

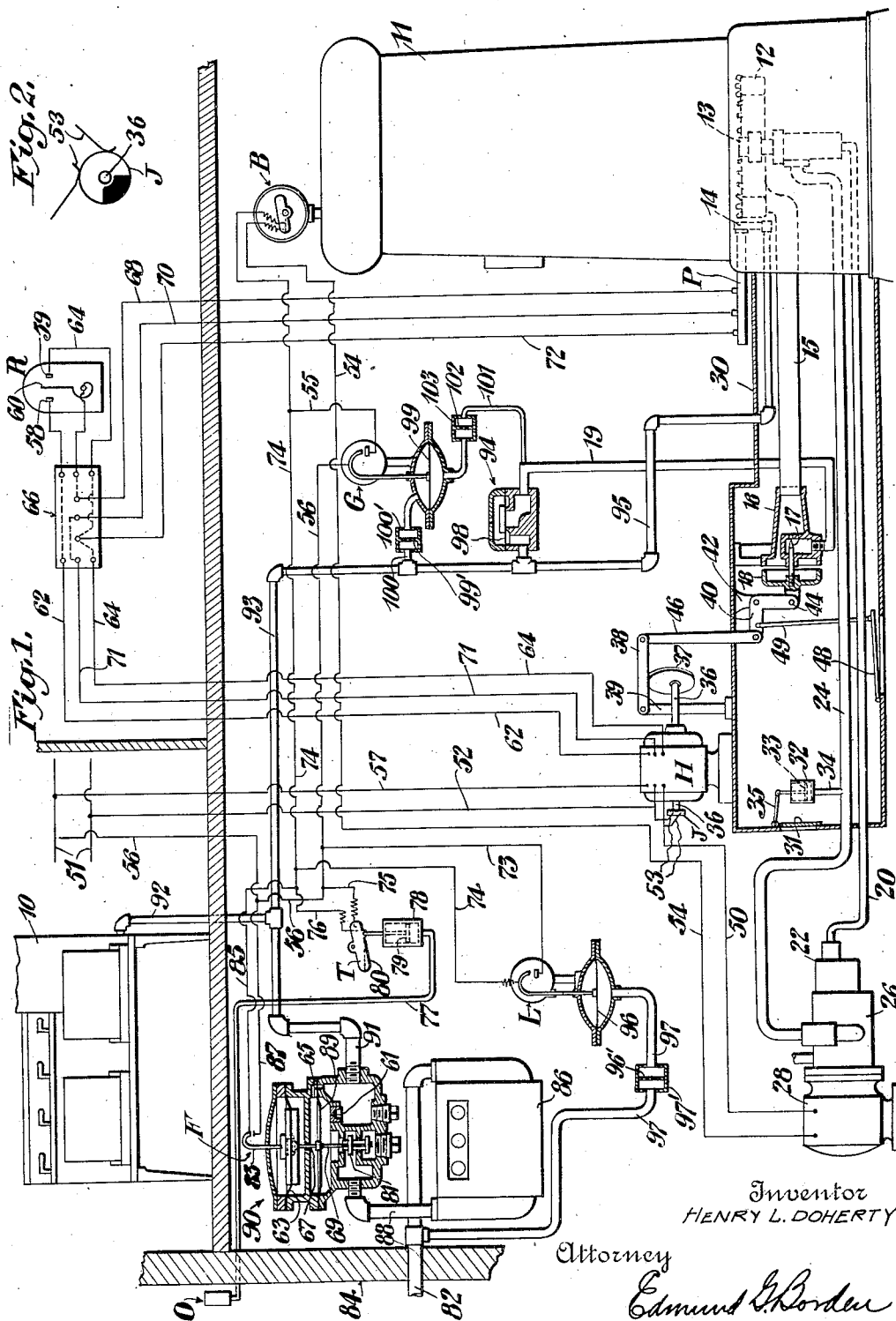
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HOUSE HEATING SYSTEM

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UNITED STATES PATENT OFFICE

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HOUSE-HEATING SYSTEM

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This invention relates to a method and apparatus which shall provide for heat requirements in gas-burning heating systems at such times as gas may not be available or the supply thereof be limited.

Regardless of the particular manner in which gas may be metered to the consumer, it not infrequently happens during periods of unusually cold weather that the flow of gas is insufficient to meet the consumer's requirements,—the reduction in flow being occasioned by the great general demand for gas at such periods. Gas is sometimes metered to the consumer in such a manner that only a limited amount of gas can be taken from the mains at any given time. When such is the case, the consumer must choose as to which of his gas burning appliances shall have first call on the available supply. For example, as between a kitchen range and a house heating furnace, the former would be given the preference and the furnace fired by some other kind of fuel while the preferred appliance is consuming the available supply of gas.

The present invention aims to provide an oil burning system in connection with a gas-fired heating appliance, such as a house-heating furnace, and to so correlate the same therewith that the oil burning system will automatically function when the gas supply to the furnace is not sufficient to satisfy the heat requirements.

Another aim or object of the invention is to make the oil burning system subject to control by the outside or weather temperature preferably in such a manner that the oil burning system will be put into active operation in advance of the immediate heat requirements of the home being heated when the outside temperature falls to a predetermined point.

Another object is to provide a house-heating system which shall be mutually advantageous to the gas company as well as to the consumer. To this end the invention provides a house-heating system adapted to utilize gas as the base or normal fuel and oil as a supplementary fuel whereby the consumer obtains the advantages of a base fuel of high-heating-value and which moreover

is clean, easily burned, and for which no storage provision need be made by the consumer,—advantages which obviously appeal very greatly to the consumer,—and whereby the gas company supplying the gas will not be called upon to provide gas-storage equipment or gas-making equipment greatly in excess of the normal load requirements or in other words, equipment which would be called into use only to satisfy unusual peak load requirements, requirements which would put an undue burden of expense on the company and result in increased cost of the gas.

The various novel features of the invention and additional objects of the same will more fully appear from the detailed description taken in connection with the accompanying drawings forming part of this specification.

Fig. 1 of the drawings is a diagrammatic representation of a combined gas and oil burning system embodying apparatus elements suitable for carrying out the method of the present invention;

Fig. 2 is an end elevation on an enlarged scale of the rotary switch J shown in side elevation in Fig. 1.

The gas consuming appliance having first call on the gas supply has been indicated as a kitchen range 10 and the gas consuming appliance having secondary call on the supply as a house heating furnace 11. The furnace is provided with any suitable gas burner 12, an oil burner 13, and a pilot burner 14. Leading from the gas burner 12 is a conduit or pipe 15 at the free end of which is a gas-air mixing chamber 16, the flow of gas and air to which is controlled by any suitable device as by the combined needle and cover valves 17 and 18 respectively. Gas is fed to the air-gas mixing device through a conduit 19 which is part of a gas distributing system hereinafter more fully referred to. Oil is supplied to the oil burner 13 through a conduit 20 which leads from any suitable oil pump 22. Primary air for the oil is supplied through a conduit 24 which leads from a suitable blower 26. The blower and pump are conveniently driven by common motor 28. An air box 30 has been shown as leading out-

wardly from below the firebox chamber in which the oil and gas burners are mounted.

In order that the requisite amount of secondary air may be supplied to the oil burner when the same is operating, the air box is provided with damper 31 which is adapted to be opened by the pressure of the primary air supplied by the blower 26. The damper-operating means may be of any preferred form but as shown, there is provided a cylinder 32 within which is a piston 33, a pipe 34 connecting the cylinder 32 with the primary air pipe 24. The damper is provided with a lever arm 35 to the free end of which the piston 33 is connected by a piston rod. As the air pressure in the primary air pipe 24 builds up, the piston 33 will be moved to open the damper 31 as will be readily understood.

The gas and oil burning systems above described are under the control of a room thermostat R. Included in the room thermostat control system is a motor H so constructed that it will rotate its shaft 36 through one-half revolution at a time and then stop, the work done by the motor including among other things the operation of a circuit switch J for the motor 28 as will more fully appear. When the room thermostat R is in a no-call-for-heat position, electrical connections are established between the motor H and the thermostat whereby the motor will be actuated to shut off the flow of gas to the gas burner and also to cut off the flow of oil to the oil burner in case oil and gas are being burned at the same time.

The means for shutting off the gas supply upon actuation of the motor may be of any approved form. As shown, however, the shaft 36 of the motor H is provided with a cam 37 which is adapted to move a bar 38 pivoted on a standard 39. An elbow lever 40 is pivoted between its ends on a suitable support 42. One end of the lever is connected as at 44 with the cover valve 18 of the air gas mixing device and the other end is connected to the bar 38 by means of a link 46.

In order to open the air box 30 to the atmosphere when gas is being burned there is provided a damper 48 which is adapted to be opened when the motor H is actuated to permit gas to flow to the gas burner. The damper 48 is conveniently connected by means of a link 49 with the elbow lever 40 whereby movement will be imparted to the damper at the same time that movement is imparted to the air and gas controlling valves 18 and 17, respectively.

When the motor H is actuated to shut off the gas supply it also interrupts the continuity of a power line 50—52 between the combined pump and blower motor 28 and the main power circuit 51, thus preventing motor 28 from running. This break in the power line 50—52 may be effected in any desired manner as by a switch J (see Figs. 1 and 2) mounted

on shaft 36 outside the casing of the motor H disposed between the adjacent terminals 53 of said power circuit. The switch J is so arranged that when shaft 36 is in one position of rest, one side 50 of the power circuit leading to the pump motor 28 is closed, and when it is in its other position of rest said power circuit is open. Essentially the switch J (see Fig. 2) comprises a 90° segment of conducting material placed in a non-conducting disc affixed to the end of the motor shaft 36, brushes 53 being provided at the ends of the adjacent terminals of the circuit 50 for operative engagement with the rotary switch. The other wire of the power circuit of motor 28 is indicated in part at 54, the same leading to a normally closed switch in a boiler thermostat B. A wire 55 connects the thermostat B with one side of a normally open switch G. From switch G the circuit runs through wire 56 to the power circuit 51. The motor H is connected to the power circuit 51 by wires 52 and 57.

The room thermostat R has two fixed contacts 58 and 59 between which operates the movable element 60. Contacts 58 and 59 lead direct to the motor H through wires 62 and 64 respectively, said wires passing through a junction box 66. The movable element 60 of the thermostat is also connected to motor H by way of wire 68, 70 and 71. Between wire 68 and 70 is a thermostat P which normally keeps the circuit through said wires closed when the pilot 14 is burning.

When the room thermostat R is in a no-call-for-heat position, the movable element 60 will have moved to the right and closed the circuit between wires 64 and 71. The motor H will therefore be actuated to shut off the flow of gas to the burner 12 and to break the power circuit 50—52 of the oil pumping motor 28 by opening switch J. When the room thermostat R is in a call-for-heat position, the movable element will have moved to the left and closed the circuit between wires 62 and 71. The motor H will therefore be actuated to start the flow of gas to the burner 12 and to close the power circuit 50—52 of the oil pump 28 at switch J, whereupon if the pump motor circuit is otherwise complete it will be actuated to supply air and oil to the oil burner 13.

The pilot thermostat P is so constructed that upon accidental extinguishment of the pilot light the circuit 64—71 will be closed whereby to actuate the motor H to shut off the flow of gas to the gas burner and to break the power circuit 50—52 of the motor 28 at switch J. To this end the pilot thermostat P is provided with wire 72 which taken with wire 70 provides a circuit which will close the circuit between wire 64 and 71 with the result that the motor H will be actuated to prevent the flow of fuel to the burners.

The boiler governor thermostat B is set to

break the power circuit (which includes wire 54) leading to the motor 28 when the temperature of the boiler reaches a maximum safety limit.

Connected in parallel across the normally open switch G are two normally open switches L and T. One side of the switch L has a wire 73 connecting with the wire 56 which leads from the power circuit 51 to switch G. The other side of the switch is connected by a wire 74 to one side of the boiler thermostat B. One side of the switch T also connects with wire 56 through wire 75 and the other side connects with wire 74 (and hence to the boiler thermostat B) through wire 76.

The switch T is controlled by a thermostat O on the outside of the house, a wall of which is shown at 84. The thermostat may be of any suitable type but has been shown as of the pneumatic type. A tube 77 leads from the thermostat proper to a cylinder 78 within which is a piston 79. This piston is appropriately connected with a movable element 80 of the switch T, said element being shown as a mercury tipping switch. When the outside temperature falls to a predetermined point, the movable element 80 of the switch is actuated to close the circuit between wires 75 and 76. When the circuit 75—76 is closed, the circuit between wire 56 (through wire 74) and wire 54 will be closed. If now power circuit 50—52 is closed the motor 28 will be actuated as will be readily understood. It will be remembered that if the thermostat R is in a call-for-heat position the circuit 50—52 of motor 28 will be closed. Under these conditions the oil burning system will be put into active operation even though the furnace is being supplied with gas. The switch T therefore operates to put the oil burning system into active operation in advance of the anticipated reduction of gas supply.

The gas supply main is indicated at 82 and leads to a conventional volume meter 86 from whence the gas flows by way of a pipe 88 to a flow limiting device generally indicated at 90. Screwed into the outlet side of said device 90 is a pipe 91 which divides into two branches 92 and 93. Branch 92 leads to the kitchen range 10 and branch 93 leads to a special type of valve 94 hereinafter more fully referred to and through which the gas must pass before flowing to the furnace gas burner 12 through the pipe 19. Continued as a branch from the pipe 93 is a pipe 95 which leads to the pilot 14.

The switch L is adapted to be operated by a pressure-responsive device shown as a diaphragm 96, one side of which is connected by a pipe 97 to the gas main 82 on the inlet side of the volume meter 86. When the pressure in a supply main 82 falls below a predetermined point the switch L will be closed. Upon the switch L being closed, the circuit to motor 28 will be closed along one line there-

of, namely, between wires 56 (through 74) and 54 and consequently the motor 28 will be free to operate to put the oil burning system into operation provided its power circuit 50—52 is closed. As already indicated the power circuit 50—52 will be closed through the switch J when the thermostat R is in a call-for-heat position.

The valve 94 interposed between the gas pipes 19 and 93 is so constructed that the flow of gas will be cut off when the pressure in the line between said valve 94 and the flow limiting device 90 falls to a predetermined point. The valve 94 may be of any preferred construction but as shown it consists of a weighted diaphragm 98 which controls a flow passage. When the gas pressure in the line 93 is sufficiently high it will raise the diaphragm off its seat and permit gas to flow into the pipe 19 on the outlet side of said valve. When the gas pressure in the line 93 is not sufficiently high to raise the diaphragm, means are provided for closing one side of the power circuit to the oil pump motor 28 so that if the room thermostat R is in a call-for-heat position the heat requirements may be met by the burning of oil in the furnace. The means for closing said circuit has been shown as including a diaphragm 99 which on one side is subject to the pressure of the gas in the line 93 leading to the valve 94 and which on its other side is subject to the pressure existing within the pipe 19 on the outlet side of the valve 94. A pipe 100 leads from the top of the diaphragm to the pipe 93 and a pipe 101 leads from the under side of the diaphragm to the pipe 19. When the diaphragm 98 has closed the flow passage in the valve 94 the switch G will close the oil pump motor power circuit 54—56 and consequently the motor will be free to operate if the room thermostat R is in a call-for-heat position.

The flow limiting device 90 through which the gas passes after having passed through the flow meter 86 may be of any approved construction. Briefly stated, the gas after entering the device passes through a restricted orifice 61 from whence it flows to the outlet pipe 91. Within the device is a weighted diaphragm 63, the under side of which is subject to the pressure of the outgoing gas by way of a port 65 and an opening 67 in a wall below the diaphragm. Depending from the diaphragm and extending through the opening 67 is a stem 69 to the lower end of which is secured a valve 81 adapted to shut off the flow of gas to the orifice 61 such closure being affected when the pressure of the gas on the outlet side of the orifice is high enough to elevate the diaphragm 63. Secured to the top of the diaphragm is a post 83 to which is attached one end of a wire 85 which leads to the wire 74 which in turn leads to the motor 28 through wire 54. The post is adapted

to the wire 74 which in turn leads to the motor 28 through wire 54. The post is adapted

to make contact with the terminal of a wire 87 which is connected to the wire 56 which leads from the power circuit 51. The switch between the wires 85 and 87 may for convenience of description be termed switch F and may be of any preferred form. When the pressure of the gas on the outlet side of the orifice 61 falls below a predetermined point, the diaphragm 63 will move downwardly a sufficient distance to close the switch F. When the switch F is closed one side of the power circuit leading to motor 28 will be closed and hence if the room thermostat R is in a call-for-heat position the motor 28 will be put into operation with the result that oil burning system will be put into operation.

The interior mechanism of the flow limiting device 90 also includes a diaphragm 89 the upper side of which is subject to the same gas pressure as the under side of the diaphragm 63, namely, the pressure of the gas which has passed through the orifice 61. The under side of diaphragm 89 is subject to the pressure of the incoming gas. The valve stem 69 passes through a central opening in the diaphragm 89 in such a manner that under certain conditions of operation relative movement may be had between the diaphragm 89 and the valve stem 69. In order to enable the valve stem to be moved upwardly by the diaphragm 89 the valve stem is conveniently provided with a shoulder or abutment above the diaphragm 89.

The mode of operation of the flow limiting device 90 is such that only a limited amount of gas can be taken from the supply main 82. The customer will usually have the device 90 so regulated that enough gas can always be obtained to satisfy the maximum requirements of the primary gas consuming appliances such as the kitchen range. If gas should be flowing to the furnace 11 at the time it is desired to operate the kitchen range 10 or other primary gas consuming appliances, the valve 94 will operate to close off the flow of gas to the furnace burner 12 when the pressure of the gas in the line 93 leading to said valve 94 falls below a predetermined point.

In order that the house may not suffer for lack of heat during such time as the supply of gas to the furnace gas burner 12 is cut off and the room thermostat R is in a call-for-heat position, the switch G associated with the valve 94 will close the circuit to the motor 28 whereupon the oil burning system will be put into operation.

In order that the circuit-controlling diaphragms 96 and 99 may not be too sensitive to slight variations in pressure, suitable means for causing a lag in the operation of the diaphragms may be provided. Such means may conveniently take the form of restrictions in the pipe lines leading to the diaphragms, the restrictions preferably being arranged in relatively small receivers or

chambers in which the gas passing through the restrictions enters.

Referring to the drawings, the restriction in the pipe line 97 leading to the diaphragm 96 is indicated at 96' and its receiver at 97'. The restriction in the pipe line 100 leading to the upper side of the diaphragm 99 is indicated at 99' and its receiver at 100'. The restriction in the pipe line 101 leading to the bottom of the diaphragm is indicated at 102 and its receiver at 103.

It will be noted that the weather subject thermostat O is so connected to the oil burning apparatus that it will function to put said apparatus into active operation irrespective of the type of device or means through which gas is supplied to the furnace. As regards the broad idea of weather control of the oil burning system, the gas pipe 88 leading from the volume meter 86 could just as well lead directly to the gas-air mixer 16 or in other words to the gas burner 12 and the same is true as regards the control exercised on the oil burning system by the switch L which is subject to the control of the gas pressure in the main 82. That is to say, as regards these two controlling means the demand limiting device 90 and the cut-off valve 94 could just as well be omitted. It is, however, preferred to employ the cut-off valve 94 in connection with the gas-main-pressure responsive device 96 and to set said device 96 for actuation of the oil burning system at a pressure higher than the low point pressure which will cause the cut-off valve 94 to function. The pressure responsive device 96 will, therefore, set the oil burning system into operation or make it ready for operation before the reduction in gas main pressure makes itself felt at the cut-off valve 94 and consequently the device 96 is to this extent independent of the valve 94 in the arrangement shown. As previously indicated the cut-off valve 94 will cut off the flow of gas to the furnace when the gas pressure in the line leading to said valve falls below a predetermined point whereby the available supply of gas to which the customer is entitled by the demand limiting device is conserved for other uses. While the cut-off valve 94 will operate to cut off the flow of gas to the furnace when a certain predetermined low pressure obtains between the demand limiting device 90 and said valve whereby to conserve the available supply of gas for use in the primary gas appliances, the valve 94 performs an additional function which is that it will function to cut off the flow of gas to the furnace when the gas pressure in the gas main 82 falls to a predetermined low point thereby making available for other than furnace purpose the supply of gas in the gas system as a whole between the gas plant and the individual consumers being supplied with gas. In view of the fact that the cut-off valve 94 will cut off the flow

of gas to the furnace when the gas pressure in the pipe leading to said valve falls to a predetermined low point it is obvious that the demand limiting device can be dispensed with and a direct connection made between the pipe 93 and the pipe 88 leading from the volume meter 86. The demand limiting meter 90 performs a very special function which is that it limits the amount of gas which a customer is entitled to use in a given period of time, but the omitting of the demand limiting device with its consequent function would not in any manner interfere with the operation of the cut-off valve 94 as regards its function of cutting off the flow of gas to the furnace when the gas pressure on its inlet side falls below a predetermined point.

When the switch G is operated due to the cut-off of the flow of gas to the furnace by the valve 94, the oil burning system comes into operation to burn oil in place of gas in the furnace. The switch L on the other hand when operated by the gas pressure in the gas main will put the oil burning system into operation irrespective of whether or not gas is being supplied and burned in the furnace and consequently oil and gas may be burning at the same time and until such time as the pressure in the gas main 82 falls low enough to cause the valve 94 to cut off further flow of gas to the furnace.

It is of course understood that as between the weather-subject thermostat O and the room-temperature-controlled thermostat R, the latter is the master control of the entire system. Considering for the moment one phase of the relationship between the two said thermostats, it will of course be understood that thermostat R operates between two predetermined temperature points, namely, the maximum and minimum desirable room temperatures, and that thermostat O operates at a temperature which is below—usually very considerably below—the minimum desirable room temperature. Said thermostatic control system involves, therefore, three distinct temperature points. It will also be remembered that the control exercised by thermostat O is effective even though the furnace gas burner 12 is being furnished with a full supply of gas. It will now be apparent that the thermostat O will function to put the oil burning system into operation or to make it ready for operation if thermostat R is in a call-for-heat position provided the thermostat O is subject to a temperature low enough to cause it to operate the switch T.

It will be understood from the foregoing description that gas is the base or primary fuel normally relied upon to satisfy the fuel requirements of the furnace; that the oil burning system is provided to take care of the fuel requirements when the gas supply is not sufficient for that purpose; that the oil

burning system is so controlled that it will come into active operation when the weather temperature falls to a certain low degree even though gas may at the time be flowing to the furnace; that it will come into active operation when the gas-pressure in the main falls below a predetermined point; that it will come into active operation when the gas supply to the furnace has been cut off; and that it will come into active operation depending on certain conditions existing in a device for limiting the flow of gas from the gas main.

While the invention has been described with considerable particularity of detail it is to be understood that no limitations are intended except as may be defined by the appended claims.

What is claimed is:

1. The combination of means for supplying the fuel requirements of a house heating system, comprising a gas burning system adapted to supply the fuel requirements of the furnace as long as the pressure on the gas being supplied to the system is maintained at a given pressure, an oil burning system, and electrically operable means under the control of said gas pressure for putting the oil burning system into active operation to supply fuel oil to the furnace when the gas pressure falls to a predetermined point.

2. The combination specified in claim 1, and means for cutting off the flow of gas to the furnace when the gas pressure falls to a predetermined point.

3. The combination of means for supplying the fuel requirements of a house heating system, comprising a gas burning system adapted to operate on a continuously limited supply of gas which is sufficient to satisfy the fuel requirements of the furnace as long as said supply is available at a given minimum pressure, an oil burning system, and means for cutting off the supply of gas to the furnace when the gas pressure of the available limited supply is less than said given minimum pressure, and for putting the oil burning system into active operation to supply fuel oil to the furnace when said gas supply has been cut off.

4. The combination of means for supplying the fuel requirements of a house heating system, comprising a gas burning system adapted to supply the fuel requirements of the furnace as long as the pressure on the gas being supplied to the system is maintained at a given pressure, an oil burning system and a thermostat subject to weather temperature adapted to put the oil burning system into active operation to supply fuel oil to the furnace when a predetermined low weather temperature has been reached.

5. The combination specified in claim 4, and means adapted to cut off the flow of gas to the furnace when the gas pressure drops to a predetermined point,

6. A method of operating a house heating furnace provided with means for burning gas and oil, wherein the gas pressure is a controlling medium for the oil burning system, comprising burning gas in the furnace as long as the gas pressure remains above a predetermined minimum, and automatically cutting off the gas and burning oil only in the furnace when the gas pressure falls below said predetermined minimum.

7. A method of operating a house heating furnace provided with means for burning gas and oil, comprising burning gas in the furnace as long as the gas pressure remains above a predetermined minimum, automatically shutting off the flow of gas to the furnace when the gas pressure falls below said predetermined minimum and burning oil in place of gas while the gas pressure remains below said predetermined minimum.

8. A method of operating a house heating furnace provided with means for burning gas and oil, comprising burning gas in the furnace as long as the gas pressure remains above a predetermined minimum, and automatically cutting off the gas and burning oil in the furnace when the weather temperature falls to a predetermined degree.

9. In combination, a house heating furnace equipped with a gas burner and an oil burner, means permitting gas to flow to the gas burner only as long as the gas pressure remains above a predetermined minimum, mechanism adapted to feed oil to the oil burner, and apparatus controlled by said means for setting said mechanism into operation to feed oil to the oil burner when the gas pressure falls below said predetermined minimum.

10. In combination, a house heating furnace equipped with a gas burner and an oil burner, a device permitting gas to flow to the gas burner as long as the gas pressure remains above a predetermined minimum, mechanism adapted to feed oil to the oil burner, pressure-responsive means associated with said device, and means controlled by the pressure-responsive means for setting said mechanism into operation to feed oil to the oil burner when a predetermined differential pressure exists on said pressure-responsive means.

11. In combination, a house heating furnace equipped with a gas burner and an oil burner, a device permitting gas to flow to the gas burner only as long as the gas pressure is above a predetermined minimum, mechanism adapted to feed oil to the oil burner, means controlled by said device for setting said mechanism into operation to feed oil to the oil burner when the gas pressure is below said predetermined minimum, and for rendering said mechanism inoperative when the gas pressure is greater than said minimum.

12. In combination, a house heating furnace equipped with a gas burner and an oil

burner, a device permitting gas to flow to the gas burner as long as the gas pressure remains above a predetermined point, mechanism adapted to feed oil to the oil burner, a thermostat adapted to move to call-for-heat and no-call-for-heat positions, and means controlled by said device for setting said mechanism into operation to feed oil to the burner when the device has cut off the flow of gas to the gas burner and when the thermostat is in a call-for-heat position.

13. In combination, a house heating furnace equipped with a gas burner and an oil burner, mechanism adapted to feed oil to the oil burner, a device permitting gas to flow to the gas burner as long as the gas is over a given pressure, means controlled by said device for setting said mechanism into operation to feed oil to the oil burner when the gas pressure falls below said given pressure, a thermostat subject to weather temperature, and means subject to the control of said thermostat adapted to set said mechanism into operation independently of said device when the weather temperature falls to a predetermined point.

14. In combination, a house heating furnace equipped with a gas burner and an oil burner, a supply main for supplying gas to the gas burner including gas pressure responsive means for limiting the amount of gas which can be withdrawn from the supply main during any given period of time, mechanism adapted to feed oil to the oil burner, a device responsive to the pressure of gas in the supply main, and means controlled by said device for setting said mechanism into operation to feed oil to the oil burner when the gas pressure in the supply main falls below a predetermined point.

15. The combination of means for supplying the fuel requirements of a househeating system, comprising a gas burning system and an oil burning system, means for cutting off the supply of gas when the pressure thereof falls to a predetermined low point, means controlled by said means for putting the oil burning system into operation, and means for putting the oil burning system into operation upon a fall in pressure of the gas supply which is not sufficient to operate the first mentioned means.

16. The combination of means for supplying the fuel requirements of a househeating system, comprising a gas burning system and an oil burning system, means for cutting off the supply of gas when the pressure thereof falls to a predetermined low point, means controlled by said means for putting the oil burning system into operation, means for putting the oil burning system into operation upon a fall in pressure of the gas supply which is not sufficient to operate the first mentioned means, and a weather controlled device for putting the oil burning

system into operation at a predetermined degree of out-door temperature irrespective of the pressure of the gas being supplied to the gas burning system.

17. The combination of means for supplying the fuel requirements of a house heating system comprising a normally functioning gas burning system and a normally non-functioning oil burning system, and means subject to the weather temperature for putting the oil burning system into operation at a predetermined weather temperature while the gas burning system is functioning.

18. The combination of means for supplying the fuel requirements of a house heating system comprising a normally functioning gas burning system and a normally non-functioning oil burning system, means subject to the weather temperature for putting the oil burning system into operation at a predetermined weather temperature while the gas burning system is functioning, and means under the control of the gas supply pressure for cutting out the gas burning system while the oil burning system is functioning and when the gas pressure falls to a predetermined low point.

19. A method of operating a househeating system using gas as the base fuel and adapted to use oil as a secondary fuel, comprising burning gas until the pressure of the gas supply falls below a predetermined point at which the gas supply is cut off, burning oil along with the gas immediately prior to the fall in the gas pressure to said predetermined point, and continuing to burn oil after said predetermined pressure has been reached.

20. A method of operating a househeating system using gas as the base fuel and adapted to use oil as a secondary fuel, comprising burning both gas and oil when the weather temperature is at a predetermined low point and discontinuing the burning of oil when the weather temperature rises above said predetermined point while still continuing to burn gas.

21. In a fluid fuel heating system, the combination of a gas burner, an oil burner, and means responsive to changes in the weather temperature adapted to place said oil burner in operation when the weather temperature drops below a predetermined low point.

22. In a fluid fuel heating system, the combination of means for burning gas, an oil burner, normally inoperative means for feeding fuel oil to the oil burner, a thermostat subject to weather temperature, a thermostat subject to indoor temperature, means under the control of the indoor thermostat adapted to cut off the flow of gas to the gas burning means when a predetermined temperature has been reached, and means under the control of the weather thermostat for making

ready the operation of means for feeding oil to the oil burner.

23. In a fluid fuel heating system, the combination of means for burning gas, an oil burner, normally inoperative means for feeding fuel oil to the oil burner, a thermostat subject to weather temperature, a thermostat subject to indoor temperature, means under the control of the indoor thermostat adapted to cut off the flow of gas to the gas burning means when a predetermined temperature has been reached, and means under the control of the weather thermostat for making ready the operation of means for feeding oil to the oil burner, the operation of said oil feeding means being under the final control of the indoor thermostat.

24. In a heating system, the combination of a normally functioning fuel burning device, a normally non-functioning fuel burning device, and means under the control of the weather temperature for putting said normally non-functioning fuel burning device into operation.

25. In a heating system, the combination of two fuel-burning devices, temperature controlled means for governing the operation of said devices, one of said devices normally functioning as long as a given maximum temperature has not been reached, and the other of said devices normally functioning as long as a temperature which is substantially below a given minimum temperature prevails.

26. In a heating system, the combination of two fuel-burning devices, and temperature operated means for controlling the operation of said devices, said means operating at a given temperature to put at least one of said devices into operation and operating at a lower temperature to put both of said devices into operation and operating at a given temperature higher than either of said temperatures to put such devices as are functioning out of operation.

27. A method of operating a house heating system provided with two fluid-fuel burning means comprising operating both of said means as long as a given low temperature prevails, discontinuing the operation of one of said means when a temperature higher than said given low temperature prevails, and discontinuing the operation of the going of said means when a predetermined temperature higher than either of said temperatures prevails.

28. The combination with a pair of fuel-burning devices, of means for supplying fuel thereto from a source of variable supply and means for shutting off one of said devices in accordance with the reduction in the supply of said fuel.

29. The combination with a furnace of means for supplying separate fuels thereto and mechanism responsive to the pressure

at which one of said fuels is supplied for controlling the supply of one of said fuels.

30. The combination with a steam generating boiler of means for supplying separate fuels thereto and pressure responsive mechanism independent of the pressure of steam generated for controlling the supply of one of said fuels.

31. The combination with a domestic heating system including a furnace and a gas burner and an oil burner in said furnace, of a mechanism adapted to feed oil to the oil burner, a device permitting gas to flow to the gas burner whenever the indoor temperature drops below a predetermined point, a thermostat responsive to changes in outdoor temperature, means controlled by said thermostat for setting said mechanism into operation to feed oil to the oil burner whenever the outdoor temperature falls below a predetermined point, a thermostat responsive to changes in indoor temperature, and means subject to the control of said thermostat adapted to throw said mechanism out of operation irrespective of the outdoor temperature whenever the indoor temperature exceeds a predetermined point.

32. The combination with a domestic heating system including a furnace and a gas burner and an oil burner in said furnace, of a mechanism adapted to feed oil to the oil burner, a main for supplying gas to the gas burner including a valve, a thermostat responsive to changes in indoor temperature, means controlled by said thermostat for opening the valve in said gas supply main to feed gas to the gas burner whenever the indoor temperature falls below a desired point, a thermostat responsive to changes in outdoor temperature, means controlled by said outdoor thermostat for setting said mechanism into operation to feed oil to the oil burner whenever the outdoor temperature falls below a predetermined point, and means subject to the control of said indoor thermostat adapted to cut off the flow of gas to the gas burner and to throw said mechanism out of operation whenever the indoor temperature rises much above said desired point.

In testimony whereof I affix my signature.

HENRY L. DOHERTY.

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