

April 26, 1927.

1,625,796

F. S. DENISON

IGNITION CONTROLLING MEANS

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2 Sheets-Sheet 1

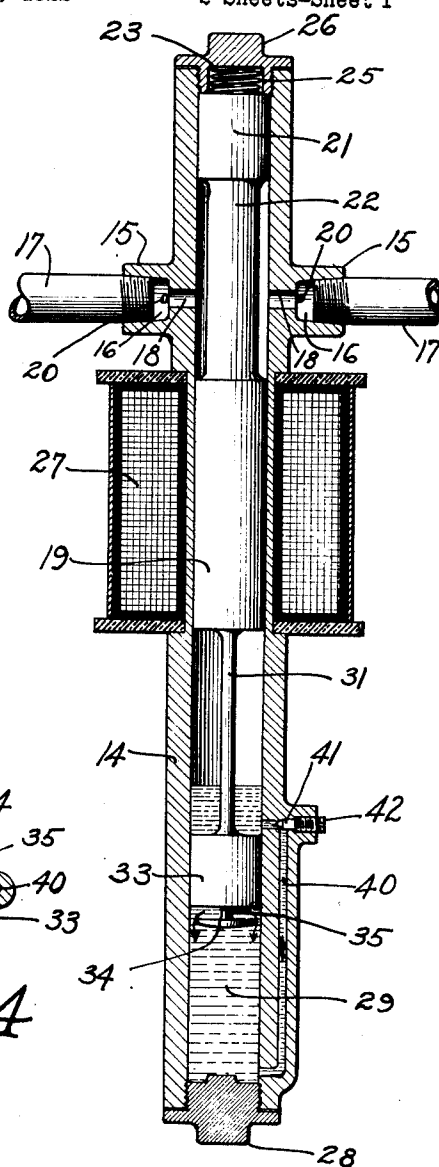
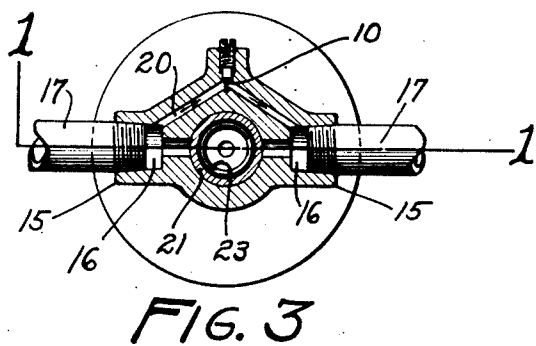
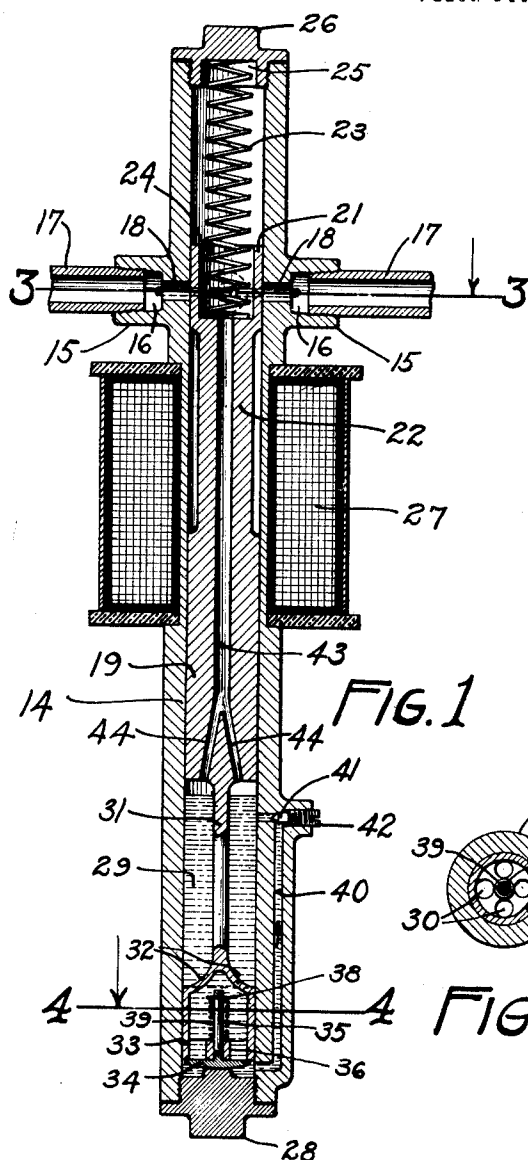


FIG. 2

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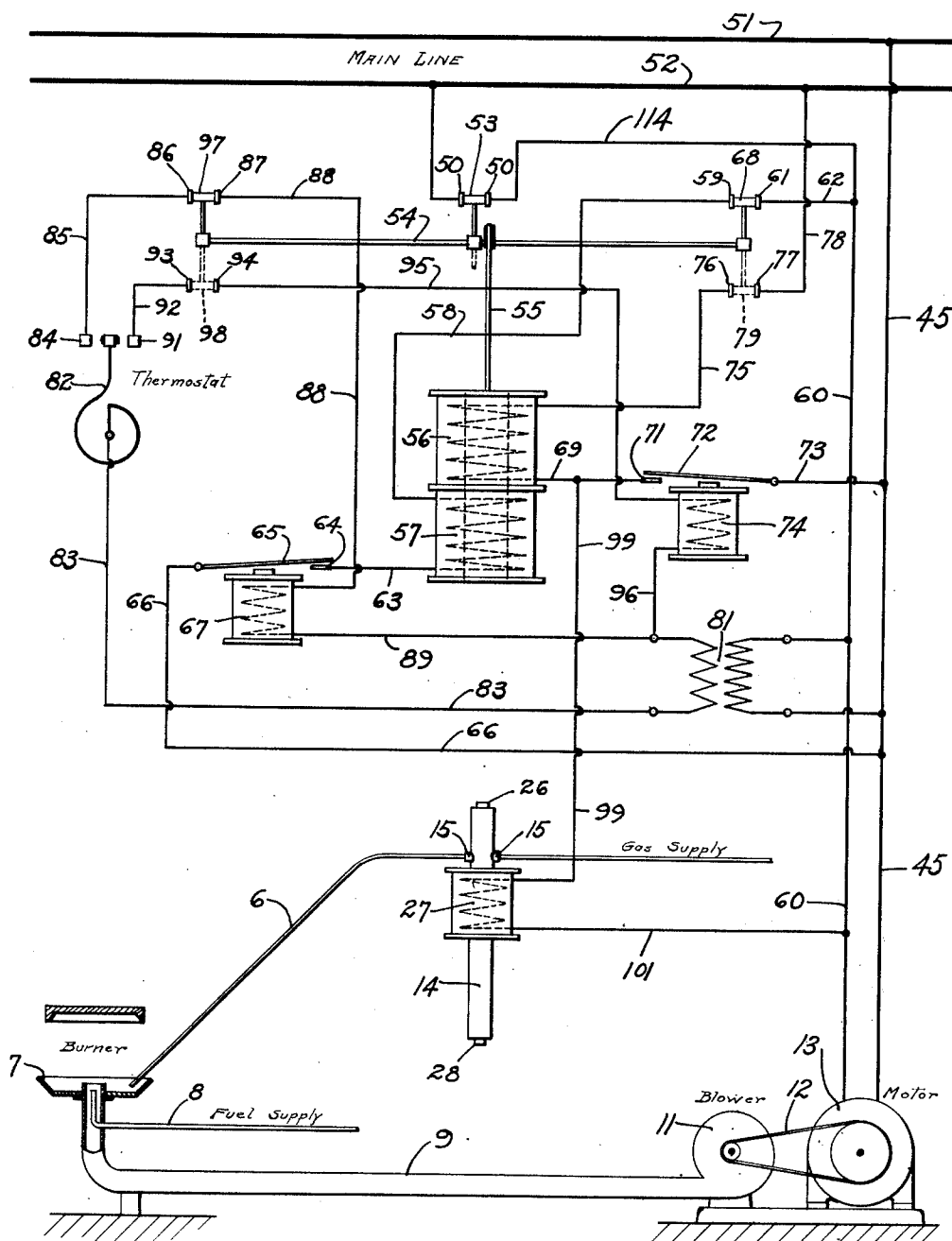
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2 Sheets-Sheet 2



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FIG. 5

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UNITED STATES PATENT OFFICE.

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IGNITION-CONTROLLING MEANS.

Application filed December 8, 1922. Serial No. 605,736.

This invention relates to improvements in means for the control of ignition such, for example, as that provided by a pilot flame of a combustible gas. Such control is particularly useful in conjunction with heating plants of the oil-burning type now in common use in the heating of buildings. It is old in such installations to employ a pilot flame of gas furnished from the usual commercial city mains or otherwise, such flame being adapted to ignite the vaporized fuel when a supply thereof is turned on. In the employment of such a pilot flame it is highly advantageous to provide means for enlarging the flame at least temporarily. Such pilot flame is particularly desirable in connection with such liquid fuel burning apparatus employing a blower for the vaporization of the liquid fuel. The pilot flame should preferably be kept continuously burning during the season of use of this heating apparatus and hence, to save gas, the pilot flame should normally be relatively small. It is therefore desirable, when the vaporized fuel is to be ignited, that the pilot flame be enlarged not only to assure ignition of the vaporized fuel, but also, when used with blower apparatus, to overcome the tendency of the relatively small pilot flame to be blown out by the blast of air from the blower before the vaporized fuel has been ignited. Preferably, too, this enlarged pilot flame should be returned to the previous diminished state after ignition of the vaporized fuel in order to prevent waste of the relatively more expensive gas. In this novel invention, means are provided to enlarge the pilot flame for a predetermined interval and thereafter to effect the return of the pilot flame to its previous diminished state. Furthermore, this novel device is particularly adapted for use in combination with liquid fuel burning apparatus employing a motor blower to vaporize the fuel.

In the selected embodiment of this invention here disclosed for purpose of explanation of the invention, the flame-enlarging means is electrically operated and its energizing circuit may be connected to the motor circuit for energization simultaneously therewith, so that the flame may be enlarged when the blower motor is started.

The object therefore of this invention is

to provide an improved ignition-controlling means.

Other objects of the invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the drawings, there has been disclosed a structure designed to carry out the objects of the invention but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a longitudinal sectional view of the solenoid-controlling device for the pilot flame valve, the view being taken on the line 1—1 of Figure 3;

Figure 2 is a view somewhat similar to Figure 1 but showing the valve as nearly completing its valve-opening movement;

Figure 3 is a cross-sectional view on the line 3—3 of Figure 1;

Figure 4 is a cross-sectional view on the line 4—4 of Figure 1; and

Figure 5 is a wiring diagram showing the controlling means adapted for operation in combination with a thermostatically controlled heating plant.

This present selected embodiment of the invention is shown in conjunction with a thermostatically controlled heating plant. The novel features of such an indicated installation (with the exception of the present ignition control) form the subject-matter of a prior co-pending application by the inventor hereof Serial No. 580,360, filed August 7, 1922.

Broadly, this invention is directed to the employment of means for automatically enlarging a pilot flame and of means for diminishing the enlarged flame after a predetermined interval. The operation of such means is preferably electrical in nature in order to lend itself readily for use in combination with an electrically controlled liquid fuel burning apparatus, as for example of a type which is in turn thermostatically controlled. As here shown a valve is interposed in the gas supply pipe of the pilot flame with a by-pass around the valve to supply a relatively small amount of gas sufficient to maintain the normal small flame. Thus, opening of the valve increases

the supply of gas to the flame with consequent enlargement thereof while subsequent closure of the valve returns the flame to its normal small size.

5 The construction of the novel device may be first described and thereafter its use in conjunction with an electrically controlled liquid fuel burning apparatus.

10 The means for furnishing a supply of combustible gas may be by way of a gas supply pipe 6 leading from a city main, or other usual source of supply not necessary to be shown, and terminating at the burner pan 7 of a liquid fuel burner apparatus. Of such an apparatus, there is here diagrammatically shown, a liquid fuel supply pipe 8 connected to a source and terminating upwardly within the end of the blower pipe 9 through which air is forced by the blower 11 driven by the belt 12 from the electric motor 13. The vaporization of the liquid fuel by the forced air is well-known in this art. The pan end of the gas pipe 6 is adapted to discharge normally, during the seasonal run of the apparatus, a relatively small amount of combustible gas which is ignited to form the normal, small pilot flame. It is this small pilot flame which it is desirable to enlarge when the blower is started and thus to assure the successful ignition of the vaporized fuel and to prevent the relatively small flame from being blown out.

35 A valve mechanism is interposed in the gas supply pipe so that flow through the valved passage may be permitted and stopped, a small flow of gas being by-passed around the valve to assure a constant supply for the small pilot flame.

40 The preferred form of valve mechanism comprises an elongated, substantially cylindrical housing 14 having opposed bosses 15 having recesses 16 to receive in threaded engagement the opposite end portions 17 of the gas pipe 6. Each boss has a port 18 by means of which gas may enter within the cylindrical housing and may pass therefrom to the pilot flame. The inside of the housing is hollow and has slidably mounted therein a plunger 19 effecting a close sliding fit with the inner annular walls thereof. The upper end portion of the plunger provides a valve 21 adapted to close the inlet and outlet ports 18 thereby to prevent passage of gas to the pilot flame. Adjacent this valve end of the plunger is a reduced plunger portion 22 which, when opposite the ports 18, permits passage of gas through the housing from the inlet port to the outlet port whereby a relatively large amount of gas is fed to the pilot flame whereby the latter may be enlarged to ignite the vaporized fuel and also to avoid being blown out by the forced air from the blower 11 when in operation. In Figure 1, the portion of the plunger 19 which forms the valve 21 is shown in its

normal passage-closing position which is also the lowered or descended position of the plunger within the housing 14. The plunger yieldably occupies such normal descended position by virtue of gravity when the housing is mounted in its upright position; however, spring-tension may be employed. As shown in Figure 1 and 2, a compression spring 23 may be mounted with its lower end terminally received within a recess 24 upwardly presented by the valve 21 while its upper end may be received within a recess 25 downwardly presented by the cap 26 received in threaded engagement upon the upper end of the housing 14 and preferably closing this housing end to prevent escape of gas therefrom. The relatively small supply of gas for the normal small pilot flame is ported through a by-pass 20 provided in the housing around the valve 21. Gaseous flow through this by-pass may be adjustably regulated by means of the needle-valve 10 received in threaded engagement in the housing and terminally projecting within the by-pass 20 to constrict the same.

90 The preferred means for effecting the opening of the valve 21 is by way of an electromagnetic coil such as the solenoid 27 of a conventional type which is positioned about the housing. An electric circuit is provided for this solenoid and, upon energization of the solenoid, the metallic plunger will be upwardly pulled in accordance with the well-known functions of such electrical apparatus. The elevated position of this plunger-core, consequent upon solenoid energization, is shown in Figure 2.

100 The energization of the solenoid 27 is preferably automatically effected as, for example, by means of a thermostat, as will be subsequently described. Furthermore, means are provided so that the energization of the solenoid is only momentary so that the plunger may be released, after its upward travel, and thereafter be permitted to resume its normal descended passage-closing position. In this novel device, the time-interval consumed by the plunger in moving to closing position may be predetermined and adjusted to attain the desired interval which is advantageous for any given installation.

115 The lower end of the housing 14 is closed by means of the screw-plug 28 by which a fluid, such as oil 29, is retained therein. The lower portion of the plunger is reduced to form a stem 31 terminating in forks 32 integral with an open-ended sleeve 33. The lower edge of this sleeve forms an annular valve seat for the valve 34 having an integral stem 35 slidably borne by the cylindrical hub 36 held to the sleeve by a plurality of radial integral arms 37 separated by the circular apertures 30 shown in Figure 4.

125 The valve-stem 35 projects above the hub 36 and has a collar 38 pinned thereto. A

compression spring 39 is held upon the stem between the collar and the upper end of the hub. This spring yieldably holds the valve 34 in normal seated position. When ascent of the plunger occurs, the oil above the valved sleeve downwardly forces open the valve 34 and permits the sleeve freely to pass through the oil in its upward travel with the plunger as is indicated in Figure 2. But, subsequent de-energization of the solenoid and tensioned gravitational descent of the plunger is damped or retarded as the valve tensionably resumes seated position. Oil displaced by plunger-descent is slowly ported around the descending sleeve by a by-pass 40, provided on one side of the housing casting. The rate of flow of the oil upwardly through the by-pass 40, and hence the length of time-interval required for damped plunger-descent, may be adjustably predetermined by means of the needle 41 adapted adjustably to constrict the by-pass 40. This needle is carried by a screw 42 received in threaded engagement within a counterbored aperture leading to the by-pass.

It will be noted that, as the plunger is elevated from the position shown in Figure 1 toward that shown in Figure 2, there might be a tendency to compress the air confined within the housing between the upper end of the valve 21 and the cap 26. To overcome any such tendency a conduit 43 is bored axially through the major portion of the plunger and downwardly terminates in the two angled ports 44 so that, upon travel of the plunger, the air may oppositely pass. Such freedom of air flow within the housing not only prevents compression above the valve 21 but also prevents any creation of a partial vacuum in the lower portion of the housing between the upper surface of the oil and the lower end of the wide portion of the plunger.

As above stated, the solenoid is energized only momentarily and, the preferred energization is effected by connecting the solenoid circuit to the apparatus set forth in the inventor's above-mentioned prior co-pending application. Such apparatus may now be described in conjunction with the diagram of Figure 5 but without going into greater detail than is necessary to explain such use of the present invention.

Broadly, Figure 5 discloses a liquid fuel burner installation of the type employing a motor 13 adapted to drive the blower 11 to deliver air under pressure to the burner. The control of the blower-motor and solenoid circuit are so inter-related that, when the motor circuit is closed, the solenoid circuit is closed, but the latter is opened again after a predetermined interval while the motor circuit remains closed. Furthermore, both of these circuits may be automatically

opened by thermostatic means while the motor circuit is also closed thermostatically.

The thermostatic control of the motor may first be explained and thereafter the control of the gas-valve solenoid circuit.

Generally considered, there is provided a switch having a pair of spaced terminals and a circuit-closer co-operable therewith to complete a circuit through such terminals. This circuit-closer is preferably operable by means of an electric current operating through an armature and solenoids of opposite polarity. Means are provided singly to energize these two solenoid coils so that the armature may be moved in a direction to effect the desired opening or closing of the switch. The means here shown for singly energizing the coils is a thermostatic device.

The lead 45 of the motor 13 is directly connected to the side 51 of the main line circuit while the lead 60 of the motor is connected to the other side 52 of the main line through a circuit-closer 53 and its spaced blades 50. This circuit-closer is shown in Figure 5 in closed position but is adapted to be upwardly rocked to open the motor circuit.

A convenient mode of rocking this circuit-closer both out of and into circuit-closing position is provided by means of the rock-shaft 54 which carries the circuit-closer 53. This rock-shaft is adapted to be rocked by an armature 55 reciprocably mounted within the aligned cores of two solenoids which are adapted singly to be energized to produce opposite polarity so that the armature may be selectively moved in opposite directions. One solenoid may be referred to as the upper circuit-closer 97, blade 87, wire 88, electro- the lower or circuit-opening coil 57.

The selective energization of these two coils is effected, in this apparatus, by means of a thermostat. Each coil is provided with a circuit leading to a suitable source of electric energy and each such coil-circuit is adapted to be electromagnetically closed or opened by the thermostat and the parts are so arranged that the upper or circuit-closing coil is energized by the cold side of a thermostat circuit while the lower or circuit-opening coil is energized by the hot side of the thermostatic circuit.

Each coil is provided with a circuit connected to the main line. The lower coil 57 has a wire 58 leading from the top of its winding to a contact blade 59 insulated from a complementary contact blade 61 having a wire 62 connected to the lead 60 of the motor circuit. The lower coil also has a wire 63 leading from the bottom of its winding to a contact 64 projecting for circuit-closing engagement below a movable armature contact 65 operable to make-and-break this lower coil circuit. This armature-contact 65 is

normally yieldably held out of engagement with the contact 64 by any suitable means. The armature-contact 65 is provided with a wire 66 in an electrical connection with the lead 45 of the motor. An electromagnet 67 is positioned beneath the armature-contact 65 and is adapted, upon energization by the hot side of the thermostat, to break indirectly the motor circuit, as later described. Thus, the lower coil 57 is provided with its circuit which may not only be opened and closed by means of an armature at one point but also may be opened and closed at another point across the blades 59 and 61. The closure of this latter break is by means of a circuit-closer 68 carried by the rock-shaft 54 and operable thereby. This circuit-closer 68 is thus co-operable with the motor circuit closer 53.

The upper coil 56 has a wire 69 leading from the bottom of its winding to a contact 71 projecting for circuit-closing engagement below a movable armature-contact 72 operably to make-and-break this upper coil circuit. This armature-contact 72 is normally and yieldably held out of engagement with the contact 71 by any suitable means.

The armature-contact 72 is electrically connected by the wire 73 to the lead 45 of the motor circuit. An electro-magnet 74 is positioned below the armature-contact 72 in order, upon energization, to draw the contact 72 to the contact 71 to close the coil circuit across this break. The electromagnet 74 is adapted to be energized by the cold side of the thermostat in order indirectly to start the motor and, it may be noted in passing, that the gas-valve-solenoid circuit is adapted to be closed when the circuit through this upper coil 56 is closed. The wire 75 leads from the upper portion of the coil 56 to the knife blade 76 electrically insulated from the complementary knife blade 77 connected by the wire 78 to the main line 52. The break across the blades 76 and 77 is adapted to be closed by a circuit-closer 79, carried, similarly to the circuit-closer 68, by the rock-shaft 54. This circuit-closer 79 is here shown in dotted lines in order to indicate that it is not in circuit-closing position because the circuit-closer 68 is so shown it being understood that these circuit-closers are oppositely moved. That is, when circuit-closer 68 is in closing position, the circuit-closer 79 is in circuit-opening position and vice versa.

The electromagnets 67 and 74 are adapted to be selectively energized, preferably by a thermostatic circuit. Such circuit may derive its electric energy from the main circuit through the transformer 81. The thermostatic circuit comprises the usual hot and cold sides with thermo-bar connection. Such a thermostat is diagrammatically represented in Figure 5, wherein the usual

thermo-bar 82 is electrically connected to the secondary winding of the transformer by means of the wire 83. The hot contact 84 has a wire 85 terminating in the knife blade 86 which is insulated from its complementary knife blade 87 having a wire 88 running to the upper portion of the winding of the electromagnet 67 while the wire 89 runs from the lower portion thereof to the secondary or low-tension side of the transformer 81.

The cold side contact 91 is connected by the wire 92 to the knife blade 93 similarly insulated from its complementary knife blade 94 which in turn is connected by the wire 95 to the upper portion of the winding of the electromagnet 74 having its lower portion thereof electrically connected by the wire 96 to the wire 89 of the secondary or low-tension side of the transformer 81. Circuit-closers 97 and 98 are carried upon the rock-shaft 54 and are similar in construction and operation to the circuit-closers 68 and 79 carried at the opposite end of the rock-shaft.

Before describing the incorporation of the gas-valve-solenoid circuit in this apparatus, the operation of the above parts may be first explained.

In the position of the parts in Figure 5, the apparatus is shown in position wherein the thermo-bar 82 has previously been bent by room temperature to cause electrical contact with the hot side contact 84 whereby current may flow from the secondary winding of the transformer 81, through the presented circuit, as follows: wire 83, thermo-bar 82, hot contact 84, wire 85, blade 86, circuit-closer 97, blade 87, wire 88, electromagnet 67, wire 89, and back to the secondary winding. The electromagnet 67 is thus energized with the result that the armature-contact 65 is downwardly pulled to effect electrical connection with the contact 64 whereby the following circuit is closed; lead 45, wire 66, armature-contact 65, contact 64, wire 63, opening-coil 57, wire 58, blade 59, circuit-closer 68, blade 61 and wire 62 to the other lead 60. Thus, the lower opening coil 57 is energized with the result that the armature 55 is inwardly pulled, the shaft 54 rocked and the circuit-closer 53 is raised to break the lead 60 of the motor circuit at the spaced insulated blades 50. The motor circuit is thus thermostatically opened resulting in cessation of the motor, blower, and burner functions.

The parts are re-set automatically for a call for heat by the cooling thermo-bar. As the rock-shaft raises the thermostatic circuit-closer 97 and coil circuit-closer 68 their complementary circuit-closers 98 and 79, respectively, are moved to engage and close the breaks across the blades 93-94 and the blades 76-77. Thus, when the thermo-bar

bends to engage the cold contact 91, another circuit is closed from the secondary winding of the transformer 81, through the thermo-bar contact 91, wire 92, blade 93, circuit-closer 98, blade 94, wire 95, electromagnet 74, wire 96 to the secondary winding. The electromagnet 74 is thereby energized to attract the armature contact 72 to close with the contact 71 whereby a circuit is presented from the main line side 51, motor lead 45, wire 73, armature-contact 72, contact 71, wire 69, closing coil 56, wire 75, blade 76, circuit-closer 79, blade 77, wire 78 to the other main line side 52. The closing coil 56 is thus energized, the rock-shaft returned to the full-line position in Figure 5 and the motor circuit closed, and the motor, blower and burner function.

Turning now to the incorporation of the gas-valve-solenoid circuit in this apparatus, it may be noted that, when the rock-shaft 54 is returned to its Figure 5 position, the circuit-closers 97 and 68 are likewise returned to the indicated closed position, while the circuit-closer 79 is simultaneously moved by the rock-shaft to open position so that the circuit through the closing coil 56 is opened. Thus, by connecting the solenoid 27 with the circuit of this coil 56, the solenoid 27 may be energized when the coil 56 is energized to start the motor. To this end, a wire 99 is connected to the coil wire 69 and to the winding of the solenoid-27. The other end of this winding is connected by the wire 101 to the motor lead 60. Thus, coincident with energization of the motor-starting coil 56, the solenoid 27 will be energized. Furthermore, as such energization of the coil 56 is only momentary (because its circuit is immediately opened by the circuit-closer 79) so also, the energization of the solenoid is only momentary. Such momentary energization of the solenoid is sufficient to elevate the plunger 19 so that upon immediate de-energization, its timed descent may commence. As before described, plunger-elevation opens the valve and permits increased gaseous flow to the pilot flame as the motor starts and is so maintained until the predetermined interval of plunger-descent has expired and the plunger has again resumed its normal position cutting off the relatively large supply of gas so that the pilot flame resumes its normally small size.

I claim as my invention:

1. A device of the class described comprising a cylinder, a pilot pipe connected with the cylinder across its bore, a valve slidable in the cylinder adapted when in one position to interrupt flow through the pipe across the bore, a by-passage in the cylinder connecting the pipe around the bore, a coil embracing the housing adapted when energized to move the valve to open position,

said valve on de-energization of the coil being adapted to return to a closed position, and means adjustable to regulate the speed rate of valve return.

2. A device of the class described comprising a cylinder, a pilot pipe connected with the cylinder across its bore, a valve slidable in the cylinder adapted when in one position to interrupt flow through the pipe across the bore, a by-passage in the cylinder connecting the pipe around the bore, a coil embracing the housing adapted when energized to move the valve to open position, said valve on de-energization of the coil being adapted to return to a closed position by gravity, and means adjustable to regulate the speed return of valve return.

3. In a device of the class described, a tubular housing having liquid therein, a pipe line connected with the housing for communication across its bore, a valve member slidable in said bore as a piston for interrupting the flow from the pipe line across the bore when the valve is in one position, said valve member having a tubular head, in the liquid, a valve normally closing the one end of said head, said housing having a by-pass arranged to communicate with the liquid at opposite sides of the tubular head.

4. In a device of the class described, a tubular housing having a coil embracing it, and having liquid therein, a pipe line connected with the housing for communication across its bore, a by-pass connecting the pipe around the bore, a valve member as a piston for interrupting the flow from the pipe line across the bore when the valve is lowered as a result of deenergization of the coil, said valve member having a tubular head fitting the housing as a piston, a valve normally closing the lower end of the head, said housing having a by-pass arranged to communicate with the liquid at opposite sides of the tubular head.

5. In a device of the class described, a tubular housing having a coil embracing it, and having liquid therein, a pipe line connected with the housing for communication across its bore, a by-pass connecting the pipe around the bore, a valve member as a piston for interrupting the flow from the pipe line across the bore when the valve is lowered as a result of deenergization of the coil, said valve member having a tubular head fitting the housing as a piston, a valve normally closing the lower end of the head, said housing having a by-pass arranged to communicate with the liquid at opposite sides of the tubular head, and said valve member having a passage therein communicating with the housing at opposite ends.

6. A device of the class described comprising a tubular housing having a solenoid coil embracing it, and having liquid in its lower portion, pipe sections connected with the

housing for communication across its bore, a by-pass connecting the pipe sections around the bore, an elongated valve member as a solenoid core slidable in said bore as a piston and having a head for interrupting the flow from the pipe sections across the bore when the valve is lowered as a result of de-energization of the coil, said valve member having a tubular head fitting the housing as a piston and having a spring-actuated valve normally closing the lower end of the head, said housing having a by-pass arranged to communicate with the liquid at opposite sides of the tubular head.

7. In a device of the class described, a tubular housing having a coil embracing it and having liquid therein, pipe sections communicating with the housing across its bore, a by-pass connecting the pipe sections around the bore, a valve member slidable in the bore for interrupting the flow from the pipe line across the bore when the valve is in one position, said valve member having a tubular head as a piston, a valve normally closing one end of the head, said head being re-

ciprocable in the liquid, and said housing having a by-pass arranged to communicate with the liquid at opposite sides of the head.

8. Ignition controlling means adapted for use in combination with a liquid fuel burning apparatus including a pilot burner, a pipe adapted to supply gas to the pilot flame, a valve housing interposed in the pipe and having a passage therethrough, a valve slidably mounted in the housing and adapted to control said passage, a solenoid surrounding the housing and adapted upon energization to move the valve to open position whereby an increased amount of gas is supplied to the pilot flame to enlarge the same, said valve being adapted upon de-energization of the solenoid to return to a position whereby the pilot flame is reduced, and adjustable means to predetermine the time interval of valve-return whereby the time of flame-enlargement may be adjustably predetermined.

In witness whereof, I have hereunto set my hand this 15th day of November 1922.

FREDERICK S. DENISON.