May 5, 1953 R. L. PERL ET AL 2,637,391

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

Filed Feb. 1, 1952 4 Sheets-Sheet 1

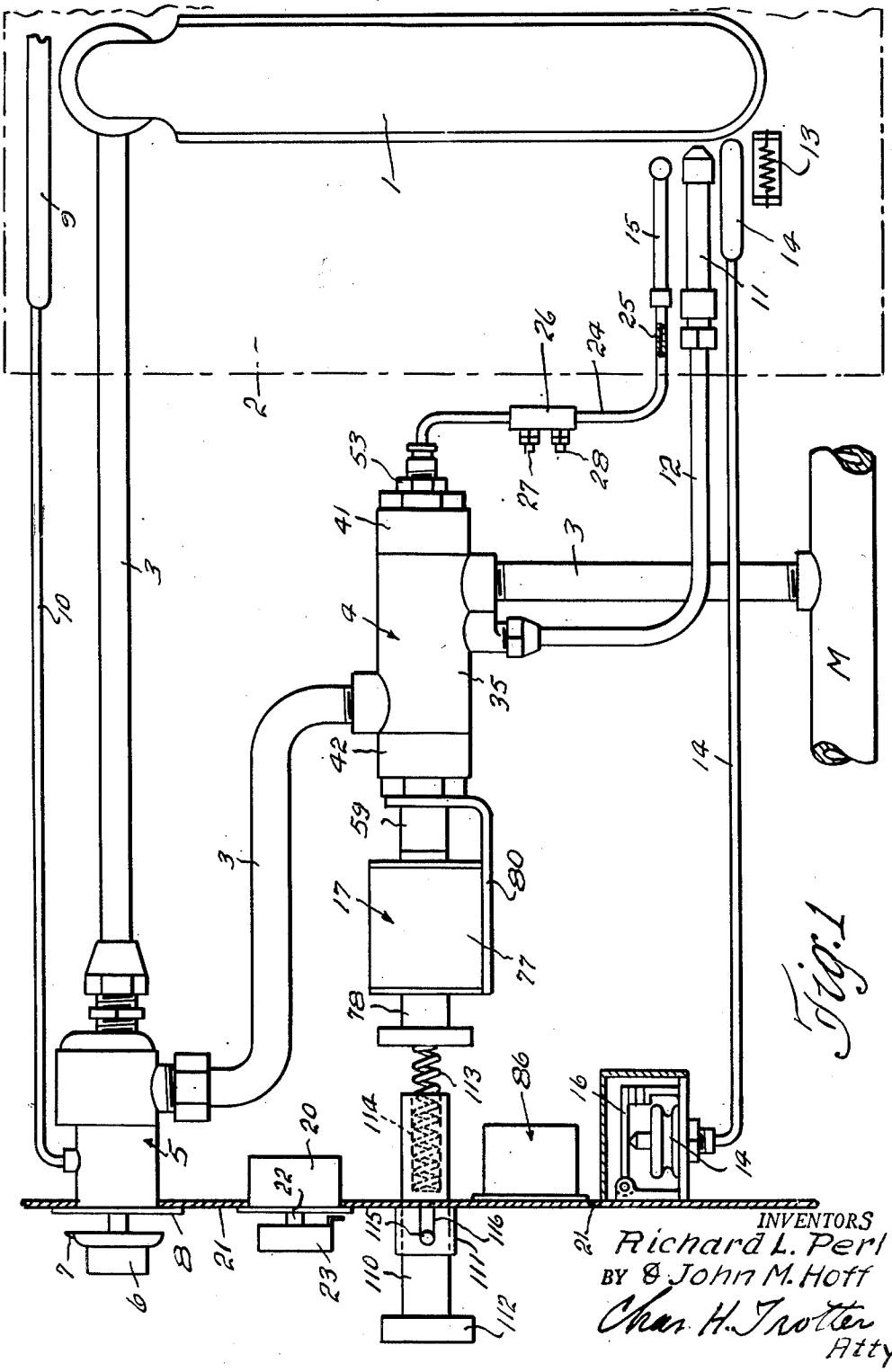


Fig. 1

INVENTORS
Richard L. Perl
BY & John M. Hoff
Chas. H. Trotter
Atty.

May 5, 1953 R. L. PERL ET AL 2,637,391

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

Filed Feb. 1, 1952 4 Sheets-Sheet 2

Fig. 2

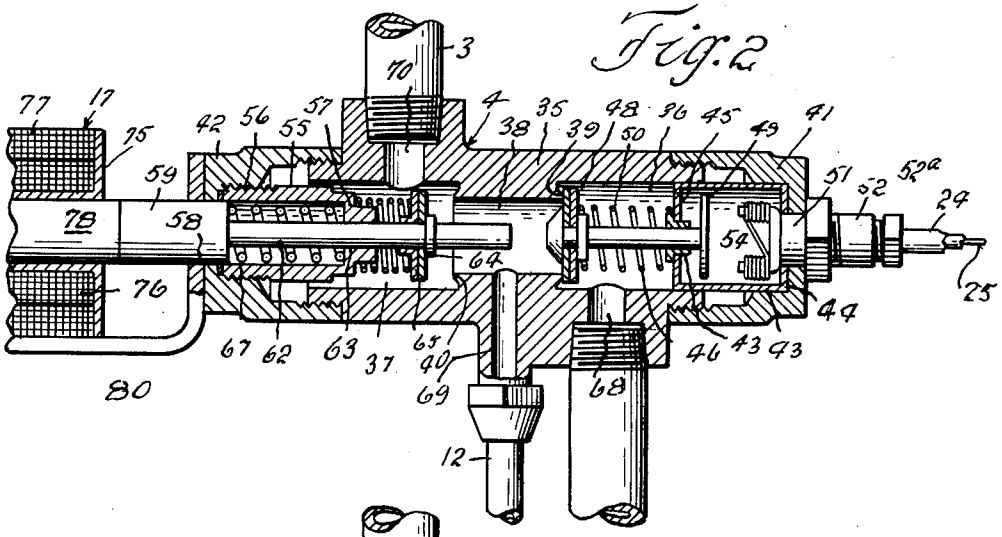
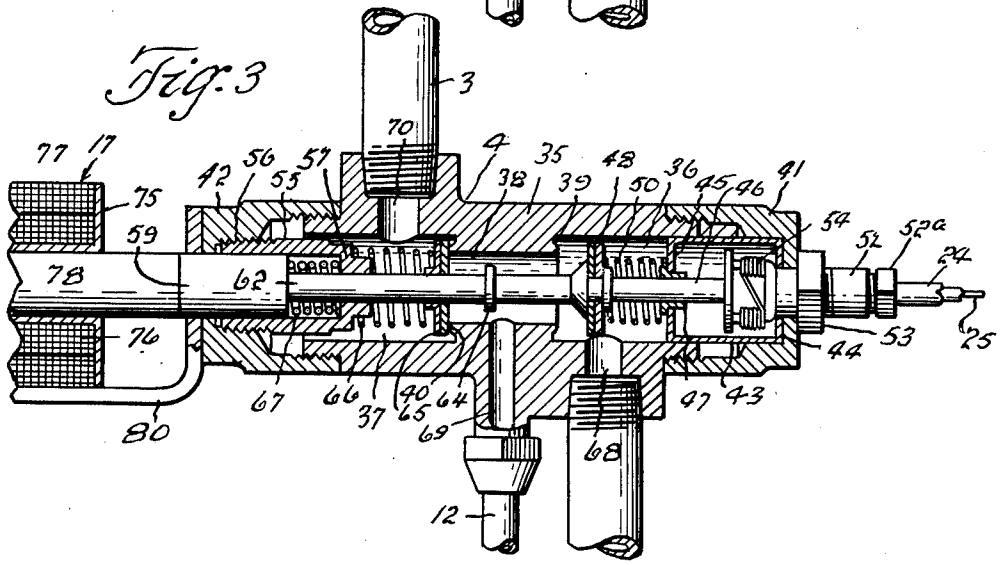


Fig. 3



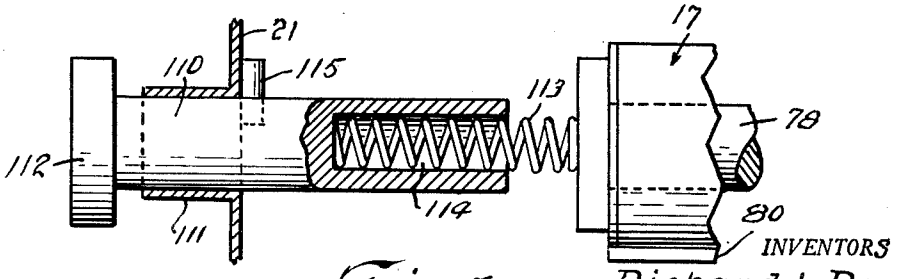


Fig. 5

INVENTORS
Richard L. Perl
BY & John M. Hoff
Chas. H. Trotter
Atty.

May 5, 1953 R. L. PERL ET AL 2,637,391

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

Filed Feb. 1, 1952 4 Sheets-Sheet 3

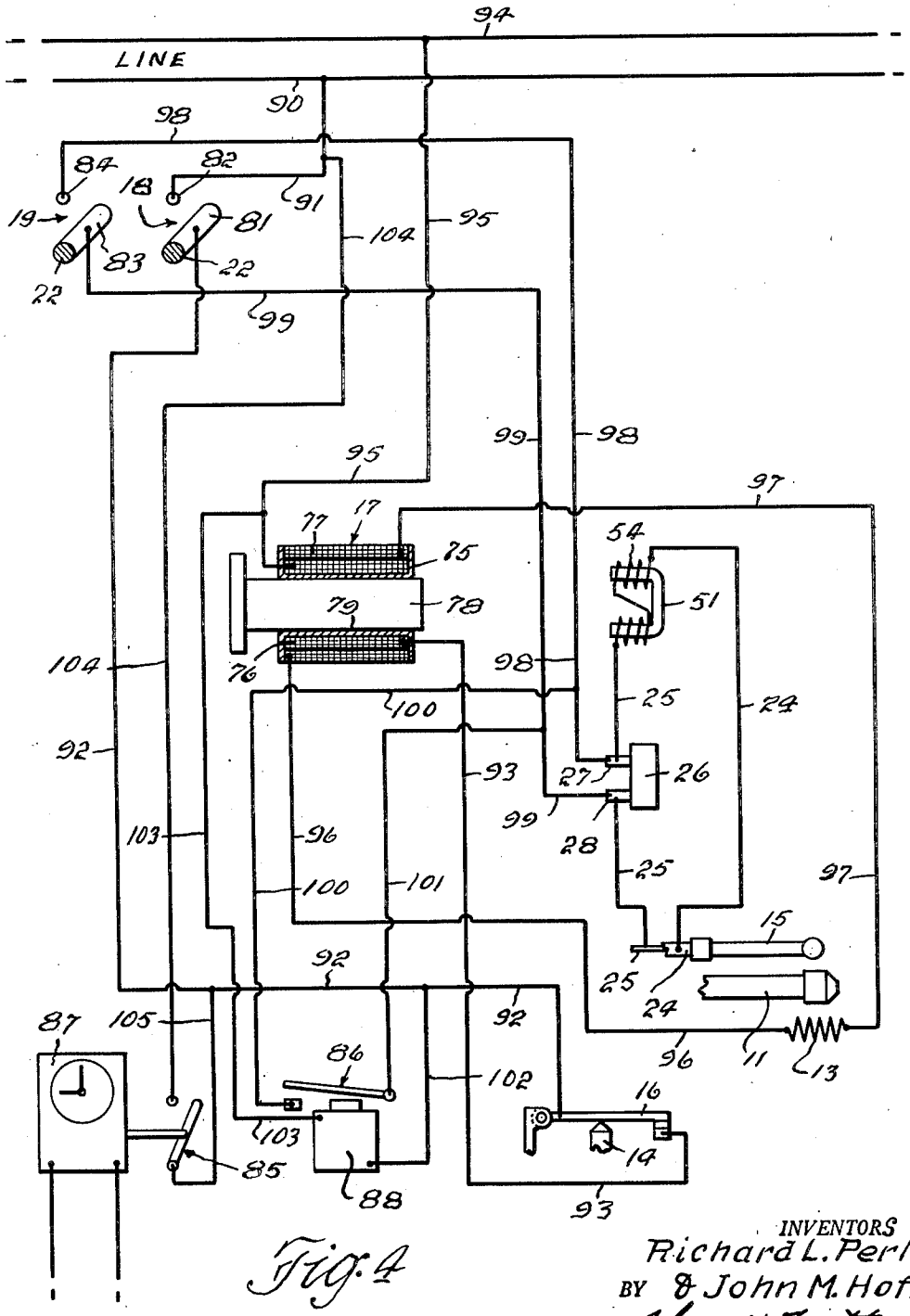


Fig. 4

INVENTORS
Richard L. Perl
BY & John M. Hoff
Chas. H. Trotter
Atty.

May 5, 1953 R. L. PERL ET AL 2,637,391

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

Filed Feb. 1, 1952 4 Sheets-Sheet 4

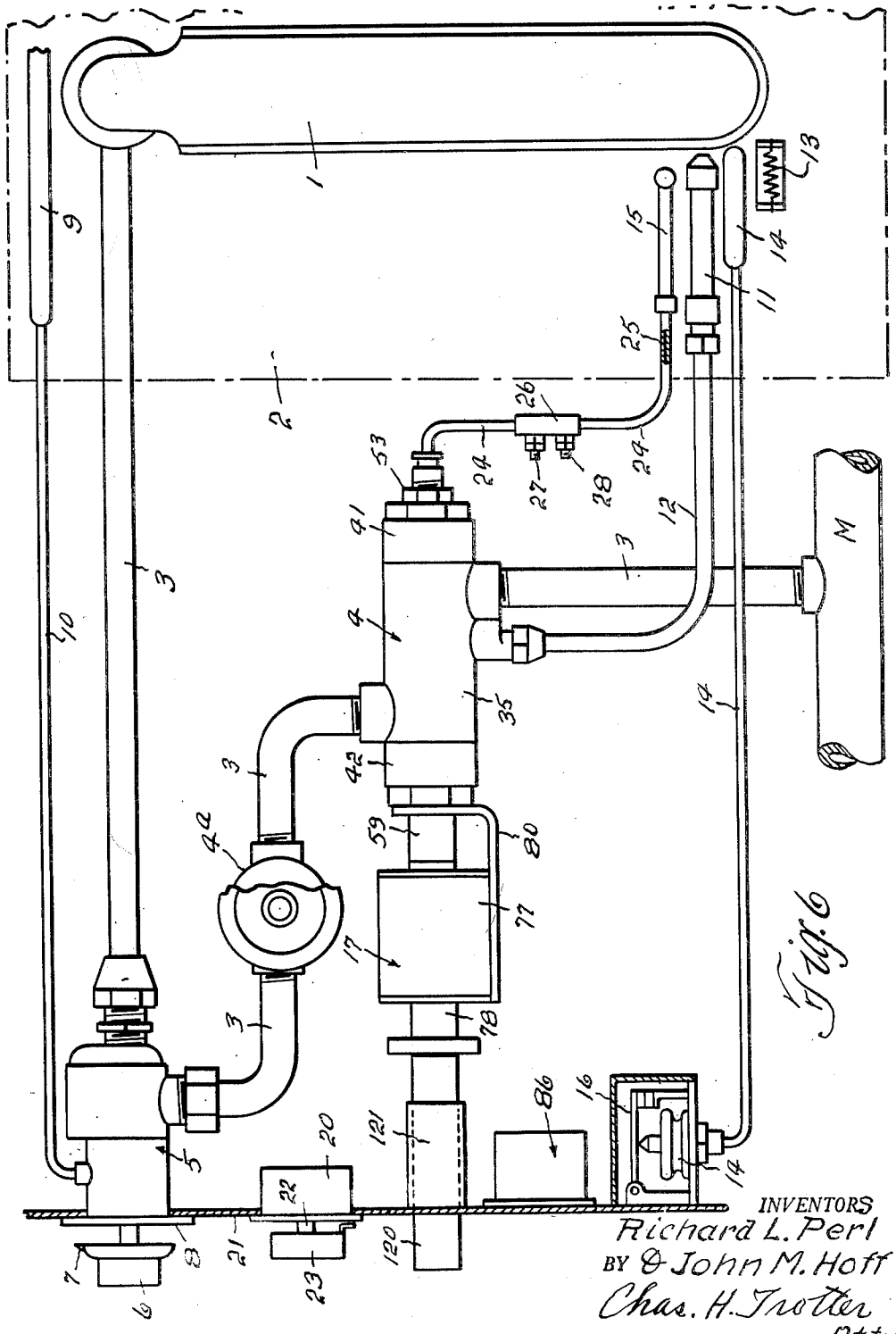


Fig. 6

INVENTORS
Richard L. Perl
BY & John M. Hoff
Chas. H. Trotter
Atty.

Patented May 5, 1953

2,637,391

UNITED STATES PATENT OFFICE

2,637,391

AUTOMATIC IGNITION AND CONTROL MECHANISM FOR OVEN BURNERS

Richard L. Perl, Galion, and John M. Hoff, Mansfield, Ohio, assignors to The Tappan Stove Company, Mansfield, Ohio, a corporation of Ohio

Application February 1, 1952, Serial No. 269,356

16 Claims. (Cl. 161—9)

1

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 mechanism shown in the co-pending application of Charles M. Mayer and John M. Hoff filed April 3, 1950, Serial No. 153,664, now Patent No. 2,577,737. 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. The apparatus is so constructed and arranged that we also utilize this safety control unit to turn the gas on and off to initiate and terminate operation of the main burner, and thereby eliminate all manually operable shut off valves generally used in burner control apparatus of this character.

Our improved apparatus includes a main gaseous fuel burner by which the oven in a

2

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 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, and a standard thermostatically operated oven temperature control valve to the main burner. A normally open master control switch is provided to initiate operation of both the pilot burner and the main burner. The closing of the master control switch energizes through a normally closed thermostatically opened switch, an electric resistance ignition element and a solenoid transformer which is operatively connected to the safety control unit. The energization of the solenoid transformer causes it to set the safety control unit to permit the flow of gas to the pilot burner while cutting off the supply of gas 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 causes it to set the safety control unit is automatically operated by spring means to supply gas to the main burner through 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 electro-magnet 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 electric ignition element and the solenoid transformer are again energized, since the master control switch is still closed. The energization of the solenoid transformer will cause it to operate the safety control unit to establish 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. In the event of a power failure during normal operation of the oven, the main burner will continue to operate normally under the control of the oven temperature regulator valve until the operation of the burner is terminated, assuming of course that the pilot burner continues to burn. In the event of a power failure before gas is turned on to initiate operation, the pilot burner can be manually ignited as will be hereinafter explained. The supply of gas to both the main burner and the pilot burner will then be controlled by the pilot burner through the thermocouple and safety control valve mechanism as previously described.

In order to extinguish the pilot burner and the main burner to terminate operation we provide an interrupter switch in the circuit between the thermocouple and the safety control unit. This switch is located in the same casing as the master control switch and is opened and closed in unison with the opening and closing of the master control switch. Then when the interrupter switch is opened the circuit between the thermocouple and the safety control unit is broken which permits the safety control unit to cut off the supply of gas to both the pilot burner and the main burner and thus terminate operation.

When it is desired to use the apparatus in conjunction with any standard time control mechanism, we provide a normally open supplemental master switch and a normally open supplemental interrupter switch. The supplemental master switch is interposed in the solenoid transformer circuit in a by-pass around the master switch, and the supplemental interrupter switch is interposed in the thermocouple circuit in parallel with the interrupter switch. The supplemental master switch is adapted to be opened and closed at predetermined set times by the time control mechanism and the supplemental interrupter switch is adapted to be closed by a relay which is energized by the closing of the supplemental master switch. 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. At the set time the time control mechanism will close the normally open supplemental master switch which will effect the closing of the supplemental interrupter switch and 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 master switch at the set later time to terminate operation. The opening of the supplemental master switch will effect the opening of the supplemental interrupter switch which will open the thermocouple circuit and allow 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 different 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. We also provide means by which the safety control unit may be manually actuated to admit gas to the main burner to initiate operation thereof, and to cut off the supply of gas thereto to terminate operation thereof.

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 improved 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 eliminate all manually operable shut off valves in a control system of the character described.

Another object of the invention is to provide means, in an automatic ignition and control system for oven burners, whereby the system may be set for manual control during prolonged power failure.

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 positions they are automatically moved to when the master control switch is closed to initiate the operation of the main oven burner;

Fig. 4 is a wiring diagram showing the switches and the main control valve in off position;

Fig. 5 is a detail sectional view showing the apparatus set for manual control; and

Fig. 6 is a view similar to Fig. 1 showing a slightly modified form of the invention.

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, and an oven temperature control valve 5. 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, and the oven temperature control valve 5 to the burner 1. The oven temperature control valve 5 is operative to regulate the amount of gas flowing to the burner 1 in order to maintain the oven 2 at any desired set temperature. The valve 5 is set to any desired temperature by a handle 6 having a pointer 7 which cooperates with a graduated dial 8 carried by the valve 5. The valve 5 is controlled according to the temperature setting by a thermostatic element 9 which is mounted in the oven 2 and is connected to the valve 5 as shown at 10. 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. Gas is also supplied to a pilot burner 11 through a branch conduit 12 which extends between the safety control valve mechanism 4 and the pilot burner 11. The pilot burner 11 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 13 is operatively associated with the pilot burner 11 in position to ignite the pilot burner 11 when gas is supplied thereto. A thermostatic element 14 and a multiple thermocouple 15 are mounted in position to be heated by a flame from the pilot burner. The thermostatic element 14 is operative to open and close a switch 16 which controls the energization of the electrical ignition element 13 and a solenoid transformer 17 which when energized operates the safety control unit to supply gas to the pilot burner 11 only as will be described in connection with the description of the safety control unit and the operation of the whole apparatus. The thermocouple 15, when heated, is operative to hold the safety control unit in condition to maintain the supply of gas to both the pilot burner 11 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.

A master control switch 18 is provided to initiate operation of the burner 1, and an interrupter switch 19 is provided to terminate operation thereof. The switches 18 and 19 are mounted in a case 20 secured to an accessible panel 21 mounted on the range and are opened and closed in unison by a switch stem 22 and a switch handle 23.

An electric circuit between the thermocouple 15 and the safety control unit 4 is established by a copper tube 24 which encloses an insulated wire 25. The wire 25 is severed between the thermocouple 15 and the safety control unit 4 and an interrupter 26 having terminals 27 and 28 is interrupted between the several ends. One of the severed ends of the wire 25 is connected to the terminal 27 and the other severed end is connected to the terminal 28. The purpose of the interrupter 26 will be explained in detail in connection with the description of the operation of the apparatus.

The construction of the safety control unit 4 and its connection to the solenoid transformer 17 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 24 and the other end of which is connected to the wire 25 in the tube 24. The tube 24 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 cicular 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 12 and the bore 38 is provided to supply gas to the pilot burner 11; 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 oven temperature control valve 5.

The solenoid transformer 17 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 17 may be operatively associated with the safety control unit 4 in any suitable manner. As shown herein it is mounted on an arm 80, 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.

The master control switch 18 comprises the arm 81 and the stationary contact 82; and the interrupter switch 19 comprises the arm 83 and the stationary contact 84. The contacts 82 and 84 are suitably secured to the casing 20. The arms 81 and 83 are rigidly secured to the stem 22 for rotation therewith so that the switches 18 and 19 are opened and closed in unison when the stem 22 is rotated by the switch handle 23.

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 open supplemental master switch 85 and a normally open supplemental interrupter switch 86. The supplemental master switch 85 is adapted to be closed and opened by a standard time control mechanism 87; and the supplemental interrupter switch 86 is adapted to be closed by a relay 88 which is energized by the closing of the supplemental master switch 85.

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 close the master switch 18 and the interrupter switch 19 to initiate operation, and then open these switches to terminate operation. When the switches 18 and 19 are closed current will flow from one side 90 of the line through the lead 91 to the contact 82 of the switch 18, thence through the switch arm 81 and lead 92 to the normally closed thermally open switch 16. The current then flows through the switch 16 and lead 93 to the primary winding 76 of the solenoid transformer 17 and from there back to the other side 94 of the line through the lead 95. The solenoid transformer 17 is now energized, and the electric ignition element 13, which is connected to the secondary winding 77 of the solenoid transformer by the leads 96 and 97 is also energized. 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 11 where it is ignited by the ignition element 13, but it 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 15 and the thermal element 14. The thermocouple being heated generates a minute current of the order of 200 to 250 millivolts which flows from the thermocouple through the tube 24 to the winding 54 of the electromagnet 51 and from there through the wire 25 to the terminal 27 of the interrupter 26. From the terminal 27 the current flows through the lead 98, contact 82, switch arm 81 and lead 99 to the terminal 28 of the interrupter 26, and from there back to the thermocouple 15 through the wire 25. 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 17, 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 14 causes it to open the normally closed switch 16 which breaks the circuit to and de-energizes the solenoid 17 and consequently the ignition element 13. As soon as the solenoid transformer 17 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 to the main burner 1 where it is ignited by the pilot burner 11. Under normal conditions the burner 1 will now operate under control of the oven temperature control valve 5 until its operation is terminated by the opening of the switches 18 and 19. The opening of the interrupter switch 19 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 supply of gas to both the main burner and the pilot burner. If the pilot burner is extinguished for any reason during operation, then the thermocouple 15 and the thermal element 14 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 11 and the main burner 1. When the thermal element 14 cools, which is after the thermocouple 15 has cooled, the switch 16 will close. The apparatus will then re-cycle as described as soon as gas is available.

The supplemental interrupter 86 is interposed in the thermocouple circuit in series with the interrupter switch 19 by the leads 100 and 101 which are connected to the leads 98 and 99 respectively. The supplemental interrupter switch 86 is necessary to adapt the apparatus for automatic control, but it performs no useful function when the apparatus is used under manual control. Nevertheless the interrupter switch 86 is always closed and opened by the closing and opening of the master switch 18 through the medium of the relay 88 which is

interposed between the leads 92 and 95 by the leads 102 and 103 which by-pass the switch 16 and the primary winding 76 of the solenoid transformer 17. As long as the master switch is closed, current will flow from the side 90 of the line through the lead 91, switch 18, lead 92, lead 102, relay 88, lead 103 and back to the other side 94 of the line through the lead 95, thus energizing the relay 88 and holding the switch 86 closed. As soon as the master switch 18 is opened the relay 88 will be de-energized which will allow the switch 86 to return to its normal open position.

For automatic operation the switches 18 and 19 are left open and the time control mechanism 87 is set to initiate operation at the desired time and to terminate operation at the desired later time. At the set time the time control mechanism 87 will close the supplemental master switch 85 which is interposed between the leads 104 and 105 which connect the lead 91 to the lead 92 and by-pass the switch 18. Current will then flow from the side 90 of the line through the leads 91 and 104, switch 85, leads 105 and 92, switch 16, and lead 93 to the primary winding of the solenoid transformer 17, and from there back to the other side 94 of the line through the lead 95. Current will also flow from the lead 92 through the lead 102, relay 88 and leads 103 and 95 to the side 94 of the line. The solenoid transformer 17 and the electric ignition element 11 are now energized, and the supplemental interrupter switch 86 is closed. The solenoid transformer 17, being energized will shift the interrupter valve mechanism and the control valve mechanism in the safety control unit 4 from the positions shown in Fig. 2 to the positions shown in Fig. 3 which admits gas to the pilot burner 11 while cutting off the supply of gas to the main burner 1. The pilot burner 11 is then ignited by the electric ignition element 13 and heats the thermocouple 15 and the thermostatic element 14. The current generated by the heated thermocouple will flow from the thermocouple 15 through the tube 24 to the winding 54 of the electromagnet 51 and back to the thermocouple 15 through the wire 25, leads 98 and 101, interrupter switch 86, leads 101 and 99, and wire 25, thus energizing the electromagnet 51. The heating of the thermostatic element 14 will open the normally closed switch 16 and de-energize the solenoid transformer 17 and electric ignition element 13. The spring 67 then 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 retains the control valve mechanism in the chamber 36 in the position shown in Fig. 3. Gas will now flow to the main burner 1 which is then ignited by the pilot burner 11. The burner 1 will now operate under the control of the pilot burner 11 and the oven temperature control valve 5 until the operation thereof is terminated by the time control mechanism 87 opening the switch 85. The opening of the switch 85 de-energizes the relay 88 which effects the opening of the switch 86. The opening of the switch 86 breaks the circuit to and de-energizes the electromagnet 51 which allows the spring 50 to return the control valve mechanism in the chamber 36 back from the open position shown in Fig. 3 to the closed position shown in Fig. 2, thus cutting off the supply of gas to both the pilot burner 11 and the main burner 1 and terminating operation.

In order that the oven may be repeatedly used during a prolonged power failure without the necessity of manually lighting the pilot burner 11 with a match each time it is used, we have provided means by which the apparatus can be quickly and easily converted from a fully automatic electric ignition system to a constantly burning pilot burner ignition system. To this end we provide a plunger 110 which is slidably mounted in a sleeve 111 carried by the panel 21 in axial alignment with the armature 78 of the solenoid transformer 17 and the plunger 59 of the safety control unit 4. The outer end of the plunger 110 is provided with an actuating knob 112 and a compression spring 113, stronger than the combined strength of the springs 50, 66 and 67 in the control unit 4, is mounted in and extends out from an axial bore 114 in the inner end of the plunger 110. A pin 115 is carried by the plunger 110 and extends into an elongated slot 116 in the sleeve 111. In order to convert the apparatus to a constantly burning pilot burner system it is only necessary to close the interrupter switch 19 in the thermocouple circuit and manually depress the plunger 110 and lock it in depressed position by rotating it a few degrees until the pin 115 engages behind the panel 29 as shown in Fig. 5. The depressing and locking of the plunger 110 depresses the armature 78 of the solenoid transformer 17 and the plunger 59 of the safety control unit 4 and sets and holds the safety control unit 4 as shown in Fig. 3. Gas can now flow to the pilot burner 11, but is cut off from the main burner 1 by the interrupter valve 65. The pilot burner 11 is then ignited with a match. Under normal conditions it will now burn constantly and maintain the thermocouple 15 heated which will in turn maintain the electromagnet 51 energized. To initiate operation of the burner 1 under these conditions it is only necessary to unlock the plunger 110 by rotating it until the pin registers with the slot 116. The spring 67 will then open the interrupter valve 65 and return the plungers 59 and 110 and the armature 78 to their original positions as shown in Figs. 1 and 2. The electromagnet 51 retains the control valve 48 open as shown in Fig. 3. Gas can now flow to the main burner 1 and be ignited by the pilot burner 11. To terminate operation the plunger 110 is depressed and locked which closes the interrupter valve 65 and cuts off the supply of gas to the main burner 1 while maintaining the control valve 48 open to supply gas to the pilot burner 11.

If the pilot burner 11 is extinguished for any reason during operation of the main burner 1 under these conditions, the control valve 48 will close and cut off the supply of gas to both the main burner and the pilot burner as explained in connection with electric ignition.

When power is again available the switch 19 is opened and the plunger 110 released. The opening of the switch 19 breaks the thermocouple circuit which allows the control valve 48 to close and cut off the supply of gas to and extinguish the pilot burner 11. The apparatus is then re-set for full automatic operation.

From the foregoing it will be seen that we have provided an automatic ignition and control apparatus for gaseous fuel oven burners in which all manually operable shut off valves in the fuel supply conduit have been eliminated and that we use the automatically actuated safety control valve mechanism 4 both as a safety control valve during operation and as a cut off valve when the

burner 1 is not being used. It will also be seen that the operation of the apparatus is primarily under the control of the master control switch 18 and the interrupter switch 19 which are opened and closed in unison with each other. The closing of these switches initiates operation of the burner 1 and the opening of these switches terminates operation thereof. During operation the apparatus is automatically controlled by the pilot burner 11 and the safety control valve mechanism 4. If during operation the pilot burner 11 is extinguished for any reason the safety control valve mechanism 4 will promptly cut off the supply of gas to both the pilot burner 11 and the main burner 1, and will maintain it cut off to the main burner 1 until the pilot burner has been re-ignited.

It will also be seen that we have provided very simple means by which the apparatus can be quickly and easily converted to a constantly burning pilot burner system if desired during prolonged power failures.

In Fig. 6 we have shown a slightly different means for converting the system from a fully automatic ignition system to a constantly burning pilot burner system during prolonged power failures. In this form of the invention we interpose a manually operable shut off valve 4a in the conduit 3 between the safety control unit 4 and the oven temperature control valve 5; and we eliminate the manually actuable setting and locking mechanisms 110 to 116 and substitute therefor a plunger 120 which is slidably mounted in a sleeve 121 carried by the panel 21 in axial alignment with the armature 78 of the solenoid transformer 17 and the plunger 59 of the safety control unit 4. Otherwise the form of the invention is identical with that shown in Fig. 1 and the same reference numerals are applied to like parts. During normal operation of this form of the invention with power available the valve 4a is left open and the apparatus functions exactly as described in connection with Fig. 1. In order to convert this form of the invention to a constantly burning pilot burner system during a prolonged power failure the manually operable valve 4a in the conduit 3 and the interrupter switch 19 in the thermocouple circuit are closed. The plunger 120 is then depressed and a lighted match applied to the pilot burner 11. The depressing of the plunger 11 opens the control valve 48 in the chamber 36 of the control unit 4 which permits the flow of gas to the pilot burner 11 which is then ignited by the match. The plunger 120 must be held depressed until the pilot burner 11 heats the thermocouple 15 sufficiently for it to energize the electromagnet 51, after which the plunger 120 may be released. The electromagnet 51 being energized will now hold the control valve 48 in open position so that the pilot burner 11 will burn constantly under normal conditions. Then in order to initiate operation of the main burner 1 it is only necessary to manually open the shut off valve 4a; and to terminate operation thereof the shut off valve 4a is turned to closed position. After power is again available the shut off valve 4a and the interrupter switch 19 are opened which re-sets the apparatus for fully automatic operation as described in connection with Fig. 1.

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 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, 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, and manually actuable means by which said safety control unit is set in condition to supply fuel to said pilot burner while cutting off the supply of fuel to said main burner.

2. An automatic ignition and control apparatus as defined in claim 1 in which said master control switch and said interrupter switch are connected together to be opened and closed in unison with each other.

3. An automatic ignition and control apparatus as defined in claim 1 in which said manually actuable means comprises a depressible plunger having means to lock it in depressed position.

4. An automatic ignition and control apparatus as defined in claim 3 in which said master control switch and said interrupter switch are arranged to be opened and closed in unison with each other.

5. 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 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, 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, a normally open supplemental interrupter switch interposed in said thermocouple circuit in parallel with said interrupter switch, a relay operative when energized to maintain said supplemental interrupter switch closed, a normally open supplemental master switch disposed in series with said normally closed switch in a by-pass circuit around said master switch and operative when closed to effect the energization of said solenoid said electric ignition element and said relay, and a time control mechanism operative to close and open said supplemental master switch at predetermined set times.

6. 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 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, 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, a normally open supplemental interrupter switch interposed in said thermocouple circuit in parallel with said interrupter switch, a normally open supplemental master switch operative when closed to effect the closing of said supplemental interrupter switch and the energization of said solenoid and said electric ignition element, and time control means operative to close and open said supplemental master switch at predetermined set times.

7. An automatic ignition and control apparatus as defined in claim 6 in which said supplemental master switch is disposed in parallel with said master switch.

8. An automatic ignition and control apparatus, as defined in claim 5, in which said relay is disposed in series with said supplemental master switch in a circuit which by-passes said normally closed switch and said solenoid.

9. 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 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, means responsive to said pilot burner and operative to maintain said normally closed switch open while said pilot burner is ignited, and manually actua-

ble means by which said safety control unit is set in condition to supply fuel to said pilot burner while cutting off the supply of fuel to said main burner.

10. An automatic ignition and control apparatus as defined in claim 9 in which said master control switch and said interrupter switch are connected together to be opened and closed in unison with each other.

11. An automatic ignition and control apparatus as defined in claim 9 in which said manually actuable means comprises a depressible plunger having means to lock it in depressed position.

12. An automatic ignition and control apparatus as defined in claim 11 in which said master control switch and said interrupter switch are arranged to be opened and closed in unison with each other.

13. 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 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, means responsive to said pilot burner and operative to maintain said normally closed switch open while said pilot burner is ignited, a normally open supplemental interrupter switch interposed in said thermocouple circuit in parallel with said interrupter switch, a relay operative when energized to maintain said supplemental interrupter switch closed, a normally open supplemental master switch disposed in series with said normally closed switch in a by-pass circuit around said master switch and operative when closed to effect the energization of said solenoid, said electric ignition element and said relay, and a time control mechanism operative to close and open said supplemental master switch at predetermined set times.

14. 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 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, means responsive to said pilot burner and operative to maintain said normally closed switch open while said pilot burner is ignited, a normally open supplemental interrupter switch interposed in said thermocouple circuit in parallel with said interrupter switch, a normally open supplemental master switch operative when closed to effect the closing of said supplemental interrupter switch and the energization of said solenoid and said electric ignition element, and time control means operative to close and open said supplemental master switch at predetermined set times.

15. An automatic ignition and control apparatus as defined in claim 14 in which said supplemental master switch is disposed in parallel with said master switch.

16. An automatic ignition and control apparatus, as defined in claim 13, in which said relay is disposed in series with said supplemental master switch in a circuit which by-passes said normally closed switch and said solenoid.

RICHARD L. PERL.
JOHN M. HOFF.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,290,048	Hildebrecht	July 14, 1942
2,577,787	Mayer et al.	Dec. 11, 1951
2,578,717	Mayer et al.	Dec. 18, 1951