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CONTROL APPARATUS

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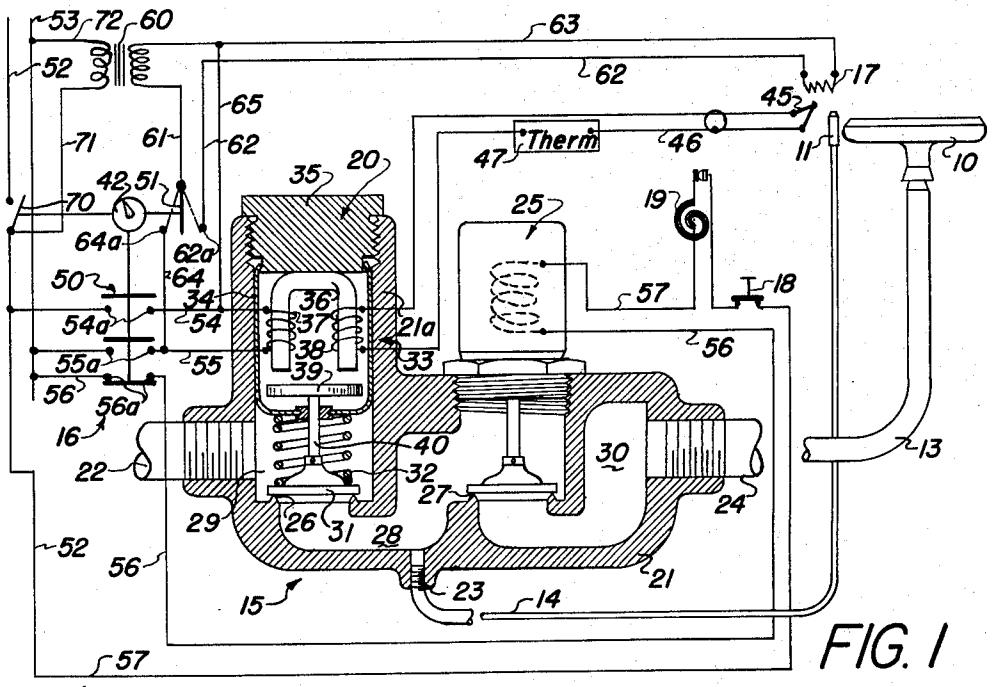


FIG. 1

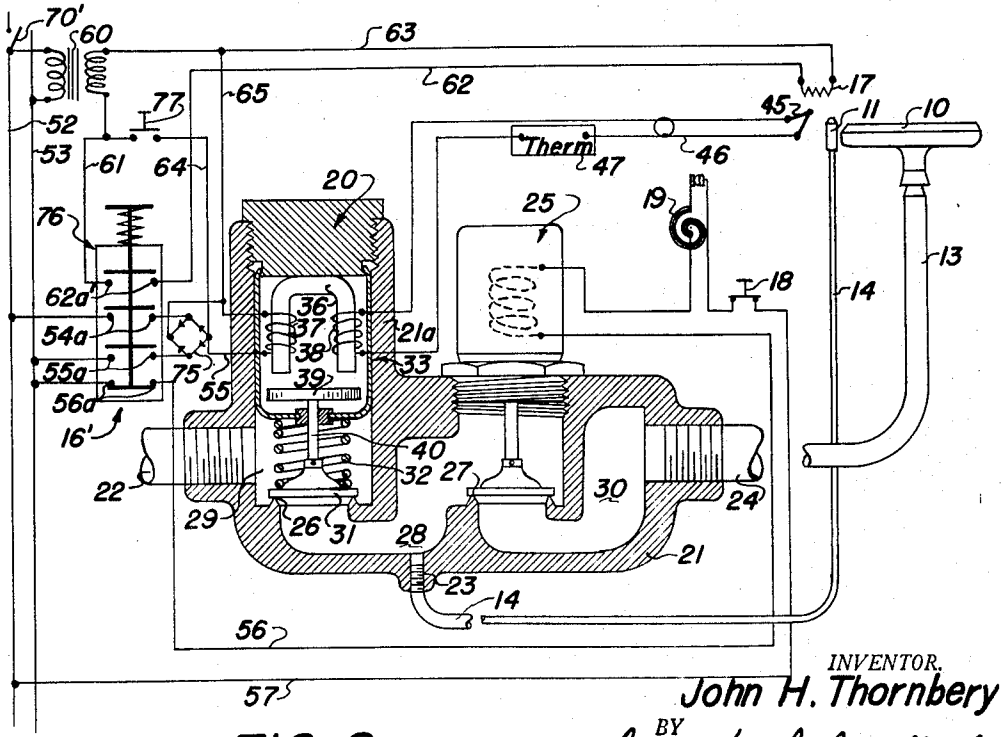


FIG. 2

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CONTROL APPARATUS

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This invention relates to control apparatus for fluid fuel burning systems and more particularly to automatic control apparatus for controlling the flow of fluid fuel to and ignition of said fuel at main and pilot burners.

In the control of gaseous fuel to clothes dryers, and the like, it has long been desired to have a simple, safe, compact control apparatus which, upon initiation of operation of the control by the operator, automatically ignites and controls the fuel flow to the main and pilot burners while at the same time affording protection against overheating, current failures, gas failure, or mechanical malfunctioning.

It is, therefore, a general object of this invention to provide an improved fuel control and ignition apparatus affording the above-mentioned desirable operational features and having means for initiating the operational cycle thereof from a remote location such as a control panel or the like.

Another object of the invention is to provide an improved fuel control and ignition system of the class described having line voltage means for initiating from said remote location, operation of said apparatus and ignition of the pilot burner fuel, said apparatus also having flame sensitive means for maintaining the apparatus operative following ignition and as long as the pilot burner remains ignited.

Another object of the invention is to provide an apparatus as above characterized wherein flow control means for the piot burner is connectable to both a line power and very low power source of electric energy, the line power source being operable to move the flow-control means to flow-permitting position, the low power source being inoperative to move the flow-control means to a flow-permitting position, however, once line voltage energization moves the flow-control means to the flow-permitting position, the flame sensitive means, if energized, is operable to maintain the flow-control means in said position upon cessation of the line voltage energization thus combining in a single flow-control means the "motor" and the "safety" shut-off function.

Another object of the invention is to provide a control apparatus as above set forth wherein the combined "motor" and "safety" flow-control means is connected to thermoelectric generating means associated with the pilot burner for low voltage D.C. electric energization for safety shut off and connected to a line voltage source of either A.C. or D.C. electric energy for initial energization and movement, there also being means for selectively connecting a relatively lower voltage A.C. source to said flow-control means to cause nullification of the effect of the D.C. thermoelectric current and effectively deenergize the flow-control means.

Another object of the invention is to provide an apparatus of the above character wherein the low voltage A.C. source of electric energy aforementioned is also connectable to the igniter means for energization thereof.

Another object of the invention is to provide an apparatus of the above character with timing means operable

to sequentially effect the aforementioned line voltage energization of the combined "motor" and "safety" valve, lower voltage A.C. energization of the ignition means, disconnection of both of the above sources of power, connection of the line voltage source to a second electroresponsive valve and finally, disconnection of the line voltage source from the second valve while simultaneously effecting a short duration connection of the lower voltage A.C. source to the combined "motor" and "safety" valve, the last-named connection effecting closure of that valve to end the cycle.

Another and specific object of the invention is to provide apparatus similar in type to the aforegoing and of a modified form in that it may be manually actuated or cycled as distinguished from apparatus which is time controlled, or cycled.

A further object of this invention is to provide a control apparatus of the aforementioned general characteristics wherein the flame sensitive safety means associated with the first electroresponsive valve means effects closing of the fuel passage to both the main and pilot burners in the event of failure of the pilot burner to initially ignite or upon outage of said pilot burner following ignition, thereby providing 100 percent safety shut off of the fuel.

Another object of the present invention is to provide an apparatus of the aforementioned general characteristics which is well adapted for mass production manufacture, is easily installed by non-skilled technicians, and is otherwise well adapted for the purposes for which it was designed.

The novel features that are characteristic of the invention are set forth with particularity in the appended claims. The invention, itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood by the following description of a specific embodiment when read in connection with the accompanying drawings, in which:

Figure 1 is a semi-diagrammatic view of applicant's control apparatus associated for control of a clothes dryer, parts of the apparatus being shown semi-diagrammatically; and

Figure 2 is a view of a modified form of control apparatus.

While the improved fuel control and ignition apparatus is shown and described in connection with a clothes dryer, it is to be understood that the improved apparatus is not limited to use with this type of equipment, but is adapted for use equally well with other gaseous fuel burning equipment, for example, unit heaters, water heaters, commercial and central housing heating equipment and other types of space heaters.

Referring now to Figure 1, a fluid fuel burner **10** and pilot ignition burner **11** may be disposed to provide heat for a clothes dryer and the like and may be supplied through conduits **13** and **14** with fuel under pressure from a suitable source (not shown). Electroresponsive ignition means **17** may be disposed adjacent the pilot burner for ignition of the fuel emanating therefrom.

Valve means **15** is disposed to control the fuel flow in conduits **13** and **14** and may contain therein a pair of serially arranged electroresponsive valve assemblies **20** and **25**, valve assembly **20** being a combination "motor" and "safety" valve and valve assembly **25** being an electro-responsive temperature controlled or "thermostatic" valve as shall later be explained. More particularly, the valve means **15** comprises a valve casing **21** having an inlet **22** connected to a source of fluid fuel and a main outlet **24** connected to main burner conduit **13**. The interior of the valve casing **21** may be formed with successive chambers such as an inlet chamber **29**, intermedi-

ate chamber 28 and outlet chamber 30. As shown, a first valve seat 26 is formed in a partition wall of the valve casing separating the inlet chamber 29 from the intermediate chamber 28 and another valve seat 27 is formed in another partition wall separating the intermediate chamber 28 from the outlet chamber 30. A pilot outlet 23 is formed in the bottom wall of valve casing 21 for cooperation with the conduit 14 thereby providing communication of the pilot burner 11 with the intermediate valve chamber 28.

The thermostatically controlled valve assembly 25 may take the form of any suitable electroresponsive valve assembly of the energized-open deenergized-closed type, for example, a solenoid or the like, and is disposed in the intermediate valve chamber 28 for cooperation with seat 27 to thereby control the fuel flow to the main burner 10 only. As shown, the electrical circuit to the valve 25 comprises a pair of conductors 56 and 57, the latter being connected through a door actuated switch and thermostat which are conventionally illustrated at 18 and 19 respectively. The energization of valve 25 is also controlled by control means 16 which, as shown, may be disposed remotely from the valves 20 and 25 and with which conductor 56 is associated as shall be later explained.

The combination "motor" and "safety" valve assembly 20 is disposed ahead or upstream of thermostatic valve assembly 25 and within the valve inlet chamber 29 for cooperation with the seat 26. The actuation means 33 for the combination "motor" and "safety" valve assembly 20 may be mounted in a generally tubular upstanding boss 21*a* of the casing and comprises a generally tubular casing or hood member 34 which may be spun over a threaded end closure member 35, the latter threadably engaging the interior of boss 21*a* as shown. Fixedly mounted to end member 35 within the hood member 34 is a generally U-shaped magnet core 36 having energizing windings 37 and 38 wound on the legs thereof for purposes as shall be more fully described.

An elongated stem 40 slidably projects through an end wall of the hood member 34, one end of the stem carrying a valve disc 31 for cooperation with seat 26 and the other carrying an armature 39 for cooperation with core 36. A coiled compression spring 32 may be surroundingly disposed on the stem 40, one end of which abuts the disc 31 and the other of which engages a bottom wall of the tubular hood member 34 to bias the armature 39 away from magnet core 36 and valve disc 31 toward engagement with seat 26.

The energizing winding 37 associated with magnet core 36 may be referred to as the "motor" winding and is operable when energized by a line voltage source of electric energy to attract the armature 39 from its retracted position into engagement with the pole faces of the magnet core 36 against the bias of spring 32. It is contemplated that the energizing source used for this purpose will be either line power 110 volt alternating current, or line power 110 volt rectified direct current either of which will create sufficient magnetic flux in the magnet core 36 to attract the armature 39 from its retracted position.

The other magnet energizing winding 38 may be referred to as a "safety" winding and for that purpose is connected to thermoelectric generator means 45 by suitable means such as the coaxial lead connector 46 as shown. High temperature limit switch means 47 may be connected in the thermoelectric circuit to open the latter in the event of overheating of the apparatus. Mention is made that the electric energy produced by the thermoelectric generator means 45 when energized is a direct current of low order and predetermined steady value depending on the construction of the thermoelectric circuit. Ordinarily the thermoelectric generator will produce sufficient current to energize safety winding 38 and create flux in the core 36 to maintain the armature 39 in attracted relation once that position is attained, but insufficient flux to move the armature 39 to attracted relation from its retracted position against the bias of spring 32. If, for some reason such as pilot outage, faulty apparatus and the like, the thermoelectric generator does not produce current within a normal range, the current flow decreases to a so-called "drop-out" value where the bias of spring 32 is stronger than the attractive force of the flux generated by winding 38 and consequently the armature 39 moves away from the pole faces of core 36, disc 31 thereupon seating on seat 26 for shut off of the fuel flow.

The flux created by certain values of alternating current voltage superimposed upon the flux created by winding 38, will also cause the armature 39 to drop out and move to deenergized position. Special note is made of the fact that low voltage, for example 10 volts, as distinguished from high voltage, for example 110 volts, alternating current energization of "motor" winding 37 will nullify the flux produced by the energized "safety" winding 38 to also cause drop out of the armature and seating of valve disc 31. This obtains because one half of each cycle of the low voltage alternating current energization will tend to create magnetic flux flow of opposite polarity to the flux created by D.C. energization of winding 38, the former neutralizing the latter to the "drop-out" value thereby allowing the spring 32 to pull the armature away from the pole faces. Care must be taken that the low voltage A.C. energization being applied to "motor" winding 37 to cause "drop out" of the armature 39 is of an amplitude which will not tend to overpower in distinction to "neutralizing" the flux produced by the D.C. winding 38 and thus retain the armature attracted. Energization of winding 37 by 10 volt alternating current has been found to be satisfactory for dropping out the armature 39 while winding 38 is energized by generator means 45.

As the amount of A.C. voltage increases, the voltage amplitude increases, thus, the speed that the voltage passes from one polarity peak to the other increases, and the unit of time the voltage is in a "neutralizing" range decreases. The result is that when high A.C. voltage is applied to "motor" winding 37 while "safety" winding 38 is energized, the one half cycle of opposite polarity does not cause "drop out" because before the spring 32 can start the armature 39 away from the pole faces, the amplitude is to the point that an overpowering flux of opposite polarity retains the armature against the pole faces. Thus, the time interval the voltage is in the "neutralizing" range is critical as to whether "drop out" occurs. "Drop out" will occur when the current flow in winding 37 is of opposite polarity to winding 38 and of a low enough amplitude such that a time interval is presented so that the combination with the voltage in the D.C. winding add up to a value below the "drop-out" value so as to effectively neutralize the D.C. winding 38 without overpowering it.

When "motor" winding 37 is energized by line power (such as 110 volts A.C.), the amplitude of the A.C. voltage is exceedingly high as compared with the D.C. voltage level in winding 38 and the unit time the A.C. voltage is in the "neutralizing" range is exceedingly low. Thus, the flux created by "motor" winding 37 when energized by line power is of an amount that the armature 39 is attracted in the first instance and retained in the attracted relation independent of low power D.C. energization of "safety" coil 38. The relative values of voltage in the low power D.C. energization of "safety" winding 38 and high power A.C. energization of "motor" winding 37 are preferably such that the short unit time the alternating current is in the "neutralizing" range during normal connection to line power together with the additional unit of time caused by A.C. voltage lag in returning to zero polarity upon cessation of the A.C. power is too short a total time period in the "neutraliz-

ing" range to cause "drop out" if the low power D.C. winding **38** is energized. It is thus seen, that the armature **39** will remain attracted to the pole faces of magnet **36** upon cessation of high power A.C. current in winding **37** if the D.C. winding **38** is energized. The foregoing explains how a single power unit may attract an armature upon high power A.C. energization and retain the armature attracted on low power D.C. energization after cessation of the high power energization.

High power D.C. as contrasted with A.C. energization of "motor" winding **37** for original pull in or attraction of the armature **39** ("motor" action) does not present any particular polarity problems in shifting the armature from control by "motor" winding **37** over to "safety" winding **38**, but does necessitate the use of a D.C. rectifier in the circuit such as shown at **75** in Figure 2 (the reason for the positional relationship of the rectifier in that circuit will be explained later). To recapitulate, the energization of "motor" winding **37** with either ordinary A.C. line power or line power rectified is operable to pull in armature **39** from its retracted position and upon cessation of energization of winding **37** thereby, energized "safety" winding **38** is operable to hold in the armature **39** if the thermoelectric generator means **45** is energized. Later reenergization of "motor" winding **37** with low power A.C. is operable to neutralize the "safety" winding **38** and cause "drop out" of the armature and seating of the disc **31**.

Control means **16** for cycling the apparatus will now be described. As shown in Figure 1, the control means **16** may comprise suitable relay means **50**, a main switch means **70**, igniter and shut-off switch means **51** and timing or clock means **42**, the latter being disposed on a control panel of a dryer or the like in a position easily accessible for actuation by an operator. It is to be noted that the control means **16** may be disposed remotely from valves **25** and **20** since it is no longer necessary to manually cock the safety valve as was heretofore necessary. The clock means **42** may be of any suitable type such as a spring wound or electrically powered means that is operable to actuate the main switch **70**, the relay means **50** and igniter and shut-off switch means **51** to various positions in a predetermined sequence to control the circuits to the valve assemblies **20** and **25** and to the igniter **17** as shall now be described. Clock means of this type are well known in the art, and the specific structural character of the clock means actually utilized forms no part of the present invention.

The relay means **50** is operable to alternatively energize valves **20** and **25**, and comprises three sets of contacts **54***a*, **55***a*, and **56***a*. To energize the valves, suitable line power conductors **52** and **53** may be connected to a source of 110 volt A.C. power and to the "motor" winding **37** of valve assembly **20** by conductors **54** and **55** through contacts **54***a* and **55***a*. Valve **25** may be connected to the line power conductors **52** and **53** by conductors **56** and **57** through contacts **56***a*. As shown in Figure 1, the relay means **50** is under the control of the clock means **42**, and is movable thereby between a first and a second position, the first position energizing "motor" winding **37** of valve assembly **20** by closing contacts **54***a* and **55***a* while opening contacts **56***a* for deenergization of valve **35**. Conversely, the second position of the relay means **50** affords closure of contacts **56***a* and opens contacts **54***a* and **55***a*.

Means for low power alternating current energizing of the igniter **17** is provided by a transformer **60**, the primary of which is directly connected to line conductors **52** and **53** by suitable conductors **71** and **72**. It is to be noted that conductor **71** is connected to line power conductor **52** so as to be under the control of the main power switch **70**. The secondary of transformer **60** is connected to igniter **17** through conductor **61**, the igniter and shut-off switch means **51**, contact **62***a* and conductors **62** and **63**.

The igniter and shut-off switch means **51** is here shown as a three positional switch sequentially actuated by the clock means **42**, the normal position of the switch being dead or neutral as shown in full line in Figure 1. The second position of the switch (to the right as viewed in Figure 1) engages the switch **51** with contact **62***a* to complete the aforementioned igniter circuit. A third position (to the left as viewed in Figure 1) of the switch **51** places it in engagement with a contact **64***a* to energize thereby "motor" winding **37** of valve assembly **20** with low power A.C. power from transformer **60** through conductors **61**, **64**, **55**, **54**, **65** and **63**.

The sequence of operation of the main switch means **70**, relay means **50** and igniter and shut-off switch means **51** by the clock means **42** will be described in the operation of the apparatus which is as follows:

Assume the following initial conditions:

Thermoelectric generator **45** cold, main switch **70** open, switch means **51** in its first or dead position and thus the igniter circuit deenergized, relay means **50** in its second position with contacts **56***a* made and contacts **54***a* and **55***a* open, thermostat **19** unsatisfied, door switch **18** made, and valve assemblies **20** and **25** deenergized and seated preventing all fuel flow to burners **10** and **11**, all as shown in Figure 1 of the drawings.

To start the apparatus in operation, an operator may set the timing means **42** to thereby establish the desired period of the drying cycle. Immediately after the setting or cocking of the timing means **42**, it sequentially closes the main power switch **70**, and depresses the relay means **50** to its first position so as to make contacts **54***a* and **55***a* to energize "motor" winding **37** of valve assembly **20**, and opens contacts **56***a* to interrupt the circuit to valve assemly **25**. Since the "motor" coil **37** is now energized across the line power, the armature **39** is attracted lifting valve disc **31** away from seat **26**, thus permitting fuel to flow into intermediate chamber **28** and out outlet **23** to the pilot burner **11**. Inasmuch as the circuit to valve assembly **25** is open, no fuel may flow to the main burner **10**, thereby permitting safe lighting of the pilot burner **11**. Simultaneously, with the foregoing, the timing means **42** actuates igniter and shut-off switch means **51** from its first to its second position into engagement with contact **62***a* which completes the circuit to the igniter **17**. If desired, a short interval may be provided between the energization of valve assembly **20** and the energization of the igniter **17** to afford a clearing of any air that may be in pilot conduit **14**.

Upon ignition of the fuel emanating from the pilot burner **11**, the thermoelectric generator **45** becomes heated generating thermoelectric current which in turn energizes "safety" winding **38** of the valve assembly **20**. The timing means **42** now causes return movement of the relay means **50** upwardly to its first position (as shown in Figure 1) which deenergizes the "motor" winding **37** and energizes the valve assembly **25** permitting main burner gas to flow for ignition by the ignited pilot burner **11**. Simultaneously, the timing means **42** actuates igniter and shut-off switch means **51** back to its first, or neutral, position, thereby interrupting the circuit to the igniter **17**.

Cessation of power at the "motor" coil **37** by opening contacts **54***a*, **55***a* places valve assembly **20** under the control of the "safety" winding **38**, which retains valve assembly **20** in flow-permitting position. Of course, if the pilot burner **11** fails to ignite, the valve assembly **20** would close preventing all fuel flow. Assuming normal ignition, the heat in the dryer will now be under the control of the thermostat **19** which will cycle valve **25** in accordance with the temperature requirements of the particular apparatus involved. If the operator should open the door to the dryer during this period, the switch **18** would open the circuit to the valve assembly **25** preventing main burner fuel flow but would not affect the fuel flow to the pilot burner, the latter being available

for reignition of the main burner upon reclosing of the door.

Just prior to the end of the drying cycle, timing means 42 actuates ignition and shut-off switch means 51 from its first, or neutral, position to its third position (to the left as viewed in Figure 1 of the drawings). This places the "motor" coil 37 in circuit with the transformer 60 which energizes "motor" coil 37 with low power A.C. voltage current to cause neutralization of the flux produced by "safety" winding 38. The armature 39 now moves away from the pole faces under the bias of spring 32 to "drop out" valve assembly 20 and prevent all fuel flow to both the main and pilot burners. The timing means 42 then returns switch 51 to its first or neutral position and opens main switch 70 shutting off the line power to the device. The cycle is now completed and the device is now returned to the original position shown in Figure 1 of the drawings.

Figure 2 shows a modified form of the apparatus which is similar in most respects to Figure 1 except that the components of control means 16' are manually actuated rather than timer controlled. In this regard the main switch 70' is manually actuated and may be positioned in line power conductor 52 to shut off all line power to the device. In Figure 2 of the drawings, the various circuits are actuated by a ganged switch 76 which, when manually depressed, simultaneously energizes "motor" coil 37 and the igniter 17 while deenergizing valve assembly 25. Upon release of the switch 76, which is spring loaded, the switch simultaneously interrupts the circuits to the igniter 17 and to "motor" coil 37 while remaking the circuit to valve assembly 25. A dash pot, if desired, may be associated with the return movement of switch means 76 to provide sufficient time for energization of the thermoelectric generating means 45 upon ignition of the pilot burner 11. At the termination of the drying cycle, as determined by the operator, a switch 77 may be depressed to connect the transformer 60 across coil 37 to thereby cause "drop out" of the valve assembly 20 to terminate fuel flow in the manner explained in Figure 1.

It is to be noted that a rectifier 75 may be placed in the circuit to "motor" coil 37 in both of the systems depicted. As shown for convenience in Figure 2, the rectifier is preferably connected ahead of the connection of conductors 64 and 65 so as to not interfere with A.C. "drop out" of valve assembly 20. The operation of this form of the device is thus high power D.C. pull in of valve assembly 20, low power D.C. hold in upon cessation thereof, then, at the end of the cycle, low power A.C. energization of valve 20 to neutralize winding 38 to cause "drop out" to terminate all fuel flow.

Although specific embodiments of the invention have been shown and described, it is with full awareness that many modifications thereof are possible. The invention, therefore, is not to be restricted with the exception insofar as is necessitated by the appended claims.

What is claimed by the invention is:

1. An automatic control device for fluid fuel burning apparatus having a burner comprising a first source of electrical energy, electroresponsive fuel flow control means for said burner comprising a flow control member movable to flow permitting and flow preventing positions, an operator for said control member comprising an electromagnet having winding means, said electromagnet being operable when said winding means is energized by current from said first source to effect disposition of said control member in flow permitting position and when said winding means is deenergized to effect disposition of said control member in flow preventing position, a flame sensitive low voltage second source of electrical energy connected in circuit with said electromagnet winding means and adapted to be responsive to operation of said burner for low voltage energization of said electromagnet sufficient to maintain said control member in flow permitting position once said member has been moved thereto, a third source of electrical energy of lower voltage than said first source, ignition means operable when energized by current from said third source to ignite said burner, first switch means for connecting said first source in circuit with said electromagnet winding means and said third source in circuit with said ignition means for energization of said electromagnet and movement of said control member to flow permitting position and for operation of said ignition means, and after a predetermined interval normally sufficient to render said burner and said second source operative, disconnecting said first source from said electromagnet winding means and said third source from said ignition means, said control member being thereafter retained in flow permitting position by said electromagnet in response to sensing of a flame at said burner by said second source, and second switch means for connecting said third source in circuit with said electromagnet winding means to nullify the effect of energization thereof by said second source and effect movement of said control member to flow preventing position.

2. An automatic control device for fluid fuel burning apparatus having a burner comprising a first source of electrical energy, electroresponsive fuel flow control means for said burner comprising a flow control member movable to flow permitting and flow preventing positions, an operator for said control member comprising an electromagnet having winding means, said electromagnet being operable when said winding means is energized by current from said first source to effect disposition of said control member in flow permitting position and when said winding means is deenergized to effect disposition of said control member in flow preventing position, a flame sensitive low voltage second source of electrical energy connected in circuit with said electromagnet winding means and adapted to be responsive to operation of said burner for low voltage energization of said electromagnet sufficient to maintain said control member in flow permitting position once said member has been moved thereto, a third source of electrical energy of lower voltage than said first source, ignition means operable when energized by current from said third source to ignite said burner, and time controlled switch means for connecting said first source in circuit with said electromagnet winding means and said third source in circuit with said ignition means for energization of said electromagnet and movement of said control member to flow permitting position and for operation of said ignition means, and after a predetermined interval normally sufficient to render said burner and said second source operative, disconnecting said first source from said electromagnet winding means and said third source from said ignition means, said control member being thereafter retained in flow permitting position by said electromagnet in response to sensing of a flame at said burner by said second source, said time controlled switch means after a second predetermined interval being operable to connect said third source in circuit with said electromagnet winding means to nullify the effect of energization thereof by said second source and effect movement of said control member to flow preventing position.

3. An automatic control device for fluid fuel burning apparatus having a burner comprising a first source of relatively high voltage electrical energy, electroresponsive fuel flow control means for said burner comprising a flow control member movable to flow permitting and flow preventing positions, an operator for said control member comprising an electromagnet having winding means, said electromagnet being operable when said winding means is energized by current from said first source to effect disposition of said control member in flow permitting position and when said winding means is deenergized to effect disposition of said control member in flow pre-

venting position, a flame sensitive low voltage second source of direct current connected in circuit with said electromagnet winding means and adapted to be responsive to operation of said burner for low voltage energization of said electromagnet sufficient to maintain said control member in flow permitting position once said member has been moved thereto, a third source of alternating current of lower voltage than said first source, ignition means operable when energized by current from said third source to ignite said burner, and time controlled switch means for connecting said first source in circuit with said electromagnet winding means and said third source in circuit with said ignition means for energization of said electromagnet and movement of said control member to flow permitting position and for operation of said ignition means, and after a predetermined interval normally sufficient to render said burner and said second source operative, disconnecting said first source from said electromagnet winding means and said third source from said ignition means, said control member being thereafter retained in flow permitting position by said electromagnet in response to sensing of a flame at said burner by said second source, said time controlled switch means after a second predetermined interval being operable to connect said third source in circuit with said electromagnet winding means to nullify the effect of energization thereof by said second source and effect movement of said control member to flow preventing position.

4. An automatic control device for fluid fuel burning apparatus having a main burner and a coacting pilot burner comprising a first source of relatively high voltage alternating current, first electroresponsive fuel flow control means for said burners comprising a flow control member movable to flow permitting and flow preventing positions, an operator for said control member comprising an electromagnet having winding means, said electromagnet being operable when said winding means is energized by current from said first source to effect disposition of said control member in flow permitting position and when said winding means is deenergized to effect disposition of said control member in flow preventing position, a thermoelectric generator low voltage second source of direct current connected in circuit with said electromagnet winding means and adapted to be responsive to operation of said pilot burner for low voltage direct current energization of said electromagnet sufficient to maintain said control member in flow permitting position once said member has been moved thereto but insufficient to move said control member from flow preventing to flow permitting position, a third source of alternating current of lower voltage than said first source, ignition means operable when energized by current from said third source to ignite said pilot burner, second electroresponsive fuel flow control means operable when energized by current from said first source to permit and when deenergized to prevent fuel flow to said main burner, and time controlled switch means for connecting said first source in circuit with said electromagnet winding means and said third source in circuit with said ignition means for energization of said electromagnet by current from said first source and movement of said control member to flow permitting position and for operation of said ignition means, and after a predetermined interval normally sufficient to render said pilot burner thermoelectric generator operative, disconnecting said first source from said electromagnet winding means and said third source from said ignition means and connecting said first source in circuit with said second control means for fuel flow to said main burner, said control member being thereafter retained in flow permitting position by said electromagnet in response to sensing of a flame at said pilot burner by said second source, said time controlled switch means after a second predetermined interval being operable to connect said third source in circuit with said electromagnet winding means to nullify the effect of energization thereof by said thermoelectric generator and effect movement of said control member to flow preventing position.

5. An automatic control device for fluid fuel burning apparatus having a burner comprising a first source of electrical energy, electroresponsive fuel flow control means for said burner comprising a flow control member movable to flow permitting and flow preventing positions, an operator for said control member comprising an electromagnet having winding means, said electromagnet being operable when said winding means is energized by current from said first source to effect disposition of said control member in flow permitting position and when said winding means is deenergized to effect disposition of said control member in flow preventing position, a flame sensitive low voltage second source of electrical energy connected in circuit with said electromagnet winding means and adapted to be responsive to operation of said burner for low voltage energization of said electromagnet sufficient to maintain said control member in flow permitting position once said member has been moved thereto, a third source of electrical energy of lower voltage than said first source, ignition means operable when energized by current from said third source to ignite said burner, first switch means having an ignition position for connecting said first source in circuit with said electromagnet winding means and said third source in circuit with said ignition means for energization of said electromagnet and movement of said control member to flow permitting position and for operation of said ignition means, said first switch means also having an operating position disconnecting said first source from said electromagnet winding means and said third source from said ignition means, and permitting retention of said control member in flow permitting position by said electromagnet in response to sensing of a flame at said burner by said second source, and second switch means for connecting said third source in circuit with said electromagnet winding means to nullify the effect of energization thereof by said second source and effect movement of said control member to flow preventing position.

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