

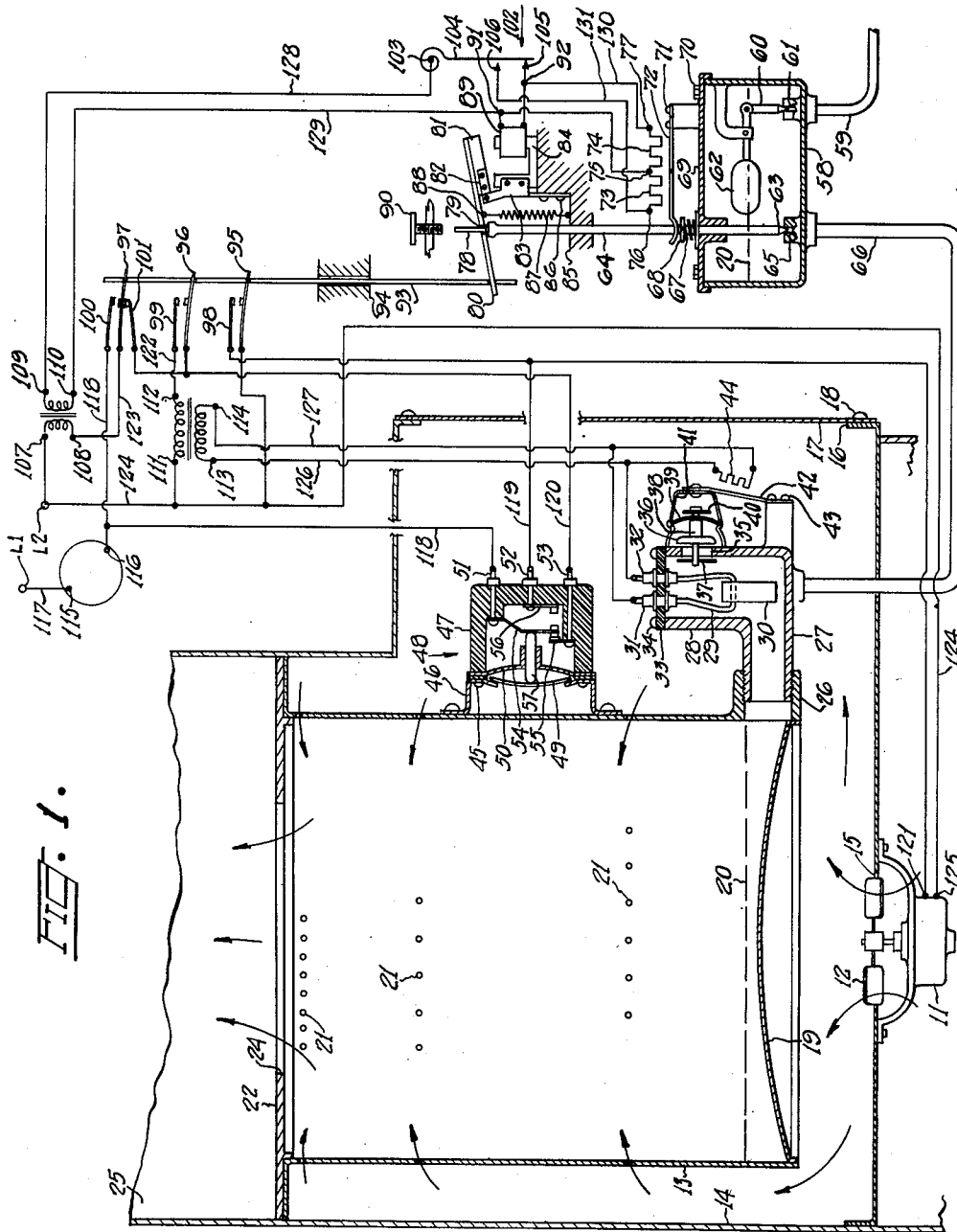
June 2, 1953

A. L. JUDSON
CONTROL FOR VAPORIZING OIL BURNERS
WITH ELECTRIC IGNITION

2,640,648

Filed Oct. 16, 1950

3 Sheets-Sheet 1



INVENTOR
ALBERT L. JUDSON

BY *E. B. Birkenbeul*

ATTORNEY

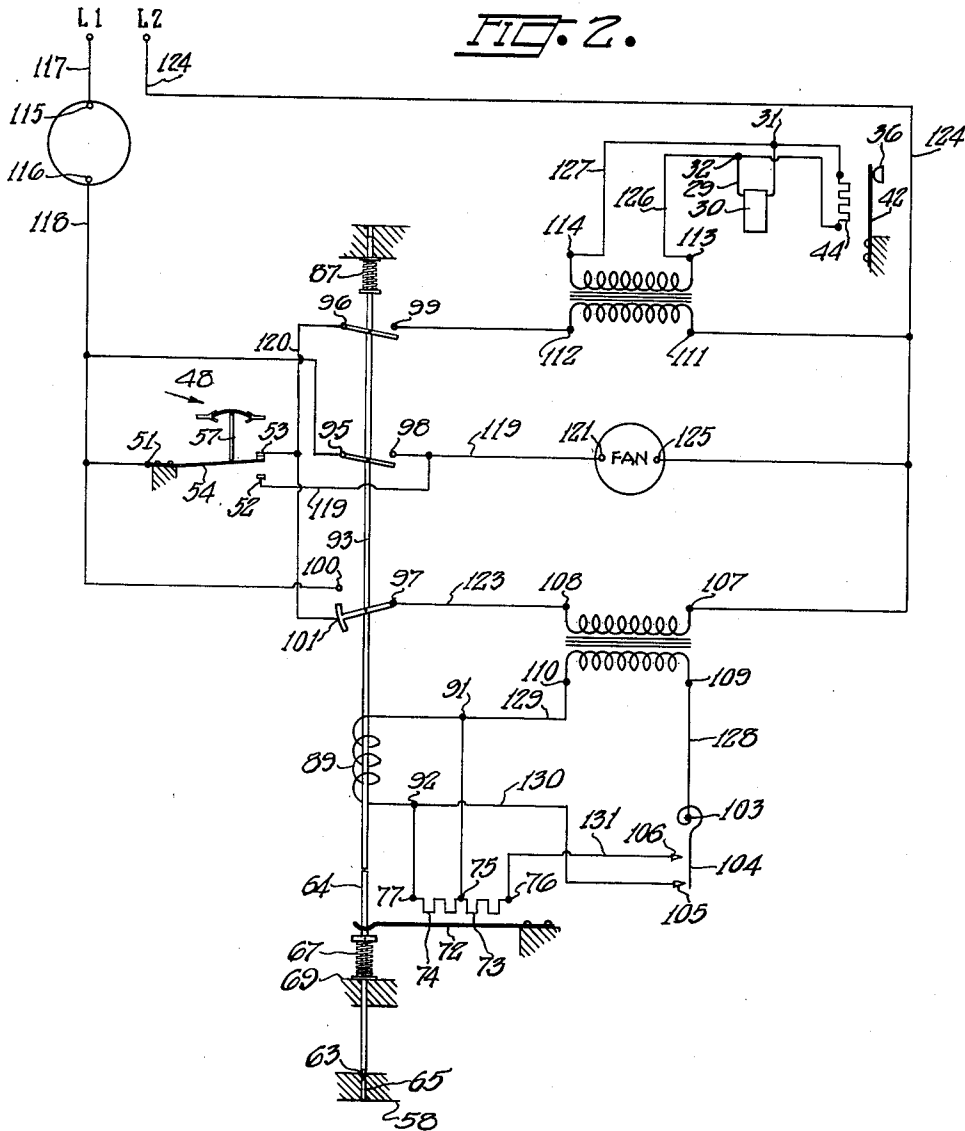
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FIG. 3.

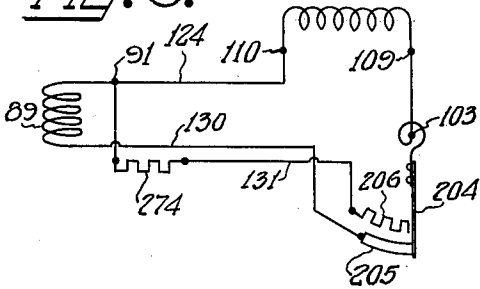


FIG. 4.

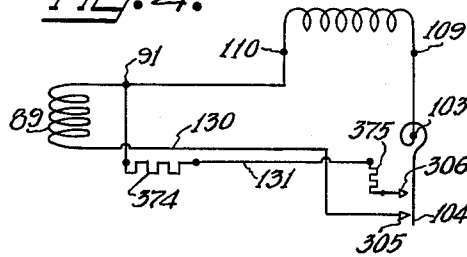
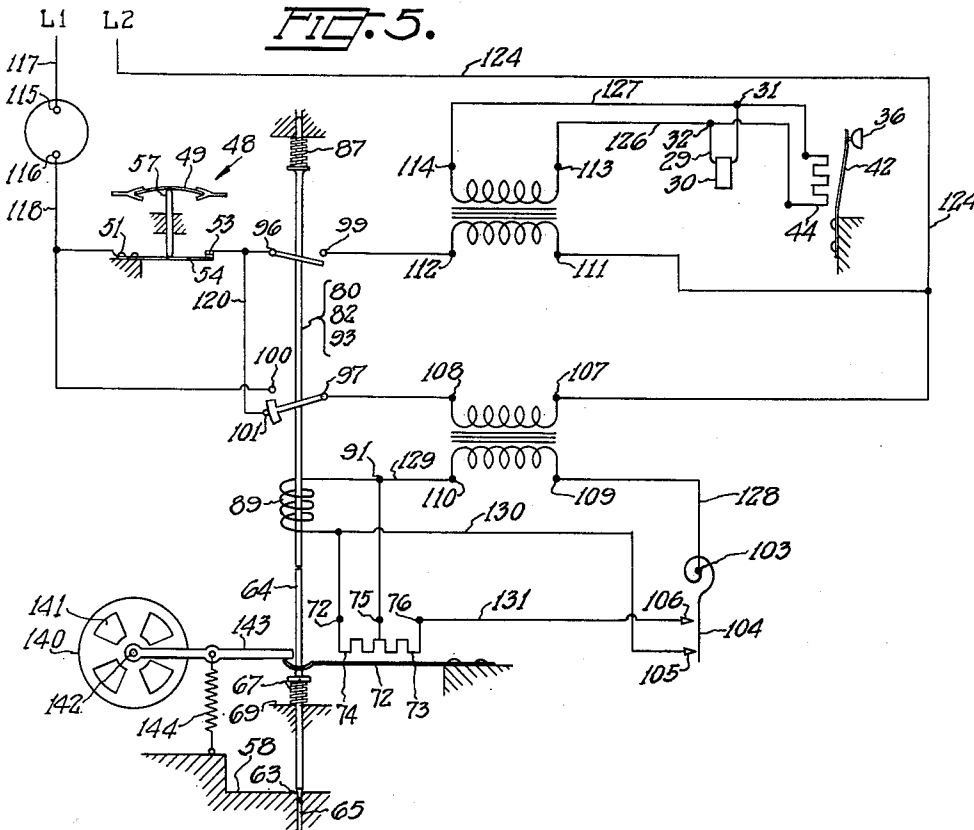


FIG. 5.



INVENTOR
ALBERT L. JUDSON

BY *E. B. Buehner*

ATTORNEY

UNITED STATES PATENT OFFICE

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CONTROL FOR VAPORIZING OIL BURNERS
WITH ELECTRIC IGNITIONAlbert L. Judson, Portland, Oreg., assignor to Iron
Fireman Manufacturing Company, Portland,
Oreg.

Application October 16, 1950, Serial No. 190,316

10 Claims. (Cl. 236—1)

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My present invention comprises the addition of an automatic electric control circuit and mechanism to the "Combination Oil Burner Inlet and Igniter" of my patent application S. N. 174,265 filed July 17, 1950. My application S. N. 174,265 discloses a combination oil inlet and igniter applied to a vaporizing oil burner of the type comprising a combustion receptacle in which oil is progressively evaporated for continuous combustion by the heat of combustion and to which combustion air is progressively supplied to complete the combustion of the oil. In substance the oil inlet and igniter combination of that application comprises a separate, small, intermittently operated, electrically ignited oil burner which produces an ignition flame outside the main burner simultaneously with the introduction of oil into the main burner and injects into the main burner at starting an ignition flame. My present invention comprises, in combination therewith, means for safely controlling the operation of the ignition oil burner together with the control of the supply of oil and air to the main burner, all in response to the requirements for heat as relayed to the control by a condition responsive instrument such as a space thermostat.

It is the principal object of my invention to provide a vaporizing oil burner system which can be automatically operated and controlled by a condition responsive instrument and which will neither be required to be manually ignited nor required to maintain a pilot flame when there is no call for heat.

It is a second object of my invention to supply my system with a safety means adapted to test the main burner for the successful completion of the ignition function and to shut off the igniter when ignition is complete.

It is a third object of my invention to start instantaneously a limited flow of oil to the main burner and the ignition burner on a call for heat and then to gradually increase the rate of oil flow to the main burner as ignition is established.

It is a fourth object of my invention to prevent the attempted ignition of the burner while the temperature of the main burner combustion receptacle is above a predetermined temperature.

It is a fifth object of my invention to assure a supply of combustion air to the main and ignition burners whenever a cycle of operation is started in response to the condition responsive control.

It is a sixth object of my invention to maintain the supply of combustion air in effective coopera-

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tion with the combustion receptacle of the main burner after the call for heat has been satisfied and until the combustion receptacle temperature has been reduced to a pre-determined safe starting value.

It is a seventh object of my invention to stop the supply of oil instantaneously to the burner when the call for heat has been satisfied.

It is an eighth object of my invention to provide means for modulating over an effective range of supply of oil to the burner in response to the heat requirements of the heating load.

It is a ninth object of my invention to provide a simplified operating system where all of the above objects are not necessary of attainment.

It is a tenth object of my invention to provide means for programming the supply of combustion air to the ignition burner in accordance with the operating characteristics of the burner.

How these and other objects are attained will be apparent on reference to the following description referring to the attached drawings in which:

Fig. 1 is a schematic drawing of the mechanism and circuit of my more complete invention.

Fig. 2 is a simplified schematic drawing of the circuit of Fig. 1.

Figs. 3 and 4 are variations of the condition responsive circuit of Figs. 1 and 2.

Fig. 5 is a schematic representation of a simplified form of my invention.

In the figures like reference characters refer to like parts.

Referring now to the drawings there is shown an electric motor 11 driving a fan 12 adapted to deliver atmospheric air for combustion from the outside to the inside of a plenum chamber formed between a main oil burner oil vaporizing or combustion receptacle 13 and an outer enclosure 14 having an air entrance hole 15 in its bottom and an inspection hole 16 at one side closed by a cover 17 secured to enclosure 14 by screws 18. Receptacle 13 has an upwardly curved bottom member 19 for reducing the supply of oil it can hold below a given oil level 20 as well as to control the vaporizing oil. Holes 21 for the injection of combustion air into receptacle 13 are of such size and arrangement as are found best adapted to the duties of the particular design of burner. Cast iron top member 22 rests on the horizontal top flange of receptacle 13 and is for the purpose of forming the reduced diameter flame outlet 24 for receptacle 13. Shown broken off is the upwardly extending combustion chamber 25 of the heat exchanger to which the burner is attached in use. Arrows show the path of the

combustion air into receptacle 13 and the discharge of flame and products of combustion therefrom.

Threaded into half coupling 26 welded to receptacle 13 is ignition oil burner body 27 which together with the upwardly extending walls 28 form a well for the electric igniter comprising a nickel chromium resistance wire 29 and a capillary wick 30. The ends of wire 29 are crimped into terminal fittings 31 and 32 secured into insulating cover 33 sealed by screws 34 to the top of walls 28 of body 27. An air port 35 formed in wall 28 is selectively closed by valve disk 36 having valve stem 38 extending rearwardly through port 35 and having pin 37 through the end thereof to limit the forward motion of valve disk 36. The forward extending end of stem 38 is shouldered as shown and has its reduced end section headed to confine strut spring 39 and disk 40 loosely thereon. The ends of strut spring 39 are confined in recesses formed in the legs of U-shaped leaf spring 41, as shown. The base of U spring 41 is riveted to bimetal blade 42 which in turn is secured to the body 27 by screws 43. Electric resistance type heater 44 is insulatedly carried on bimetal 42. The details of the foregoing parts are perhaps more clearly shown in my prior application above noted. The position of valve 36 shown in the drawing is slightly away from port 35 as would be the case when bimetal 42 is at room temperature and the ends of the U spring 41 rest against wall 28. As heater 44 is energized bimetal 42 flexes in a clockwise direction carrying the valve mechanism with it until pin 37 strikes the inside of wall 28 and stops the opening motion of disk 36. As blade 42 continues to flex, strut spring 39 is held and forced over center, giving disk 36 a sudden movement towards port 35 but disk 36 is prevented from closing port 35 by the action of disk 40, the periphery of which limits the possible amount of rearward flexure of strut spring 39. It is seen therefore that all the time blade 42 is flexing in a clockwise direction, valve disk 36 is away from port 35 and the port is open to the passage of air. But due to pin 37 and the cocking action of spring 39, disk 36 is never far away from port 35 so that whenever blade 42 starts to cool and flex in a counterclockwise direction, disk 36 will close port 35 almost immediately. As blade 42 continues to cool, the shoulder on stem 38 presses on spring 39 and forces it over center in the forward direction thus again opening port 35 to the passage of air. Further cooling of blade 42 causes the legs of U spring 41 to again come to rest against wall 28 as shown. It is seen that throughout this heating and cooling cycle of blade 42, port 35 is always open except for an interval after blade 42 starts to cool.

Secured by screws 45 to supporting legs 46 welded to receptacle 13 is insulating body 47 of temperature responsive single pole, double throw, snap acting, switch 48, whose dished bimetal actuator 49 is loosely confined at its periphery between the extended flanges of legs 46 and guide member 50 secured by screws 45. Secured to insulating body 47 by terminal screws 51, 52, and 53, respectively, are switch blade 54, cold contact 55, and hot contact 56, blade 54 being resilient and biased to contact with cold contact 55, and to cause insulating operating stem 57 loosely guided in member 50 to follow but not crowd bimetal disk 49. When the receptacle 13 attains a predetermined temperature, disk 49 goes forwardly over center with a snap action and, through stem

57, causes blade 54 to leave contact 55 and suddenly contact contact 56. On cooling, the reverse action takes place.

A continuous supply of burner oil is available by gravity feed to constant level oil container 58 through supply pipe 59 and port 61 controlled as shown schematically by needle valve 60 actuated by float 62 to maintain the oil level 20 in container 58. Needle valve 63 on stem 64 cooperates with port 65 to control the supply of oil from container 58 through pipe 66 to the main burner receptacle 13 through ignition burner body 27. Stem 64 is biased upwardly by coil spring 67 confined between disk 68 secured to stem 64 and cover 69 secured by screws 70 to container 58. Secured to cover 69 by screws 71 is bimetal blade 72, the bifurcated end of which straddles stem 64 in position to restrain the upward movement of stem 64 under the bias of spring 67. It should be noted that with valve 63 closing port 65 as shown with blade 72 at room temperature, there is some pre-determined clearance between the bifurcated end of blade 72 and the upper side of disk 68 so that stem 64 could move upwardly and allow oil to flow into receptacle 13 at a low rate when the upward movement of stem 64 is limited by blade 72 in its cold condition.

Resistance heaters 73 and 74 having a common terminal 75 and other terminals respectively 76 and 77 are insulatedly carried on blade 72.

Stem 64 is shouldered at its upper end and its reduced end 78 passes loosely through a hole 79 in bar 80 smaller than the main diameter of stem 64. Bar 80 is secured to armature 81 carried on hinge leaf 82 hinged as shown to hinge bracket 83, which also secures the electromagnetic core 84 in position on frame 85 by screws 86. Spring 87 strained between frame 85 and hook 88 secured to bar 80 biases armature 81 and bar 80 in a counterclockwise direction and by causing bar 80 to rest on the shoulder of stem 64 overcomes the upward bias of spring 67 and maintains valve 63 closed on its port 65. Operating coil 89 on one leg of core 84 will, when energized, attract armature 81 causing bar 80 to rotate in a clockwise direction overcoming the bias of spring 87 and allows stem 64 to move upwardly under the urge of spring 67 and restraint of blade 72 to a limit position preset by adjusting screw 90. Coil 89 has terminals 91 and 92. Switch operating member 93 of insulating material is guided in a frame member at 94 and is linked with bar 80 to be moved upwardly and downwardly thereby and take with it resilient switch blades 95, 96 and 97. In the downward position of member 93, blades 95, 96, and 97 are respectively separated from stationary contact blades 98, 99, and 100, while in the upward position of member 93, blades 95, 96, and 97 are respectively in contact with blades 98, 99, and 100. Also in the downward position of blade 97 it is in contact with blade 101. Blades 97, 100, and 101 form what is known as an overlapping switch since blade 97 in its mid-position contacts both blades 100 and 101.

At 102 is shown a condition responsive control such as a space thermostat having a stationary terminal 103, a blade 104, a first stationary contact 105 and a second stationary contact 106.

A control transformer is shown to have primary terminals 107 and 108 and secondary terminals 109 and 110. An ignition transformer is shown to have primary terminals 111 and 112 and secondary terminals 113 and 114. A limit

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control is shown to have terminals 115 and 116, although the use of such an instrument is optional. The electric supply line terminals are shown as L1 and L2.

As shown, electric wire 117 connects terminals L1 and 115. Wire 118 connects blades 100 and 95 with terminals 116 and 51. Wire 119 connects terminal 52 to blade 98 and terminal 121 of the fan motor. Wire 120 connects terminal 53 with blades 96, and 101. Wire 122 connects blade 99 with terminal 112 of the ignition transformer. Wire 123 connects blade 97 with terminal 108 of the control transformer. Wire 124 connects line terminal L2 to control transformer terminal 107, to ignition transformer terminal 111 and to fan motor terminal 125. Low voltage wires 126 and 127, respectively, connect ignition transformer secondary terminals 113 and 114 to igniter resistor terminals 32 and 31 and to the terminals of heater 44. Low voltage wire 128 connects control transformer secondary terminal 109 to thermostat blade terminal 103. Low voltage wire 129 connects control transformer secondary terminal 110 to relay coil terminal 91 and heater terminal 75. Wire 130 connects thermostat stationary contact 105 to heater terminal 77 and relay coil contact 92. Wire 131 connects thermostat stationary contact 106 to heater terminal 76.

The operation of the form of my invention shown schematically in Fig. 1 and in simplified circuit arrangement in Fig. 2, is as follows—In the drawings the parts are shown at room temperature when there is no call for heat. Now assume that the temperature of the room lowers and thermostat blade 104 moves to the left and contacts stationary contact 105. Control transformer primary is already energized from L1 and L2 through wire 117, the limit control, wire 118, blade 54 and contact 53 of snap switch 48, wire 120, overlapping switch blades 101 and 97, wire 123 and wire 124. The relay coil 89 is then energized from the control transformer secondary through wire 129, thermostat contact 105, blade 104, and wire 128. The relay armature 82 closes on core 84, rotates bar 80 clockwise and throws switch operating member 93 upward closing switch blade 95 on blade 98, blade 96 on blade 99 and transferring contact of switch blade 97 from blade 101 to blade 100. At the same time the downward bias of spring 87 on valve stem 64 is overcome by the relay and spring 67 raises valve 63 from port 65 until further movement is restrained by blade 72 which then gradually begins to rise due to the increasing influence of heater 74 energized when relay coil 89 was energized. The lifting of valve 63 starts oil to flow through pipe 66 into ignition burner body 27 where it contacts wick 30 on its way to burner receptacle 13.

When blade 95 contacts blade 98 the fan motor is energized from L1 and L2 through wire 117, the limit control, wire 118, switch blades 95, 98 and wires 119 and 124.

When switch blade 96 contacts blade 99 the primary of the ignition transformer is energized from L1. L2 through wire 117, the limit control, wire 118, blade 54 and contact 55 of switch 48, wire 120, blades 96, 99, and wire 122 and 124. The ignition transformer secondary circuit being always continuous from terminals 113 and 114 through wires 126 and 127 and heater 44 in parallel with igniter wire 29, igniter wire 29 immediately starts to heat up and vaporize and ignite the vapor of part of the oil wicked up by

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wick 30, the oil vapor being mixed within the igniter well walls 28 with combustion air urged through air port 35 by fan 12 as indicated by the arrows in Fig. 1. At the same time heater 44 is influencing blade 42 to hold air valve 36 open and cock spring 39 for quick closure as previously explained.

As the ignition flame grows it gradually extends out into receptacle 13 over the oil entering receptacle 13 through body 27 and combustion of the oil which has flowed into receptacle 13 is accelerated to the point where the temperature of receptacle 13 has increased sufficiently to influence bimetal disk 49 of switch 48 to snap to the right and transfer contact of blade 54 from contact 55 to contact 56 (or from terminal 53 to terminal 52). When this occurs wire 118 is disconnected from wire 120 and the primary winding of the ignition transformer is no longer energized from L1 and L2. Igniter wire 29 cools and heater 44 cools allowing blade 42 to cause air valve 36 to move towards wall 28 and close off the supply of air to the ignition burner for a long enough time to snuff out the ignition flame and then to reopen to allow purging air to flow through the ignition burner as long as the fan is in operation. The mechanism of the operator for air valve 36 has been explained above.

Also when switch 48 is actuated by the heat of receptacle 13, blade 54 closes on contact 56 and wire 118 is connected to wire 119 setting up a holding circuit for the fan motor around switch blades 95, 98 thus assuring the continued operation of the fan until receptacle 13 has cooled sufficiently to allow switch 48 to snap back to its room temperature position shown. The thermostat is still calling for heat, the main burner has been ignited and is burning oil at the maximum rate allowed by blade 72 as heated by heater 74. Should this amount of heat be insufficient to prevent the room temperature from dropping further, thermostat blade 104 restrained by contact 105 will bow over against contact 106 thus energizing heater 73 and causing blade 72 to allow valve 63 to open valve port 65 to supply oil to receptacle 13 at a higher maximum rate. Assuming that burning at this new rate the burner causes the room temperature to rise then thermostat blade 104 will straighten away from contact 106 and the oil flow will be lowered. Should the room heat requirement be between the two maximum oil rates set by heater 74 or by heater 74 plus heater 73, thermostat blade 104 will follow the room temperature and move repeatedly into and out of contact with contact 106 and maintain the average oil flow rate required. Should the oil flow rate set by heater 74 alone be too great to satisfy the heat requirements of the room, then the room temperature will rise sufficiently to move thermostat blade 104 away from contact 105 and both heater 74 and relay coil 89 will be deenergized allowing spring 87 to return all parts except switch 48 to the position shown in Fig. 1. Valve 63 will shut off all oil from the burner but fan 12 will continue to run until all oil has been burned from receptacle 13 and switch 48 snaps to its cold position. It should be noted that after the thermostat and relay have shut down the burner, neither the primary coil of the control transformer nor the primary coil of the ignition transformer can again be energized until switch 48 returns to its cold position, but that when switch 48 returns to its cold position a

new start and cycle of burner operation can be initiated by the thermostat.

In Figures 3 and 4 are shown alternate methods of modulating the control of the heat supplied by the oil burner as governed by the rate of oil flow to the burner as limited by the position of bimetal blade 72 as influenced by the heaters shown in Figs. 1 and 2 as 73 and 74.

In Fig. 3 the thermostat is modified so that the blade 204 is not itself influenced by heat but is positioned by the bimetallic spiral which supports blade 204 from fixed terminal 103. Contact 205 is a conducting plate over which blade 204 may slide in contact therewith and contact 206 is a resistor over which blade 204 may slide in contact therewith and thereby change the resistance of the circuit of heater 274. The operation of this form of modulating control circuit is apparent in that as the room temperature falls, blade 204 contacts with plate 205 and resistor 206 and energizes relay coil 89 and heater 274 from transformer secondary terminals 109, 110. This starts the burner with a low maximum size fire but if the temperature of the room continues to fall, blade 204 will move in a clockwise direction and cut out resistance from resistor 206 thus increasing the current and consequent heat supplied by heater 274 and increasing the oil supply to the burner by the influence of heater 274 on bimetal blade 72 of the oil control mechanism. It is understood that the thermostat bimetal spiral is sufficiently isolated from heater 206 as not to be largely affected thereby.

In Fig. 4 the thermostat is generally similar to the thermostat of Figs. 1 and 2 but has a thermostat heater 375 added into the circuit between heater 374 and contact 306. The resistance of heater 375 is small relative to heater 374. In this case when the temperature of the air surrounding the thermostat cools below the set temperature, blade 104 contacts with contact 305 and starts the burner on low fire. If this fire is not sufficient to raise the temperature of the room, the blade 104 tries to continue in a clockwise direction but is restrained by contact 305 and bows to the left until it makes contact with 306, thus energizing heater 374 and increasing the oil supply to the burner as previously explained. As blade 104 continues in contact with 306, the oil supply will be increased to the maximum capacity of the furnace unless the heat supplied by the furnace becomes sufficient to start the thermostat moving towards its open position. To give better operation and prevent overshooting of the heat supply, the heater 375 adds a small amount of heat to the thermostat and causes blade 104 to leave contact 306 before it otherwise would. It is thus seen that as long as any heat is required from the furnace, blade 104 will remain in contact with 305 and keep the burner in operation, but by repeatedly contacting with 306 blade 104 causes the oil supply to be modulated to the needs of the heating loads.

Other arrangements for modulating the oil supply to the burner in accordance with the requirements are possible but the examples shown are sufficient to illustrate the methods used. The simplest type of operation, and in many cases the best, would be with a plain on and off control using a single contact thermostat like the one shown in Figs. 1 and 2 would be with contact 106 eliminated and with wire 131 and heater 73 also eliminated from the system. Then the resistance of heater 74 would be such that when up to temperature the oil supply would be at the

maximum rate required for the load at any time.

In Fig. 5 is shown a somewhat simplified form of my invention to be used with a natural draft rather than with a forced draft type of burner. In other words, Fig. 5 is substantially Fig. 2 with the combustion air fan motor and its associated circuits and circuit elements eliminated and with a mechanically operated modulating damper added to control the combustion air supplied by natural draft conditions. Such a damper is not always desirable or used with natural draft burners since in many cases in small furnace installations the advantages of securing complete and sootless combustion is of greater economic value than attaining a greater theoretical combustion efficiency as determined by CO₂ readings and temperature readings of the flue gases.

In Fig. 5 it is seen that from Fig. 2 there has been eliminated hot contact 52 of switch 48, wires 119, fan motor 121, 125, and fan switch 95, 98. Also it is noted that as an optional structure there has been added the damper disk 140 with air openings 141 and rotatably secured to pin 142 fastened to arm 143 biased in a clockwise direction by spring 144 and movable in a counter-clockwise direction against the bias of spring 144 by bimetal blade 72 under the influence of heaters 73 and 74. The construction and mounting and related parts of a damper disk such as 140 is well known in the art. Except for the elimination of the fan motor and its associated circuits and circuit elements the operation of the system shown in Fig. 5 is readily understood from the above explanation of the operation of the system of Figs. 1 and 2.

Having thus completely disclosed two desirable forms of the apparatus of my invention and described four forms of the condition responsive circuit thereof and completely explained the operation thereof, I claim—

1. A control system for vaporizing oil burner of the type comprising a combustion receptacle in which oil is progressively evaporated for continuous combustion by the heat of said combustion and to which air is progressively supplied to complete said combustion, said system comprising; electric means for igniting said oil in said receptacle; an oil valve adapted to control the flow of oil to said receptacle; a first means biasing said valve to its closed position; a heat responsive means adapted on a call for heat to instantly render said biasing means ineffective; a second means biasing said valve towards its open position; a bimetal restraining means in initial spaced relation to said second biasing means, means including said second biasing means effective when said heat responsive means responds to a call for heat to quickly open said valve a limited amount determined by said bimetal restraining means, and means including an electric heater for said bimetal restraining means energized upon said call for heat to decrease the restraining action of said bimetal restraining means to allow said valve to be gradually opened to a pre-set full open position by said second biasing means; means cooperating with said condition responsive means to initiate the operation of said ignition means; a cold-closed temperature responsive means associated with said receptacle; means adapting said temperature responsive means to terminate the operation of said ignition means; and means operatively associated with said temperature responsive means and said condition responsive means to render said condition responsive means ineffective.

tive to initiate the operation of said ignition means and to render said first biasing means ineffective when said receptacle is above a pre-determined temperature.

2. The system of claim 1 including a fan adapted to supply combustion air to said burner, a motor for driving said fan, means cooperating with said motor and said heat responsive means to cause said fan to deliver air to said receptacle whenever said heat responsive means is maintaining said first biasing means ineffective, and means adapted to prevent said heat responsive means for interrupting the operation of said fan when said receptacle is above a pre-determined temperature.

3. The system of claim 1 including means for varying the rate of supply of combustion air supply to said receptacle and means coupling said last named means to said oil valve to increase the air supplied to said receptacle as the oil supply to said receptacle is increased.

4. The system of claim 1 including additional means adapted to vary the opening of said valve in response to said condition, said additional means including circuit means and means included in said heat responsive means and said electric heater for said bimetal means to increase the current supplied to said electric heater to increase the opening of said oil valve as required by said heat responsive means.

5. A control system for a vaporizing oil burner of the type comprising a combustion receptacle in which oil is progressively evaporated for continuous combustion by the heat of said combustion and to which air is progressively supplied to complete said combustion, said system comprising: electric ignition means for initiating the ignition of said oil in said receptacle; means adapted to control the flow of oil to said receptacle; a first means biasing said oil flow controlling means to its no flow position; a condition responsive means adapted on a call for heat suddenly to render said biasing means ineffective; a second means biasing said oil flow controlling means to its full flow position; a bimetal means adapted when cold to limit the initial opening of said oil flow controlling means by said second biasing means when said first biasing means is ineffective; an electric heater for said bimetal means; means cooperating with said condition responsive means on a call for heat to energize said electric heater and thereby gradually to increase the limit of opening of said oil flow controlling means by said second biasing means; means cooperating with said condition responsive means on a call for heat to energize said electric ignition means; a cold closed temperature responsive switch means associated with said receptacle; means adapting said temperature responsive means to terminate the operation of said electric ignition means; and means operatively associated with said temperature responsive means and said condition responsive means to render said condition responsive means ineffective to initiate the operation of said electric ignition means and ineffective to render said first biasing means ineffective; whereby on each call for heat by said condition responsive means when said temperature responsive means is in its cold position said electric ignition means will be energized, said first biasing means will be rendered ineffective, said valve suddenly will be opened by said second biasing means to a low limit of oil flow set by said bimetal means, and said oil flow will be increased gradually to a preset high limit; and whereby on each call for heat by said condi-

tion responsive means when said temperature responsive means is in its hot position the actuation of said electric ignition means and the rendering ineffective of said first biasing means and the heating of said bimetal will be delayed until said temperature responsive means returns to its cold position.

6. A control system for a vaporizing oil burner of the type comprising a combustion receptacle in which oil is progressively evaporated for continuous combustion by the heat of said combustion and to which air is progressively supplied to complete said combustion, said system comprising: means for controlling the flow of oil to said receptacle; means to ignite said oil in said receptacle; means for suddenly operating said controlling means to stop the flow of oil to said receptacle; means for suddenly operating said controlling means to start the flow of oil to said receptacle at a limited rate; means for gradually increasing the limit of said rate of oil flow to said receptacle; a heat responsive means adapted on a call for heat to actuate said oil flow starting means, said ignition means and said limit increasing means; said flow stopping means being operatively associated with said heat responsive means and adapted to operate when said call for heat is satisfied; and a temperature responsive means adapted to delay the effectivity of said heat responsive means to start said oil flow and ignite said oil until the temperature of said receptacle is reduced to a safe pre-set value.

7. A control system for a vaporizing oil burner of the type comprising a combustion receptacle in which oil progressively is evaporated for continuous combustion by the heat of said combustion and to which air progressively is supplied to complete said combustion, said system comprising: a source of power; a cold closed space thermostat switch; a cold closed combustion thermostat switch adjacent said receptacle; an oil valve adapted to control the rate of oil flow to said receptacle; means biasing said valve towards its open position; a bimetal means adapted when cold to limit the opening of said valve to a pre-set low rate of oil flow therethrough; a circuit including said power source and an electric heater adapted to be energized on the closure of said space thermostat switch and heat said bimetal means gradually to open said valve to a higher rate of oil flow therethrough; an electric igniter adapted when energized to initiate the ignition of said oil in said pot; a normally open switch; a circuit including said power source and an electrically operated relay adapted to be energized on closure of said space thermostat switch; said relay being adapted, when de-energized, instantaneously to close said oil valve; said relay being adapted when energized to close said normally open switch; said igniter, said normally open switch and said combustion thermostat switch being connected in series with said power source, whereby when said normally open switch and said combustion thermostat switch are closed said igniter will be energized and when said combustion thermostat switch is opened under the influence of oil combustion in said receptacle said igniter will be de-energized.

8. The control system of claim 7 including a single pole double throw switch; one throw of said switch being normally open and the other throw of said switch being normally closed and both throws of said switch being closed during the operation of switching from one throw to the

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other; said relay being adapted to close said normally open throw of said double throw switch and to open said normally closed throw of said double throw switch when said relay is energized on closure of said space thermostat switch; said normally closed throw of said double throw switch and said cold closed combustion thermostat switch being in a first series circuit with said power source and being adapted to permit the energization of said relay and said bimetal heater through said space thermostat switch when all three are closed; said normally open throw of said double throw switch being in parallel with said first series circuit to form a second series circuit with said power source to maintain said relay and said bimetal heater energized when said combustion thermostat switch opens on a rise in temperature of said receptacle while said space thermostat switch is closed; and said combustion thermostat switch being adapted to prevent the energization of said relay and said bimetal heater from said power source when said space thermostat switch closes and said combustion thermostat switch is open.

9. The control system of claim 7 including a damper means adapted to control the air supply to said receptacle, and means operatively coupling said damper means with said oil valve, whereby

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as said oil valve is opened by said relay and said bimetal means said damper will be positioned to cause the air supply to said receptacle to increase as the oil supplied to said receptacle is increased.

10. The control system of claim 7, including a fan adapted when driven to supply air to said burner; a motor for driving said fan; a hot closed temperature responsive switch adjacent said receptacle; a second normally open switch connected in parallel with said hot closed switch and adapted to be closed by said relay when said relay is energized; and circuit means adapted to energize said motor from said power source through said normally open switch when said relay is energized and to maintain said motor energized when said hot closed switch is closed and said relay is de-energized.

ALBERT L. JUDSON.

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