Aug. 20, 1935. G. B. SHAWN 2,011,779

GAS BURNER CONTROL

Original Filed Nov. 6, 1931 2 Sheets-Sheet 1

Fig. 1.

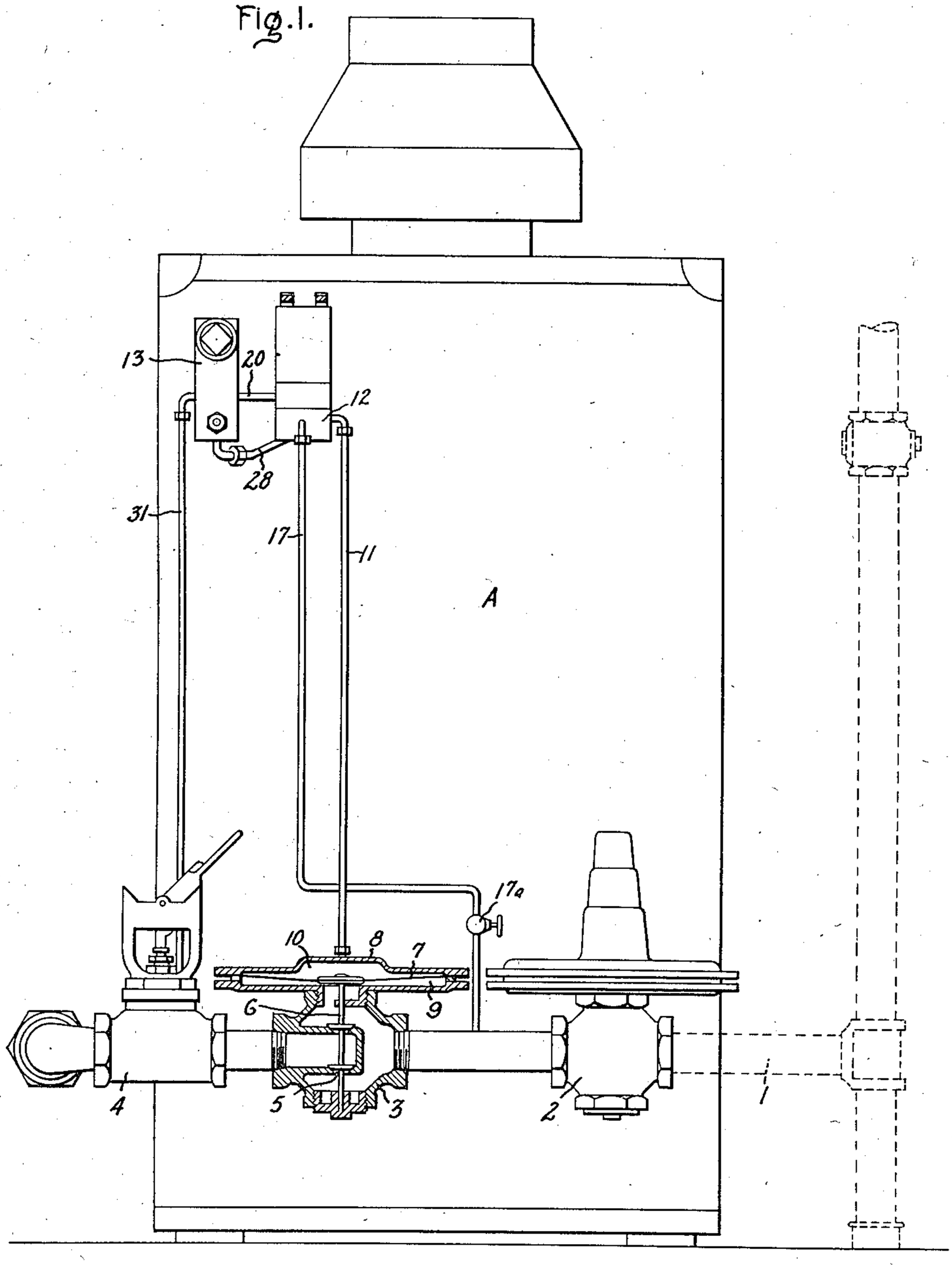

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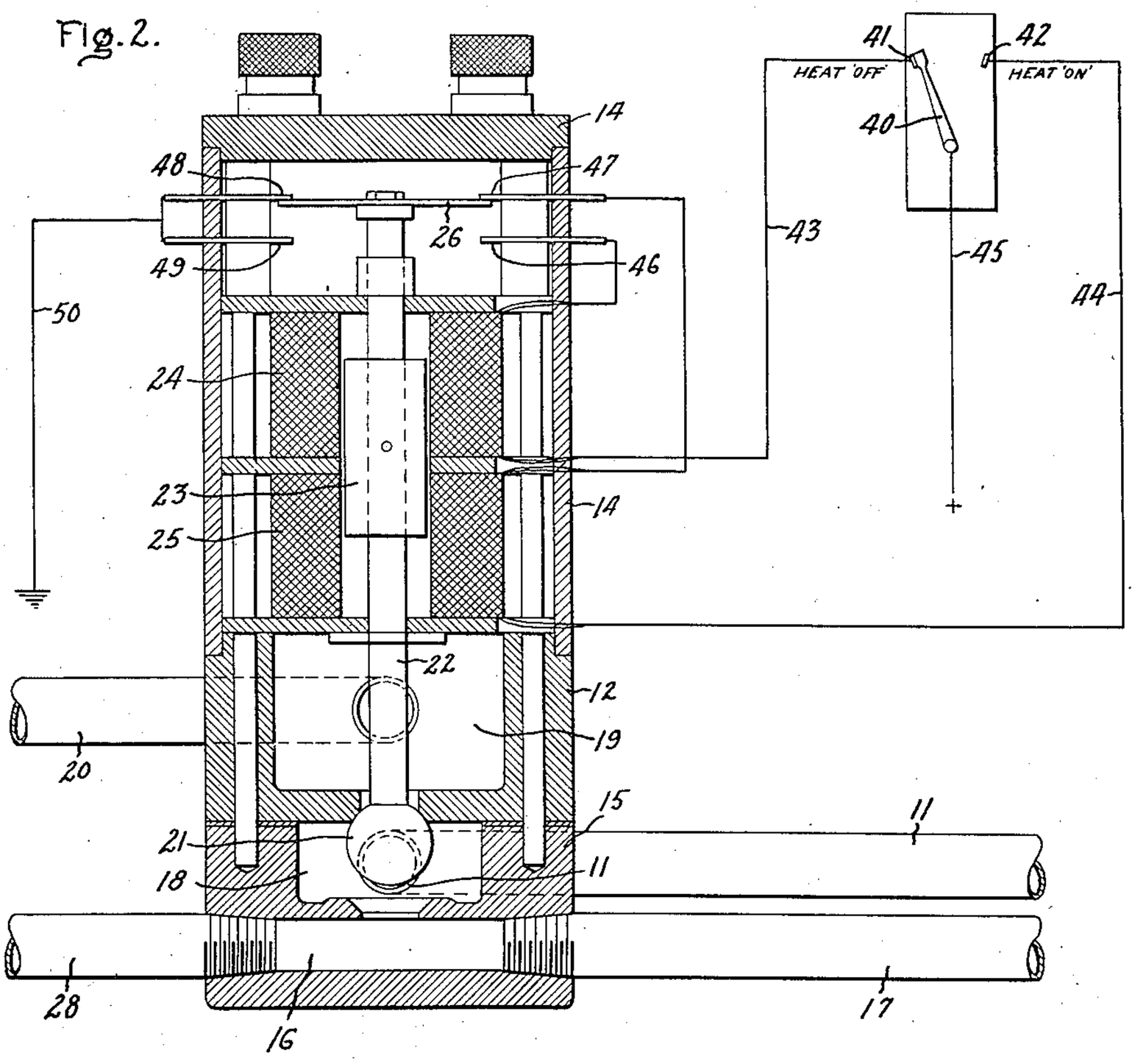
Fig. 2.



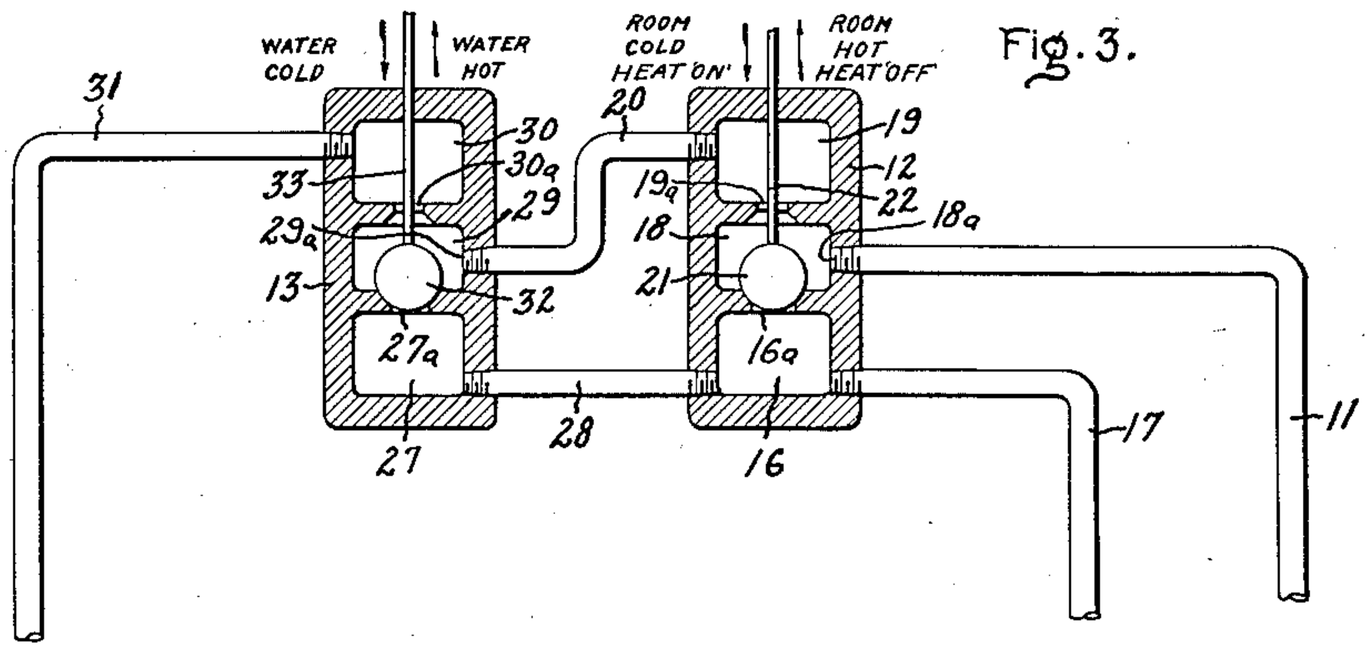


Fig. 3.

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2,011,779

UNITED STATES PATENT OFFICE

2,011,779

GAS BURNER CONTROL

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Original application November 6, 1931, Serial No. 573,390. Divided and this application March 27, 1934, Serial No. 717,544

5 Claims. (Cl. 236—84)

This application is a division of application, Serial No. 573,390, now Patent No. 1,956,136, filed November 6, 1931, for Service resumption mechanism.

The present application relates to an improved valve control system, particularly the improved valve control system for gas fired boilers in house heating service in which two three-way pilot valves, each operable automatically in accordance with predetermined conditions, jointly control the operation of the main gas burner snap action diaphragm valve to one position and separately control the operation thereof to another position as disclosed in said parent application.

With this control system the house heating gas fired boiler is normally controlled automatically by means of a snap action valve of diaphragm or other type which in turn is controlled by a three-way pilot valve operated between "heat on" and "heat off" positions by electrical means such as electromagnets under the control of a room thermostat. In such a system when the room temperature is high the three-way electromagnetic pilot valve is in the "heat off" position and the main burner snap action gas valve is in closed position. Then in case the current fails or some part of the electrical equipment gets out of order or the electromagnetic three-way pilot valve sticks so that when the room cools down and the electromagnet or other device should normally move the pilot valve to "heat on" position it fails to do so. Such a contingency is adequately taken care of by the service resumption mechanism disclosed and claimed in said parent application which enables the three-way pilot valve, at the will of the operator, to be moved to its "heat on" position under the particular contingencies such as referred to.

These same contingencies referred to above are just as likely to occur when the room temperature is low and the main burner snap action gas valve is in the open position with the burners of the gas fired boiler lighted and in full operation. Under such conditions, it is extremely dangerous to rely upon the householder or operator discovering the failure of the automatic temperature control and manually operating the electromagnetic three-way pilot valve to the "heat off" position.

In order to automatically protect against such dangerous conditions in accordance with my present invention, an independently operable three-way pilot control valve is provided and interconnected in cooperating relation with the room thermostat controlled electromagnetic three-way valve. This independently operable pilot valve is arranged to be operated in response to any of the varying conditions in the boiler ordinarily utilized for the safety control thereof, such as by a device subject to water level in the boiler, to the steam pressure of the boiler, to the temperature of the water in the boiler or to any other one or more of the same or similar factors of boiler operation. The cooperating relation of the two three-way valves is such that the independently operable valve is able to supersede the control of the electromagnetic three-way valve and independently effect operation of the main gas burner snap action diaphragm gas valve to the off position upon the occurrence of abnormal or dangerous conditions in the boiler.

Furthermore, the improved three-way pilot valve control system of the present invention results in a very rapid response of the snap action diaphragm valve to both the open and the closed positions, thereby increasing the certainty as well as the safety of control for the gas fired heating boiler. My improved control system also avoids the various difficulties encountered in the use of valve control systems employing bleeder orifices which inherently produce a relatively slow response of the snap action diaphragm valve.

In the drawings, Fig. 1 is a side elevation showing a hot water heating boiler equipped with the invention, the main burner snap action gas valve being shown in section; Fig. 2 is a sectional elevation, somewhat diagrammatic, illustrating the electromagnetic control or pilot three-way valve with the electrical operating mechanism therefor, and the room thermostat electric circuits; and Fig. 3 is a sectional diagram of the associated three-way control valves.

In the arrangement shown in the drawings, A indicates a gas fired boiler, the burners of which (not shown) are supplied with gas coming from a supply main 1 through the usual pressure regulating valve 2, snap action valve 3, and hand cut-off valve 4. The snap action valve 3 is of common type, including the valve member 5 whose stem 6 is attached to and is operated by a diaphragm 7 in a casing 8, the lower chamber 9 of which is always in open communication with the pressure of the supply main 1, and the upper chamber 10 of which serves as a control chamber, being connected for that purpose to a pipe 11.

Said pipe communicates with suitable control mechanism, which in the form shown includes an electro-magnetically operated three-way pilot valve, generally indicated at 12, and a boiler controlling three-way valve generally indicated at 13, the latter valve being actuated by any varying condition in the boiler ordinarily utilized for safety control thereof, such as by a device subject to water level, to steam pressure, to water temperature, or to any other one or more of the same or similar factors of boiler operation.

In the drawings, for simplicity of illustration, the boiler control valve 13 is shown as subject only to variations in water temperature be-

cause said boiler is designed for a hot water heating system.

The electromagnetically operated three-way pilot valve 12 will first be described. It is shown diagrammatically in Fig. 3 and in detail in Fig. 2. Generally speaking, the electromagnetic valve operating mechanism is of the same type and operates in the same way as the valve operating device disclosed in a prior patent to Arthur F. Ericson, No. 1,439,231, granted December 19, 1922, to which reference may be had for a more complete description if necessary. This electromagnetic valve operating mechanism includes the necessary coils or electromagnetic elements for actuating the valve, and a switch which forms a part of the control circuits for said coils and is operated for resetting purposes, as will appear.

Referring to Fig. 2, the particular three-way electromagnetic pilot valve mechanism in the present system includes a suitable casing 14 attached to a valve body 15, said casing and valve body being sealed against any escape or loss of gas to the atmosphere. The valve body includes three chambers, to wit, a lower chamber 16 communicating with the gas supply main 1 through the pressure port 16*a* by a pipe 17 having a hand valve 17*a* so as to be supplied at all times when the hand valve is open with the full pressure of the supply, an intermediate chamber 18 communicating through the intermediate port 18*a* by way of the said pipe 11 with the upper control chamber of the snap action valve, and an upper chamber 19 communicating through the vent port 19*a* with a pipe 20 leading to an escapement outlet, as will appear. In the intermediate chamber 18 is a valve member 21 on a stem 22 and movable to either of two positions on lower and upper seats and adapted to control alternatively the connection of chamber 18 to either of the chambers 16, 19. This alternately establishes communication between the intermediate port 18*a* and either the pressure port 16*a* or the vent port 19*a*.

The valve stem 22 is extended in the hollow casing 14 where it carries a core 23 movable to and fro for valve actuation by energization by one or the other of two coils 24, 25, beyond which the stem is further extended to carry and actuate switch mechanism of the general type described and illustrated in the said Ericson patent. Such switch mechanism is here illustrated only conventionally. As shown, it comprises a switch member 26 carried by but insulated from the valve stem and serving as a bridge to control the flow of current to one or the other of the two coils 24, 25. The control circuits will be later described.

The cooperating three-way boiler control valve 13 is more or less conventionally illustrated in Fig. 3. It also comprises three chambers, to wit, a chamber 27 having a pressure port 27*a* and communicating by the pipe 28 with the chamber 16 of the pilot valve, an intermediate chamber 29 having intermediate port 29*a* communicating by way of the aforesaid pipe 20 with the upper chamber 19 of the pilot valve, and an upper chamber 30 having the vent port 30*a* communicating with the pipe 31 which leads to any suitable outlet, such as to an escapement burner (not shown), as is common in devices of this kind. In the intermediate chamber 29 is a valve 32 connected to a stem 33, the movement of which is controlled by a function of boiler operation such as steam pressure, water level, or the like. In the present instance, the boiler control valve is thermostatically operated by water temperature, so that the rod 33 is movable to and fro endwise with rise and fall of water temperature. It should be understood that as the water temperature rises the valve stem 33 moves upwardly, in the diagram Fig. 3, as in the legends thereon, but in the actual assembly shown in Fig. 1 it moves horizontally.

Referring now to the electric circuits, these are of the usual three wire type, connecting the switch mechanism at the pilot valve 12 with the room temperature thermostat, which includes a thermostatically operated member 40 flexed back and forth, in response to variations in temperature, between the contacts 41, 42 in circuit with the wires 43, 44 respectively. Switch member 40 is connected to one side of the circuit, such as to positive, by wire 45. The wires 43, 44 are connected respectively through the coils 24, 25 to two contacts 46, 47 engaged alternately by the switch member 26 in its two positions, in which two positions it also engages contacts 48, 49 both connected by wire 50 to the other side of the circuit or to ground.

The operation is as follows:

Fig. 3 shows the two valves 32 and 21 employed in the control system of the present invention in their lowermost positions. Therefore, the water in the boiler is cold or at least at a normal or low temperature and the room temperature thermostat is demanding heat. In other words, valve 21 is in the "heat on" position. As a result, gas pressure flows from the supply main by way of pipe 17 to chamber 16 of valve 12 and to chamber 27 of valve 13, but it can go no farther because the valves 32 and 21 are closed. The upper chamber of the snap action valve 3 is open by way of pipe 11 to chamber 18, thence by way of the upper port to chamber 19, thence by way of pipe 20 to chamber 29, through the upper port in valve 13 to chamber 30 and thence by way of pipe 31 to the escapement burner. The pressure below the snap action valve diaphragm is greater than that above it, and the snap action valve is open so that gas flows to the burners and the furnace is producing heat.

When the room temperature rises to the proper point, the switch 40 is moved over to its appropriate contact (41 in this case), the upper coil 24 is energized, and the valve stem 22 and valve 21 are raised, switch 26 being also moved to its second position, resetting the three wire circuit ready for the reverse operation and energization of coil 25. In the new position of the parts, the connection of the snap action valve upper chamber 10 to the escapement outlet is cut off by the valve 21, which also now has opened communication between chambers 16 and 18 so that the pressure of the supply from pipe 17 flows to said upper chamber 10 of the snap action valve. Pressures on opposite sides of the diaphragm being equalized, the snap action valve closes and the furnace heat supply is shut off. When the room temperature goes down sufficiently, the switch 40 moves to its "heat on" position and the reverse action occurs. In other words, the normal action of the pilot valve 12 is to connect the upper chamber of the snap action valve either to the gas supply or to the escapement outlet, with the result of turning the furnace off or on.

At the same time, the boiler control valve mechanism, including the valve 32, is subject to variations in that factor of boiler operation which controls it, such as water temperature, and when the latter rises to the predetermined limit, ac-

cording to the setting of the parts, valve 32 rises and wholly cuts off connection of the pilot and boiler control valves to the escapement burner by pipe 31 and under all circumstances causes flow of the main gas supply pressure to the upper chamber of the snap action valve, either by way of chambers 16, 18 and pipe 11 or by way of chamber 16, pipe 28, chamber 27, chamber 29, pipe 20, chamber 19, chamber 18 and pipe 11, superseding the electromagnetic valve control and compelling the snap action valve to close and cut off the heat independently of the control of the electromagnetic valve 12.

If for any reason the current supply fails at a time when the pilot valve 21 is in its lower or "heat on" position, or if a part of the electrical equipment, such as a transformer supplying the leads 45, 50, of a part of the switch mechanism, fails when the pilot valve is in "heat on" position, or should said valve stick and fail to move upon an energization of the lower magnet 25, then the room temperature thermostat 40 would be demanding heat off but the pilot control valve 21 would be in a position holding the snap action valve open and heat would continue to be supplied. Under such emergency circumstances the furnace will remain burning subject only to the safety control of the boiler provided by the boiler three way control valve 13, which will still act as before to cause the snap action valve to close when the temperature of the boiler water rises too high independently of the failure of the electromagnetic valve in the "heat on" position.

When the temperature of the boiler water decreases, the three-way valve 13 is returned to the position shown in Fig. 3. This results in quickly venting the gas pressure on the upper side of diaphragm 7 through pipe 11, chambers 18 and 19 of valve 12, pipe 20 and chambers 29 and 30 of valve 13 to the escapement pipe 31. The gas pressure below diaphragm 7 then quickly opens the main gas valve 5.

What I claim as new and desire to secure by Letters Patent in the United States is:

1. In a gas burner control, the combination of a valve for controlling the flow of gas from a supply line to the burner, a gas pressure responsive device for operating said valve, a control conduit for admitting gas pressure to and venting gas pressure from said pressure responsive device and a pair of independently operable three-way valves interconnected with said conduit to jointly control the venting of the gas pressure from said pressure responsive valve and separately control the admission of gas pressure thereto.

2. Control mechanism for a gas burner comprising a valve for controlling the flow of gas from the gas supply line to the burner, a gas pressure responsive diaphragm operatively connected to said valve, means for applying gas pressure to one side of said diaphragm for opening said valve, conduit means for equalizing the gas pressure on the opposite sides of the diaphragm to close said valve and for venting pressure from the other side of said diaphragm to reopen said valve, and a pair of independently operable three-way pilot valves interconnected with said conduit means to jointly control the venting of the gas pressure from said other side of the diaphragm and separately control the admission of gas pressure thereto.

3. Control mechanism for a gas fired heating boiler comprising a main valve for controlling the flow of gas from a gas supply line to the burner, a pressure responsive diaphragm operatively connected with said valve, means for applying gas pressure to one side of said diaphragm to open said valve, and means for admitting gas pressure to and venting the pressure from the other side of said diaphragm including a pair of three-way valves each having a pressure port, a vent port, and an intermediate port, and interconnecting conduit means whereby the said valves jointly control the venting of the pressure from said other side of said diaphragm and separately control the admission of pressure to said other side of said diaphragm.

4. Control mechanism for gas burner comprising a main valve for controlling the flow of gas from a gas supply line to the burner, a pressure responsive diaphragm operatively connected with said valve, conduit means for admitting gas under pressure from said supply line to one side of said diaphragm for opening said valve, and conduit means including a pair of three-way valves for admitting gas under pressure from said supply line to the other side of said diaphragm to equalize the pressures thereon and thereby effect closure of said valve and for venting the gas pressure from said other side of said diaphragm to effect the reopening of said valve, said valves having a pressure admitting port, a pressure venting port, and an intermediate port with the pressure admitting port of each valve communicating with said gas supply line and with the intermediate port of one valve communicating with said other side of said diaphragm and the intermediate port of the other valve communicating with the pressure venting port of said one valve whereby said pair of valves jointly control the venting of the pressure from said other side of said diaphragm and separately control the admission of gas pressure thereto.

5. In a control system for a gas fired boiler, the combination of a diaphragm operated main valve for controlling the flow of gas from a gas supply line to the burner, means for admitting gas pressure to one side of said diaphragm to operate said valve to the open position, and means for admitting gas pressure to the other side of said diaphragm to effect closure of said valve and to vent the gas pressure from said other side of said diaphragm to effect reopening thereof including a pair of valves each having a pressure admitting port, a pressure venting port, an intermediate port, and a movable valve member for selectively establishing communication between the intermediate port and either said pressure admitting port or said pressure venting port, electromagnetic means for operating the movable valve member of one of said valves, a room thermostat for controlling said electromagnetic means responsive to a condition of the boiler for operating the other of said valves, conduit means connecting the pressure admitting ports of both of said valves with said gas supply lines, a conduit connecting the intermediate port of said electromagnetically operated valve with the other side of said diaphragm, and a conduit connecting the intermediate port of said other valve with the pressure venting port of said electromagnetically actuated valve.

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