Nov. 20, 1934. E. J. TE PAS 1,981,479

OIL BURNER CONTROL

Filed April 15, 1929 3 Sheets-Sheet 1

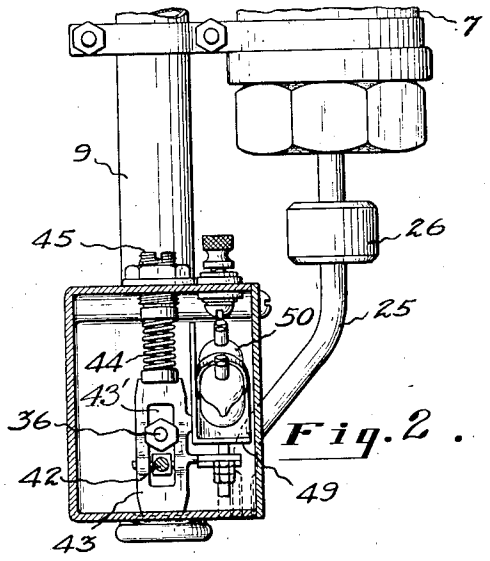
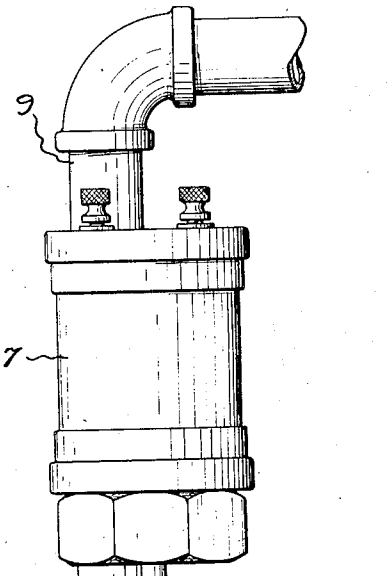


Fig. 2.



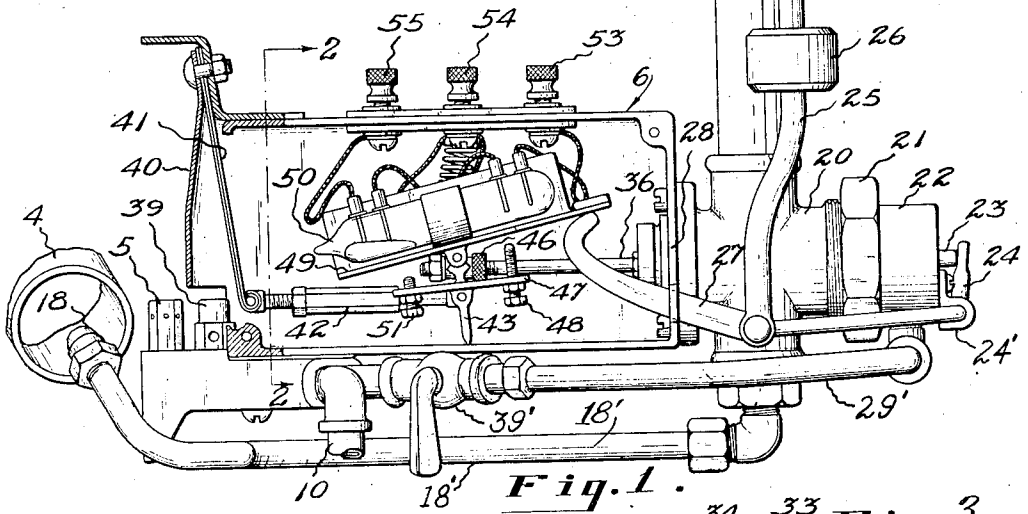


Fig. 1.

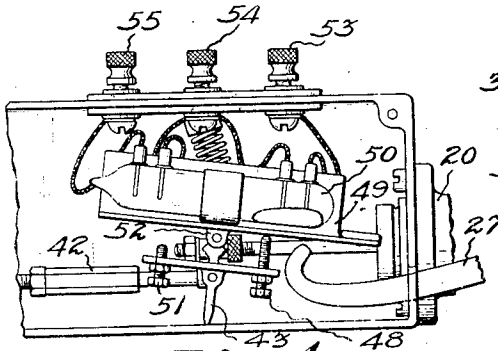


Fig. 4

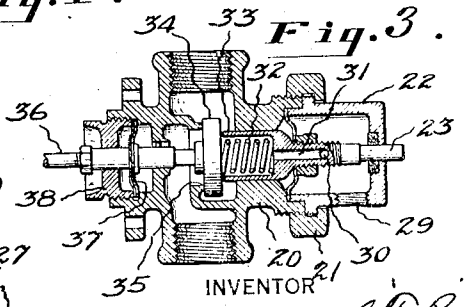


Fig. 3.

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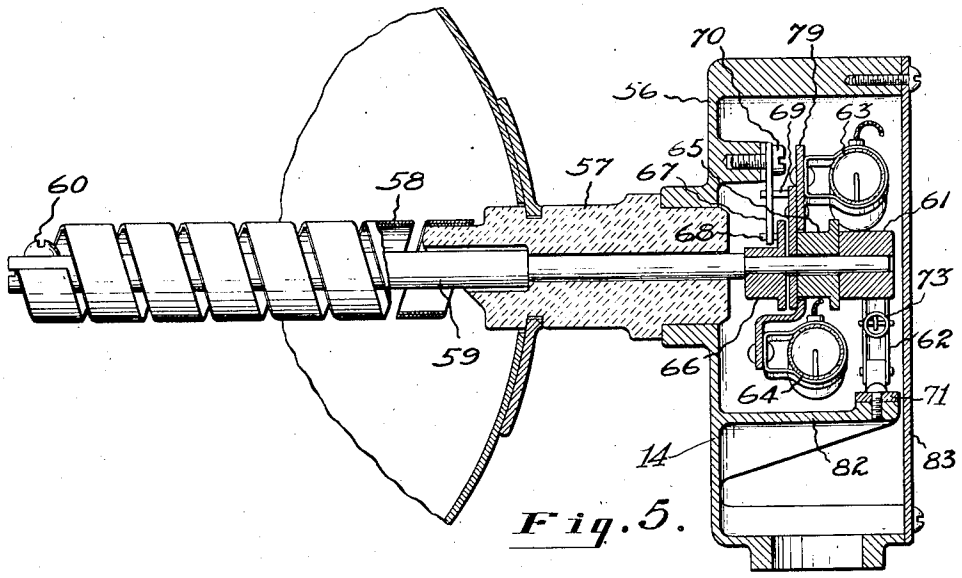


Fig. 5.

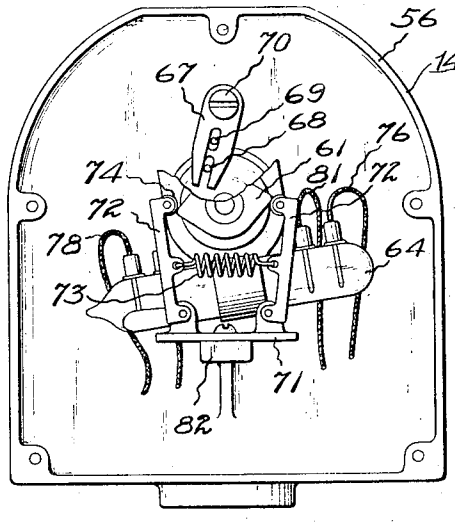


Fig. 7.

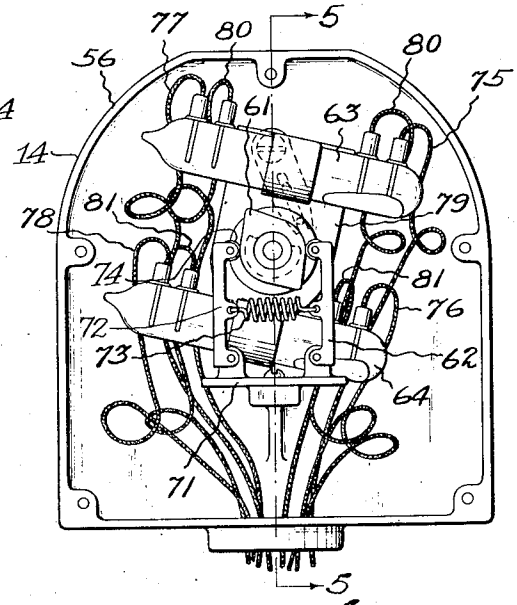


Fig. 6.

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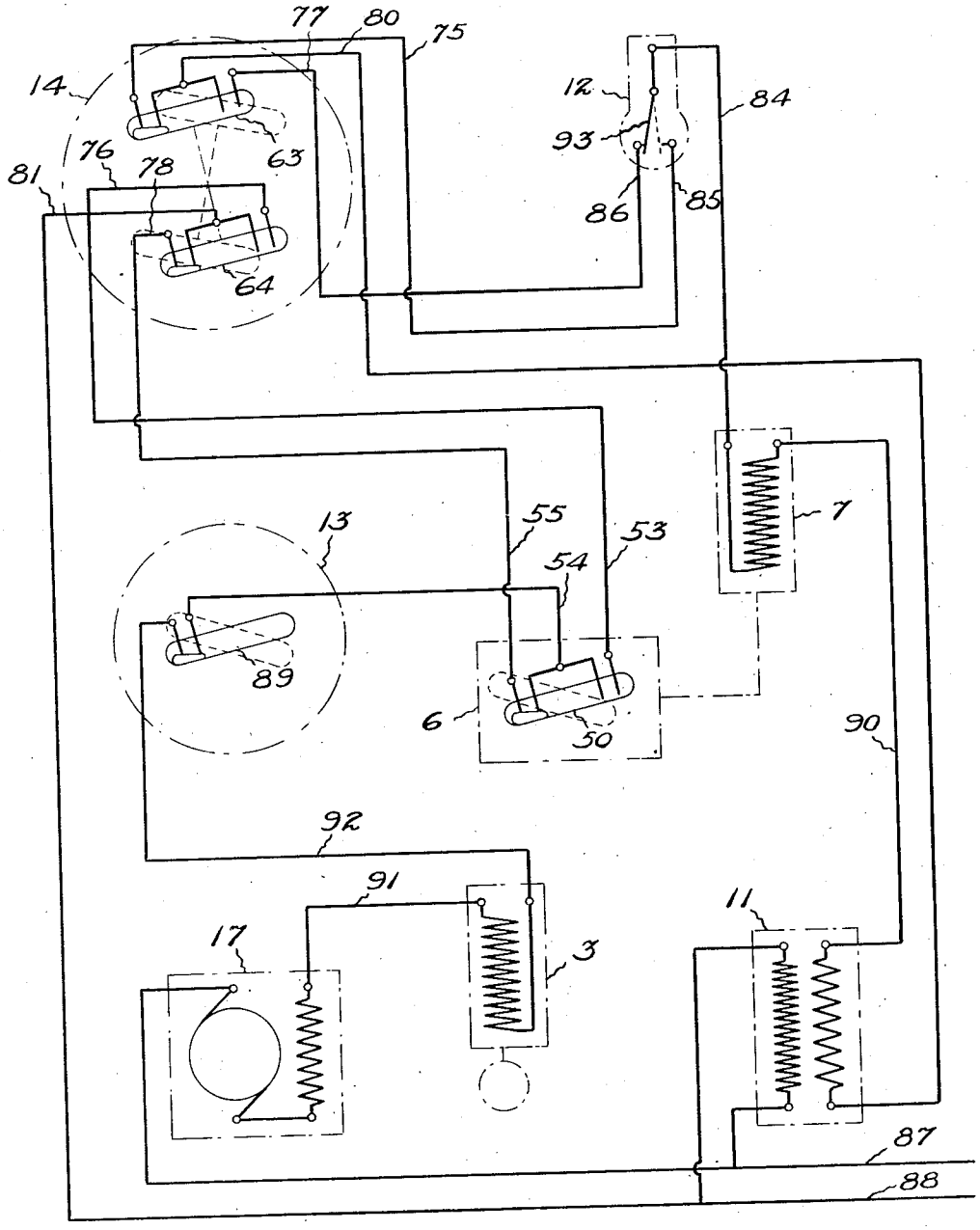


Fig. 8.

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UNITED STATES PATENT OFFICE

1,981,479

OIL BURNER CONTROL

Edmund J. Te Pas, Lakewood, Ohio, assignor to The Patrol Valve Company, Cleveland, Ohio, a corporation of Ohio

Application April 15, 1929, Serial No. 355,234

1 Claim. (Cl. 158—28)

This invention relates to oil burner controls and more particularly to the application to oil burners of safety controls of the type disclosed in my co-pending application Serial No. 271,802 which matured into Patent No. 1,842,331.

One of the principal objections to the use of oil burners is found in the possibility of explosions which are apt to occur in burners of this type, particularly when they are automatically controlled. Ordinances have been enacted in several districts of the United States to reduce some of the hazards attendant with the operation of oil burners. The most important of these legislative enactments is that which requires the use of a constantly burning gas pilot for the ignition of the oil burner.

A large number of automatically controlled oil burners are equipped with electric ignition in which an electric spark ignites either the oil, or an auxiliary gas flame, which in turn ignites the oil. It is apparent that in the event of failure of some of the electrical apparatus forming part of the ignition device the oil burner might be started and no means provided for its ignition.

This was one of the objections which the constantly burning gas pilot was supposed to overcome. The use of a gas pilot is not however entirely safe, as it is quite possible and frequently happens that the flame of the gas pilot becomes extinguished for various reasons, such as, drafty conditions in the appliance, changes in gas pressure or stoppage of the pilot regulating valve and for other causes.

One of the objects of this invention is to provide an oil burner control which uses an auxiliary and a constantly burning gas pilot burner for the ignition of the oil and which is inoperative in case of the extinguishment of the pilot burner.

Another object of this invention is to provide a safety control for oil burners which uses an auxiliary gas burner for the ignition of the oil burner.

Another object of this invention is to provide an oil burner ignition device which uses an enlarged gas flame for ignition of the oil that is automatically extinguished after the oil burner has been ignited.

Another object of this invention is to provide in an oil burner control a constantly burning pilot burner which is not affected by draft conditions within the appliance.

Another object of this invention is to provide an oil burner control that automatically re-cycles itself upon failure and resumption of the electric current supply.

Another object of this invention is to provide a gas pilot ignited oil burner in which the oil burner is inoperative in the event of either failure of the gas, oil or electrical supply.

Another object of this invention is to provide a control for oil burners in which the circuit to the oil burner motor is automatically opened upon failure of the oil supply.

Another object of this invention is to provide an improved electro-thermostatic gas valve and switch for the control and ignition of an oil burner.

Another object of my invention is to provide an improved thermostatic switch to control the operation of an auxiliary ignition gas burner and an oil burner.

A further object of this invention is to provide an oil burner control having an improved thermostatic switching mechanism under control of the oil burner and an associated thermostatic gas valve and switch to control the operation of the oil burner and the oil burner ignition means.

Stated in general terms my improved oil burner control consists of a suitable room thermostat or thermostatic switch that is connected in series with a low voltage circuit. The thermostatic switch controls a solenoid, the energizing current of which is under the further control of a second thermostatic switch that is directly responsive to the heat produced by the oil burner. The solenoid controls the operation of a thermostatic gas valve that directly controls an ignition flame for the oil burner. The oil burner motor is controlled in part by an electric switch associated with the thermostatic gas valve referred to above and by an independent thermostatic switch under direct control of the heat produced by the oil burner. An electric valve in series with the oil burner motor circuit controls the oil supply.

A gas pilot burner is positioned in front of and exteriorly of the appliance where it is accessible and where it is not affected by the draft conditions within the appliance. In the event of the extinguishment of the constantly burning gas pilot the system is inoperative and it is necessary to relight the pilot before either the ignition burner or the oil burner can be started. At the instant of starting of the oil burner a large gas flame is provided by an auxiliary gas burner to ignite the oil, insuring the quick and safe ignition of the oil burner without the danger of minor explosions which are apt to occur when a small pilot flame is used and which is apt to cause delayed ignition of the oil. Shortly after the ignition of the oil burner the heat of its flame

is utilized to cause the enlarged flame of the auxiliary gas burner to be extinguished.

If it should occur that the oil supply be interrupted the oil burner will be automatically stopped and then re-started. In the event of failure of the electrical supply for a short interval of time the oil burner is automatically stopped and upon resumption of the electrical current supply the ignition gas flame is started before the oil burner motor is brought into operation.

These and other objects and advantages will be made apparent in the following detailed description of the device and the scope of the invention will be particularly pointed out in the appended claim. Referring to the drawings forming a part of this specification:

Figure 1 is a front elevational view of the combined thermostatic valve and switch that forms a part of the oil burner control.

Figure 2 is a section taken on line 2—2 Figure 1.

Figure 3 is a section taken thru the center of the gas valve used in connection with the device shown in Figure 1.

Figure 4 is a side elevational view showing the switching mechanism in open valve position.

Figure 5 is a section taken on line 5—5 of Figure 6, showing the construction of the thermostatic switch that is used in the stack or flue of the appliance.

Figure 6 is a front elevational view of the thermostatic switch shown in section in Figure 5.

Figure 7 is a view similar to Figure 6 with the upper mercury switch removed to show the mechanical elements located behind the switch and also to show the switch in a position opposite to that of Figure 6.

Figure 8 is a wiring diagram of the electrical circuits of my improved control.

The general arrangement of the elements of my improved control are shown in their assembled relation in Figure 1, in which the numeral 1 represents a boiler. The general arrangement of the elements of my improved control will be understood from the wiring diagram Figure 8. An oil control valve 3 controls the supply of oil to the oil burner in the boiler, the oil being properly mixed and injected by the motor 17. A further solenoid 7 controls the gas valve. It will be seen that these solenoids are on separate circuits, one a high voltage circuit and the other a low voltage, the latter being stepped down from the former by means of the transformer 11. Four control switches are provided, all thermostatically operated, for producing the cycle of operation that will be disclosed hereafter. These switches include a gas valve switch 6, a room temperature switch 12, a stack temperature switch 14 and a boiler riser switch 13. The oil burner is ignited by means of an auxiliary blue flame gas burner, the air and gas mixing tube of which is indicated by 4. The ignition burner 4 is ignited by means of a constantly burning gas pilot burner 5 which is located in lighting proximity to the nozzle 18 of the burner 4.

The pilot burner 5 cooperates in the control and operation of a combined thermostatic gas valve and electric switch 6. This unit is under control of a suitable electric solenoid 7, which is in turn under control of a room thermostat or temperature responsive switch 12. The room thermostat circuit is a low voltage circuit, the higher voltage supply current being reduced by means of transformer 11.

A suitable thermostatic switching mechanism under control of the liquid being heated in the boiler is provided at 13. This device is located in the riser pipe of the boiler. A second thermostatic switch 14 is provided in the stack of the boiler. This latter device is under control of the temperature of the flue gases or heated products of combustion from the oil burner.

Considering the elements of the device just described there is an oil fired boiler which is adapted to maintain a constant temperature in the space in which the thermostat 12 is located. The thermostat 12 under certain pre-determined temperature conditions closes an electrical circuit energizing the solenoid 7. The operation of the solenoid 7 indirectly controls the auxiliary gas ignition burner 4 and the oil burner motor 17. The oil burner motor circuit is under control of two independent thermostatic switches, one of which 13, is under control of the water temperature of the boiler and the other of which 14, is under control of the temperature of the flue gases in the stack. The motor circuit is operated under the full line voltage of the source of electrical current supply.

The oil supply to the oil burner is under control of a suitable electric valve 3 that is connected in series in the circuit of the oil burner motor 17, so that the oil supply is automatically opened and closed as the oil burner is started or stopped. The construction and operation of these elements will be described in detail presently.

The nozzle of the oil burner is located relatively to the auxiliary gas ignition burner 4 so that the atomized oil and the ignition gas flame come into substantial confluence a short distance in front of the oil burner nozzle assuring a reliable and efficient ignition means for the oil burner. The gas supply for the ignition burner 4 is provided by way of the reducing nozzle 18 which is located adjacent to and in lighting proximity to the constantly burning gas pilot 5. The gas supply of the nozzle 18 is controlled by the thermostatic valve 6 that is located in the gas supply line 9.

The combined thermostatic switch and gas valve is shown in detail in Figures 1, 2, 3 and 4. This device is directly under control of the solenoid actuator 7 which consists of an energizing coil surrounding an armature connected to the rod 25. Certain of these parts are not illustrated in detail as their construction is well known. The rod 25 is provided with a weight 26 so that when the supply of electrical current to the solenoid 7 is interrupted the armature and the rod 25 will drop and assume the position shown in Figure 3.

The gas supply to the combined valve and switch 6 is by way of the conduit 9 that is in communication with the inlet opening of the valve body 20. The constantly burning pilot burner 5 is supplied with gas by way of a conduit 10 that is connected to the gas supply line 9 at a point ahead of the valve body 20.

The valve body 20 is provided with a cap or housing 22 which is connected to an extending portion of one side of the valve by means of the union nut 21. Within this housing is provided a sleeve valve consisting of a pin 23 which extends beyond the housing 22 and which at its opposite end is formed with a cylindrical sleeve that terminates in a valve seat 33. The interior of the sleeve is in communication with a passageway 31 which in turn communicates with the outlet ports 30 that lead to the space inclosed by the housing 22.

It is apparent from an examination of Figure

3 that when the valve seat or open end 33 of the sleeve valve is uncovered, a passage-way is provided for the gas from the supply line 9 by way of the bore 31 and ports 30 to the outlet opening 29 of the cap 22. Gas from the opening 29 is conducted to the burner 39 by way of the conduit 29'. A control valve 39' is provided in this conduit to regulate the maximum height of the flame at the burner 39.

Considering the elements just described it is apparent that when the solenoid 7 is energized by an electrical current its armature and associated rod 25 will be raised. The lower end of the rod 25 is pivotally connected to a crank 24 that is journaled in a bracket 24' carried on the end of the housing 22. With the preceding elements in their raised position one arm of the crank 24 is withdrawn from engagement with the pin 23. The sleeve valve 33, of which the pin 23 forms an integral part, is moved to its open position by the spring 32 the relatively light force of which ordinarily is not sufficient to overcome the force exerted by the thermostatic element 41.

When this action takes place, gas is supplied to the burner 39, by way of conduit 9, the passageway 31, ports 30 and 29 and the conduit 29'. Gas issuing from the burner 39 is ignited by the pilot burner 5 and provides a source of heat for a suitable bimetallic thermostatic strip 41 which is located adjacent to and above the burner 39. A shield 40 is provided to protect the strip 41 from the flame of the constantly burning pilot 5, and at the same time to confine the heating effect of the burner 39 to the strip 41.

The strip 41 warps upon heating and its free end shifts to the right as viewed in Figure 1. The free end of the strip is pivotally connected to an adjustable link 42 which is in turn pivotally connected to an oscillating lever 43. The lever 43 at its upper end engages a resilient lever 44. These two levers 43 and 44 when moved past the point where they are in alignment tend to assume an extreme position, either to one side or the other of their vertical position.

By this arrangement a simple and effective snap action is provided. When shifted to the right by the thermostatic strip 41, the levers 43 and 44 upon passing their dead center or aligned position shift with a snap action to their extreme right hand position under influence of the resilient member 44 and the tension which is built up in the strip 41 during the first half of this movement. The tension of the resilient member 44 may be regulated by means of an adjusting screw 45 when it is desired to change the operating characteristics of the device.

The lever 43 is provided with an aperture 43' which encompasses a spool 46. The spool 46 is adjustably carried on the rod 36 which terminates in a valve head 34. The valve head 34 cooperates with a valve seat 35 which is formed in the valve body 20 to control the gas supplied to the burner 4. Leakage of gas from the valve body 20 is prevented by means of a flexible diaphragm 37 carried by the valve stem 36 that is at its outer periphery secured to the valve body 20 by a bearing cap 38.

When the gas valve is opened by the thermostatic strip 41 the port 35 is uncovered, supplying gas to the nozzle 18 by way of the conduit 18'. Gas issuing from the nozzle 18 is ignited by the constantly burning pilot 5 and projects a long ignition flame into the combustion chamber of the boiler 1. This flame crosses the path of the atomized oil that is thrown from the nozzle 19 of the oil burner. It is to be noted that when gas is supplied to the ignition burner 4, the mercury switch 50 is tilted to the right as in Figure 4 closing the electrical circuit to the oil burner motor and the oil supply valve 3.

In the action just described a large gas flame is provided within the boiler by the burner 4, the oil supply is turned on by the valve 3, the motor is started by the tilting of the switch tube 50 and a mixture of atomized oil is thrown from the nozzle 19 into the flame of the gas burner 4. The oil is practically instantly ignited and the oil burner is now in operation. Upon the opening or uncovering of the gas port 35 of the valve body 20, the opening 33 of the sleeve valve is closed by the valve head 34 covering this opening cutting off the supply of gas to the burner 39.

Extinguishment of the burner 39 permits the thermostatic strip to cool and in a short time the valve head 34 is withdrawn from engagement with the opening 33 by reason of the shifting of the strip 41 and the action of the spring 32 which causes the valve head 34 to follow the movement of the strip 41. In this manner a regulated and a controlled gas flow is maintained to the burner 39 which causes this burner to supply just enough heat to maintain the valve head 34 and the switch 50 in the position shown by Figure 4 which they assumed upon shifting from the position shown in Figure 1.

The mercury tube switch 50 is clamped to a mounting 49 that is carried by a bracket 52 pivotally supported by the lever 43. The supporting device or mounting 49 is unbalanced and weighted on one end so that normally its right hand end as viewed in Figure 3, tends to drop down. The free movement of tube 50 and its carrier 49 with respect to the lever 43 is regulated by means of the adjusting screws 48 and 51 which are carried on a bracket 47 that is rigidly secured to the lever 43. The purpose of this arrangement is to permit the switch 50 to be automatically and independently shifted by either the thermostatic strip 41 and associated mechanism or by the lever 27 which is connected to the rod 25 that is under control of the solenoid 7. The lever 27 is slidably mounted in a suitable opening formed in the housing 28 and can only effect the operation of the switch 50 when it is tilted to the right as shown in Figure 6. The screws 48 and 51 are provided to facilitate the adjustment of the switch 50 and to compensate for changes made in the adjustment of the lever 43. Their function is merely that of limiting stops for the movement of the switch carrier 49 about its pivotal support 52.

The lead wires from the mercury switch tube 50 are connected to binding posts 53, 54, and 55 that are insulated from the switch and valve mechanism. A second and independent thermostatic switching mechanism 14 cooperating with the switch 50, is carried in the stack 15 that conducts the heated gases and products of combustion from the boiler. This latter device is provided with a helical coil 58 made up of thermostatic metal which may be similar to that used in the strip 41.

The coil 58 is rigidly secured at one end to the supporting member 57 and its other end is connected to the end of a rotatable rod 59 by means of a screw 60. The opposite end of the rod 59 is provided with a cam 61 that is rigidly and adjustably secured thereon. The cam 61 engages a pair of rollers 74 which are carried on the free ends of a pair of levers 72. The levers 72 are

connected to each other by means of a spring 73 and are pivotally mounted at their lower ends upon a supporting bracket 71.

By this arrangement rollers 74 are maintained in engagement with the cam 61 and upon the counterclockwise turning of this cam from the position shown in Figure 8 the levers 72 are spread apart and when their rollers 74 ride beyond the high points of the cam, the motion of the cam is thereby accelerated. The purpose of the cam and associated mechanism is to provide a snap action for the shifting of the mercury switch tubes 63 and 64.

The tubes 63 and 64 are carried upon a bracket 79 that is in turn carried by a member 65 rotatably mounted upon the rod 59. The snap action movement of the rod 59 and cam 61 is transmitted to the switch tubes 63 and 64 by means of shifting member 66 that is rigidly secured to the rod 59. This member 66 is provided with a pin 68 which engages a slot in the link 67. The link 67 is rotatably carried by the screw 70 which is received in the housing 56 of the thermostatic switch 14.

The link 67 is slotted for reception of a second pin 69 that is rigidly secured to the switch carrier 79. By this arrangement of the aforesaid parts when the rod 59 turns in either one direction or the other its movement is transmitted to the switches 63 and 64 by means of the pins 68 and 69 and the link 67. In this manner the switches can be swung to the positions shown in Figures 6 and 7 with a snap action.

This shifting of the switches is accomplished by the heating of the helical strip 58. When the strip 58 is in a relatively cold condition, as for example 200° F. or less the switch tubes will be in a position shown in Figure 6. Upon starting of the oil burner, the heated products of combustion cause the coil 58 to unwind and in doing so rotate the rod 59 in a counter-clockwise direction. When the high points of the cam 61 have engaged the rollers 74 the switching mechanism is shifted to the position shown in Figure 7. This changes the electrical circuits controlled by the switches. The function of the switches 63 and 64 will be described presently in connection with the explanation of the electrical circuit.

Referring to the wiring diagram, Figure 8, it is to be noted that there are two separate electrical circuits used in this control. One of these circuits will hereinafter be called the high voltage circuit. The high voltage circuit may be 110 volts or whatever voltage is provided at the supply line from the power plant. The high voltage circuit comprising the lines 87, 88, 91, 92, 53, 54, 55, 76, 78 and 81 is used to operate the motor 17 of the oil burner, and the solenoid valve 3 of the oil supply line and is connected in series with the thermostatic switches 14, 13 and 50 located in the stack and the riser of the boiler, and in the combined thermostatic gas valve 6.

The line voltage of the electric current when 110 volts is used is reduced by means of a transformer 11, to from 12 to 15 volts. The low voltage circuit indicated by the lines 90, 80, 75, 77, 84, 85, and 86 includes the thermostatic switch 14 in the stack of the boiler, the room thermostat 12 and the solenoid 7 which operates the switch and valve 6. The feed wires of the electrical supply system are indicated by wires 87 and 88. The transformer 11 is connected across this circuit.

The low voltage lines leading from the transformer are indicated by the lead wires 90 and 80. The lead wire 90 is connected in series to the coil of the solenoid 7, from the solenoid 7 a wire 84 connects with the room thermostat 12. Wire 84 is connected to the thermostatic element 93 of the room thermostat 12 and is adapted to complete a circuit with the lead wire 85 or the wire 86 depending upon the temperature of the thermostatic element 93 and the setting of the room thermostat 12.

The full line position of the several switches indicated in Figure 8 illustrates their normal position when the oil burner is in operation and the thermostat 12 is calling for more heat. When the room thermostat 12 has reached the predetermined temperature for which it is set, the element 93 shifts, closing a circuit between the wires 84 and 85 and when the thermostat is below the temperature for which it is set the circuit is by way of the wires 84 and 86. The wires 85 and 86 are connected to the lead wires 75 and 77 respectively of the mercury tube switch 63. The switch tubes 63, 64 and 50 are provided with 4 leads wires each, the inner lead wires of which are connected to each other as illustrated providing a three wire outlet from the switches.

When the temperature of the room reaches the desired point the thermostatic strip 93 of the room thermostat 12 completes or closes a circuit between the wires 84 and 85. The solenoid 7 is then energized, the lever 25 is lifted and a supply of gas is admitted to the burner 39 in the manner previously described. Heat from the burner 39 acting on the strip 41 causes the shifting of the thermostatic switch 50 to the dotted line position of Figure 8 and the opening of the gas valve controlling the burner 4.

Upon the shifting of the switch 50 the electrical circuit of the oil burner motor 17 and its oil supply valve 3 is disconnected whereupon the oil supply is cut off and the oil burner motor is stopped. The control elements remain in this position until the thermostatic element 58 of the thermostat 14, which is responsive to the heat of the flue gases has cooled sufficiently to cause this device to shift the switch tubes 63 and 64 to the position illustrated by the dotted lines Figure 8.

Upon the shifting of these tubes the low voltage circuit is broken and the armature and associated parts of the solenoid 7 assume the position shown in Figure 1, tipping the tube 50 preventing the motor circuit from being closed due to the shifting of the switch 64. When the solenoid 7 is deenergized, the crank 24 engages the pin 23 closing the gas supply to the burner 39 and the ignition burner 4 and shifting the operating parts of the mechanism to the position shown in Figure 1. The device is now in the "off" position and will remain so until the room thermostat 12 has become sufficiently cooled to close the circuit between the wires 84 and 86.

Referring now to the low voltage circuit, assuming that the room thermostat 12 has cooled sufficiently so that contact will be made as indicated by the full line position of 93 and a circuit completed between the lead wires 84 and 86. The low voltage current from the transformer 11 then passes thru the solenoid 7 and the room thermostat 12 by way of the lead wires 84 and 86 and then through the thermostatic switch tube 63 by way of the lead wires 77 and 80. At the time of this operation the thermostatic switch 14 is in an un-heated condition occupying the dotted line position and indicating that the oil burner is not in operation.

The closing of the low voltage circuit energizes the solenoid 7 causing the lifting of its armature

and the attached weight 26 and the rod 25. Upon raising of these elements the lever 27 is raised and the crank arm 24 is moved out of contact with the pin 23. Disengagement of the pin 23 permits a supply of gas to be admitted to the burner 39 in the manner previously described. This gas is then ignited from the pilot 5. The thermostatic strip 41 is then heated and after a short interval of time opens the valve controlling the gas supply to the auxiliary burner 4 and at the same time tips switch 50, placing the oil burner motor in operation. The oil from the burner is thrown in the path of the flame from the gas burner 4 and is thereby ignited.

The electrical circuit thru the oil burner motor is now by way of the main feed wires 87 and 88 thru the oil burner motor 17 and thence by way of lead wire 91 to the solenoid oil valve 3. From the oil valve 3 the electrical current is conducted by way of the wire 92 thru the closed thermostatic switch 89 which is located in the riser of the boiler and thence thru the lead wires 54 and 53 which are connected in the right hand side of the switch tube 50. The lead wire 53 from the switch 50 is connected to the right hand side of the switch 64 by the lead wires 76 and 81; the wire 81 being connected to the feed wire 88.

In this manner the circuit is closed and the oil burner motor is placed in operation. After the oil burner has been in operation for a short time the thermostatic switch that is located in the stack 15 of the boiler becomes heated, and in a short time the switch tubes 63 and 64 are shifted to the full line position shown in Figure 8. This shifting of switches 64 and 63 opens the low voltage circuit de-energizing the solenoid 7 allowing the armature of this solenoid and the associated elements to assume the position shown in Figure 1.

It will be noted that at the instant the low voltage circuit is opened the thermostatic switch 50 is tipped to the position shown in Figure 1 by means of the rocking lever 27 that is connected to the rod 25 of the solenoid 7. The high voltage circuit thru the oil burner motor was momentarily disconnected. This interruption of the oil burner circuit is however of very short duration and not sufficiently long to permit the oil burner motor to stop turning or to permit its flame to become extinguished. With the elements in this position the oil burner motor circuit is now by way of the lead wire 55 instead of 53.

Upon the de-energizing of the solenoid 7, the lever 24 engages the pin 23 urging the open end of the sleeve valve which forms a part of this pin to engage the valve head 34. This cuts off the supply of gas to the burner 39 and causes the thermostatic strip 41 to cool. Ordinarily the strip 41, when this operation takes place, is not urging the valve head 34 to its open position very strongly and the weight of the armature of the solenoid, as well as the weight 26 in rod 25 are sufficiently great to shift the valve head 34 to its closed position or the position shown in Figure 3.

This operation however is not necessary for with the parts in the position just stated, extinguishment of the burner 39 causes the strip 41 to cool and in this manner shift the operating parts of the valve to the position shown in Figures 1 and 3. The boiler and its control are now in the "on" or operating position and the ignition burner 4 is extinguished. This condition will be maintained as long as the temperature surrounding the room thermostat 12 does not exceed the temperature for which it is set

One of the important features of this control is that the constantly burning pilot light is located in front of and outside of the boiler in a very accessible position. It may be easily lighted and regulated, and is not subject to the draft conditions within the boiler.

By use of an auxiliary gas burner such as 4, to light the oil burner it is possible to provide a very large flame for this purpose as this flame operates only a few minutes at a time and does not use any great quantity of gas in fact with the combination of these two burners the gas consumption is actually less than it would be if a single constantly burning pilot burner was used to ignite the oil burner, for in the latter case it would be necessary to maintain a much larger flame when the pilot is used to ignite the oil burner.

Failure of the electrical current is not apt to cause a hazardous condition to arise, as the operating elements of the device in a very short interval of time would assume their "off" position and it would be then necessary to go thru the starting cycle of operations before the oil burner could be again started. Where such electrical current supply interruption is but momentary, the heated interior of the appliance will ordinarily ignite the oil burner upon its re-starting and in the event that such ignition does not take place, the stack thermostat will in a very short time open the motor circuit and thus stop the operation of the oil burner.

Momentary failure of the oil supply, sufficient to cause extinguishment of the oil burner, can not lead to hazardous condition with my improved control as the stack thermostat will quickly cool and open the oil burner motor circuit in the event that the heated interior of the appliance does not practically immediately re-ignite the oil burner.

Failure of the gas supply or extinguishment of the pilot burner when the oil burner is not operating renders the appliance wholly inoperative as the presence of the pilot flame is necessary for most of the steps of the operation of my improved control.

The thermostat 13 is provided as an added safety feature, and upon failure of the appliance to shut off at the proper time for any reason, overheating of the boiler will cause the switch tube 89 to assume the dotted line position of Figure 8 opening the motor circuit.

If a vapor or steam boiler is used the thermostat 13 can be replaced by a pressure actuated switch and the control will operate in the same manner as before except that pressure instead of temperature is used to actuate the switch 13.

The same elements I have shown could be readily applied to a hot air furnace using an oil burner. The only change necessary would be that of locating the thermostat 13 in one of the hot air ducts leading from the furnace.

My improved control is susceptible to various other uses and can be applied to a variety of heating appliances other than the type I have shown.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claim.

I claim:—

In a control system for electrically operated oil burners for steam, vapor and hot water heating appliances, in combination, sources of oil and gas supply, a high voltage circuit including in series connection an electric motor, an electric fuel oil valve, an electric switch responsive to the physical conditions of the water in the appliance, an electric switch mechanism responsive to the temperature of the flue gases of the appliance, and a gas flame actuated thermostatic switch mechanism, and a low voltage circuit including in series connection a remote thermostatic switch mechanism responsive to the heat generated by the appliance, a second thermostatic switch mechanism responsive to the heat of the flue gases of the appliance, an electric gas valve, a gas burner under control of said remote switch mechanism, said recond thermostatic switch mechanism and said gas valve providing a source of energy for the operation of said flame actuated thermostatic switch mechanism for controlling the operation of said oil burner.

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