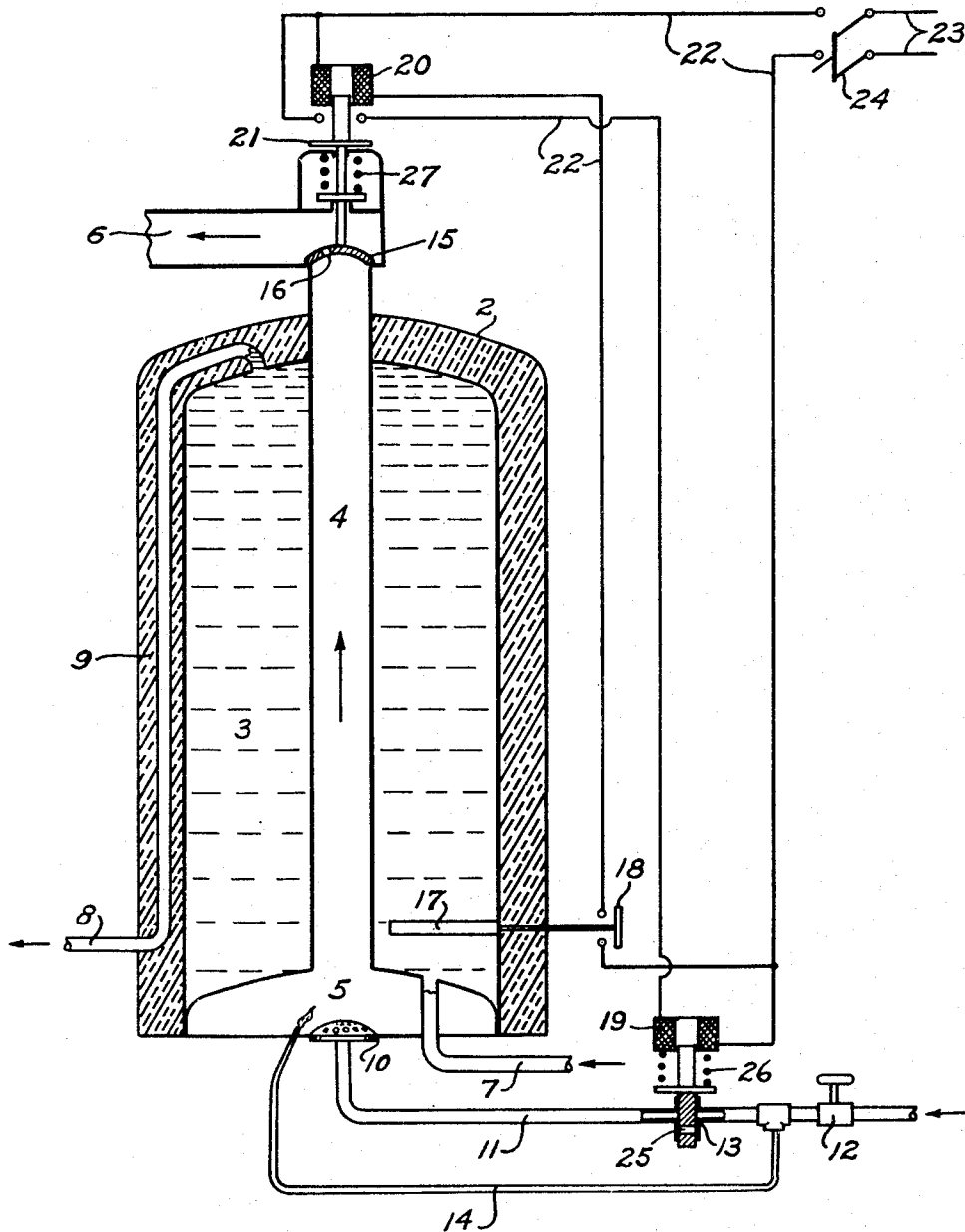


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WATER HEATING SYSTEM
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WATER HEATING SYSTEM

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The present invention relates generally to improvements in automatic water heating systems, and relates more specifically to improvements in the construction and operation of gas fired automatic liquid heaters.

The principal object of this invention is to provide a new and useful gas fired automatic liquid heating system which is simple and dependable in construction, and which is more-over automatic and highly efficient in operation.

As indicated in my co-pending application Serial No. 540,849, filed June 17, 1944, the ordinary gas fired automatic hot water heater comprises a liquid confining chamber penetrated by an upwardly extending flue for conducting hot gases of combustion to the stack. While this flue must be in open communication with the stack whenever the gas burner is active, considerable heat is wasted if such open communication is permitted to continue after the heating flame has been extinguished, due to the fact that cold air then passes through the flue and abstracts heat from the hot water. In my prior application above identified, I have disclosed an improved electrical system for preventing such undesirable loss of heat, by providing a solenoid actuated damper valve between the heater flue and the stack, another solenoid actuated fuel control valve for the fuel gas, and a thermostatically actuated switch operable by variations in temperature of the water to simultaneously open and close the two valves. Although this prior improved electrical control system is simple and practical, it may be preferable for utmost safety to effect positive opening of the damper valve shortly before the fuel supply valve is opened, in order to definitely prevent entrapment of combustible gas within the heating flue, while still retaining the desirable feature of promptly closing both valves whenever the water has been sufficiently heated.

It is therefore a more specific object of my present invention to provide an improved water heater control system of the type having a heating flue and damper and fuel supply valves, wherein the damper valve is positively opened shortly in advance of each opening of the fuel valve, while both valves are quickly closed when the water has been properly heated.

Another object of this invention is to provide a simple and exceedingly practical water heating system of the gas fuel flue heated type, and in which free circulation of air and gas through the heating flues is effectively prevented during

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periods of inactivity, but is automatically permitted whenever the gas burner is active.

A further object of the invention is to provide an improved electric control and actuating system for automatic water heaters, wherein a common thermostat actuated by variations in temperature of the water, is utilized to most effectively control the opening and closing of fuel supply and damper valves associated with the heater.

Still another object of my invention is to provide an improved hot water heating system or the like, which is extremely fool-proof and safe in operation, which may be applied at moderate cost to various commercial flue-type water heaters, and which is highly efficient in normal use.

These and other specific objects and advantages of the present improvement, will be clearly apparent from the following detailed description.

A clear conception of one embodiment of the present invention may be had by specific reference to the drawing accompanying and forming a part of this specification wherein like reference characters designate similar parts; and the single figure of which is a diagram illustrating a typical gas fired water heating system embodying the various improvements.

Although my invention has been shown diagrammatically as having been applied to a typical single flue water heater utilizing combustible gas as a heating medium and also having solenoid actuated fuel supply and damper valves activated by a single thermostat associated with the liquid confining chamber, it is not desired or intended to unnecessarily restrict the utility of the improvement or the scope of the invention by virtue of this limited and specific disclosure.

Referring specifically to the drawing, the improved automatic water heating system shown diagrammatically therein, comprises in general a main water heater 2 having the usual heat insulated liquid confining chamber 3 penetrated by an upright gas flue 4 for conducting hot gases of combustion from a lower combustion chamber 5 to a stack or outlet connection 6; a cool liquid supply pipe 7 communicating with a lower portion of the confining chamber 3; a hot liquid discharge pipe 8 communicating with an upper portion of the liquid chamber 3 and extending downwardly through and outwardly from the lower part of the chamber insulating jacket 9; a gas burner 10 disposed within the combustion chamber 5 centrally beneath the flue 4 and receiving its supply of gas through a fuel supply line 11 having a shut-off valve 12 and a solenoid actuated fuel

control valve 13 therein; a pilot gas supply line 14 communicating with the main gas supply line 11 between the valves 12, 13 and terminating adjacent to the burner 10; a solenoid actuated damper valve 15 having therein a small gas escape opening 16 and being interposed between the upper outlet end of the flue 4 and the stack connection 6; a thermostat 17 operable by variations in temperature of the liquid in the chamber 3 to automatically open and close an electric switch 18; independent solenoids 19, 20 associated with the fuel supply and damper valves 13, 15 respectively; another electric switch 21 operable by movement of the damper valve 15 to activate the solenoid 19; and electric wiring 22 connecting the various switches and solenoids and being connectible with the main power line 23 through a main switch 24.

The main heater 2 may be of any desired capacity and of relatively well known construction, and the main switch 24 may be operable either manually or automatically with the aid of the usual and well known mechanism for controlling the heating system in accordance with the demand for hot water. As shown, the automatic fuel control valve 13 is of the sliding type having a gas passage 25 therein adapted to register with the adjacent sections of the fuel supply line 11 when the valve 13 is open; and this valve is adapted to be opened when the solenoid 19 is energized by closing of the switch 21, and is closed by a coil spring 26 whenever the solenoid 19 is deenergized. The automatic damper valve 15 is shown as being of the poppet type adapted to seat against the upper outlet end of the flue 4; and this valve 15 is adapted to be opened when the solenoid 20 is energized by closing of the switch 18 by the thermostat 17, and is also closed by a coil spring 27 whenever the solenoid 20 is deenergized. The switch 18 will be closed automatically whenever cold water entering the chamber 3 through the inlet pipe 7, contacts the thermostat 17, and will open automatically whenever warm water fills the chamber 3 and contacts the same thermostat 17. It is important to note, that the two solenoids 19, 20 are not connected in series, and that the damper valve 15 must open wide and effect closing of the switch 21, before the fuel control valve 13 will open; but both valves 15, 13 will close at approximately the same time when the switch 18 is opened.

During normal operation of the improved water heating system, and assuming the chamber 3 to be filled with warm water, the thermostatically controlled switch 18 will be open and the valves 13, 15 will be closed as shown in the drawing, so that the supply of fuel will be cut off and cold air is prevented from circulating freely through the flue 4 by the damper valve 15. When the switch 24 is closed and warm liquid is withdrawn from within the chamber 3 through the outlet pipe 8, cool liquid enters the chamber 3 through the supply pipe 7 and promptly causes the thermostat 17 to close the switch 18. This closing of the switch 18 first energizes the solenoid 20 and causes the damper valve 15 to open until the switch 21 is closed. Closing of the switch 21 will immediately energize the solenoid 19 and will thus cause the fuel control valve 13 to open shortly after the damper valve 15 has been opened. Opening of the valve 13 will cause the pilot to immediately ignite the fuel gas delivered from the burner 10 into the combustion chamber 5, and the prior opening of the damper valve 15 will permit free escape of gases of com-

bustion from the chamber 5 and flue 4 to the stack through the connection 6.

If withdrawal of warm liquid from within the chamber 3 through the outlet pipe 8 continues at a rate sufficient so that the chamber 3 cannot become filled with warm liquid, then the valves 13, 15 will remain open during such liquid withdrawal period.

If, however, the withdrawal of liquid is not sufficient to prevent the entire chamber 3 from becoming filled with warm water, then the warm liquid will eventually contact the thermostat 17 and will again cause the switch 18 to open. This opening of the switch 18 will cause the solenoid 20 to immediately become deenergized, whereupon the spring 27 will become effective to promptly close the damper valve 15 and to open the switch 21. Opening of the switch 21 will immediately cause the solenoid 19 to become deenergized, thus permitting the spring 26 to close the fuel control valve 13, so that both the valve 15 and the valve 13 will be closed at approximately the same time.

It will thus be noted that my present improved system provides simple but effective means operable by variations in the temperature of the liquid within the chamber 3, for initially opening the damper valve 15 and shortly thereafter opening the fuel control valve 13 whenever the burner 10 is to be placed in operation; and for insuring positive and approximately simultaneous closing of the valves 13, 15 whenever the burner 10 becomes inactive. This closing of the damper valve when the fuel supply is shut off effectively prevents loss of heat from within the water chamber 3 by eliminating free circulation of gases through the flue 4; and in case the pilot light should become extinguished during periods of inactivity of the heating system, any slight quantities of gas escaping into the combustion chamber 5 will rise through the flue 4 and will escape to the stack through the small opening 16 formed in the damper valve 15. Utmost safety of the system is thus insured at all times, and the functioning is obviously entirely automatic. The electrical interconnection of the valves 13, 15 is obviously far superior to any mechanical connection which might be provided, since such mechanical connection must necessarily include levers, cams and other parts which are liable to become inoperative and thus preclude safety and reliability in operation. If for any reason the current which normally energizes the solenoids 19, 20, should fail, neither valve 13, 15 will open when the switch 18 is closed; but whenever current is available at the time the switch 18 closes, the damper valve 15 will first be opened and this opening will be promptly followed by opening of the fuel supply valve 13. Opening of the switch 18 will result in prompt closing of both of the valves 13, 15 and the improved electrical controlled system makes it possible to utilize the improvement in conjunction with automatic water heating systems wherein the heater is turned on and off by manipulation of a faucet or other hot water utilizing device.

From the foregoing detailed description of the construction and operation of a typical water heating system embodying my invention, it will be apparent that my present improvement provides a system which is very simple in structure and highly efficient in operation, and which will effectively prevent loss of heat due to free circulation of cool air through the flue heater, during periods of inactivity of the burner. The efficiency of the heating system is thus enhanced to

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a maximum, and the electrical system functions to insure quick and reliable operation of the valves with utmost safety. By utilizing the thermostat 17 for actuating the solenoids 19, 20 as an activating source, the opening and closing of the damper and fuel supply valves is quickly effected in accordance with variations in the temperatures of the liquid within the chamber 3, and the improved system can obviously be applied to various types of hot water heaters having one or more heating flues penetrating the fluid confining chamber. The various parts of the improved system are so simple that the entire assemblage can obviously be manufactured and installed at moderate cost, and also makes these parts readily applicable to either existing or new water heaters.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode of operation herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art.

I claim:

1. In a water heating system, a chamber having a lower water inlet and an upper water outlet, a fuel burner beneath said chamber, a heating flue for conducting gases of combustion upwardly from said burner through the water in said chamber, a fuel supply valve for said burner, a flue valve for controlling delivery of gases from said flue, an independent solenoid for directly opening each of said valves, an independent spring for directly closing each of said valves, a thermostat operable directly by variations in temperature of the water within said chamber, an electric switch operable directly by said thermostat, and another electric switch operable directly by the movement of said flue valve, said switches being operable in succession to cause said flue and fuel valve solenoids to open their respective valves in rapid succession whenever the thermostat switch is closed and to cause said springs to simultaneously

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close both valves whenever the thermostat switch is opened.

2. In a water heating system, a chamber having a lower water inlet and an upper water outlet, a fuel burner beneath said chamber, a heating flue for conducting gases of combustion upwardly from said burner through the water in said chamber, a fuel supply valve for said burner having a reciprocable actuating stem, a flue valve for controlling delivery of gases from said flue and also having a reciprocable actuating stem, an independent solenoid coacting directly with each of said valve stems for opening the valves, an independent spring for directly closing each of said valves, a thermostat operable directly by variations in temperature of the water within said chamber, an electric switch operable directly by said thermostat, and another electric switch operable directly by the reciprocation of said flue valve stem, said switches being closable in succession to cause said flue and fuel valve solenoids to open their respective valves in rapid succession whenever the thermostat switch is closed and to cause said springs to simultaneously close both valves whenever the thermostat switch is opened.

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