May 5, 1953 R. L. PERL ET AL 2,637,390

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

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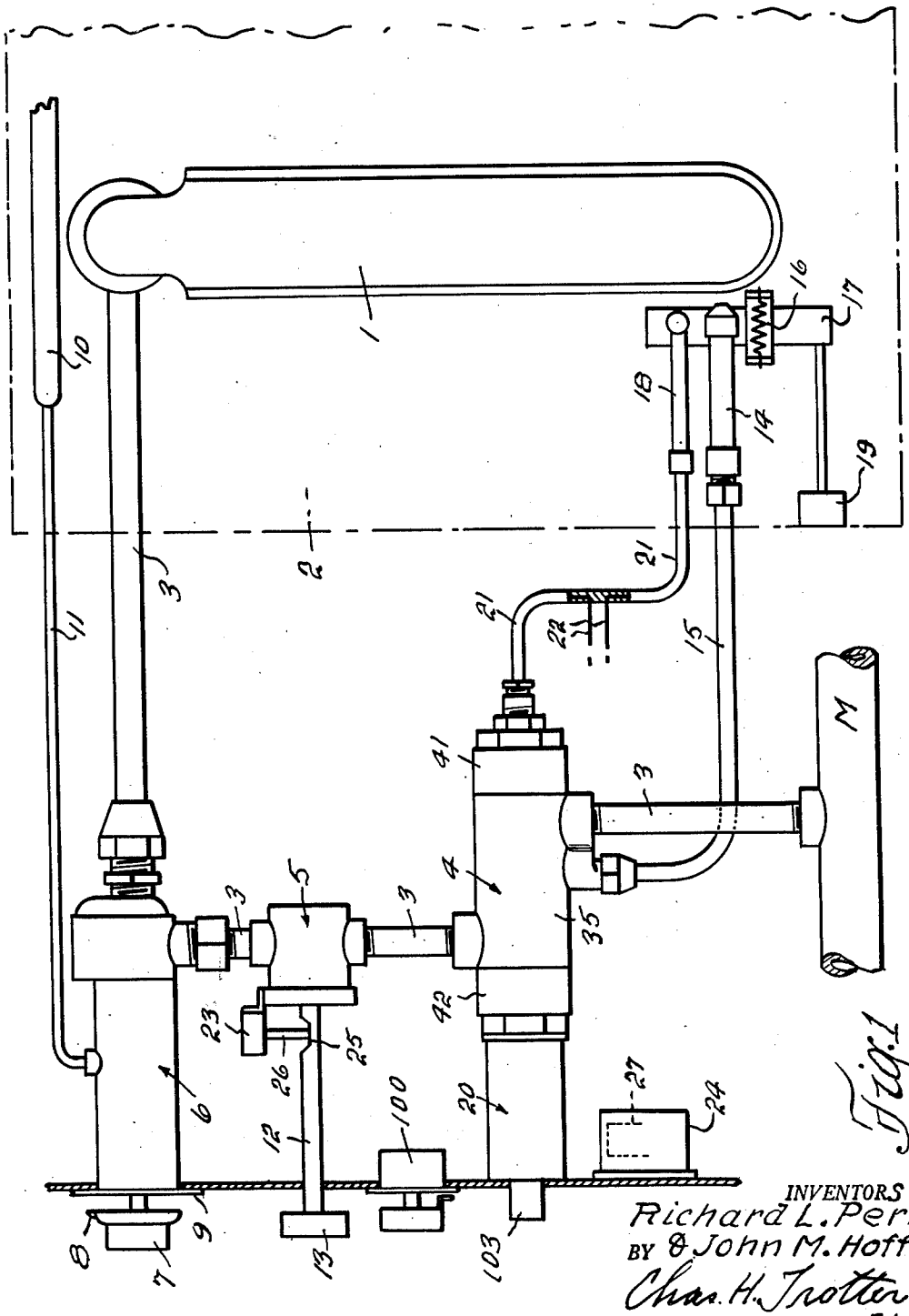



Fig. 1

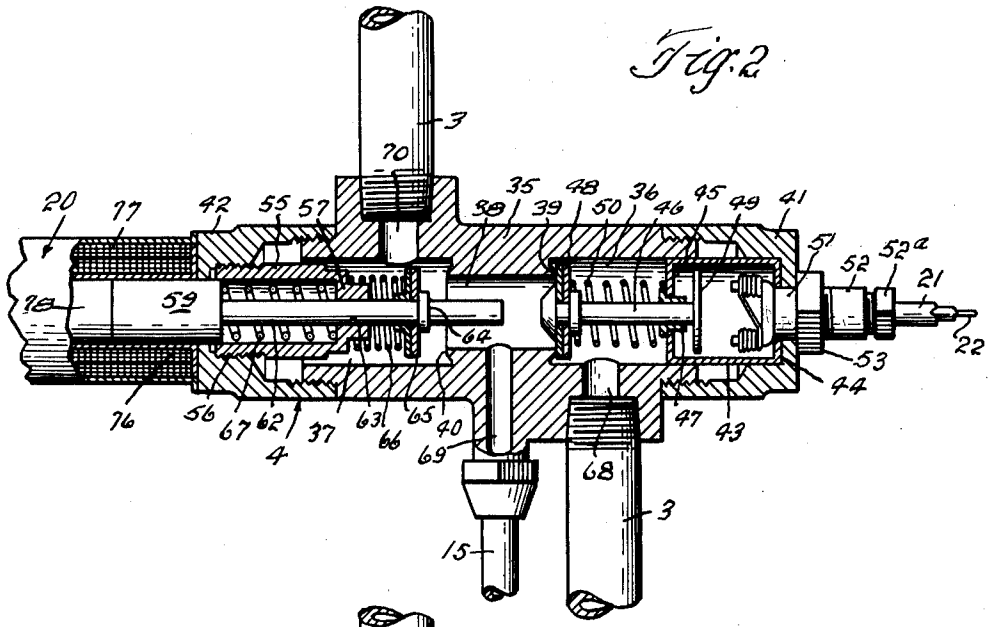
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Fig. 2



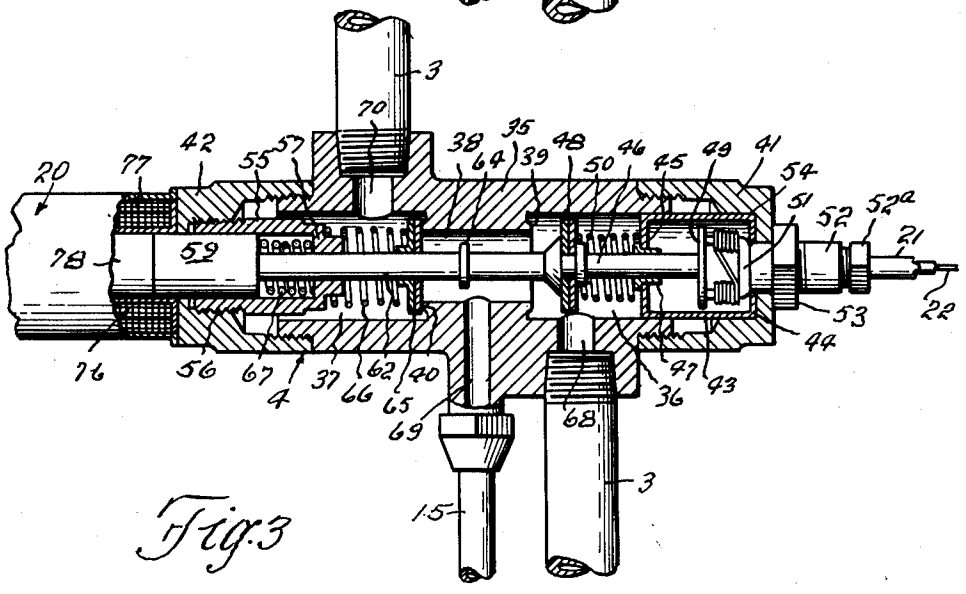




Fig. 3

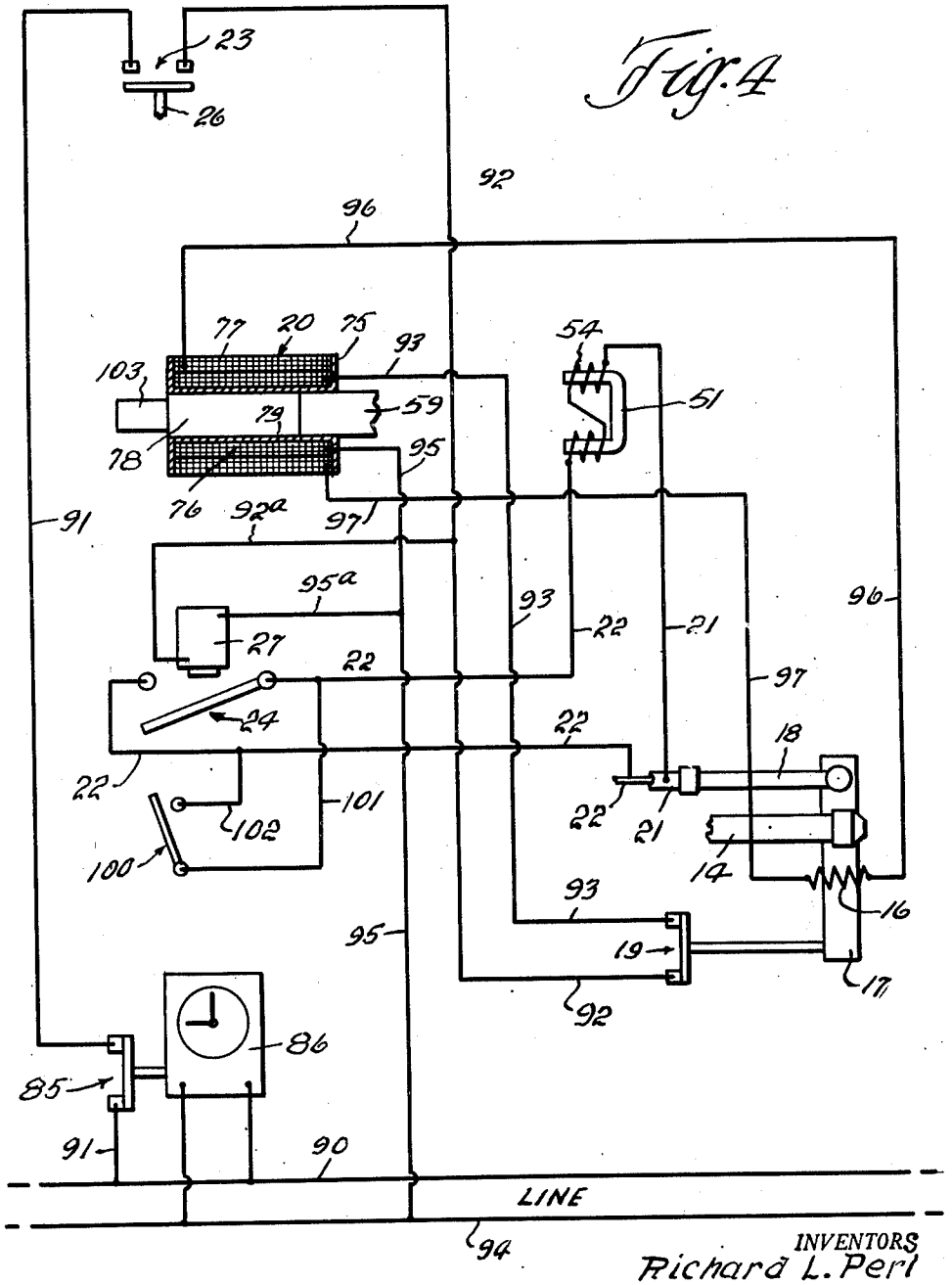
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Fig. 4




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# UNITED STATES PATENT OFFICE

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## AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

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Application December 10, 1951, Serial No. 260,906

20 Claims. (Cl. 161—9)

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This invention relates to an automatic electric ignition and control mechanism for cooking range burners using gaseous fuel and is a modification of the control mechanisms shown in the co-pending applications of Charles M. Mayer and John M. Hoff filed April 3, 1950, Serial No. 153,664, now Patent No. 2,577,787, and our co-pending application, Serial No. 269,356, filed February 1, 1952. It is especially designed and adapted for automatically igniting and controlling the operation of oven burners in cooking ranges, and may be used in conjunction with a time control mechanism or independently thereof as desired.

The mechanism is designed for use with a main gaseous fuel burner which is adapted to be ignited by a gaseous fuel pilot burner. As long as the pilot burner is ignited it is immaterial whether or not the main burner burns constantly. It may be extinguished for some reason, but it will be promptly re-ignited by the pilot burner if fuel is supplied thereto. But if the pilot burner is extinguished for any reason while the main control valve is still open to supply gas to the main burner a very dangerous situation sometimes arises. Let us assume that both the pilot burner and the main burner are extinguished during operation for some reason. Gas can then flow to the main burner but since the pilot burner is extinguished the main burner will not be ignited and unburned gas will accumulate in the oven which may violently explode when an attempt is made to ignite either the main or pilot burner. It has been found by experience that both the pilot burner and the main burner are frequently extinguished during operation. This is sometimes due to a momentary failure of the gas supply or the slamming of the oven door or to various other reasons.

In order to prevent any accumulation of unburned gas and thus eliminate danger of an explosion therefrom in the event the pilot burner is extinguished for any reason during operation, we provide in our improved apparatus a safety control unit by which the supply of gas to both the main burner and the pilot burner is completely cut off, in the event the pilot burner is extinguished for any reason during operation.

Our improved apparatus includes a main gaseous fuel burner by which the oven in a cooking range is heated. The main burner is adapted to be ignited by a gaseous fuel pilot burner which burns only during the time the oven is in operation. At other times the supply of gas to both the main burner and the pilot burner is cut off by the safety control unit which is interposed in a

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conduit between the gas supply manifold and the main burner. During operation gas flows from the manifold into a safety control unit. From the safety control unit gas flows through a small branch conduit directly to the pilot burner; and through the main conduit, a manually operable normally closed main control valve, and a standard thermostatically operated oven temperature control valve to the main burner. A normally open master control switch associated with the main control valve is provided to initiate operation of both the pilot burner and the main burner. The master control switch is arranged to be closed by the opening of the main control valve and to be opened by the closing of the main control valve. The closing of the master control switch energizes, through a normally closed thermostatically opened switch, a solenoid transformer which is operatively connected to the safety control unit, and the solenoid transformer when energized energizes an electric resistance ignition element. The energization of the solenoid transformer causes it to set the safety control unit to permit the flow of gas from the safety control unit to the pilot burner while cutting off the supply of gas from the safety control unit to the main burner. The pilot burner is ignited by the electric ignition element and projects a flame against a thermostatic element which is operatively connected to the normally closed switch, and against a thermocouple which is operatively connected to an electromagnet in the safety control unit. After the thermostatic element becomes heated it opens the normally closed switch which de-energizes the solenoid transformer and the electric ignition element. As soon as the solenoid transformer is de-energized the safety control unit is automatically operated by spring means to supply gas to the main burner through the main control valve and the oven temperature control valve. The main burner is then ignited by the pilot burner. The thermocouple, as long as it is heated by the pilot burner, maintains the safety control unit through the electromagnet in condition to supply gas to both the main burner and the pilot burner. The oven temperature control valve then regulates the supply of gas to the main burner so as to maintain the desired oven temperature. As long as the pilot burner is ignited the main burner will burn normally under the control of the oven temperature control valve. But if during operation the pilot burner is extinguished for any reason the thermocouple will immediately cool and allow the safety control unit to automatically

cut off the supply of gas to both the main burner and the pilot burner. As an example of the manner of operation of the apparatus, let us assume that during operation the pilot burner is suddenly extinguished, for instance, by a momentary failure of the gas supply from the manifold to the burners. The thermocouple immediately cools, allowing the safety control unit to cut off communication between the manifold and both the main burner and the pilot burner. Then after the thermostatic element has cooled, closing the normally closed switch, which is maintained open by the thermostatic element during normal operation of the oven, the solenoid transformer and the electric ignition element are again energized, since the master control switch is still open. The energization of the solenoid transformer will cause it to operate the safety control unit to reestablish communication between the manifold and the pilot burner only. Then when gas is again available the pilot burner will be re-ignited and re-establish normal operation of the oven as previously described.

When it is desired to use the apparatus in conjunction with any standard time control mechanism, we provide a normally closed supplemental control switch which is disposed in series with the master control switch. The supplemental control switch is adapted to be opened and closed at predetermined set times by the time control mechanism. When used the time control mechanism is set to initiate operation of the oven burner at a predetermined time and to terminate operation thereof at a predetermined later time which will open the normally closed supplemental control switch. The main control valve is then manually opened and the master control switch is simultaneously closed. At the set time the time control mechanism will close the supplemental control switch which will effect the energization of the solenoid transformer and the electric ignition element. The apparatus will then operate as previously described in connection with manual control until the time control mechanism opens the supplemental control switch at the set later time to terminate operation. The opening of the supplemental control switch will cause the safety control unit to cut off the supply of gas to both the main burner and the pilot burner, thus terminating operation.

Prolonged power failures of many hours and sometimes of even several days duration frequently occur in various parts of the country. In order to eliminate the necessity of either keeping the main burner burning constantly during a prolonged power failure or manually actuating the safety control unit, as is normally done by the solenoid transformer, and then lighting the pilot burner with a match, we provide means by which the pilot burner may be arranged to burn constantly instead of being extinguished each time the supply of gas to the main burner is cut off. The operation of the main burner is then controlled by the opening and closing of the main control valve.

The principal object of the invention is to provide an improved electrical ignition and automatic control system for cooking range oven burners using gaseous fuel.

Another object of the invention is to provide in an electrical ignition and control system of the character described means for completely shutting off the supply of gas to both the main burner and the pilot burner in the event the pilot burner becomes extinguished for any reason during operation.



Another object of the invention is to provide an oven burner ignition and control system of the character described wherein the pilot burner may be arranged to burn only when the main burner is turned on or to burn constantly if desired.

Another object of the invention is to provide in an automatic ignition and control system for oven burners means by which the system may be easily converted from a fully automatic system to a constantly burning pilot burner system.

Still another object of the invention is to provide an improved electrical ignition and control system of the character described which may be used in conjunction with a time control mechanism or independently thereof as desired.

Other and more limited objects of the invention will be apparent from the following specification and the accompanying drawing forming a part thereof, wherein:

Fig. 1 is a diagrammatic layout showing our improved electrical ignition and safety control mechanism applied to a cooking range oven burner using gaseous fuel.

Fig. 2 is an enlarged central vertical section through the safety control unit showing the various parts in position to cut off the supply of fuel to both the pilot burner and the main burner.

Fig. 3 is a view similar to Fig. 2 showing the various parts in the position they are automatically moved to when the master control switch is closed to initiate the operation of the main oven burner; and

Fig. 4 is a wiring diagram of the apparatus.

Referring now to the drawings by reference characters, the numeral 1 indicates a gaseous fuel burner which is mounted in or in heating relation to a cooking range oven 2. Gaseous fuel is supplied to the burner 1 from a manifold M through a conduit 3. Interposed in the conduit 3 are a safety control valve mechanism generally indicated by the numeral 4, a manually operable main control valve 5, and an oven temperature control valve 6. During operation gas flows from the manifold M through the conduit 3 to the safety control unit 4, to be described in detail hereinafter. From the safety control unit 4 the gas flows through the conduit 3, the main control valve 5, and the oven temperature control valve 6 to the burner 1. The oven temperature control valve 6 is operative to regulate the amount of gas flowing to the burner 1 during operation in order to maintain the oven 2 at any desired set temperature. The valve 6 is set to any desired temperature by a handle 7 having a pointer 8 which cooperates with a graduated dial 9 carried by the valve 6. The valve 6 is controlled according to the temperature setting by a thermostatic element 10 which is mounted in the oven 2 and is connected to the valve 6 as shown at 11. The main control valve 5 is a standard shut off valve which is manually opened and closed by a handle 12 and a valve stem 13. The oven temperature control valve 5 is of standard well known construction. Consequently it is not shown in detail herein. There are many different constructions available any one of which will work equally well herein. If desired the shut off valve 5 and the oven temperature control valve 6 may be combined as a single unit and both actuated by the same handle and stem. Many such combined valves are available. Gas

is also supplied to a pilot burner 14 through a branch conduit 15 which extends between the safety control valve mechanism 4 and the pilot burner 14. The pilot burner 14 is disposed adjacent the rear end of the main burner 1 in position to ignite the burner 1 when gas is supplied thereto. An electrical ignition element 16 is operatively associated with the pilot burner 14 in position to ignite the pilot burner 14 when gas is supplied thereto. A thermostatic element 17 and a multiple thermocouple 18 are mounted in position to be heated by a flame from the pilot burner. The thermostatic element 17 is operative to open and close a switch 19 which controls the energization of electrical ignition element 16 and a solenoid transformer 20 which when energized operates the safety control unit to supply gas to the pilot burner 14 only as will be described in connection with the description of the safety control unit and the operation of the whole apparatus. The thermocouple 18, when heated, is operative to hold the safety control unit in condition to maintain the supply of gas to both the pilot burner 14 and the main burner 1, as will also be described in connection with the description of the safety control valve mechanism and the operation of the apparatus. An electric circuit between the thermocouple 18 and the safety control unit 4 is established by a copper tube 21 and an insulated wire 22 within the tube 21.

A master control switch 23 and an interrupter switch 24 which cooperate with each other and with the main control valve 5 are provided to control the operation of the apparatus. The master control switch 23 is associated with the main control valve 5 and is adapted to be opened and closed by a cam 25, carried by the valve stem 12, through a link 26. The arrangement is such that the switch 23 is simultaneously closed with the opening of the main control valve 5, and is simultaneously opened with the closing of the valve 5. The interrupter switch 24 is interposed in the thermocouple circuit as shown in Fig. 4. It is normally open and is arranged to be maintained closed by a relay 27 when the relay is energized. The energization of the relay 27 is controlled by the master control switch 23 as will be explained hereinafter.

The construction of the safety control unit 4 and its connection to the solenoid transformer 20 will now be described, reference being had to Figs. 2 and 3, of the drawings. This unit comprises a casing 35 having a chamber 36 in one end thereof and a chamber 37 in the other end thereof. The chambers 36 and 37 are connected by a bore 38 of reduced diameter. A valve seat 39 is located at one end of the bore 38 and a similar valve seat 40 is located at the other end of the bore 38. The chamber 36 is closed by a removable cap 41 and the chamber 37 is closed by a removable cap 42. A sleeve 43, having end walls 44 and 45, is carried by the cap 41 and extends into the chamber 36. A valve stem 46 which is slidably mounted in a bushing 47 carried by the end wall 45 of the sleeve 43, extends from the chamber 36 into the sleeve 43. A control valve 48 of suitable material is secured to one end of the valve stem 46 within the chamber 36, and an armature 49 is secured to the other end of the stem 46 within the sleeve 43. A spring 50 disposed about the valve stem 46 between the control valve 48 and the end wall 45 of the sleeve 43 normally holds the control valve 48 against the valve seat 39. An electromagnet 51 is secured to one end of a hollow exteriorly threaded stud 52 which extends out through aligned apertures in the end wall 44, of the sleeve 43, and in the end of the cap 41. A nut 53 screwed onto the outer portion of the stud 52 securely holds the magnet 51 and the sleeve 43 in place. The legs of the magnet 51 have a winding 54 thereon, one end of which is connected to the tube 21 and the other end of which is connected to the wire 22 in the tube 21. The tube 21 is inserted into the hollow stud 52 and is held in place by a screw fitting 52a. A sleeve 55 is screwed into a threaded recess in the end of the cap 42, as indicated at 56, and extends into the chamber 37 a slight distance. One end of the sleeve 55 is closed by an end wall 57, and the other end, which is open, registers with a circular aperture 58 in the end wall of the cap 42. A plunger 59 is slidably mounted in the sleeve 55 and extends out through the aperture 58 in the cap 42. A stem 62, which is secured to the inner end of the plunger 59, extends out through an aperture 63 in the end wall 57 of the sleeve 55, and through the chamber 37 and into the bore 38. The stem 62 has a collar 64 rigidly secured thereon between the end wall 57 and the outer end of the stem. An interrupter valve 65 of suitable material is slidably mounted upon the stem 62 between the end wall 57 of the sleeve 55 and the collar 64. The interrupter valve 65 is adapted to engage the valve seat 40 to cut off the flow of gas into the chamber 37 during the initiation of operation as will be hereinafter described. A compression spring 66 disposed about the stem 62 between the end wall 57 and the valve 65 normally yieldingly holds the valve 65 against the collar 64. A compression spring 67 which is stronger than the spring 66 is disposed about the stem 62 within the sleeve 55 between the inner face of the end wall 57 and the inner end of the plunger 59. The spring 67 is operative to return the plunger 59, stem 62 and valve 65 from the position shown in Fig. 3 back to their normal position as shown in Fig. 2, against the resistance of the spring 66. A port 68 in the casing 35 provides communication between the chamber 36 and the conduit 3 to allow gas to flow from the manifold M through the conduit 3 into the chamber 36. During normal operation of the main burner 1 gas flows from the chamber 36 through the reduced intermediate bore 38 and into the chamber 37. A port 69 which establishes communication between the branch conduit 15 and the bore 38 is provided to supply gas to the pilot burner 14; and a port 70 establishes communication between the chamber 37 and the conduit 3 to permit the flow of gas from the chamber 37 to the main burner 1 through the main control valve 5 and the oven temperature control valve 6.

The solenoid transformer 20 comprises a spool 75 on which are wound the primary winding 76 and the secondary winding 77. An armature 78 is slidably mounted in the bore 79 of the spool 75. The solenoid transformer 20 may be operatively associated with the safety control unit 4 in any suitable manner. As shown herein it is secured to the cap 42 of the safety control unit 4, with the armature 78 thereof in axial alignment with the plunger 59 of the safety control unit 4.

In order to accommodate the apparatus for automatic control whereby operation of the main oven burner 1 may be automatically initiated at a predetermined set time and automatically terminated at a predetermined set later time, we provide a normally closed supplemental master

switch 85 which is adapted to be opened and closed by a standard time control mechanism 86.

The operation of the apparatus will now be described, particular reference being had to Fig. 4 of the drawings. For manual control it is only necessary to manually open the main control valve 5 and close the master switch 23 to initiate operation, and then manually close the main control valve 5 and open the master switch 23 to terminate operation. When the switch 23 is closed current will flow from one side 90 of the line through the lead 91 to the switch 23, thence through the switch 23 and lead 92 to the normally closed thermally opened switch 19. The current then flows through the switch 19 and lead 93 to the primary winding 76 of the solenoid transformer 20 and from there back to the other side 94 of the line through the lead 95. The relay 27 is connected to the leads 92 and 95 between the switches 23 and 19 by the leads 92*a* and 95*a* so that it will always be energized when the master switch 23 is closed. The solenoid transformer 20 and the relay 27 are now energized, and the electric ignition element 16, which is connected to the secondary winding 77 of the solenoid transformer by the leads 96 and 97 is also energized. The relay 27 being energized closes the switch 24 in the thermocouple circuit and the solenoid transformer 17 being energized shifts the various parts of the safety control unit from the positions shown in Fig. 2 to the position shown in Fig. 3. Gas can now flow to the pilot burner 14 where it is ignited by the ignition element 16, but gas cannot yet flow to the main burner 1 since the interrupter valve mechanism in the chamber 37 of the safety control unit is maintaining the entrance thereto closed. The pilot burner being ignited heats the thermocouple 18 and the thermal element 17. The thermocouple being heated generates a minute current of the order of 200 to 250 millivolts which flows from the thermocouple through the tube 21 to the winding 54 of the electromagnet 51 and from there through the wire 22 and switch 24 back to the thermocouple 18. The thermocouple current energizes the electromagnet 51 sufficiently for it to hold the control valve mechanism in the chamber 36 in the position shown in Fig. 3 after it has been moved to this position by the solenoid transformer 20, but not enough for the electromagnet to attract the mechanism from the position shown in Fig. 2 to the position shown in Fig. 3. The heating of the thermal element 17 causes it to open the normally closed switch 19 which breaks the circuit to and de-energizes the solenoid transformer 20 and consequently the electric ignition element 16. As soon as the solenoid transformer 20 is de-energized the spring 67 returns the interrupter valve mechanism in the chamber 37 back from the position shown in Fig. 3 to the position shown in Fig. 2 while the electromagnet 51 holds the control valve mechanism in the chamber 36 in the position shown in Fig. 3. Gas can now flow through the main control valve 5 to the main burner 1 where it is ignited by the pilot burner 14. Under normal conditions the burner 1 will now operate under control of the oven temperature control valve 6 until its operation is terminated by the opening of the switch 23 and the simultaneous closing of the valve 5. The closing of the manually operable valve 5 cuts off the flow of gas from the control unit 4 to the main burner 1, but it does not cut off the flow of gas to the pilot burner 14. This is effected by the opening of the master control switch 23 which breaks the circuit to the relay 27 and allows the interrupter switch 24 to open. The opening of the interrupter switch 24 breaks the thermocouple circuit and de-energizes the electromagnet 51 after which the spring 50 returns the control valve mechanism in the chamber 36 back from the position shown in Fig. 3 to the position shown in Fig. 2, thus cutting off the flow of gas from the safety control unit 4 to both the main burner and the pilot burner. If the pilot burner is extinguished for any reason during operation, then the thermocouple 18 and the thermal element 17 will cool. The electromagnet 51 will then be de-energized and release the control valve mechanism in the chamber 36 which will then be returned by the spring 50 to the position shown in Fig. 2 cutting off the supply of gas to both the pilot burner 14 and the main burner 1. When the thermal element 17 cools, which is after the thermocouple 18 has cooled, the switch 19 will close. The apparatus will then re-cycle as described as soon as gas is available.

In order to adapt the mechanism for automatic operation of the burner 1 we interpose the normally closed supplemental control switch 35 in the lead 91 in series with the main control switch 23 and provide the standard time control mechanism 86 which is operative to close and open the switch 85 at predetermined set times. During manual control of the burner 1 the switch 35 is maintained closed. For automatic control the time control mechanism 87 is first set to initiate operation at a predetermined time and to terminate operation at a predetermined later time. The setting of the time control 87 automatically opens the switch 85. The valve 5 is then manually opened and the switch 23 closed. The opening of the valve 5 and the closing of the switch 23 will have no effect as long as the switch 85 is open since the safety control unit 4 is in the condition shown in Fig. 2 with the valve 43 in the chamber 36 cutting off the flow of gas from the safety control unit 4 to both the main burner 1 and the pilot burner 14. At the set time the time control mechanism will close the switch 85 after which the mechanism will function exactly as described in connection with manual control until time to terminate operation. At the predetermined set time for terminating operation the time control mechanism 86 will open the switch 85 which will break the circuit to the relay 27 and allow the switch 24 to open. The opening of the switch 24 in the thermocouple circuit will de-energize the electromagnet 51 in the safety control unit 4 and release the valve 43. The spring 50 will then close the valve 43 and cut off the flow of gas to both the main burner 1 and the pilot burner 14. At any time thereafter the apparatus may be re-set for manual control by closing the valve 5 and switch 35 and opening the switch 23. If during automatic operation the pilot burner 14 is extinguished for any reason the apparatus will function to cut off the supply of gas as described in connection with manual operation.

In order that the oven may be repeatedly used during a prolonged power failure without the necessity of manually lighting the pilot burner 14 with a match each time it is used, we provide means by which the apparatus can be quickly and easily converted from a fully automatic electric ignition system to a constantly burning pilot burner system. To this end we connect a normally open switch 100 in parallel with the interrupter switch 24 in the thermocouple circuit by

the leads 101 and 102. In order to convert the apparatus to a constantly burning pilot burner system the normally open switch 100 is closed and the safety control unit 4 is manually set and held in the condition shown in Fig. 3, by depressing the button 103 secured to the armature 73, in which condition gas can flow to the pilot burner 14 and be ignited by a match. The control unit 4 must be held as shown in Fig. 3 until the pilot burner 14 has heated the thermocouple 13 sufficiently for it to energize the electromagnet 51 after which the button 103 may be released. The electromagnet 51 will hold the control valve in the chamber 36 open as shown in Fig. 3 and the spring 67 will return the interrupter valve in the chamber 36 back to open position shown in Fig. 2. Then the operation of the burner 1 is manually controlled by the opening and closing of the valve 5. Obviously the apparatus cannot be automatically controlled by the time control mechanism 86 during a power failure.

From the foregoing it will be apparent to those skilled in this art that we have provided a very simple and efficient mechanism for accomplishing the objects of the invention.

It is to be understood that we are not limited to the specific construction shown and described herein as various modifications may be made therein within the scope of the appended claims.

What is claimed is:

1. In an automatic ignition and control apparatus of the character described the combination of a main burner, a pilot burner operative to ignite said main burner, an electric ignition element operative when energized to ignite said pilot burner, a gaseous fuel supply manifold, a main conduit through which fuel is supplied to said main burner from said manifold, a safety control unit operative to cut off the supply of fuel to said main burner and said pilot burner interposed in said conduit between said main burner and said manifold, a manually operable shut off valve interposed in said conduit between said safety control unit and said main burner, a branch conduit extending between said safety control unit and said pilot burner through which fuel is supplied to said pilot burner, a solenoid operatively associated with said safety control unit, said solenoid being operative upon energization to first set said safety control unit in condition to supply fuel to said pilot burner while cutting off the supply of fuel to said main burner and upon subsequent de-energization to set said safety control unit in condition to also supply fuel to said main burner, an electromagnet associated with said safety control unit and operative when energized to maintain said safety control valve in said last set condition, a thermocouple adapted to be heated by said pilot burner, an electric circuit between said thermocouple and said electromagnet through which said magnet is energized by said thermocouple when said thermocouple is heated, an interrupter switch interposed in said circuit and operative to open and close said circuit and thereby control the energization of said electromagnet, a normally open master switch which is operative when closed to effect the energization of said solenoid and said electric ignition element, a normally closed switch disposed in series with said master switch which is operative when opened to effect de-energization of said solenoid and said electric ignition element, and a thermostatic element adapted to be heated by said pilot burner and operative when heated to maintain said normally closed switch open and when cool to maintain said normally closed switch closed.

2. An automatic ignition and control apparatus as defined in claim 1 in which said master control switch and said shut off valve are connected together to be actuated in unison with each other.

3. An automatic ignition and control apparatus as defined in claim 2 in which the closing and opening of said master switch effects the closing and opening of said interrupter switch.

4. An automatic ignition and control apparatus as defined in claim 1 in which the closing and opening of said master switch effects the closing and opening of said interrupter switch.

5. An automatic ignition and control apparatus as defined in claim 1 in which a relay is disposed in series with said master switch and is operative when energized to maintain said interrupter switch closed.

6. An automatic ignition and control apparatus as defined in claim 5 in which a time control switch is disposed in series with said master switch and said relay, and a time control mechanism is provided which is operative to open and close said time control switch at predetermined set times.

7. An automatic ignition and control apparatus as defined in claim 5 in which a normally open manually actuable switch is disposed in parallel with said interrupter switch.

8. An automatic ignition and control apparatus as defined in claim 1 in which a time control switch is disposed in series with said master switch, and a time control mechanism is provided which is operative to open and close said time control switch at predetermined set times.

9. An automatic ignition and control apparatus as defined in claim 8 in which means is provided by which said master switch and said shut off valve are actuated in unison.

10. An automatic ignition and control apparatus as defined in claim 8 in which means is provided which is rendered operative to close said interrupter switch by the closing of said master switch.

11. An automatic ignition and control apparatus as defined in claim 10 in which means is provided by which said master switch and said shut off valve are actuated in unison.

12. In an automatic ignition and control apparatus of the character described the combination of a main burner, a pilot burner operative to ignite said main burner, an electric ignition element operative when energized to ignite said pilot burner, a gaseous fuel supply manifold, a main conduit through which fuel is supplied to said main burner from said manifold, a safety control unit operative to cut off the supply of fuel to said main burner and said pilot burner interposed in said conduit between said main burner and said manifold, a manually operable shut off valve interposed in said conduit between said safety control unit and said main burner, a branch conduit extending between said safety control unit and said pilot burner through which fuel is supplied to said pilot burner, a solenoid operatively associated with said safety control unit, said solenoid being operative upon energization to first set said safety control unit in condition to supply fuel to said pilot burner while cutting off the supply of fuel to said main burner and upon subsequent deenergization to set said safety control unit in condition to also supply fuel to said main burner, an electro-

magnet associated with said safety control unit and operative when energized to maintain said safety control valve in said last set condition, a thermocouple adapted to be heated by said pilot burner, an electric circuit between said thermocouple and said electromagnet through which said magnet is energized by said thermocouple when said thermocouple is heated, an interrupter switch interposed in said circuit and operative to open and close said circuit and thereby control the energization of said electromagnet, a normally open master switch which is operative when closed to effect the energization of said solenoid and said electric ignition element, a normally closed switch disposed in series with said master switch which is operative when opened to effect de-energization of said solenoid and said electric ignition element, and means responsive to said pilot burner and operative to maintain said normally closed switch open while said pilot burner is ignited.

13. An automatic ignition and control apparatus as defined in claim 12 in which said master control switch and said shut off valve are connected together to be actuated in unison with each other.

14. An automatic ignition and control apparatus as defined in claim 13 in which the closing and opening of said master switch effects the closing and opening of said interrupter switch.

15. An automatic ignition and control apparatus as defined in claim 12 in which the closing and opening of said master switch effects the closing and opening of said interrupter switch.

16. An automatic ignition and control apparatus as defined in claim 12 in which a relay is disposed in series with said master switch and is operative when energized to maintain said interrupter switch closed.



17. An automatic ignition and control apparatus as defined in claim 16 in which a time control switch is disposed in series with said master switch and said relay, and a time control mechanism is provided which is operative to open and close said time control switch at predetermined set times.

18. An automatic ignition and control apparatus as defined in claim 16 in which a normally open manually actuable switch is disposed in parallel with said interrupter switch.

19. An automatic ignition and control apparatus as defined in claim 12 in which a time control switch is disposed in series with said master switch, and a time control mechanism is provided which is operative to open and close said time control switch at predetermined set times.

20. An automatic ignition and control apparatus as defined in claim 19 in which means is provided by which said master switch and said shut off valve are actuated in unison.

RICHARD L. PERL.
JOHN M. HOFF.

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