April 6, 1943. W. M. COUZENS 2,315,773

BURNER CONTROL SYSTEM

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Fig. 1.

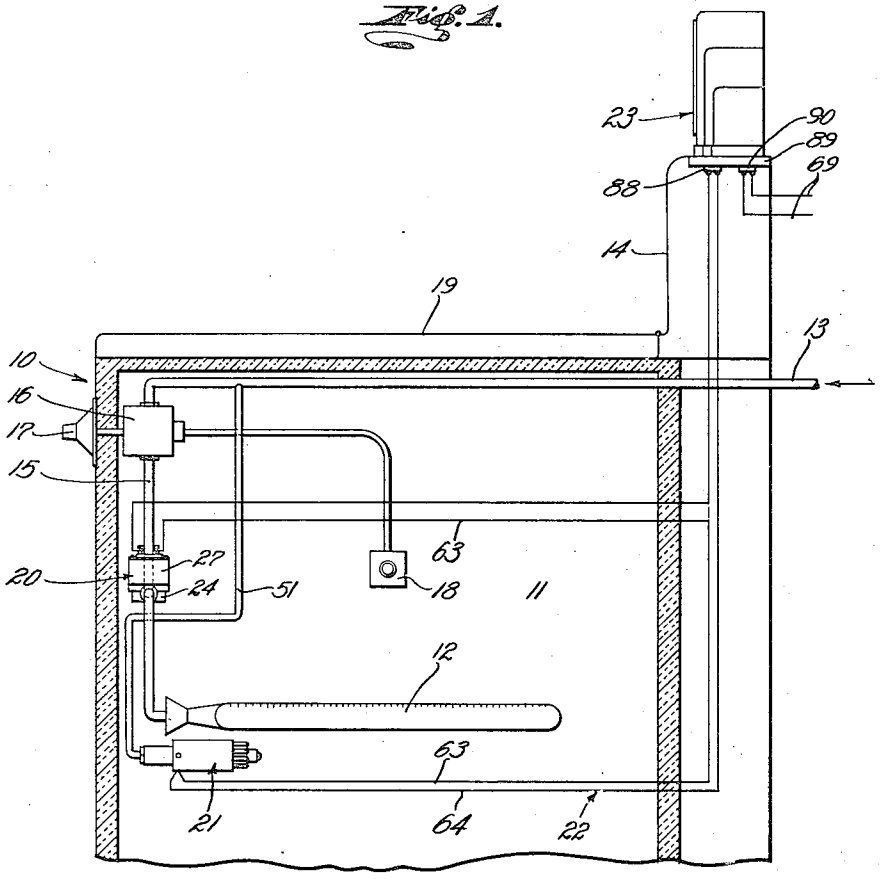


Fig. 2.

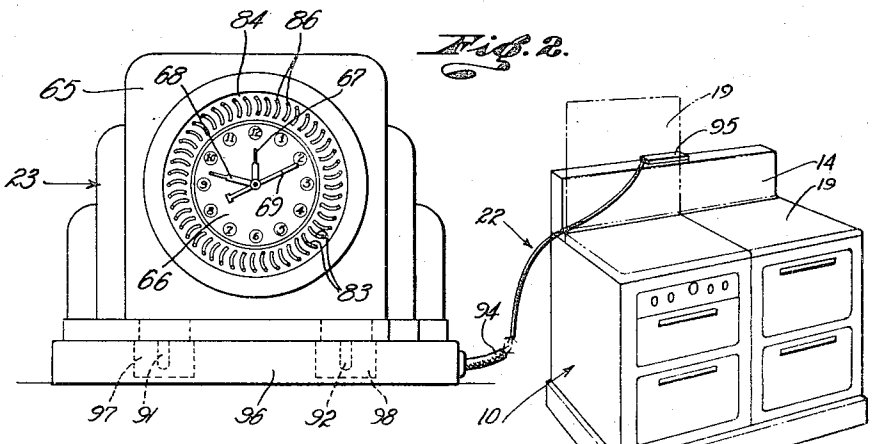
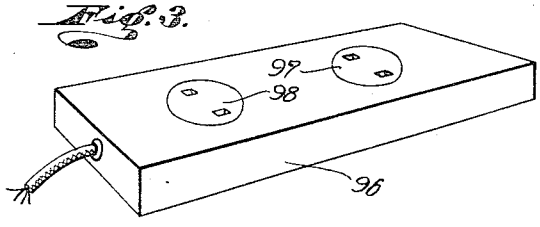


Fig. 3.



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Fig. 4.

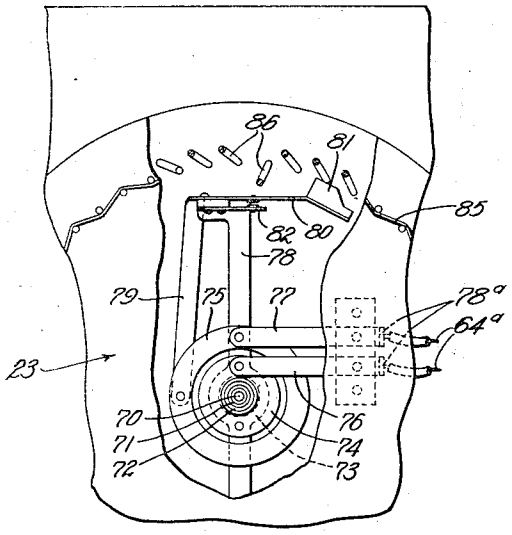


Fig. 5.

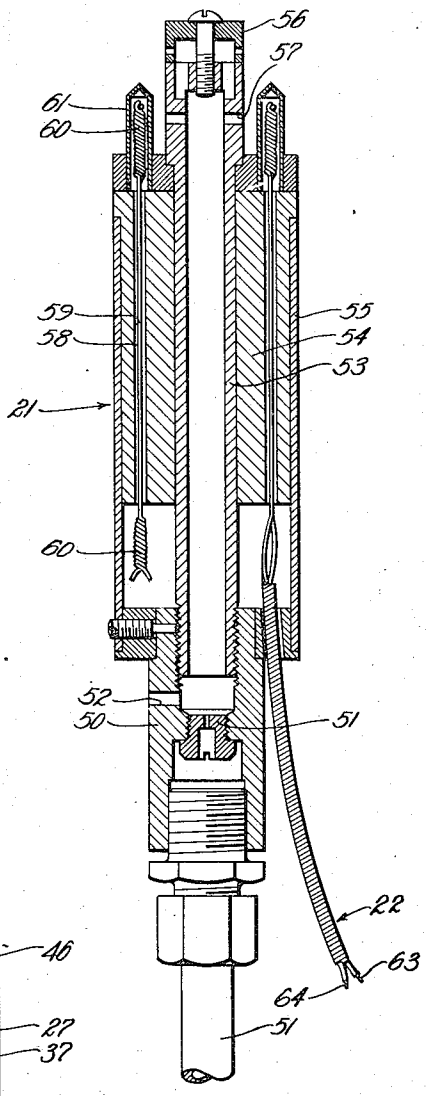
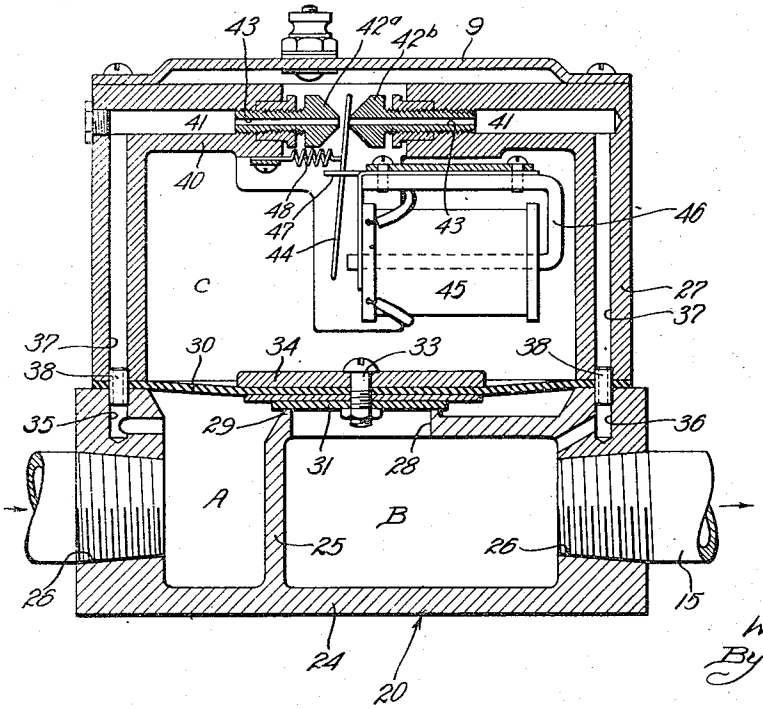


Fig. 6.



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UNITED STATES PATENT OFFICE

2,315,773

BURNER CONTROL SYSTEM

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Application January 17, 1940, Serial No. 314,273

7 Claims. (Cl. 161—9)

This invention relates to controls or control systems and relates more particularly to controls for burners. A general object of this invention is to provide dependable, efficient and practical controls for burners.

Another object of this invention is to provide a control system for the burner of a fluid fuel cooking range or other fluid fuel appliance that embodies an electrically controlled valve governing the burner, a remote control element, such as a time switch, or the like, in the control circuit of the valve and a dependable and effective flame generator or thermo-electric means for the generation of the current used in the circuit, said thermo-electric means eliminating the necessity of an outside source of electrical energy for use in the control system. The burner control system of the present invention is characterized by a current generating means, providing electrical energy for the control or operation of the main burner valve and its circuit, that is energized by a flame of the fuel used in the range or appliance, thus making the range or appliance entirely self-contained and dependent only upon the fuel supply service, and making it unnecessary to provide or use an outside source of electrical energy such as batteries or electric utility lines.

Another object of this invention is to provide a control system of the character mentioned in which the generating means, providing current for the operation of the main burner valve and its circuit, constitutes a safety element positively precluding opening of the valve in the event of extinguishment of the pilot burner or failure of the fuel supply.

Another object of this invention is to provide a burner control means of the character mentioned embodying a portable remote control in the nature of a time switch or clock controlled switch adapted, at will, to be positioned on the range or appliance or at a point remote from the appliance, where it does not interfere with the free use of the lift tops or other parts of the range or appliance, without altering the connections, etc., without installing special fuel carrying parts, and without providing special couplings, or the like.

Another object of this invention is to provide a burner control means of the character mentioned that is long wearing and successfully operative under all conditions of operation.

Another object of this invention is to provide a control means of the character mentioned that embodies a minimum number of silent, safe, and dependable parts, and does not require a manual starting means for use when lighting the pilot.

A further object of this invention is to provide a burner control of the character mentioned that cannot cause or result in the leakage of the fluid fuel and cannot produce hazardous electric arcs or short circuits.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view illustrating the manner in which the control of the present invention may be employed in a cooking range to govern the oven burner. Fig. 2 illustrates the cooking range in reduced perspective and shows the manner in which the time switch means or clock control may be arranged at a point remote from the range. Fig. 3 is a perspective view of the plug block for the clock. Fig. 4 is an enlarged fragmentary vertical sectional view of the clock control illustrating the contact means and the associated parts. Fig. 5 is a longitudinal detailed sectional view of the thermo-electric means or flame generator and Fig. 6 is a vertical detailed sectional view of the valve controlling the oven burner.

The control of the present invention has numerous uses and applications and is particularly useful for the control of the burners of fluid fuel appliances such as cooking ranges, etc. In the following detailed description I will describe the control of the present invention associated with a typical gas burning cooking range for the control of its oven burner. It is to be understood that the invention is not to be construed as limited or restricted to this typical application.

The typical cooking range illustrated in Figs. 1 and 2 comprises the usual range body 10 provided with an oven compartment 11 having a suitable burner 12. A main fuel supply line 13 enters the range body 10 to supply fuel to the burner 12 and the other burners of the appliance. A guard rail 14 extends along the top of the range body 10 at its rear edge. The control of the present invention serves to govern a fuel line 15 leading to the oven burner 12 and receiving its fuel from the main line 13. I have shown a manually regulable thermostatically controlled valve 16 interposed in the line 15 between the control of the present invention and the main fuel line 13. The operating part 17 of the valve 16 is accessible at the front of the range body 10

and the thermostat 18 of the control or valve 16 is, of course, disposed in the compartment 11 or at its wall. The range may include the usual hinged cover or covers 19 for its top burners, etc. The covers 19 are adapted to be raised to a position such as indicated in the broken lines in Fig. 2. The present invention is not primarily concerned with the details of the manually regulable valve 16 or the other elements of the range mentioned above, and such details are omitted from the description.

The improved control of the present invention may be said to comprise, generally, an electrically operated or governed valve 20 in the fuel line 15 of the burner 12, means 21 generating current for the control or operation of the valve 20, a control circuit 22 for the valve 20 energized by the generating means 21 and a time controlled switch or clock controlled switch 23 connected in the circuit 22.

The valve 20 is connected in the pipe or line 15 to control the flow of fuel or gas to the burner 12. The valve 20 is operated by or is under the control of the circuit 22 so that it may be opened or made to close by a remote switch means such as the clock controlled switch means 23. In the preferred construction the valve 20 comprises a body 24 interposed in the pipe or line 15, see Fig. 6. The valve body 24 has two chambers A and B separated by a partition 25 and the body 24 is connected in the line 15 so that the upstream part of the line is in communication with the chamber A and the downstream side or burner part of the line communicates with the chamber B. In the case illustrated spaced parts of the line 15 are threaded in openings 26 in opposite sides of the body 24 to communicate with the chambers A and B. A head or chambered housing part 27 is secured to the upper side of the body 24. A suitable cover plate 9 closes the upper end of the part 27 and the interior of the part 27 constitutes a control chamber C. A port 28 is formed in the upper wall of the body 24 to communicate with the chamber B and is surrounded at its upper end by a suitable valve seat 29. A flexible diaphragm 30 is arranged across the lower end of the chamber C and carries a valve disc 31 for cooperating with the seat 29. In practice the margin or edge portion of the diaphragm 30 may be secured between the top of the valve body 24 and the lower end of the housing part 27. A bolt or screw 33 secures the valve disc 31 to the diaphragm 30 and may serve to retain a weight 34 on the upper side of the diaphragm. The weight 34 urges the diaphragm 30 downwardly so that the disc 31 seals with the seat 29. The upper side of the chamber A is open so that the fluid pressure therein acts upwardly against the diaphragm 30. With the fluid pressures in the chambers A and C substantially equal the valve disc 30 is held closed against the seat 29 by the weight 34. When the pressure in the chamber C is reduced or brought to atmospheric pressure the super-atmospheric pressure in the chamber A lifts the diaphragm 30 and the valve disc 31 so that the fuel flows from the chamber A through the port 28 into the chamber B and thence through the line 15 to the burner 12.

The valve 20 further includes an electrically governed pilot valve means controlling the pressure in the chamber C and thus governing the operation of the diaphragm 30 and valve disc 31. A port 35 leads from the chamber A and a similar port 36 leads from the chamber B. Fluid ports 37 extend upwardly through the end walls of the part 27 from the ports 35 and 36. Opposing webs or bosses 40 are formed on the walls of the part 27 and have aligned openings 41 communicating with the ports 37. Tubular dowels 38 are fitted in the ends of the ports 35 and 36 and are received in the lower ends of the ports 37. Jets 42^a and 42^b are fitted in the opposing ends of the openings 41 to project toward one another. The jets have reduced passages or ports 43 extending through them. The outer ends of the jets 42^a and 42^b are pointed or bevelled away to have very limited seats or surfaces at the outer ends of their ports 43. It will be observed that the port 43 of the jet 42^a places the chamber A in communication with the control chamber C and that the port 43 of the jet 42^b is adapted to put the chamber C in communication with the chamber B and the down stream side of the line 15.

A novel electrically actuated or governed valve 44 controls the ports 43 of the jets 42^a and 42^b. A sensitive electromagnet or solenoid coil 45 is suitably secured in position adjacent the jets 42^a and 42^b. In the particular case illustrated the coil 45 is attached to the under side of a boss 40 as by a bracket 46, it being understood that the coil may be otherwise mounted if desired. The coil 45 is adapted to act on or operate the valve 44. The valve 44 is a pivoted flapper valve having a lower portion in adjacent relation to the active end of the coil 45 to form the armature of the coil. The valve 44 is supported between its ends on a flat pivot 47 to move with a minimum of friction. The upper arm or part of the valve 44 is cooperable with the ends of the jets 42^a and 42^b to close their ports 43. A spring 48 serves to bias the valve 44 so that it is normally in the position illustrated in Fig. 6 where it closes the port 43 of the jet 42^b and leaves the port 43 of the jet 42^a open and in full communication with the chamber C. With the valve 44 in the normal position just mentioned the pressure in the chamber C is substantially the same as that in the chamber A so that the valve disc 31 is closed against its seat 29. Upon energization of the coil 45 the valve 44 is pivoted to a position where it closes the jet 42^a and opens the jet 42^b to communicate with the chamber C. This allows the fluid pressure in the chamber C to pass to the low pressure chamber or down stream chamber B so that the pressure in the chamber C becomes less than the pressure in the chamber A and the valve disc 31 is moved to its open position by the fuel pressure in the chamber A acting on the diaphragm 30.

The means 21 for generating current for the operation or control of the main valve 20 is a thermo-couple or thermo-electric means energized by the heat produced by the flame of a pilot burner for the main burner 12. The means 21 is the energy source of the control or system and in accordance with the invention is associated with the pilot burner for igniting the oven burner 12. The pilot burner comprises a tubular base 50 supplied with fuel by a line 51 connected with the main supply line 13. The pilot burner base 50 has a suitable jet 51 and an air induction port 52 above the jet, see Fig. 5. A tubular assembly is secured to the pilot burner base 50 to extend upwardly or outwardly therefrom. This assembly includes an inner tube 53 for passing the air and fuel mixture, a tube 54 of dielectric material arranged around the tube 53, and an outer tubular shell 55. The tube 54 is supported by the shell 55 and is shorter than the tube 53 to be spaced

some distance above the burner base 50. A burner tip 56 is provided on the upper end of the inner tube 53 and the tube 53 has lateral flame ports 57 below the tip.

The generator or means 21 is an electro-thermal device of circular multiple thermocouple design embodying a plurality of circumferentially spaced thermocouples of wires of dissimilar metals arranged through longitudinal openings 59 in the tube 54 and having connected or twisted parts 60 projecting from the opposite ends of the tube. The parts 60 at the upper or outer end of the tube 54 are enclosed in caps 61 while the parts 60 at the inner ends of the couples 58 are housed by the shell 55. The thermocouples 58 are connected in series and there is a sufficient number of thermocouples 58 to develop the required potential or voltage. In practice there may be twelve thermocouples 58 connected in series. The thermocouples 58 associated with the pilot burner, as just described, have their upper parts 60 in the drawings heated by the pilot flame, while their lower parts 60 remain at a much lower temperature, and this temperature differential provides for the generation of the current or electric potential. The generator produces sufficient electrical energy to effectively operate the system when there is a pilot burner flame having an input of less than 500 B. t. u. per hour.

As above noted, the generator or generating means 21 constitutes the sole source of electrical energy for the operation of the system and in the event of pilot flame extinguishment the generation of current ceases and the system is de-energized so that the main valve 20 closes or remains closed, as the case may be. Thus the pilot flame generator or generating means 21 forms a safety element preventing opening of the valve 20 in the event the flame of the pilot burner is extinguished.

The control circuit 22 handles the current generated by the means 21 and connects with the coil 45 of the valve 20 to energize the same under the control of the time switch or clock controlled switch 23. The circuit 22 may be a simple wiring system comprising two leads 63 and 64 extending from the series connected couples 58 of the generating means 21. The lead 63 may extend directly to a post of the valve coil 45 and the lead 64 may extend to the clock controlled switch 23 and thence to the other pole of the coil, see Fig. 1. The manner in which the lead 64 is connected with the clock control 23 will be later described. The leads 63 and 64 are of course suitably insulated and of suitable gauge. The posts of the coil 45 may be arranged on the cover plate 9.

The switch 23 is connected in the circuit 22 to govern energization of the valve operating or reversing coil 35. In accordance with the broader aspects of the invention the switch 23 may be any suitable form of time switch or clock controlled switch. In the drawings I have illustrated a clock controlled switch of the type described in Patent No. 2,098,965, granted to H. C. James, Jr., November 16, 1937.

The clock controlled switch 23 includes a suitable case 65 having a clock dial 66. Hour, minute and second hands 67, 68 and 69, respectively, move across the dial 66 in the usual manner and are driven or operated by a suitable mechanism within the case 65. The clock hands may be operated by a typical spring wound or spring driven gear train, or, if desired, may be operated by a synchronous alternating current motor supplied with current from an alternating current supply source. Where the control system of the present invention embodies the generating means 21 as the only required source of current for its operation it is usually preferred to employ a spring wound or spring driven gear train for the operation of the clock controlled switch 23, in order that the range or appliance may require only one utility service, namely the fluid fuel supply. However, in the drawings I have indicated electric leads 69 as a supply circuit for the operation of a synchronous motor for driving the clock 23, this being the operating means disclosed in the above mentioned James patent. It is to be understood that in most cases it will be preferred to employ a spring wound clock mechanism and that the disclosure of the energizing wires 69 is not to be taken as a restriction or limitation.

Shafts or arbors 70, 71 and 72 carry the hands 67, 68 and 69, respectively. The hour hand arbor 72 supports and drives an insulated carrier 73 on which is arranged a pair of collector rings 74 and 75. Brushes 76 and 77 are suitably supported in the case 65 to cooperate with and supply current to the rings 74 and 75, respectively. The brushes 76 and 77 are interposed in the lead 64 of the circuit 22, this lead being broken and having its ends secured to suitable posts 78a on the brushes 76 and 77. Counter-weighted arms 78 and 79 are secured to the carrier 73 and are connected with the rings 74 and 75, respectively. The arms 78 and 79 are insulated one from the other. The arm 79 carries a flexible switch arm 80 provided with a cam 81. A contact 82 is provided on the arm 78 and is engageable by the switch arm 80 when the latter is depressed or flexed. The switch arm 80 is normally out of engagement with the contact 82.

Means are provided for flexing the switch arm 80 into engagement with the contact 82 at any selected time and for any selected period to complete the circuit 22. Cranks or actuators 86 are arranged in openings or slots 83 in a ring 84 arranged in surrounding relation to the dial 66. There is an annular series of actuators 86 and slots 83. The actuators 86 are normally out of the path of the cam 81 but their projecting forward parts may be manipulated to move them in the slots 83 to positions where their inner parts are in the path of the cam 81, so that these inner parts serve to depress the arm 80 into engagement with the contact 82. A spring wire 85 yieldingly holds the actuators 86 in position. One or a series of consecutive actuators 86 may be moved to their active positions so that the cam 81 will be depressed by them to engage the arm 80 with the contact 82. The cam 81 is designed so that its engagement with an actuator 86 holds the arm 80 in engagement with the contact 82 for a given period, say 15 minutes, and the actuators 86 are so spaced and arranged that the setting of a series of consecutive actuators will hold the circuit 22 closed for a period bearing a given relation to the number of actuators that have been set. The actuators 86 may be formed and related so that the circuit 22 may be closed for a period of any selected duration at any time of day. It will be seen that the clock controlled switch 23 may be controlled by its actuators 86 to cause the valve 20 to be opened at any selected time and to remain open for any selected period.

It is a feature of the invention that the clock

control or switch 23 is portable so that it may be arranged on the range or appliance or may be positioned at a suitable remote point, as desired. It is contemplated that the clock controlled switch 23 be seated on the guard rail 14 to occupy a substantially central position on the upper face or edge of the rail. However, in some ranges the raised or elevated covers 19 conceal the clock controlled switch 23 and make it inaccessible when the latter is arranged in such a position on the rail 14. The invention provides an arrangement by means of which the clock controlled switch 23 may be positioned on the guard rail 14 or may be moved to a remote point, as desired, and yet remain operative. In one manner of carrying out the invention a socket 88 is arranged on a platform 89 on the rail 14 and the lead 64 of the circuit 22 connects with the socket. Where the operating means of the clock controlled switch 23 is driven by an electric motor the wires 69 are connected with a similar adjacent socket 90. The clock case 65 carries a plug 91 to which wires 64ª of the lead 64 are connected. The wires 64ª extend from the plug 91 to the posts 78 of the brushes 76 and 77. The wires in the case 65 for carrying the energizing current of the operating motor may be connected with a similar spaced plug 92. The plugs 91 and 92 project from the lower side of the case 65 and are adapted to cooperate with or enter the sockets 88 and 90, respectively. With the plugs 91 and 92 in the sockets 88 and 90 the clock controlled switch 23 is connected in the control circuit 22 to govern the operation of the system. When it is desired to remove the clock controlled switch 23 from the rail 14 and yet maintain it in operation a flexible extension cord 94 is provided which includes or contains extensions of the lead 64 and wires 69. Blocks 95 and 96 are provided on the opposite ends of the cord 94. The block 95 has suitable plugs (not shown) cooperating with the sockets 88 and 90, while the block 96 has sockets 97 and 98 for receiving the plugs 91 and 92, respectively. The block 96 may be positioned in any suitable or convenient position and the clock controlled switch 23 may be seated in the operative position on the block to control the circuit 22 and the main valve means 20.

Under normal conditions prior to actuation of the clock controlled switch 23 the valve means 20 is closed, that is, the valve disc 31 cooperates with the seat 29 to prevent fuel flow to the burner 12. The jet 42ª and the associated conductor 37 and port 35 maintain the control chamber C in communication with the chamber A so that the pressures on the opposite sides of the diaphragm 30 are substantially equal and the weight 34 holds the valve closed. The flame of the pilot burner normally energizes the means 21 so that it generates current for the circuit 22. However, as the clock controlled switch 23 is normally open the coil 45 is normally de-energized. By suitably manipulating one or more of the actuators 86 the clock controlled switch 23 may be set to cause opening of the valve means 20 and operation of the main burner 12 for a selected period.

When the cam 41 on the switch arm 80 comes into contact with the set actuator or actuators 86 the arm 80 engages the contact 82 to complete the circuit 22. When the circuit 22 is completed the coil 45 is energized to pivot the valve 44 against the action of the spring 48. This closes the jet 42ª and opens the jet 42ᵇ. Opening of the jet 42ᵇ with the jet 42ª closed allows the fluid pressure in the chamber C to quickly bleed into the chamber B and the down stream side of the line 15. This creates an unequal pressure condition in the chambers A and C and the diaphragm 30 is raised by the fluid pressure or fuel under pressure in the chamber A. With raising of the diaphragm 30 the valve disc 31 moves away from the seat 29 so that the fuel flows through the line 15 to the burner 12. The burner 12 remains in operation so long as the actuators 86 hold the cam 81 in engagement with the contact 82. When the cam 81 leaves the last set actuator 86 the arm 80 moves out of engagement with the contact 82 and the circuit 22 is broken. This, of course, de-energizes the coil 45 and the valve 44 returns to its normal position under the action of the spring 48 so that it closes the jet 42ᵇ and opens the jet 42ª to the chamber C. With the jet 42ª open to the chamber C the pressure in the chamber C soon becomes equal to the pressure in the chambers A and B and the weight 34 moves the diaphragm 30 downwardly to close the disc 31 against the valve seat 29. This, of course, cuts off the supply of the fuel to burner 12.

If at any time the pilot flame is extinguished the means 21 becomes de-energized, that is, it no longer functions and no longer supplies current to the circuit 22. Accordingly, closing of the clock control switch 23 following extinguishment of the pilot flame cannot open the valve means 20 as there is no current in the circuit 22 for the energization of the coil 45. The means 21 thus constitutes a safety control for preventing the discharge of gas from the burner 12 when the pilot flame is extinguished.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. In a cooking range having a main fluid fuel burner and a pilot burner each provided with a fuel supply line, the combination of valve means controlling the supply line of the main burner, electrically actuated means for controlling the valve means, a control circuit for the electrically actuated means, a clock controlled switch in said circuit, and thermo-electric means energized by the flame of the pilot burner supplying current to said circuit.

2. A control for a main fluid fuel burner having a supply line carrying fuel under pressure and having a pilot burner, the control comprising valve means in said line including a valve body interposed in the line, an imperforate diaphragm in the body having one side subjected to the pressure in the line, a valve operable by the diaphragm, means yieldingly holding the valve closed, control valve means having a position where it imposes the line pressure on the other side of the valve and a bleeding position where it bleeds the pressure from said other side of the diaphragm and holds said other side of the diaphragm out of communication with the supply line whereby the valve moves to the open position, electromagnetic control means for operating the control valve from the first named position to the bleeding position, and thermoelectric means energized by the flame of the pilot burner supplying operating current to the electromagnetic means.

3. A control for a main fluid fuel burner having a supply line carrying fuel under pressure and

having a pilot burner, the control comprising valve means in said line including a valve body interposed in the line, an imperforate diaphragm in the body having one side subjected to the pressure in the line, a valve operable by the diaphragm, means yieldingly holding the valve closed, control valve means having a normal position where it admits the line pressure to the other side of the diaphragm and having a bleeding position where it bleeds the pressure from said other side of the diaphragm back into said line at the downstream side of the valve body whereby the valve moves to the open position, spring means urging the control valve to the normal position, electromagnetic means for operating the control valve to the bleeding position, a control circuit for the electromagnetic means, a clock controlled switch for the control circuit, and means energized by the flame of the pilot burner generating current for the operation of the electromagnetic means.

4. In burner control apparatus, the combination with a burner, of a thermoelectric responsive control valve for governing the flow of fuel to the burner, ignition means for igniting the fuel at said burner, a thermoelectric circuit connected to said valve and having thermocouple means subject to the heat of said ignition means for opening said valve and holding same open when said ignition means is operative, and a time controlled switch connected in series circuit relation with said valve and said thermocouple means and operative independently of temperature jointly with said thermocouple means to open and close said valve at preselected times and when said ignition means becomes respectively operative and inoperative to light the fuel at the burner.

5. In combination, a burner, a fuel supply pipe leading to said burner, a diaphragm valve in said pipe, said valve having a diaphragm provided with a valve member, a diaphragm chamber for said diaphragm, means for bleeding fuel into said diaphragm chamber from said fuel supply pipe anterior of said valve and for relieving the pressure in said diaphragm chamber, control means governing said fuel bleeding and pressure relief means, a supply pipe for a pilot light in juxtaposition to said burner, thermocouple means placed in position to be heated by said pilot light, an electro-magnet connected in circuit with said thermocouple means and operative when energized by the thermoelectric current set up by the heat of the pilot light on said thermocouple means to actuate said control means from a first position shutting off said pressure relief means to a second position opening said pressure relief means and shutting off said bleed means and to hold said control means in said second position, said control means being operative when the pilot light is extinguished to said first position, and a time controlled switch connected in circuit with said thermocouple and said electromagnet and operative independently of temperature to open and close said circuit for operation of said control means from one of said first and second positions to and from the other position at different preselected times.

6. In combination with a cooking range having a main fluid fuel burner and a pilot burner therefor each provided with a fuel supply line, the combination of valve means controlling the supply line of the main burner, electrically actuated means for controlling the valve means, a control circuit for the electrically actuated means, a clock controlled switch connected in said circuit at a point remote from the range, and thermoelectric means energized by the flame of the pilot burner supplying current to said circuit.

7. In burner control apparatus, the combination with a burner, of ignition means for igniting the fuel at the burner, thermocouple means adapted to be subjected to the heat of said ignition means, an electroresponsive valve governing the flow of fuel to the burner and connected in circuit with said thermocouple means, and a time controlled switch connected in circuit with said thermocouple means and said valve.

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