and the pilot outlet part 54. Pilot opening 74 is normally closed by the enlarged inner end 76 of a spool-type valve closure 78. The enlarged outer end 77 of the spool valve 78 is connected by stem 80 to pushbutton 24. Spring 84 disposed between the button 24 and an annular surface 86 on the casing 49 normally maintains the spool valve in the position shown in FIGURES 5 and 7, wherein the enlarged inner end 76 closes pilot opening 74. O-ring 75 in the wall of opening seals with valve end 76. When the button 24 is pushed inwardly, the spool valve 78 will be moved against the force of the spring 84.

As shown in FIGURE 6, as the spool 78 moves in-

wardly, the smaller central portion 88 thereof will be disposed in the pilot opening 74, spanning O-ring 75. The inner valve end 76 then unseats the main valve closure 70. With the valve closures so positioned, communication is established between the inlet port 50, the main opening 64, the main outlet passage 66 and port 52 and through the pilot opening 74 with the pilot outlet port 54.

Axial movement of stem 80 of the spool valve 78 is guided by annular boss 90 through which the stem slides. Annular collar 92 on body 26 is disposed concentrically around boss 90 and guides movement of the pushbutton 24. Spring 84 is seated in the annular channel 96 formed by boss 90 and flange 92 and exerts force on button 24.

The electromagnetic assembly 58 is conventional per se. It functions to maintain the main valve closure 70 in its unseated position (FIGURE 7) when temperature at the face of the catalytic fabric 46 is above a predetermined level. The assembly includes the thermocouple probe 36, positioned in the vicinity of the catalytic fabric (see FIGURES 1 and 2), an electromagnetic core 98 disposed within the casing 49 (see FIGURE 5), an energizing coil 100 wrapped around one pole of the core and connected to the thermocouple probe 36. Armature 102, connected to the main valve closure 70 by means of stem 104, is adapted to be attracted toward the poles of core 98.

As shown in FIGURE 5, the main and pilot outlet ports 52 and 54 are internally threaded and closed by threaded fittings 106 and 108 having minute longitudinal orifices 110 and 112 therethrough. Such orifices dictate the velocity and volume of gas flowing into the pilot tube 30 and looped distribution tubing 32.

Typically, the size of the several orifices in the heater may be as follows:

	ASME No.
Orifice 110 in fitting 106	70
Orifice 110 in fitting 108	71
Orifice 40 in plug 38	65
Orifice 34 in gas distribution tubing 32	
upper rows	55
lower rows	72

Outlet opening 114 in the pilot tube 30 may be the size of an ASME No. 74 drill.

For operation, the heater is started by pressing inwardly the pushbutton 24 of starter valve 26 and holding an ignition flame (such as a lighted match adjacent the outlet orifice 114 of the tube 30 to ignite gaseous fuel issuing therefrom. When button 24 is pushed inwardly, the spool valve 78 moves into the position shown in FIGURE 6, simultaneously bringing the smaller central or necked-down portion 88 of the spool 78 into registry with the pilot opening 74 and unseats the main valve closure 70. With communication between the inlet port 50 and the outlet ports 52 and 54 thus established, gas under pressure flows from the inlet ports and through both outlet ports in the direction of the arrows shown in FIGURE 6.

The ignited gas at the outlet 114 of pilot tube 30 heats the thermocouple 36 and generates electric current in coil 100 to energize the core 98. When so energized, the core will magnetically attract the armature 102 toward contact therewith.

The gas flowing through the main outlet port 52 will flow through the gas distribution loop 32 and the orifices 34 therein. Also, upon initial burning, gas may flow through the system throughout the outlet port 54 when open. Plug 38 functions somewhat as a check and may be replaced by a check valve stopping gas flow from part 52 toward pilot 114 when port 54 is closed.

As gas flows through the orifices 34 in looped tubing 32, it impinges on the rear plate 42 of casing 12 (see FIGURE 4) and flows and diffuses forwardly through wool matting 44. The matting quite evenly distributes the

gas flowing therethrough. From the matting the gas percolates through the catalytic fabric 46 where it undergoes substantially flameless combustion and heat which radiates forwardly through the screen 48 and grill 18. So long as the temperature on the forward side of the catalytic fabric 46 is above a predetermined level, the thermocouple 58 will maintain the electromagnetic core 98 energized and magnetically attract the armature 102 holding main valve closure 70 of starter valve 26 in the raised position shown in FIGURE 7. The pushbutton 24 may very shortly after ignition be released to allow spring 84 to retract the spool valve 78 to its closed position (FIGURE 7) wherein it blocks gas flow to the pilot outlet port 54 and pilot tubing 30. Since the main valve closure 70 is held unseated to uncover the main valve opening 64 simultaneously with the uncovering of the pilot opening 74, gas will immediately flow through the looped distribution tubing 32 and catalytic fabric 46 as well as through the pilot opening 114, thereby speeding the generation of heat. Starter valve pushbutton 24 need only be held inwardly for a short period of time.

During operation of the heater the temperature may be controlled by adjusting the rotary control valve knob 20 to increase or decrease the flow of gas from its source through the heater.

If the gas flowing through the catalytic fabric 45 should fail to combust at any time after the pushbutton 24 has been released, the temperature in the vicinity of the thermocouple will lower, thereby de-energizing the electromagnetic core 98 and permitting the spring 72 to return the main valve closure 70 to its seated (FIGURE 5) position. Gas flow through the valve main opening 64 and to the main valve outlet ports 52 and 54 is then blocked and no harmful gas fumes will issue from the heater. The starter valve must be actuated again in the manner described above to restart the heater.

It will be apparent to those skilled in the art that changes and modifications may be made within the skill of the art without departing from the spirit and scope of the invention as set forth in the subjoined claims.

What is claimed is:

1. In combination, a catalytic heater comprising:

a catalytic, gas-pervious barrier comprising a thermally-resistant cloth having a plurality of gas passages therethrough and a catalytic metal incorporated therewith and a closed loop gas conduit serially perforated to distribute gaseous fuel through and over the surface of said catalytic barrier; and

a valve for initiating the flow of gaseous fuel to said gas conduit means; said improved valve, comprising; a valve casing having an inlet port, a main outlet port and a pilot outlet port;

partition means separating said inlet port from said main and pilot outlet ports;

a main opening in said partition means communicating with said main outlet port;

a main valve closure normally seated to cover said main opening and block communication between said inlet port and said main outlet port;

a pilot opening in said partition means between said main opening and said pilot outlet port;

a pilot valve closure normally covering said pilot opening to block communication between said main opening and said pilot outlet port;

manually-operable means associated with said pilot valve closure for moving said pilot valve closure to a position wherein it simultaneously opens said pilot outlet port and unseats said main valve closure to establish communication between said inlet port and said main and pilot outlet ports;

thermally-operable electromagnetic means associated with said main valve closure for maintaining said main valve closure in its unseated position when the temperature of the gas passing through said catalytic barrier is above a predetermined level; and

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said closed loop gas conduit having its ends coupled one to said main and the other to said pilot outlet ports.

2. The structure according to claim 1 in which the conduit is juxtaposed to said barrier so that said perforations are directed away therefrom.

3. The structure according to claim 1 in which there is a pilot nozzle in said conduit directed at said thermally-operable means and more closely associated with said pilot outlet port than said main outlet port.

4. The structure according to claim 3 in which there is a ported plug in said conduit in the proximity of said pilot nozzle and there are no perforations in the conduit between said plug and the pilot outlet port.

5. In combination, a heater comprising a gas-pervious catalytic barrier and a closed loop gas supply conduit adapted to distribute gaseous fuel through and over the surface of said barrier; and a valve for initiating and controlling gaseous fuel supply to said conduit, comprising:

a valve casing having an inlet port, a main outlet port and a pilot outlet port;

partition means separating said inlet port from said main and pilot outlet ports;

a main opening in said partition means communicating with said main outlet port;

a main valve closure normally seated to cover said main opening and block communication between said inlet port and said main outlet port;

a pilot opening in said partition means between said main opening and said pilot outlet port;

a pilot valve closure normally covering said pilot opening to block communication between said main opening and said pilot outlet port;

manually-operable means associated with said pilot valve closure for moving said pilot valve closure to a position wherein it simultaneously opens said pilot outlet port and unseats said main valve closure to establish communication between said inlet port and said main and pilot outlet ports;

thermally-operable electromagnetic means associated

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with said main valve closure for maintaining said main valve closure in its unseated position when the temperature of the gas passing through said catalytic barrier is above a predetermined level; and said closed loop gas conduit having its ends coupled one to said main and the other to said pilot outlet ports.

6. A heater, comprising:

means forming an open-face chamber including a main panel;

an elongated distribution tube shaped in a single plane to provide a tortuous path of distribution between its ends, said tube being disposed within said chamber adjacent said main panel and having a series of longitudinally spaced perforations therein directed at said main panel;

wool batt means in said chamber in juxtaposed contact with said distribution tube opposite said panel;

a foraminous catalytic barrier disposed at the face of said wool batt means oppositely to said distribution tube;

and a single controllable means associated with both ends of said distribution tube for supplying gaseous fuel thereto at the initiation of combustion, and including means limiting gaseous fuel supply to a single end of said distribution tube when substantial combustion at the catalytic barrier is established.

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CHARLES J. MYHRE, Primary Examiner

U.S. Cl. X.R.

126—92; 431—329