

June 26, 1928.

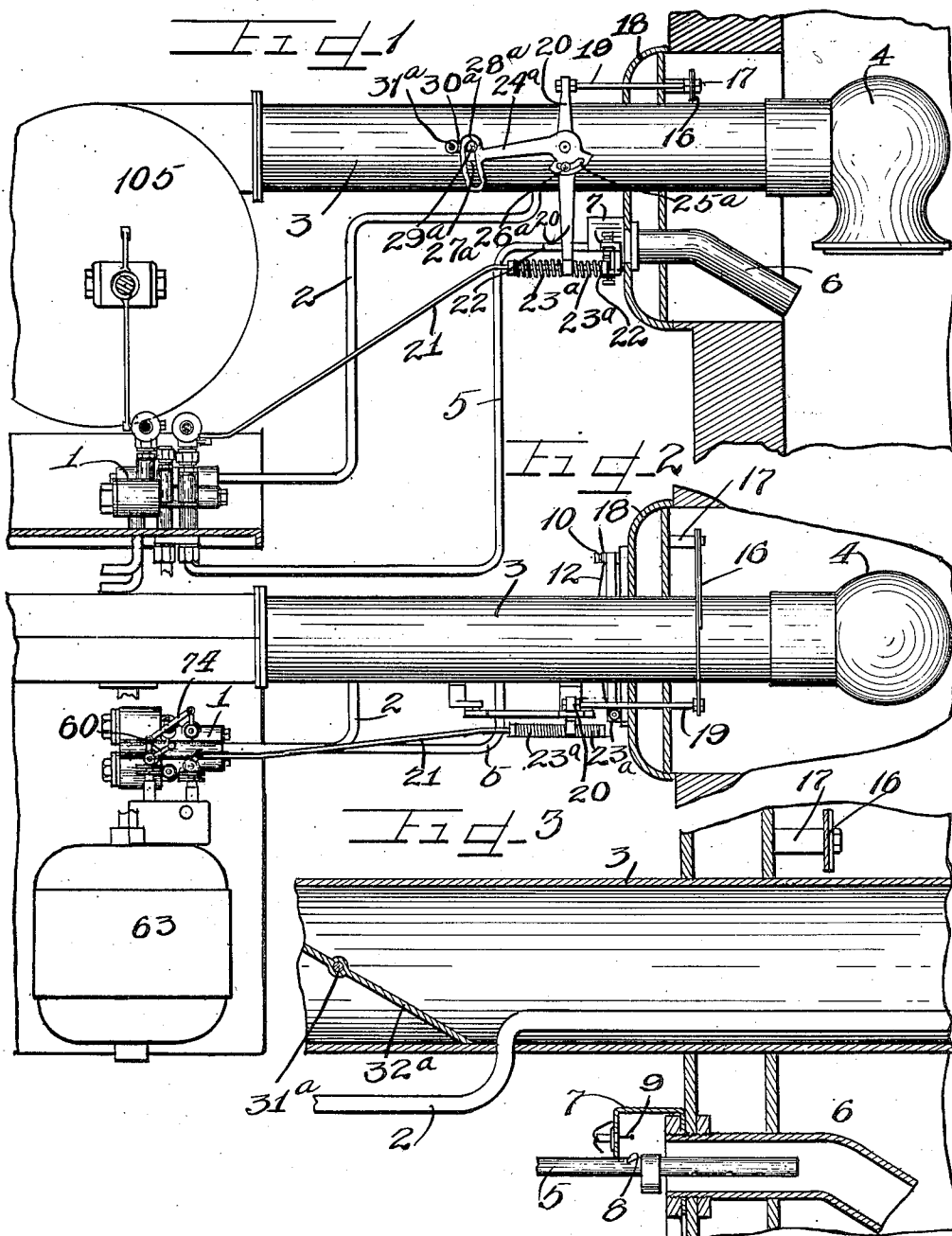
1,675,133

C. L. RAYFIELD

LIQUID FUEL BURNING SYSTEM

Filed Nov. 5, 1924

3 Sheets-Sheet 1



INVENTOR
Charles L. Rayfield.
Charles L. Rayfield
Attys.

June 26, 1928.

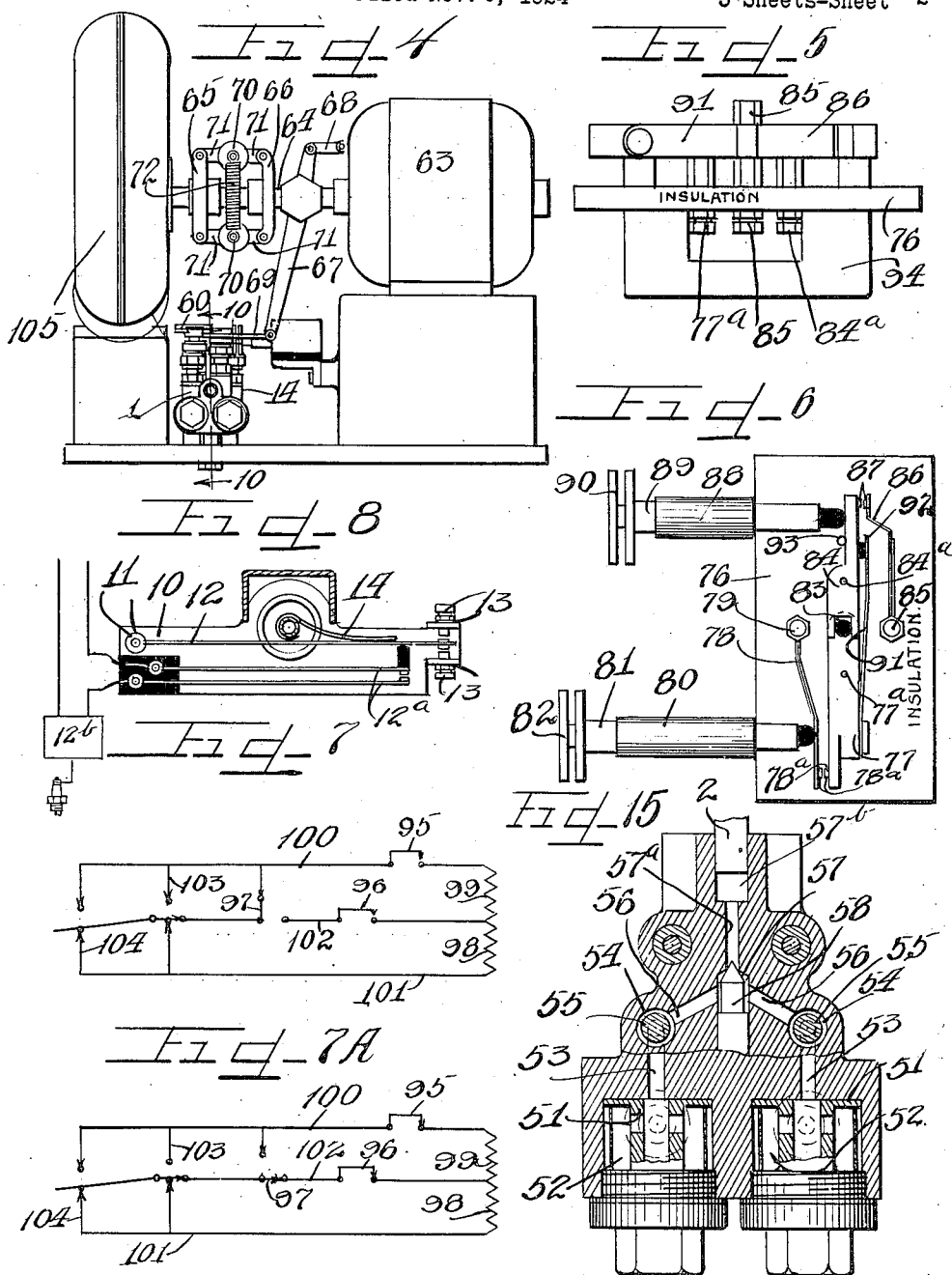
1,675,133

C. L. RAYFIELD

LIQUID FUEL BURNING SYSTEM

Filed Nov. 5, 1924

3 Sheets-Sheet 2



Inventory
Charles L. Trayfield
Charles L. Trayfield
Atty

by

Atlys.

June 26, 1928.

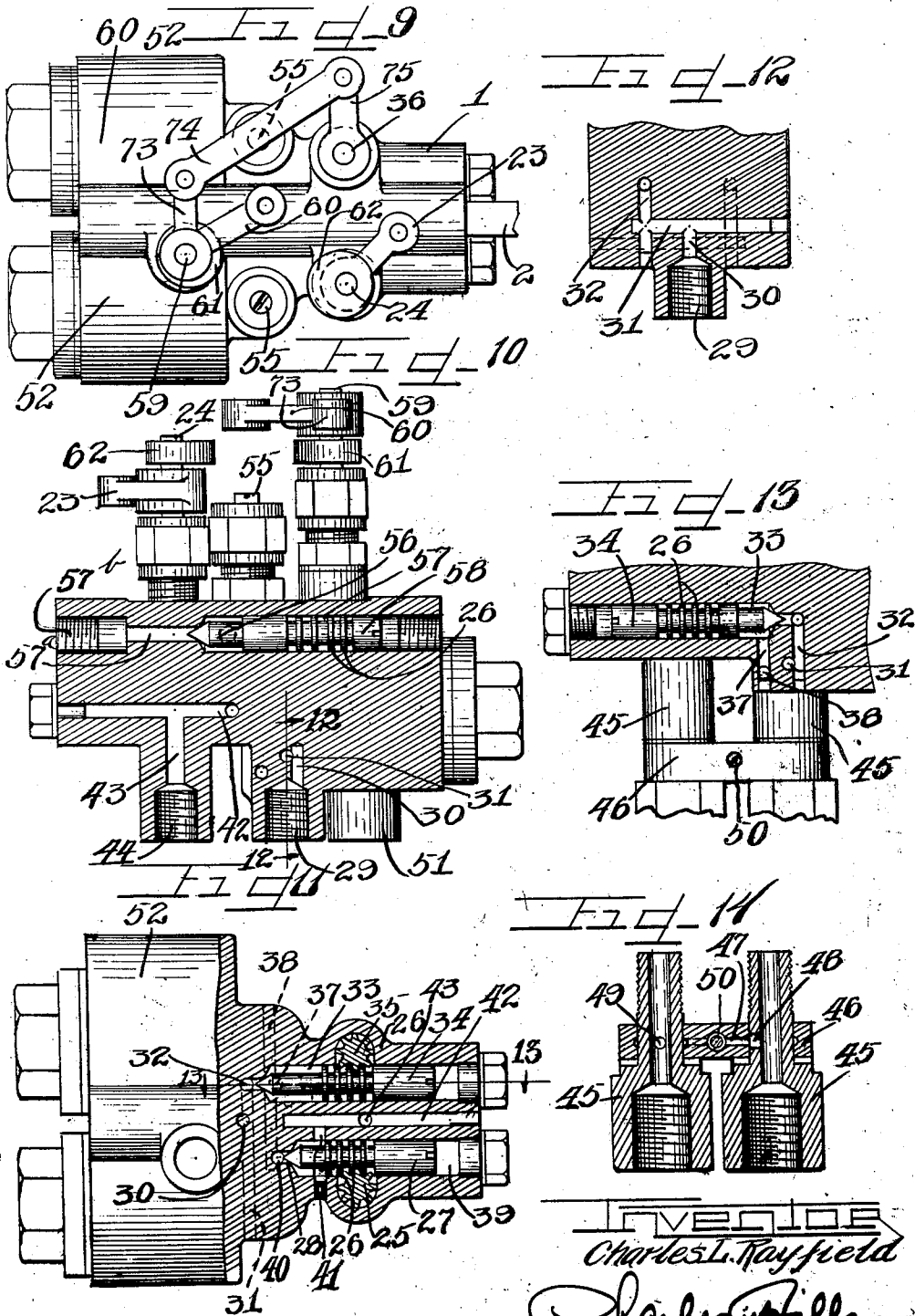
1,675,133

C. L. RAYFIELD

LIQUID FUEL BURNING SYSTEM

Filed Nov. 5, 1924

3 Sheets-Sheet 3



INVENTOR
Charles L. Rayfield
Charles L. Rayfield
Attys.

UNITED STATES PATENT OFFICE.

CHARLES L. RAYFIELD, OF CHICAGO, ILLINOIS, ASSIGNOR TO RAYFIELD MANUFACTURING CO., A CORPORATION OF ILLINOIS.

LIQUID-FUEL-BURNING SYSTEM.

Application filed November 5, 1924. Serial No. 747,884.

This invention relates to a liquid fuel burning system and it is among the objects of this invention to provide a controlling mechanism for automatically regulating the heat, and automatic dual control for the gas, an automatic pilot light control, and automatic means for controlling the fuel and motor to prevent the latter from being started while the furnace is too hot to prevent explosion.

The invention comprises the novel structure and combinations of elements hereinafter described and more particularly pointed out and defined in the appended claims.

In the accompanying drawings which illustrate a preferred embodiment of this invention and in which similar reference numerals refer to similar features in the different views,

Figure 1 is an elevational view of the oil burning system showing the front furnace wall in section.

Figure 2 is a top plan view of the oil burning system with parts omitted and parts in section.

Figure 3 is an enlarged fragmentary vertical sectional view through the air blast pipe and adjacent parts.

Figure 4 is a side elevational view of the operating means for the system connected to the controlling valves.

Figure 5 is a bottom edge plan view of the motor controlling switch.

Figure 6 is an enlarged interior plan view of the switch.

Figure 7 is a diagrammatic view of the wiring and controls showing the position of parts for stopping the motor when the room is overheated.

Figure 7^A is a view similar to Figure 7 showing the position of parts for starting the motor when the room has been sufficiently cooled.

Figure 8 is an elevational view of a thermostatically controlled switch for the pilot light.

Figure 9 is a top plan view of the valve housing.

Figure 10 is a vertical sectional view upon the line 10—10 of Figure 4.

Figure 11 is a part sectional and part elevational view of the valve mechanism shown in Figure 1.

Figure 12 is a sectional view upon the line 12—12 of Figure 10.

Figure 13 is a sectional view upon the line 13—13 of Figure 11.

Figure 14 is an enlarged sectional view through the gas inlet and outlet of the valve housing.

Figure 15 is a sectional view thru part of the fuel passages in the valve housing.

The illustrated apparatus for explaining this invention comprises a valve mechanism 1 through which the liquid fuel and igniting gas pass. From the valve mechanism the liquid fuel passes through a feed pipe 2 which enters an air pipe 3 and extends to the point of combustion in a hollow cap or hood 4 on the end of the air pipe. This hood is closed except at its lower end through which the fuel descends. The igniting gas passes from the valve mechanism through a feed pipe 5 which extends into a flame spout 6 or the like. At the rear end of the flame spout, there is a small pilot light housing 7; the gas pipe being provided with a small opening or aperture 8 in said housing for the pilot light.

A spark plug 9 (Figure 3) extends through the housing 7, just above the pilot light aperture 8. This spark plug is in an independent circuit controlled by a thermostatically controlled switch shown in detail in Figure 8. In referring to said figure it will be noted that the switch comprises a supporting member 10 having a post terminal 11 at one end; a resilient leaf spring or switch element 12 in electrical contact with said post extends between a pair of terminal posts 13. A thermostatic element in the form of a leaf spring 14 normally rests upon the switch element 12. This thermostatic element is maintained in position by having one end coiled about a stud 15 extending from the support 10. The thermostatic element is adapted to be influenced by the heat of the pilot light for maintaining the switch element 12 in contact with the upper post 13. However, if the pilot light goes out and the furnace has cooled off as when the system is shut down, the thermostatic element 14 will cool sufficiently to flex downwardly and force the switch 12 into contact with the lower post 13, preventing the motor from being started when the pilot light is out. As the switch element 12 de-

scends it will close a switch 12^a in a separate spark plug circuit for energizing the spark plug for igniting the pilot light. Then after the thermostatic element is heated again, it will flex and allow the resilient switch 12 to rise and contact the upper part allowing the motor to be started. It should be understood that the terminals 11 and 13 are connected in the motor circuit.

10 A thermostatic bar 16 is also placed within the furnace, one end thereof is supported upon a stud 17 suitably secured upon the furnace door 18. A rod 19 is attached at one end to the other end of the thermostatic
15 bar. The other end of the rod 19 is secured to a lever 20 pivoted intermediate its ends upon the air pipe 3. The lower end of the lever 20 is apertured for receiving a control rod 21, provided with a pair of
20 spaced nuts 22 upon opposite sides of the lever 20. Coil springs 23^a are confined between said nuts and lever 20 and provide yielding abutments against which the lever 20 is adapted to act when shifting the con-
25 trol rod 21.

An arm 24^a is also supported upon the pivot of the lever 20. This arm has an extended hub provided with an arcuate slot 25^a through which a clamping screw 26^a extends for clamping the arm 24^a in any ad-
30 justed position within the limits of the slot 25^a. The projecting end of the arm 24^a is provided with an arcuate slot 27^a having a notch 28^a in which a stud 29^a is normally
35 seated. The stud 29^a projects from a short crank arm 30^a which is secured upon the end of the rod 31^a that supports the rotary valve 32^a in the air pipe.

The thermostatic bar 16 is responsive to
40 the heat of the furnace. It will flex under proper temperature and draw the rod 19 inwardly to swing the lever 20 for regulating the air valve 32^a. As the thermostatic bar is heated it will operate the rod 21 and gradually close the gas supply valve as will later appear.

The rod 21 is connected to a crank arm 23 secured upon a stem 24, the lower end of which is in the form of a small gear 25 that
50 extends into the valve housing 1 as shown in Figure 11. The gear 25 is in mesh with circular teeth or flanges 26 upon a valve rod 27, the inner end of which is conical for closing a gas port 28 through which
55 the gas must pass in order to reach the furnace. Rotation of the stem 24 will shift the valve 27 for regulating or closing the gas passage.

The gas which may come from a city
60 main or from any other source enters the valve housing through a port 29 (Fig. 10) from which a passage or duct 30 extends. The passage 30 communicates with a horizontal passage 31 (Figs. 12 and 13) which in turn communicates with a vertical pas-

sage 32 which communicates with a cylindrical bore 33 in the valve housing. A valve in the form of a rod 34 slides in the bore 33, the inner end of this valve is of conical formation for closing the passage between
70 the passage 32 and bore 33. The valve rod 34 is also provided with circular flanges or teeth 26 which are in engagement with a small gear 35 on the lower end of a stem
75 36. (Fig. 9).

From the bore or cylindrical chamber 33 the gas escapes through a vertical passage 37 which communicates with a horizontal passage 38 which leads to a point under a
80 second bore or cylindrical chamber 39 (Fig. 11) in which the aforementioned valve rod 27 is mounted. A vertical passage 40 connects the horizontal passage 38 with the aforementioned port 28 that communicates with the cylindrical chamber 39. From the
85 cylindrical chamber 39, the gas passes through a short duct 41 into a horizontal passage 42 from which it escapes through a passage 43 to the outlet 44 which communi-
90 cates with the pipe 5.

A pair of coupling members 45 (Fig. 14) are screwed into the outlet port 44 and the inlet port 29 of the valve housing. These coupling members have axial bores extend-
95 ing therethrough, the outer ends of which are enlarged and threaded. The aforementioned gas pipe from the city main is threaded into the coupling member 45 that is connected in the inlet port 29, these
100 coupling members having restricted necks inwardly of the enlarged bores. A yoke member 46 is mounted upon these restricted necks, and is provided with a bleeder pas-
105 sage 47 which communicates with the bores in the couplings 45 through the ports 48 and 49 in the said necks. A needle valve in the form of a screw 50 threaded into the yoke
110 46 may be adjusted for regulating the bleeder passage 47. When the main supply of gas is cut off through either the valve 27 or 34, a limited amount will flow through the bleeder passage for the pilot light.

Liquid fuel and air also pass through the valve housing 1 and a proper control is provided therefor. In Figure 15 I have
115 illustrated a pair of ports 51 which extend from the bottom of the valve housing to a pair of screening chambers 52 in which the fuel and air may be screened; one chamber being for the fuel and the other for the air. Passages 53 extend from these screening
120 chambers to a pair of vertical chambers 54 in which needle valves 55 are located for varying the flow of fuel and air. Passages 56 extend from the vertical chambers 54 to
125 a longitudinal bore or chamber 57 which is also shown in detail in Figure 10. A restricted passage 57^a leads from the cylindrical chamber 57 and communicates with an enlarged threaded bore 57^b in the end of
130

the valve housing 1 in which the fuel supply pipe 2 is threaded. A valve 58 in the form of a rod having a conical end adapted to close or regulate the fuel passage 57^a is located in the cylindrical chamber 57 for sliding movement. To this end, the rod is provided with a series of circular teeth or flanges which are in mesh with a small pinion or gear similar to the gear 25. This small pinion or gear forms the lower part of a stem 59 which extends through a suitable aperture in the valve housing. A crank arm 60 is secured upon the upper end of the stem 59 for a purpose that will later appear. A cam 61 is also secured upon the stem 59. A similar cam 62 is secured upon the aforementioned stem 24. These cams are adapted for operating a switch for controlling the motor as will later more fully appear.

The fuel valve 58 is adapted to be regulated by the speed of the motor, and is adapted to be closed when the motor stops for any reason. To this end the motor which is designated by the reference numeral 63 (Fig. 4) has a centrifugal governor upon its shaft 64. This governor comprises a yoke 65 rigidly secured upon the motor shaft and a slidable yoke 66, having an extended hub upon which a lever 67 is rockably mounted intermediate its ends. The upper end of said lever is pivotally connected to the motor casing by means of a short link 68 and its lower end is connected by means of a link 69 to the aforementioned arm 60. The yoke members 65 and 66 support centrifugal weights 70 by means of toggle links 71 which pivotally connect the weights to said yokes. The weights are connected by the usual spring 72. It is therefore evident that the shifting movements of the yoke 66 will rock the lever 67 for regulating and shutting off the fuel supply. The hub of the arm 60 that controls the fuel supply has a second arm 73 which is connected by a link 74 with a crank arm 75 upon the aforementioned stem 36 that controls the aforementioned gas valve 34. Consequently when the motor stops the governor will operate the lever 67 for simultaneously rotating the stems 59 and 36 for shutting off the fuel and gas. At the same time the cam 61 will operate a switch in the motor relay circuit. This switch is illustrated in Figure 6, and will now be described.

In referring to Figure 6 it will be observed that the switch comprises an insulated base 76 upon which a conductor lever 77 is mounted by means of a pivot post 77^a. A resilient conductor 78 is mounted upon one terminal post 79 upon the base. The conductors 77 and 78 have cooperating contact points 78^a. A cylindrical sleeve 80 is suitably supported upon the base 76 and a plunger 81 is slidably mounted in the sleeve. The inner

end of the plunger is insulated and is adapted for engaging the resilient switch member 78, while the outer end is in the form of a head 82 adapted to be engaged by the cam 61.

Upon the inner end of the contact member 77 there is an insulated stud 83 which is engaged by the bifurcated end of the conductive lever 84 pivoted intermediate its ends upon a pivot post 84^a upon the base 76. Beneath the lever 84, there is a terminal post 85 upon which a resilient switch member 86 is secured. The switch member 86 and lever 84 have cooperating contact points 87. A second sleeve 88 is mounted upon the base 76 and a plunger 89 is slidably mounted in said sleeve. The inner end of the plunger is insulated for engaging the lever 84, and the outer end has a head 90 which is adapted for engagement with the cam 62 that is actuated by the thermostat in the furnace. A leaf spring 91 is secured upon the conductor 77 and extends beyond the pivot 84^a of the lever 84 where it is adapted for engagement with an insulated button 92 upon the lower surface of the lever 84. A stud 93 on the base 76 forms an upper stop for the lever. The function of the leaf resides in its tendency to maintain the conductor levers in alignment. The sleeves 80 and 88 are integral with a bracket 94 (Figure 5) attached to the rear of the base 76.

This oil burning system also embodies a room thermostat and boiler regulator which are diagrammatically illustrated in Figures 7 and 7^A. In referring to Figure 7 which shows the position of parts when the room is overheated, 95 represents the switch actuated by the plunger 89, which is normally closed during normal operation for cutting off the gas supply, 96 represents the switch actuated by the plunger 81 that is under control of the speed governor on the motor shaft. 97 represents the room thermostat, 98 and 99 represent the relay coils that actuate the motor switch, the outer ends of these coils having the wires 100 and 101 while the inner ends are connected to a middle wire 102 which connects with the governor switch, and the room thermostat. The switch 103 in connection with the middle wire represents the pilot light switch, while the switch 104 represents the boiler switch. The motor 63 which is controlled by this circuit operates the usual blower 105 for supplying air to the furnace and an oil pump may also be operated thereby for feeding the oil to the furnace.

The operation of the system will now be described. When the motor is started, the fuel and gas valves will be opened through the operation of the governor, allowing the mixture to flow to the furnace for combustion. As the furnace becomes hot, the ther-

mostatic bar 16 will actuate the rod 21 for closing the gas valve 27. The cam 62 on the stem 24 that actuated such valve, will depress the plunger 89 and close the switch 95 (Fig. 7). No current can however flow through the coils since all the controls are open.

However, if for example the room thermostat is closed as shown in Figure 7, the current will traverse the coils and cause the motor switch to be opened, causing the motor to stop. When the motor stops, the fuel and other gas valve will be closed and the cam 61 will operate the plunger 81. However, the operation of the plunger 81 will not bring the contacts 78^a together since the previous operation of the plunger 89 has tipped the outer end of the conductive lever 77 downwardly. It will be necessary for the furnace to cool off as well as the room before the motor can again be automatically started. This will safeguard against feeding a charge of fuel into the hot furnace that might cause an explosion or the like.

When the room has cooled off the switch 97 will be in the position shown in Figure 7^A, and when the furnace has sufficiently cooled off, the thermostatic bar 16 will have rotated the cam 62 for releasing the plunger 89 sufficiently to allow the contact points 78^a to come together thereby closing the governor switch 96 and opening the gas or furnace switch 95. A current will hence be established through the coil 98 for closing the motor switch for starting the motor again. After the motor starts the governor actuated switch 96 will of course, be opened and the thermostatically operated switch 95 will again be closed.

Now if the boiler should get sufficiently hot to close the switch 104, a current would flow through the coils 98 and 99 establishing a different polarity for attracting the motor switch and opening the same for stopping the motor. When the boiler and furnace have cooled off sufficiently, the motor will be automatically started again as above explained.

If the pilot light is out when the motor is idle, it will be impossible to start the same until the pilot light is again lit and the pilot light switch has been closed. It will accordingly be apparent that a novel control has been provided in this fuel heating system in which the gas is automatically shut off at a certain furnace temperature, in which the motor is automatically cut off when the room or boiler become overheated, in which the fuel and gas are automatically shut off when the motor stops, and in which the motor can not be started when the pilot light is out or while the furnace is still sufficiently hot, and in which means are provided for automatically igniting the pilot

light. It should be noted that the dual control provides a safeguard against the escape of gas, for if the gas valve 27 should not be closed when the motor stops, the closing of the other gas valve 34 by the motor will insure the shutting off of the gas.

I am aware that many changes may be made and that numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted otherwise than necessitated by the prior art.

I claim as my invention:

1. In an oil burning system a valve housing, a fuel passage and a gas passage extending through said housing, a valve for controlling the fuel passage, a pair of valves for controlling the gas passage, a thermostatically operated element for closing one gas valve, and means for simultaneously closing the other gas valve and the fuel valve, said thermostatically operated element controlling said closing means.

2. In a liquid fuel burning system comprising a furnace, a motor, a motor controlled fuel valve, a motor controlled gas valve, a second gas valve thermostatically controlled, a control circuit embodying a room thermostat for stopping the motor at a predetermined temperature, and means controlled by said second gas valve for delaying the starting of the motor until the furnace has cooled.

3. In a liquid fuel burning system a valve housing, a fuel passage and a gas passage, a valve for controlling each passage, each valve having a stem, a cam mounted upon each stem, a control circuit for the system embodying a switch controlled by said cams, and means for rotating said cams for operating said switch.

4. In a liquid fuel burning system embodying a motor, a pilot light, a control influenced by the pilot light embodying a thermostatically controlled switch, and means for igniting the pilot light controlled by the switch, said switch operating to prevent the starting of the motor when the pilot light is out.

5. In a liquid fuel burning system embodying a furnace and motor, a valve housing having a fuel passage and a gas passage, a valve for controlling each passage, thermostatic means in the furnace for controlling the gas valve, a connection between the fuel valve and motor whereby the motor automatically controls the fuel valve, a control circuit for the motor embodying a temperature actuated element adapted for causing the motor to stop at a predetermined temperature and means in said circuit controlled by said thermostatic means for preventing the starting of the motor before the furnace has cooled.

6. In a liquid fuel burning system embodying a furnace and a motor, a valve housing having a gas passage and a fuel passage, a valve for controlling each passage, a thermostatic bar in the furnace connected to said gas valve, a connection between the fuel valve and motor, a control circuit for the motor, a switch in said circuit embodying a pair of movable contact points, controlled respectively by said gas and fuel valve for the purpose set forth.

7. In a liquid fuel burning system embodying a furnace and a motor, liquid fuel feeding means controlled by the motor, a control circuit for stopping and starting the motor, temperature responsive means for opening and closing said circuit, a switch in said circuit embodying a movable contact member controlled by said fuel feeding means and a second movable contact member for controlling the first contact member, and temperature responsive means in the furnace having a connection for controlling the second movable contact member for the purpose set forth.

8. In a liquid fuel burning system comprising a motor and a furnace, a valve controlled fuel feeding mechanism connected to said motor, a valve controlled gas feeding mechanism, temperature responsive means in the furnace for controlling said gas valve, a control circuit for stopping and starting the motor, temperature responsive means for opening and closing said circuit, and a switch in said circuit controlled by said fuel and gas valves to prevent the starting of the motor before the furnace cools off.

9. In an oil burner for a furnace, a valve housing having a fuel feeding passage and a gas feeding passage, a valve for controlling the fuel passage, a pair of valves for controlling the gas passage, a thermostat for normally closing one gas valve when the furnace reaches a predetermined temperature, and a motor having a connection with the other gas valve and the fuel valve for automatically closing the same when it stops.

In testimony whereof I have hereunto subscribed my name.

CHARLES L. RAYFIELD.