

UNITED STATES PATENT OFFICE

2,552,302

CONTROL SYSTEM FOR COMBINED OIL AND GAS BURNERS

Cyril Charles Young, Kansas City, Mo.

Application July 30, 1947, Serial No. 764,698

5 Claims. (Cl. 158—11)

1

This invention relates to a control system for vaporizing type oil burning heaters and particularly to a control system for operating a combined gas and oil burning heater.

Any form of vaporizing type oil burning heater which effects the vaporization of the fuel oil by subjecting such to a high temperature prior to ignition, necessarily requires some form of specialized control system to insure that vaporizing temperature conditions are established in the heater prior to the feeding of the fuel oil thereto in any substantial quantity.

A further control problem arises in connection with the control of combined gas and oil burning heaters such, for example, as the type described and claimed in my copending application, Serial No. 764,697, filed on even date herewith. Under certain operating conditions, for example, when an adequate supply of gas fuel is available or when the outside temperatures are relatively mild, it is desirable to operate the combined gas and oil burner on gas fuel alone. Then, when the outside temperature drops, or the supply of fuel gas is diminished, it is desirable to convert the burner unit to operate with a combination of oil and gas fuel. At any time that conversion from gas to oil fuel occurs, or when the burning of fuel oil in the heater is initiated or terminated, special control arrangements are necessary to insure the establishment of proper vaporizing temperatures in the heater prior to the supply of fuel oil thereto. Likewise, at the conclusion of an oil burning heating cycle it is necessary that a vaporizing temperature be maintained in the heater unit until all flow of fuel oil into the unit has terminated.

Accordingly, it is an object of this invention to provide an improved control system for vaporizing type oil burner heaters, and particularly to a burner unit capable of operating selectively on gas or oil fuel or a combination thereof.

A further object of this invention is to provide an improved control system for combined gas and oil burner which will automatically effect the conversion of the burner from primary operation on one fuel to another fuel in response to outdoor temperature conditions, and concurrently, will maintain any desired indoor temperature.

Still another object of this invention is to provide a control system for combined gas and oil burner which will effect the conversion of the burner unit from one fuel to another at definite time intervals.

A particular object of this invention is to provide a control system for a vaporizing type oil

2

burner unit which will insure the establishment and maintenance of proper vaporizing temperature conditions within the furnace both at the initiation of the oil burning cycle and at the termination thereof.

The specific nature of this invention as well as other objects and advantages thereof will become apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings which, by way of preferred example only, illustrate one specific embodiment of the invention.

The single figure of the drawing represents a schematic circuit diagram of a preferred control system for combined gas and oil burner units embodying this invention.

A combined gas and oil burner of the type described in my above referred to copending application usually includes a first electrically operated valve in the conduit supplying fuel oil to the burner unit and, in addition, a second electrically operated valve in the gas line for operating a vaporizing burner, inspirating jet, or other auxiliary devices employed concurrently with the burning of fuel oil therein, and a third electrically operated valve controlling the flow of gas to the main gas burner jet. Thus, I provide an electrically operated valve 10 disposed in the oil line 10a, and electrically operated valve 20 disposed in the auxiliary gas line 20a and an electrically operated valve 30 disposed in the main gas lines 30a.

Electrically operated valve 10 is preferably of the delayed movement type, which I have represented schematically as comprising a thermal operating element 11 which is heated by an electrical heater element 12. Energization of electric heater element 12 will produce, after a predetermined delay, a flexing of the thermal element 11 to in turn effect the opening of the valve 10. A similar delay in closing of valve 10 is also experienced, inasmuch as the thermal element 11 will not immediately return to its cold position upon the deenergization of heater element 12.

The auxiliary gas valve 20 and the main gas valve 30 may be of any conventional rapid action type such as, for example, a solenoid operated valve unit. As is customary in domestic type of heating systems, I employ a thermostat 13 which is responsive to indoor temperature and which is commonly referred to as the room temperature thermostat. In addition, I employ a thermostat 14 which is disposed so as to be responsive to outdoor temperature. Furthermore, one or more safety thermostats or switches 15 and 16 may

3

be employed in addition in the control circuit embodying this invention to effect the interruption of all combustion in the burner unit upon the occurrence of certain emergency conditions. Such safety devices may be responsive to pilot flame ignition, oil overflow, stack temperature, and similar conditions within the burner which would make it desirable to interrupt all operations thereof.

Lastly, if it is desired to alternately cycle the burner on gas and oil operation according to a time sequence, I provide a time switch 17 which may comprise any one of several well known forms, usually clock driven, and which effects the switching of a movable pole 17a from one contact 17b to another contact 17c of the timer unit.

The circuit connection of the various elements heretofore mentioned is then effected as illustrated on the drawing. A control transformer 2 is provided having a primary winding 2a connected across terminals 1 which may be connected to any suitable source of alternating current. The secondary winding 2b of transformer 2 has one terminal 2c thereof connected in series relation with the safety thermostats 15 and 16, room thermostat 13 and the movable pole 17a of the time switch 17. The one contact 17b of time switch 17 is connected directly to one side of the heater element 12 of the electrically operated oil valve 10. The other side of heater element 12 is connected directly to the other terminal 2d of the transformer secondary 2b. The second contact 17c of the time switch 17 is connected in series with the blade 14a of outdoor thermostat 14. Outdoor thermostat 14 is of the contact shifting type wherein the blade 14a is shiftable between positions of engagement with contacts 14b and 14c respectively. When engaged with contact 14b, a circuit is completed in series with the solenoid of main gas valve 30. The other contact 14c is connected directly to the contact 17b of time switch 17 and in addition, to one side of a relay 18. The other side of the coil of relay 18 is connected to terminal 2d of transformer secondary 2b. The one side of the solenoid of auxiliary gas valve 20 is connected by a line 21 through the normally open contacts 18a of relay 18 to a point between the safety thermostats 15 and 16 and the room thermostat 13, while the other side thereof is connected directly to terminal 2d of transformer 2b.

Lastly, contacts 11a and 11b are provided adjacent the thermal element 11 of the oil valve 10 and are so arranged as to be closed by the thermal unit 11 upon the initiation of movement of such thermal element and to remain closed until the thermal element 11 returns to a position corresponding to the closed condition of oil valve 10. Contacts 11a and 11b are connected directly in parallel with the contacts 18a of relay 18.

Considering now the operation of the described control system, let it be assumed that all of the safety switches are in their normal closed position and that the room thermostat 13 is also closed, corresponding to a demand for additional heat. Further, let it be assumed that the time switch 17 has its pole 17a in engagement with the upper contact 17b. Under these conditions, the outdoor thermostat 14 is rendered ineffective in the control system and, as a result, the main gas valve 30 cannot be energized to open the main gas valve to provide gas for the main gas burner unit of the furnace.

The closure of room thermostat 13, immediately effects the energization of the heater element 12

4

of the delayed acting oil valve 10. However, due to the thermal lag involved in this valve, the valve 10 does not immediately open. The solenoid of relay 18, however, is immediately energized and closes a circuit across its contacts 18a which has the effect of energizing auxiliary gas valve 20 to open such valve and thereby supply a gas flow to the vaporizing burner, inspirator jet, and any other auxiliary gas operated devices in the furnace required for establishment of proper conditions for oil vaporization. In any event, the opening of the oil line valve 10 is delayed a sufficient length of time by the slow moving thermal element 11 so as to insure the establishment of vaporizing conditions within the burner. Thus when thermal element 11 finally opens its oil valve 10, proper vaporizing conditions have been established within the burner and the fuel oil supplied thereto through oil line 10a will be properly vaporized and burned.

When the room thermostat 13 is actuated to open its contacts, the relay 18 and the heater element 12 are immediately deenergized. While the relay 18 immediately opens its contacts 18a, such action does not effect the deenergization of the auxiliary gas valve 20, inasmuch as that valve is locked in open condition through the circuit maintained by thermal element 11 across contacts 11a and 11b. As the thermal element 11 gradually cools, it effects the gradual closing of oil valve 10, but not until the valve 10 is completely closed does it interrupt the energization circuit for the auxiliary gas valve 20. It is thereby insured that sufficient gas to maintain the vaporizing conditions within the burner unit is continuously provided until all fuel oil is cut off. There is, therefore, no danger of accumulating a large quantity of unburned fuel oil within the burner unit, although it should be pointed out that if such contingency did occur, the oil overflow safety switch would open the control circuit to cut off the supply of all fuel to the burner unit.

Now assume that the time switch 17 is operated at a desired time to effect the conversion of the burner unit from oil burning to a gas burning condition if the outdoor temperature permits. Timer switch pole 17a is therefore shifted into engagement with the lower contact 17c. If the outdoor temperature is low enough to require operation by oil burning, then the blade 14a of outdoor thermostat 14 will be in engagement with contact 14c. This completes an identical energization circuit for the oil valve 10 and auxiliary gas valve 20 as has been heretofore described, and thus the burner operates on oil fuel according to the demands of room temperature thermostat 13.

Assuming that the outdoor temperature is relatively high, then the blade 14a of outdoor thermostat 14 will engage contact 14b. Under this condition, both the oil valve 10 and the relay 18 are effectively disconnected from the control circuit and the only control action is the energization of the main gas valve 30 in response to the heat demands of room thermostat 13. Hence the combined gas and oil burner controlled by the circuit embodying this invention will operate exclusively on gas fuel until a suitable change in outdoor temperature or the action of timer switch 17 effects the conversion of the control system to oil burning condition.

It is therefore apparent that the aforescribed control system provides a simple, economical and reliable arrangement for controlling the opera-

5

tions of a combined gas and oil burner unit, and particularly a combined oil and gas burner unit wherein combustion of the oil is achieved by a vaporization process. Under all conditions of operation, the described control system insures that proper combustion conditions are maintained in the burner unit.

It will, of course, be understood that various details of construction may be modified through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In combination in a control system for a gas and oil burning heater, a first valve means controlling the supply of gas to said heater, a second valve means controlling the supply of oil to said heater, a third valve means controlling the supply of an oil vaporizing medium to said heater, means for selectively operating either said first valve means alone or said second and said third valve means concurrently and means responsive to room temperature controlling the operation of the selected valve means, and means for delaying opening of said second valve means with respect to said third valve means until oil vaporizing conditions are established in said heater.

2. In combination in a control system for a gas and oil burning heater, a first valve means controlling the supply of gas to said heater, a second valve means controlling the supply of oil to said heater, a third valve means controlling the supply of an oil vaporizing medium to said heater, means for selectively operating either said first valve means alone or said second and said third valve means concurrently and means responsive to room temperature controlling the operation of the selected valve means, and means for delaying closing of said third valve means by operation of said room temperature responsive means until said second valve means is closed.

3. In combination in a control system for a gas and oil burning heater, a first valve means controlling the supply of gas to said heater, a second valve means controlling the supply of oil to said heater, a third valve means controlling the supply of an oil vaporizing medium to said heater, means for selectively operating either said first valve means alone or said second and said third valve means concurrently, means responsive to room temperature controlling the operation of the selected valve means, and means for delaying opening of said second valve means with respect to said third valve means until oil vaporizing conditions are established in said heater, and means for delaying closing of said third valve means by operation of said room temperature responsive means until said second valve means is closed.

6

4. A control system for a vaporizing type oil burning heater comprising an electrically operated, delayed movement, oil supply valve, an electrically operated vaporizing gas supply valve, a relay having its normally open contacts connected in circuit with said gas supply valve, and room temperature responsive thermostat means for simultaneously energizing said relay and said oil supply valve, whereby said vaporizing gas supply valve opens prior to said oil supply valve, said oil supply valve having a pair of contacts arranged to be closed by initial movement of said valve from open position, and means connecting said oil valve contacts in bridging relation to said relay contacts, whereby said vaporizing gas supply valve remains open until closure of said oil supply valve.

5. A control system for a combined gas and oil burning heater comprising a first contact making thermostat responsive to variations in room temperatures, a second thermostat having a pole selectively shiftable between two contacts and being responsive to variations in atmospheric temperature, a time switch having a pole selectively shiftable between two contacts and being responsive to a predetermined time cycle, a gas valve in control of the supply of gaseous fuel to the heater, an oil valve in control of the supply of oil fuel to the heater, separate electric motor means for each in control of said gas valve and of said oil valve respectively to regulate the opening and closing thereof, circuit means electrically connecting said first contact making thermostat in series with the shiftable pole of the time switch, circuit means connecting the two contacts of the second thermostat in circuit relationship with the electric motor means in control of said gas valve and said oil valve, and circuit means connecting the two contacts of the time switch in circuit relationship to the shiftable pole of said second thermostat and the electric motor means of the oil valve, whereby said second thermostat controls selection of fuel to the heater and said time switch may be regulated to inactivate said second thermostat and effect periodic operation of the oil valve.

CYRIL CHARLES YOUNG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,786,901	Doherty -----	Dec. 30, 1930
1,840,744	Scott -----	Jan. 12, 1932
1,860,311	Klees -----	May 24, 1932
1,868,051	Doherty -----	July 19, 1932
1,885,478	Powers -----	Nov. 1, 1932
1,984,572	Frame -----	Dec. 18, 1934
2,168,680	Nordgren -----	Aug. 8, 1939