June 24, 1941. J. G. AMES ET AL 2,246,566

HEATING SYSTEM

Filed March 31, 1939 3 Sheets-Sheet 1

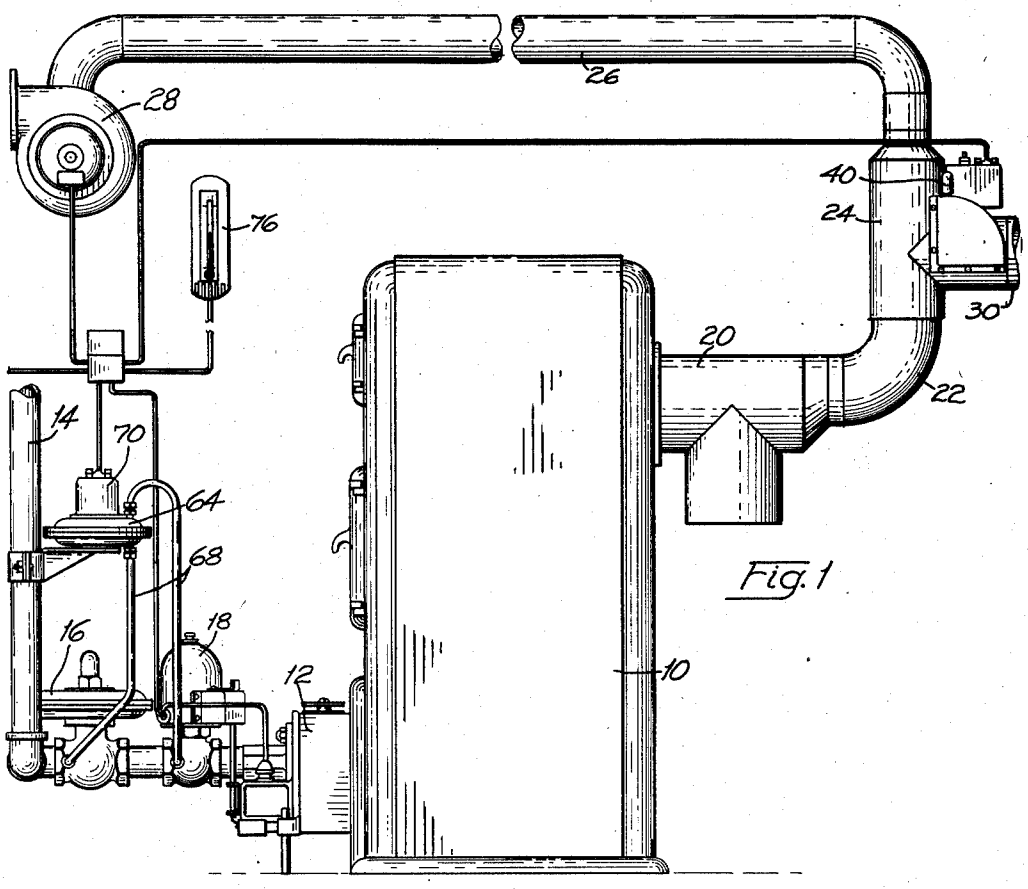


Fig. 1

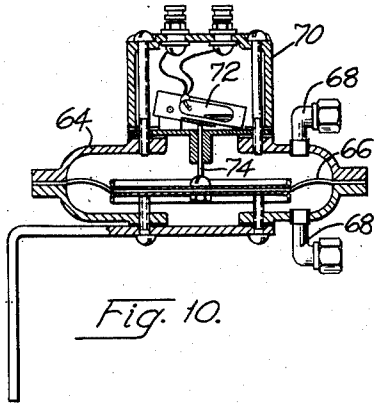


Fig. 10.

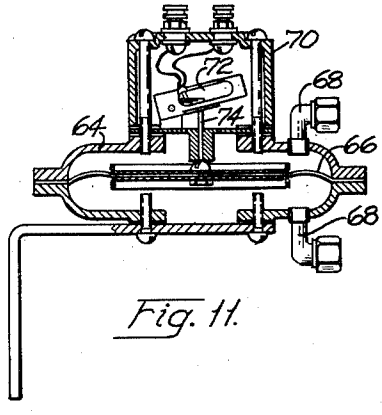


Fig. 11.

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June 24, 1941. J. G. AMES ET AL 2,246,566

HEATING SYSTEM

Filed March 31, 1939 3 Sheets-Sheet 2

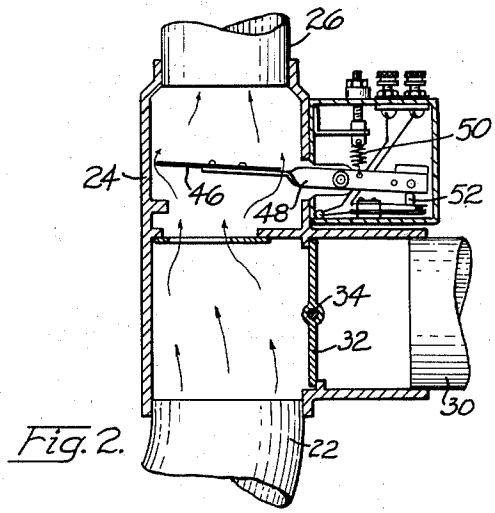


Fig. 2.

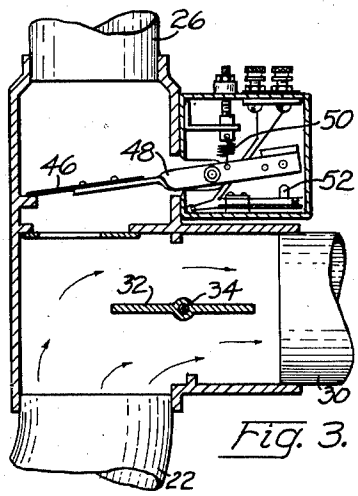


Fig. 3.

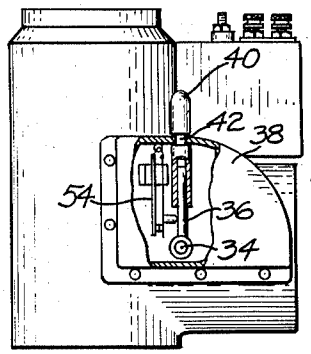


Fig. 4.

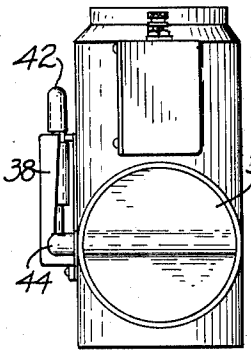


Fig. 5.

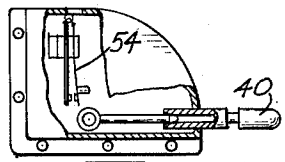


Fig. 6.

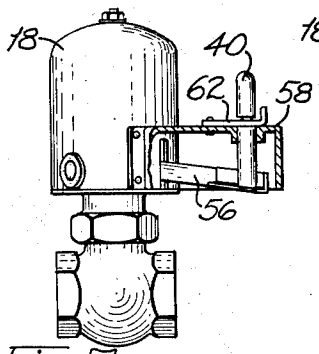


Fig. 7.

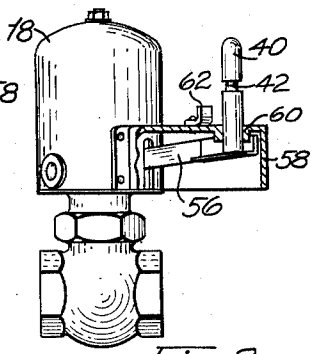


Fig. 8.

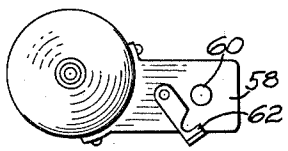


Fig. 9.

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June 24, 1941. J. G. AMES ET AL 2,246,566

HEATING SYSTEM

Filed March 31, 1939 3 Sheets-Sheet 3

Fig. 12.

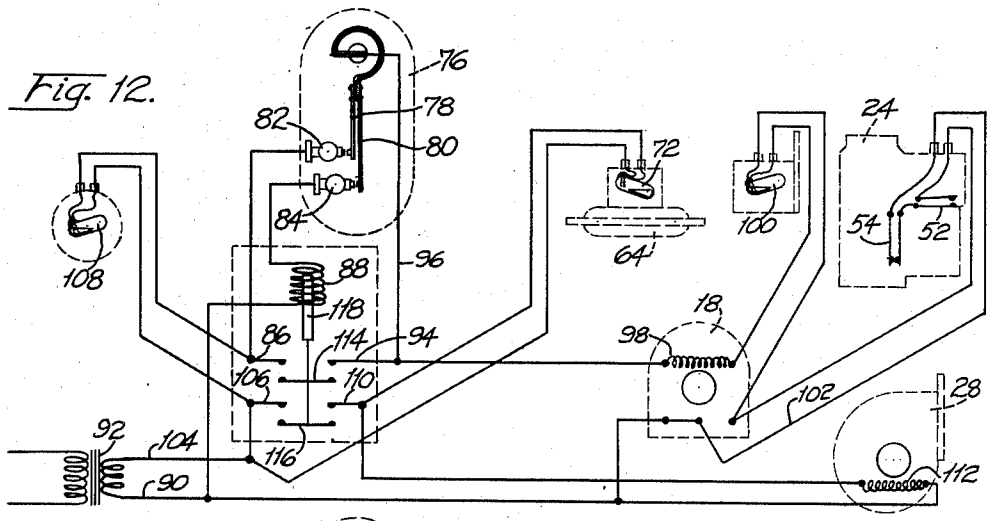


Fig. 13.

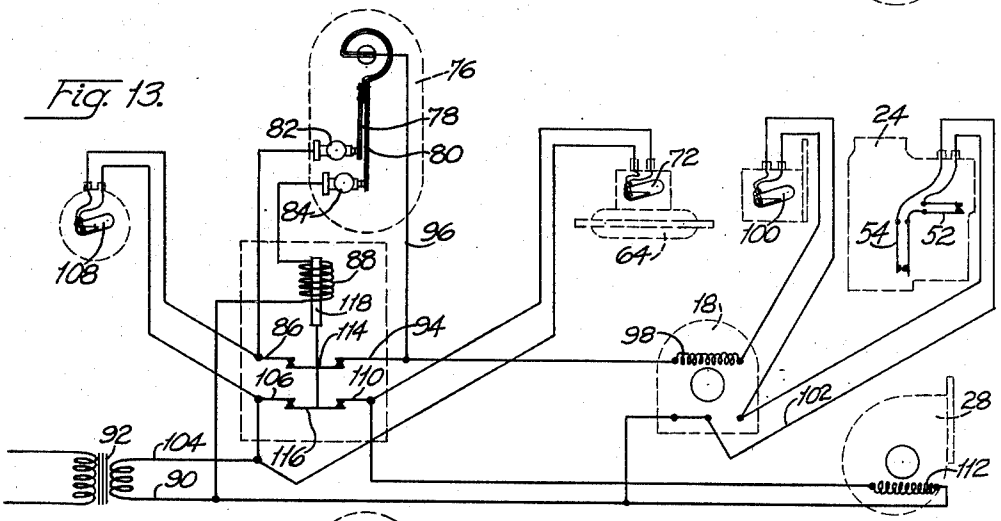
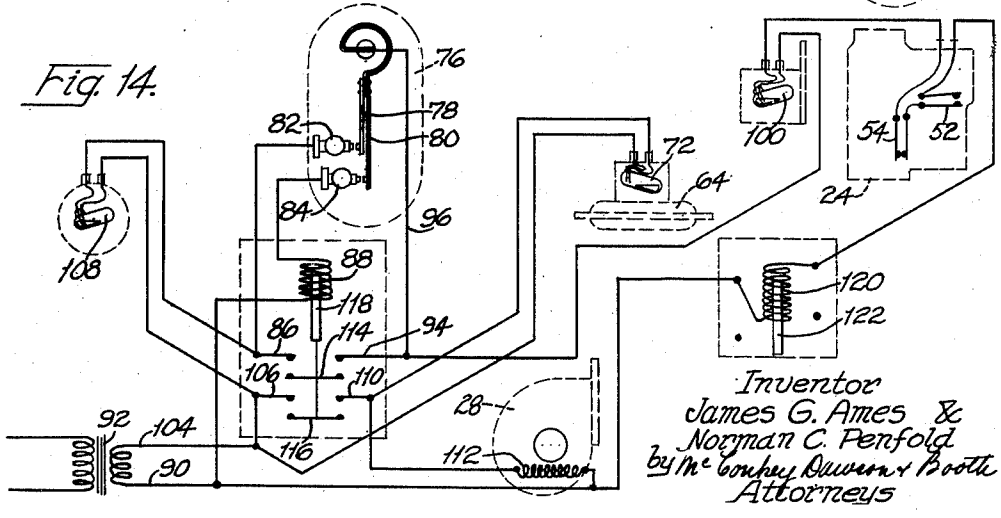


Fig. 14.



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UNITED STATES PATENT OFFICE

2,246,566

HEATING SYSTEM

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Application March 31, 1939, Serial No. 265,118

7 Claims. (Cl. 237—2)

This invention relates to heating systems and more particularly to the control of systems burning fluid fuel.

One of the objects of the invention is to provide a heating system including a furnace which may be connected either to a heat extractor or to a stack or the like. According to one important feature of the invention the system is normally operated automatically with the heat extractor connected to the furnace and an interlocking arrangement is provided between the stack connection and the furnace to prevent manual operation of the furnace except when the stack connection is open.

Another object of the invention is to provide a heating system including a valve controlled stack connection and a fuel control operated by a common key member so that the fuel control cannot be opened manually unless the stack connection is open.

Still another object of the invention is to provide a heating system including a heat extractor in which flue gas is always drawn through the heat extractor as long as fuel is supplied to the system.

Other objects, advantages and novel features of the invention will be apparent from the following description of the accompanying drawings, in which:

Fig. 1 is a diagrammatic view of a heating system embodying the invention;

Fig. 2 and Fig. 3 are enlarged partial sections showing different positions of the parts;

Fig. 4 is an enlarged partial side elevation with parts in section;

Fig. 5 is a view from the right of Fig. 4;

Fig. 6 is a partial view of Fig. 4 showing a different position;

Figs. 7 and 8 are partial sections of the fuel control valve showing different positions;

Fig. 9 is a top view of the fuel control valve;

Figs. 10 and 11 are sections of a flow switch in different positions.

Figs. 12 and 13 are circuit diagrams illustrating different operating conditions; and

Fig. 14 is an alternative circuit diagram.

The system illustrated in Fig. 1 includes a furnace of the type usually employed for domestic heating and which may be a hot air, hot water or steam furnace. As shown, the furnace is provided with a burner 12 extending into the lower portion thereof and supplied with gas through a pipe 14. The gas passes through a standard reducing valve 16 and a motor controlled valve 18 to be described more fully hereinafter.

Flue gas from the furnace flows out through a draft diverter 20 into a flue pipe 22 leading to a T fitting 24. At its upper end the fitting 24 is connected to a heat extractor shown as an elongated pipe 26 which may extend through any space desired to be heated and which is connected to an electrically driven blower 28 discharging to atmosphere. The connection 24 has at one side a pipe 30 leading to the usual stack or through any other desired passage to atmosphere.

As best seen in Figs. 2 to 5 a damper 32 is provided in the fitting 24 to close the entrance to the stack connection 30. The damper is pivoted on a shaft 34 having secured thereto an arm 36 enclosed in a suitable housing 38 at one side of the fitting. The housing is provided in its top with a slot to receive a key member 40 which is adapted to slip over the rod 36 so that the rod may be swung to open or close the valve. Figs. 4 and 5 illustrate the valve in closed position with the rod 36 and key member 40 vertical and with a groove 42 in the key member engaging the housing 38 so as to prevent removal of the key member. In order to remove the key member, it must be swung substantially to the horizontal position to open the valve 32 and may then be removed through an enlarged portion 44 of the slot in housing 38. This position of the parts is illustrated in Fig. 6.

In the path of gas flowing vertically through the housing 24 to the heat extractor pipe 26, there is provided a vane 46 carried by a pivoted lever 48. The lever is normally urged counterclockwise to the position of Fig. 3 by a spring 50 and will be moved clockwise to the position of Fig. 2 by the velocity of gas striking the vane 46.

The vane 46 is arranged to operate an electric switch 52 which is normally open and is closed by the lever 48 when flue gas is flowing through the heat extractor. A similar switch 54 is arranged in the housing 38 to be closed by the rod 36 when the valve 32 is closed and to spring open when the valve is opened as shown in Fig. 6.

The electrically controlled fuel supply valve 18 is shown as a standard motor valve which opens and remains open so long as current is supplied thereto and which closes when the current is interrupted. This valve is provided with a manual operating lever 56 enclosed in a housing 58 and which is raised when the valve is closed and lowered when the valve is opened. The housing 58 is provided in its top with a hole 60 adapted to receive the key member 40 and has a latch 62 pivoted thereon to engage the groove 42

in the key member to hold it down when desired. As shown in Figs. 7 and 8 when it is desired to open the valve 18 manually, the key member 40 may be inserted through the opening 60 to press the lever 56 down and the latch 62 may be engaged with the key member to hold it down thereby holding the valve open.

A flow switch is preferably provided to insure that the blower 28 will continue in operation as long as gas is supplied to the furnace. As shown in Figs. 10 and 11, the flow switch includes a casing 64 containing a flexible diaphragm 66 and having pipe connections 68 to points in the supply pipe 14 on the opposite sides of the reducing valve 16. When there is no flow of gas to the furnace, the diaphragm 66 will fall to the position shown in Fig. 10 but when gas is flowing, the differential pressure across the reducing valve will raise the diaphragm to the position shown in Fig. 11. In order to prevent deflection of the diaphragm when no gas is flowing, the reducing valve is preferably provided with a restricted by-pass through which pressure on the opposite sides thereof will be equalized.

The casing 64 has mounted thereon a second casing 70 containing a pivoted mercury switch 72 which is operated by the diaphragm 66 through a rod 74. When the diaphragm is in its lowered position, the switch would be open and when the diaphragm is raised due to flow of gas, the switch will be closed.

Operation of the system is preferably controlled through a room thermostat 76 which may be mounted in the space to be heated.

One desirable control circuit for the system as so far described is illustrated diagrammatically in Figs. 12 and 13. As shown therein, the thermostat 76 includes a pair of blades 78 and 80 adapted to engage contacts 82 and 84 at different temperatures. For example, the blade 80 may be arranged to engage the contact 84 at 70° and the blade 78 may be arranged to engage the contact 82 at 72°. The contact 82 is connected to a switch contact 86 and the contact 84 is connected through a solenoid 88 to one line 90 leading to a transformer or the like 92. A switch contact 94 complementary to the contact 86 is connected through a line 96 to the thermostat blades and also to a winding 98 on the supply valve 18. This valve as shown is a motor type valve. The winding 98 is connected through a safety pilot switch 100 which is closed when the pilot light is burning and opens when the pilot is extinguished to one side of the switch 52. This switch is connected in series with the switch 54 and through a line 102 to the power line 90.

The other power line 104 from the transformer 92 is connected to a switch contact 106 and through a limit control switch 108 to the contact 86. The limit control switch may be operated in response to a function of the furnace temperature so as to open when the furnace temperature reaches a predetermined degree. For example, with a hot water furnace, this switch may be opened when the water reaches a certain temperature and with a hot air furnace, it may be opened when the furnace structure itself attains a predetermined temperature. The line 104 is also connected through the switch 72 with a switch contact 110 and with a winding 112 in the motor which drives the blower 28.

The contacts 86 and 94 are bridged by a switch bar 114 and the contacts 106 and 110 are similarly bridged by a switch bar 116. The bars 114 and 116 are carried by an armature 118 operating in the coil 88.

In Fig. 12, the parts are shown in the off position in which both thermostat blades 78 and 80 are out of engagement with their respective contacts. At this time, the velocity vane 46 is moved to the position of Fig. 3 so that switch 52 is opened and since no fuel is flowing to the furnace, switch 72 is also open, though the fuel valve is closed and the blower is out of operation.

As the temperature in the space to be heated falls, the blades 78 and 80 will engage the contacts 82 and 84 respectively closing a circuit through the solenoid 88 and switch 108. This energizes the solenoid and raises the switch bars 114 and 116 to the position of Fig. 13 to complete circuits across the contacts 86 and 94 and the contacts 106 and 110. At this time, the circuit is completed through the winding 112 to start the blower 28 from line 104 through contact 106, switch bar 116 and contact 110 to the line 90. As the blower starts, the vane 46 will be elevated and switch 52 will be closed to complete a circuit through the valve winding 98 from line 90 through line 102, switches 52 and 54, pilot switches 100, winding 98, contact 94, bar 114, contact 86 and switch 108 to the line 104. Thus the valve 18 will be opened and gas will flow to the furnace, being ignited by the pilot.

As soon as the gas starts to flow, the switch 72 will be closed due to the elevation of the diaphragm 66 to complete a holding circuit through the winding 112 of blower 28 in shunt across the contacts 106 and 110. Since switch 72 will remain closed as long as fuel is flowing to the furnace, it will be apparent that the blower 28 will necessarily continue in operation as long as fuel is supplied to the furnace regardless of what occurs in the remainder of the control circuit. Thus, if for any reason, the valve 18 should stick open, the flue gases will continue to be evacuated by the blower.

As the temperature in the space rises above 70°, the blade 80 will move out of engagement with the contact 84. The winding 98 of the motor valve will, however, continue to be energized through a circuit from line 104, switch 108, contact 82, blade 78, line 96, winding 98, switch 100, switches 52 and 54 and line 102 back to the line 90. As the temperature continues to rise and reaches 72°, the blade 78 will move out of engagement with the contact 82 to interrupt this holding circuit and the winding 98 will be deenergized. At this time the fuel valve 18 will close and when the flow of fuel is interrupted, the switch 72 will open to break the circuit through the winding 112 of the blower 28. The parts are now again in the position of Fig. 12 ready for the beginning of another heating cycle.

Fig. 14 illustrates a slightly modified circuit, parts therein corresponding to like parts in Figs. 12 and 13 being indicated by the same reference numerals. The principal distinction between this construction and that of Figs. 12 and 13 lies in the substitution of a solenoid valve for the motor valve of the preceding figures. As shown, a solenoid coil 120 is arranged in circuit in substantially the same manner as the winding 98 of Figs. 12 and 13 and when energized, raises a plunger 122 which opens the fuel supply to the furnace. Operation of this control system is substantially identical to that described above and will not be repeated in detail.

In the event of a power failure or the like, it may be desired to operate the furnace manually and for this purpose the operator must remove the key member **40** from the casing **38** in the manner described above. Removal of this member necessarily opens the switch **54** and at the same time opens the valve **32** to the stack connection. Thus the furnace cannot be operated manually unless the valve **32** is open and it cannot turn on automatically when the key member **40** is removed due to the fact that switch **54** is open.

Having removed the key member, the operator may insert it through opening **60** in the valve casing **58** and may press down to depress the lever **56**, thereby opening the fuel supply valve. By swinging the latch **62** into engagement with the grooved portion **42** of the key member, the valve will be held open and the furnace will operate, products of combustion flowing past valve **32** to the stack.

While one embodiment of the invention has been shown and described in detail, it will be understood that it is illustrative only and is not to be taken as a definition of the scope of the invention reference being had for this purpose to the pending claims.

What is claimed is:

1. In a heating system having a furnace provided with fuel supply means and a stack connection, a heat extractor connected to the stack connection, a valve in the stack connection posterior to the connection to the heat extractor, means for controlling the supply of fuel to the furnace, a control circuit for said means including a switch controlled by operation of the heat extractor and a switch controlled by said valve, and means for manually opening the fuel supply means and for controlling said valve so that the fuel supply means cannot be opened manually by said last named means except when the valve is open.

2. In a heating system having a furnace provided with fuel supply means and a stack connection, a heat extractor connected to the stack connection, a valve in the stack connection posterior to the connection to the heat extractor, means for controlling the supply of fuel to the furnace, a control circuit for said means including a switch controlled by operation of the heat extractor and a switch controlled by said valve, a common detachable operating member for manually opening the fuel supply means and for controlling the valve, and means for preventing detachment of said member from the valve except when the valve is open.

3. In a heating system having a furnace provided with fuel supply means and a stack connection, a heat extractor connected to the stack connection, a valve in the stack connection posterior to the connection to the heat extractor, means for controlling the supply of fuel to the furnace, a control circuit for said means including a switch controlled by operation of the heat extractor and a switch controlled by said valve, to be closed when the valve is closed and open when the valve is open, a common detachable operating member for manually opening the fuel supply means and for controlling the valve, and means for preventing detachment of said member from the valve except when the valve is open, whereby the fuel supply means can be opened manually only when the valve and the switch controlled thereby are both open.

4. In a heating system having a furnace provided with fuel supply means and a stack connection, a heat extractor connected to the stack connection, a valve in the stack connection posterior to the connection to the heat extractor, means for controlling the supply of fuel to the furnace, a control circuit for said means including a switch controlled by flow of gas through the heat extractor and a second switch controlled by the valve to be open when the valve is open and closed when the valve is closed, a common key member for manually controlling the fuel supply means and for opening and closing the valve, and means to prevent removal of said key member from the valve except when the valve is open.

5. In a heating system having a furnace, supply means for fluid fuel including a supply valve, and a flue connection, the combination of a valve in the flue connection controlling communication thereof with a stack or the like, a common detachable operating member for both of said valves, and means for preventing removal of said member from the last named valve except when it is open so that the supply valve cannot be opened by said member unless the valve in the flue connection is open.

6. In a heating system having a furnace, supply means for fluid fuel including a supply valve, and a flue connection, the combination of electrical means for controlling the supply valve, a control circuit for said electrical means, electrical means for withdrawing flue gas through said flue connection, a control circuit for said last named electrical means, thermostatic means responsive to the temperature of the space heated by said system for controlling both of said control circuits, and pressure responsive means connected to the fuel supply means and responsive to the flow of fuel to the furnace to hold the second named control circuit closed as long as fuel is flowing.

7. In a heating system having a furnace, supply means for fluid fuel including a supply valve, and a flue connection, the combination of electrical means for controlling the supply valve, a control circuit for said electrical means, electrical means for withdrawing flue gas through said flue connection, a control circuit for said last named electrical means, a thermostatically operated switch in the second named control circuit controlling said second named electrical means in response to the temperature of the space heated by said system, a second switch in the second control circuit in shunt with the thermostatically operated switch, means responsive to the flow of fuel to the furnace to close said second switch, and a switch in the first named control circuit closed in response to the flow of gas through the flue connection.

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