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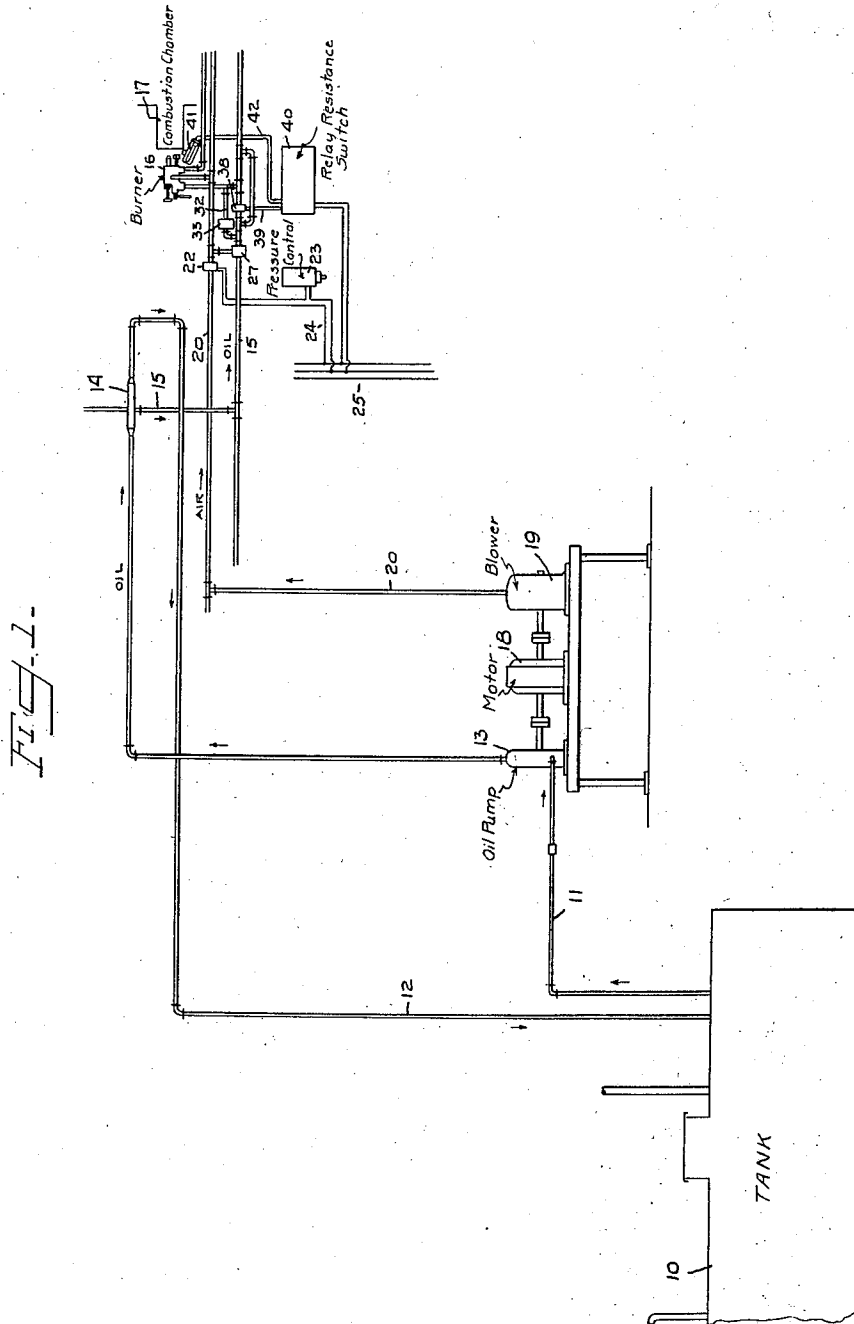
T. J. STEPHENS ET AL

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APPARATUS FOR PRODUCING AND MAINTAINING COMBUSTION OF FLUID FUEL

Filed April 21, 1933

2 Sheets-Sheet 1



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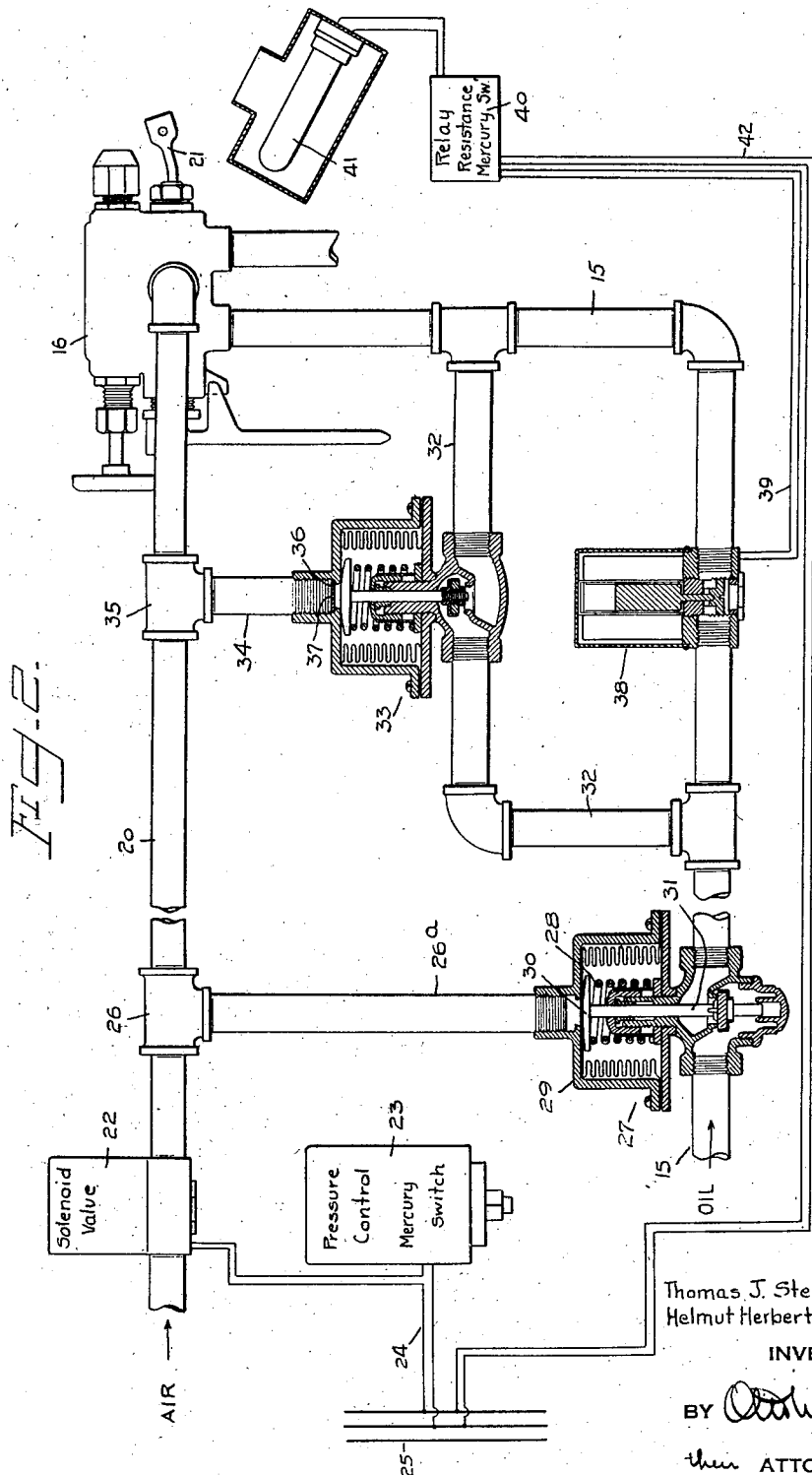
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UNITED STATES PATENT OFFICE

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APPARATUS FOR PRODUCING AND MAINTAINING COMBUSTION OF FLUID FUEL

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5 Claims. (Cl. 158—28)

This invention relates to apparatus incorporated in an oil burning system to provide against the flow of unburned fuel into the combustion zone, or chamber, of a furnace, oven or the like.

The object of the present invention is to provide apparatus for maintaining an open flow way for fuel by the creation of light in the combustion chamber or ignition zone, and we accomplish this object by means of several steps hereinafter described and the apparatus illustratively exemplified in the accompanying drawings, in which Figure 1 is a diagrammatic layout of an oil burning system incorporating therein means by which the present invention is brought into practice; Figure 2 is an elevational view of the portion of the system which governs the open flow of fuel to the burner;

Briefly, the present invention comprehends the use of the light created during ignition of the fuel discharged by the burner into the ignition or combustion zone to excite a photo-electric cell or other light responsive element, to the result of electrically energizing means for opening a normally closed valve in the main fuel line to the burner, so as to maintain it in open position just so long as light is present at the ignition end of the system. Failure in the ignition of the fuel at the delivery end would result in the loss of light sufficient to excite the cell which will effect a break in the electric circuit controlling the fuel line valve and bring the latter to its normally closed position with a consequent stop in any subsequent flow of fuel to the burner until ignition and consequent light are re-established in the ignition zone.

Referring now to the drawings, the oil burning system comprises a fuel tank 10 from which lead an oil line 11 and a return line 12. The oil line 11 supplies fuel from the tank 10 through a pump 13 to an overhead manifold conduit 14 from which one or more fuel lines 15 may be supplied from which excess fuel returns to the tank by way of the return line 12. Each fuel line 15 is capable of supplying one or more burners 16 which are arranged in position to deliver fuel into a combustion chamber 17. The pump 13 is driven by a motor 18 which is coupled to a blower or air pump 19 supplying air under pressure through an air line 20 to be utilized as an atomizing agent in the burners 16. The burners 16 may be provided with a well known type of ignition but for the sake of illustration we have depicted a gas pilot unit 21.

The foregoing is an outline of the oil burning system which contains, in addition, a plurality

of control and safety units. Referring first to the pressure control, the same comprises a solenoid valve 22 which is normally closed and placed in the air line 20 immediately beyond the blower 19 and which is electrically operated from a pressure operated mercury switch 23, the latter being in a circuit 24 connected to a main line circuit 25 opened and closed at some remote point by pressure or changes in temperature or by any other means.

The air line 20, intermediate the burner 16 and solenoid valve 22, is provided with a T-fitting 26 which leads through a pipe 26^a to an interlocking valve 27 arranged in the oil line 15 intermediate the burner and the manifold circuit 14. The valve 27 is normally held in closed position by the pressure of a spring 28 arranged in a bonnet housing 29, into which the pipe 26^a discharges. A valve plate 30 is carried by the upper end of the valve stem 31 of the valve 27, the spring 28 exerting a lifting action on the plate 30 against the pressure of air admitted through the pipe 26^a. In this construction a sufficient air pressure in the line will move the plate 30, and stem 31 so as to open valve 27 to admit fuel to flow towards the burner.

The oil line 15 beyond the valve 27 is provided by a by-pass line 32 in which a second interlocking valve 33 is arranged, the latter valve being of the same construction as 27 except that the seat is reversed and its position is normally open. An air line 34 leads off from the bonnet of the valve and connects to the air line 20 through a T-fitting 35. The opening for the air plate 36 has a small orifice 37, so that in operation the closing movement of the valve will be slow. The section of the oil or fuel line between the arms of the by-pass is provided with a normally closed solenoid valve 38 which is energized through an electrical circuit 39 and relay resistance mercury switch 40, the latter being controlled by a photo-electric cell 41 which is directed towards the combustion chamber 17 and excited by the light created at this place when ignition of the fuel is occurring. The relay switch is connected to the main line circuit 25 through a circuit 42.

In operation, our oil burning system functions as follows: At some remote point in the main circuit 25, the latter is closed and the solenoid valve 22 operates to open the flow of air to the burner 16, and to apply pressure through the pipe 26^a to quickly open valve 27 and through the pipe 34 to slowly close valve 33. This permits fuel to flow through the by-pass 32 until valve 33 is closed; and during the lag in the closing of

valve 33 sufficient fuel will be discharged from the burner 16 to start the fire if ignition conditions are present. Immediately upon ignition of the fuel, the light created thereby will actuate the photo-electric cell to close the circuit 39 and thereby open the solenoid valve 38. Thereafter fuel will flow to the burner 16 through the pipe 15 as long as the light of ignition is maintained, and whenever ignition of the fuel ceases, the valve 38 will immediately close. Likewise, the valve 27 remains open as long as there is air under pressure in the conduit 20 beyond the valve 22, but if pressure of the atomizing agent should fail from any cause, the valve 27 would automatically close. The closing means of valve 33, being under pressure of the air supply through pipe 34 is caused to gradually close as the air seeps through the orifice or restricted opening 37, and if the pilot has been extinguished, or if for any reason ignition has not occurred by the time valve 33 is closed, then and thereafter fuel cannot flow to the burner until manual attention has been given, at which time ignition conditions should be re-established.

The flow of fuel to the burner 16 is continued, through the conduit 15 during and after the closing of valve 33, only by the effect of the light from the ignited fuel in the combustion zone, which light excites the photo-electric cell, which in turn energizes the relay to close the switch 40 in the circuit 39 controlling the valve 38, thus opening the latter and allowing free flow of fuel therethrough. Failure on the part of the ignition, either at the instant of starting or at any time thereafter, will cause the cell 41 to fail to affect the switch 40, thereby permitting valve 38 to remain in, or to return to, closed position, thus stopping any further flow of fuel to the burner. As long as air pressure is maintained in the conduit to the burner it will hold the valve 33 closed against passage of fuel, and when such pressure fails, valve 27 will return to its normally closed position, thus it is obvious that fuel cannot flow from a burner through this organism unless both atomizing and ignition conditions simultaneously exist at the burner.

Having now described our invention and the manner in which the several steps of the method are performed, what we claim and desire to secure by Letters Patent is:—

1. In an oil burning system, the combination with a burner and an igniter therefor of means for feeding fuel to said burner comprising a fuel conduit having normally closed first and second valves in series, a by-pass around said second valve, a normally open valve in said by-pass, means for conducting an atomizing fluid under pressure to said burner, a pressure responsive means operatively associated with said first valve, a delayed action pressure responsive means operatively associated with said by-pass valve; said pressure responsive means being operatively connected to said atomizing fluid conducting means whereby upon initiating a flow of atomizing fluid through said conducting means said first valve is immediately opened and said by-pass valve moves slowly toward its closed position, automatic means for actuating said second valve, and a

light responsive element operable upon combustion being established to energize said automatic means to open and retain said second valve in open position.

2. An oil burning system, as claimed in claim 1, including an automatic valve for admitting the atomizing fluid to the fluid conducting means and means operable in response to a demand for heat for actuating said fluid admitting valve to open the same.

3. In a fluid fuel burning system, the combination of a burner utilizing a fluid under pressure as an agent for atomizing fluid fuel, a first conduit in communication with the burner for conducting the atomizing agent thereto, a valve operable in response to the heat demand to open or close said first conduit a second conduit in communication with the burner for conducting fluid fuel thereto, an electrically actuated valve in the second conduit which is open when energized, a second valve controlling the flow of fuel to said electric valve, a conduit having a valve therein by-passing said electric valve, means operable in response to the delivery of atomizing fluid to the burner controlling said second and by-pass valves to immediately open the former and to slowly close the latter, and means operable in response to the establishment of combustion to energize said electric valve.

4. In an oil burning system, the combination with a burner and an igniter therefor, of conduits for supplying fuel and an atomizing fluid under pressure thereto, first and second valves in said fuel conduits, control elements for each of said valves actuated by said fluid under pressure, the control element of said first valve being instantaneously operative to open its appurtenant valve and the other of said control elements being time delayed to subsequently close its appurtenant valve, means including a main valve responsive to a predetermined temperature or pressure condition for initiating a flow of atomizing fluid under pressure, a third valve in said fuel conduit a light responsive element adjacent the burner which operates, upon combustion, to open the third valve, said fuel valves being so arranged that upon the opening of said main valve to initiate burner operation fuel feed is maintained only for a time interval unless combustion is established.

5. In an oil burner system, the combination of a burner and an igniter therefor, of means for feeding fuel and an atomizing fluid to said burner including a main valve controlling the flow of atomizing fluid, first and second automatic valves controlling fuel feed and operative in response to the action of the atomizing fluid upon opening of said main valve to open the first valve immediately and after a time interval to close the second valve, and means including a third fuel valve operative to open in response to the establishment of combustion, said fuel valves being so arranged that upon the opening of said main valve to initiate burner operation fuel feed is maintained only for a time interval unless combustion is established.

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