Sept. 30, 1969 F. H. BERGQUIST 3,469,567

DOUBLE BURNER OVENS

Filed Dec. 14, 1967 2 Sheets-Sheet 1

FIG. 1

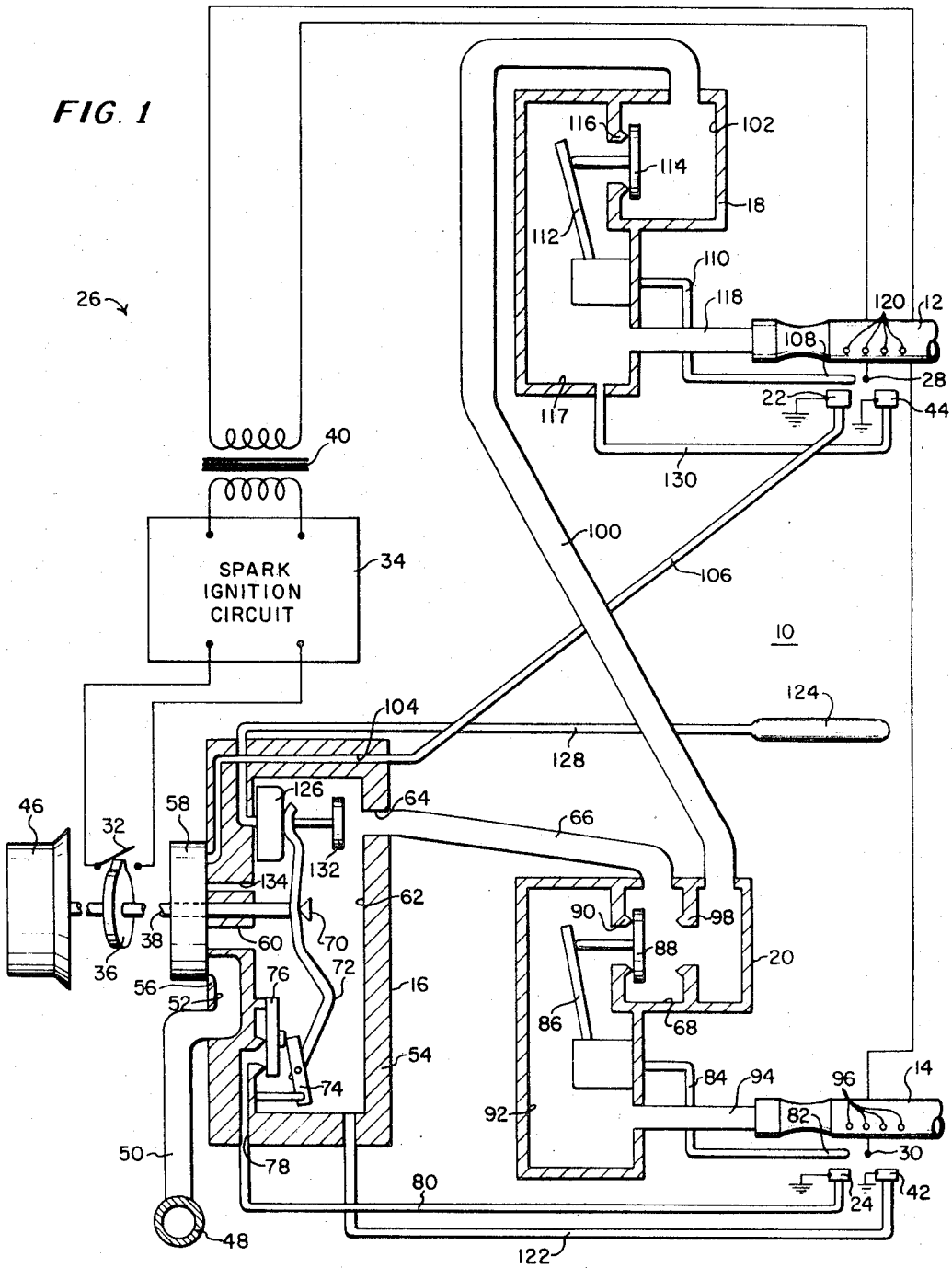

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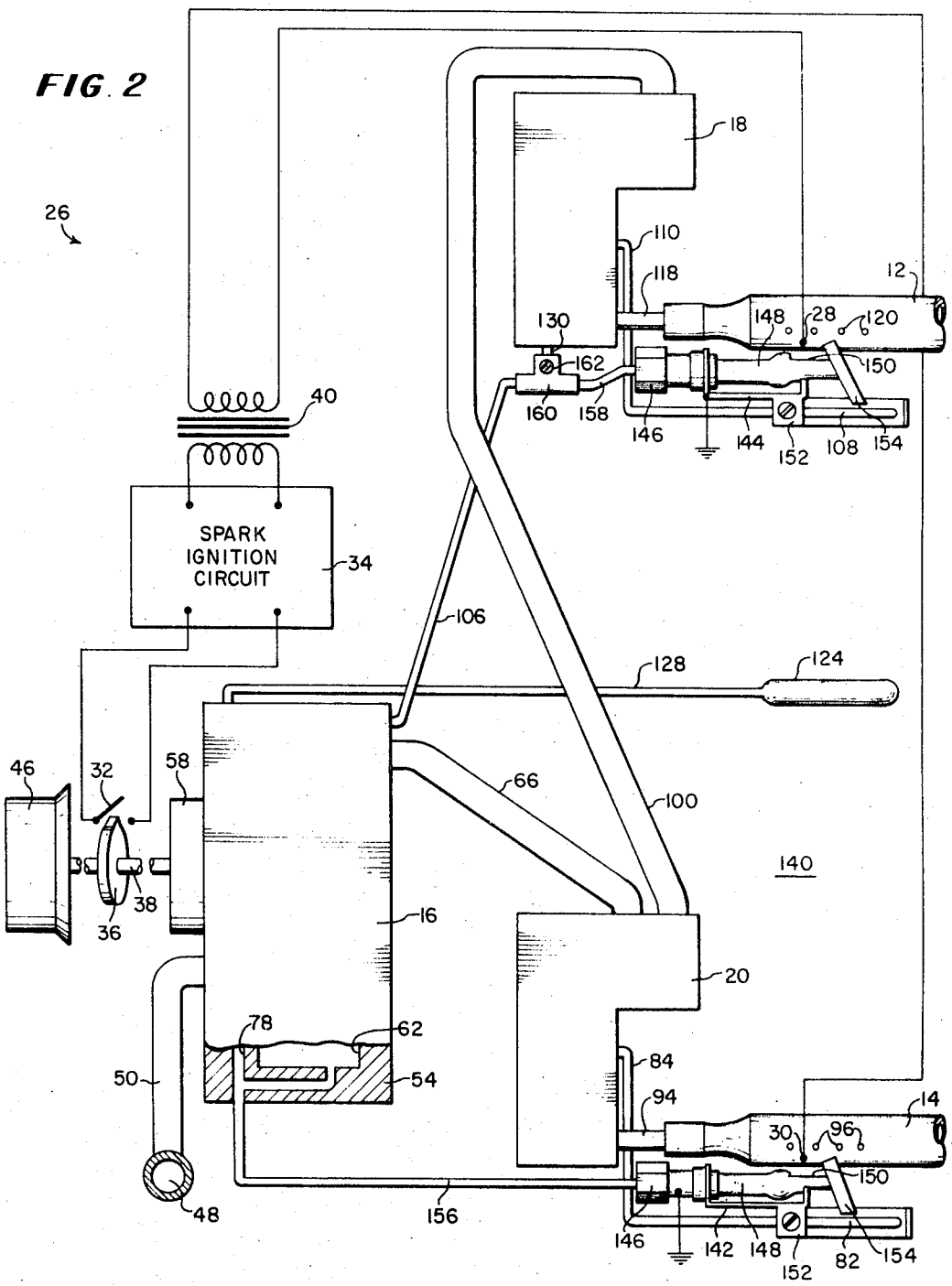
FIG. 2



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DOUBLE BURNER OVENS

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U.S. Cl. 126—39 16 Claims

ABSTRACT OF THE DISCLOSURE

A gas oven system includes a broil and a bake burner, and a safety valve system with a common inlet supplies gas to the bake or broil burner in response to a heater flame at a bake or broil heater pilot respectively. A control movable to bake and broil positions supplies gas to the safety valves and to the heater pilots. Electrical ignition operates when the control is moved to bake or broil to accomplish ignition of the heater pilot either directly or indirectly for ignition of the bake and broil burners. Ignition transfer pilots are ignited by the electrical ignition and ignite or maintain the ignition of the bake and broil burners during thermal delay periods after the control is moved between positions and pending operation of the safety valves.

The present invention relates to double burner oven apparatus and more particularly to a novel double burner gas range including means for preventing the escape of unburned gas into the oven when intermittent ignition rather than continuous pilot ignition is used.

It has been proposed to provide a gas range including an upper broil burner and a lower bake burner in a single oven cavity, together with a manually operated control for operating either the bake or the broil burner. Such systems may include a heater pilot or control pilot adjacent each burner and a safety valve or burner valve for each burner. The safety valve operates to admit gas to the corresponding burner only when a sensing element is heated by a heater flame at the corresponding heater pilot. When the oven control is set for bake operation, a heater flame is produced at the bake heater pilot and the bake safety valve opens to admit gas to the bake burner where it is ignited by the bake heater pilot or by a continuously burning standby pilot. Similarly, when the control is set for broil operation, gas flows to the broil burner where it is ignited by the broil heater pilot or by a continuously burning standby pilot.

One example of a double burner oven system of this type is disclosed and claimed in my copending application Ser. No. 621,016, filed Mar. 6, 1967, now United States Patent No. 3,386,656. In the system shown in that application there is provided an improved safety valve arrangement including means for preventing gas from flowing simultaneously to both the bake and broil burners. In the system there disclosed, the bake and broil burners are ignited either directly by continuously burning pilots located adjacent the bake and broil burners, or alternatively by the heater pilots which are in turn ignited by the continuous pilots. It is believed that the two burner system there disclosed is completely safe in that unignited gas cannot escape into the oven from the bake burner or the broil burner.

Although the two burner oven system of the above-identified application is satisfactory for its intended uses, it may be desirable in some instances to avoid the necessity of providing continuously burning pilots to accomplish ignition of the heater pilots and main burners. For example, it may be desired to avoid the gas consumption and/or heat loss associated with continuously burning

pilots. Thus it would be desirable to provide a two burner oven system utilizing intermittent ignition means such as an electric spark discharge device or the like for accomplishing ignition of the bake burner and the broil burner.

A difficulty arises, however, in two burner systems having intermittent electrical ignition due to the thermal time delay inherent in the operation of known safety valves. For example if the control is set for broil operation the broil heater pilot is ignited by the electrical ignition, and when the sensing element is heated by the heater pilot the broil safety valve opens and gas flows to the broil burner where it is ignited by the broil heater pilot. If the control is moved from the broil position to the bake position, the broil heater pilot is extinguished and the bake heater pilot is provided with a flow of gas which is ignited by the electrical ignition. During a period of thermal delay while the broil sensing element is cooling and the bake sensing element is being heated, gas continues to flow to the broil burner. Since the electrical ignition is arranged to ignite the broil heater pilot and not the broil burner itself, during this thermal delay period there is no "proof of ignition" or positive assurance that the gas flowing to the broil burner is ignited, and unburned gas might escape into the oven cavity.

Similarly, if the oven control is moved from bake to broil, gas continues to flow to the bake burner during a thermal delay period until the bake safety valve closes. Since the bake heater pilot does not receive gas during the broil operation, there is no assurance that gas emerging from the bake burner during the thermal delay period is ignited.

This problem is evident in systems using a control which shuts off the entire gas flow when it is moved from broil to bake or from bake to broil because when the gas flow is shut off, ignition at the operating burner may be discontinued. However the problem is also present with other types of controls because it is desirable to have positive proof or assurance of ignition at all times.

The admission of unburned gas into the oven, even for a limited time required for operation of a safety valve, is highly undesirable. In the first place, depending upon the amount and type of gas involved, and upon the oven venting system, a dangerous explosive condition may be produced. However, even in the absence of an explosive condition, the odor of unburned gas is objectionable to the homemaker.

Accordingly, it is an important object of the present invention to provide improved double burner apparatus including means for assuring that unburned gas does not escape into the oven.

Another object of the invention is to provide an improvement for reigniting or maintaining the ignition of one burner during a thermal delay period if the control is turned to shut off the one burner and to operate another burner.

Another object is to provide a novel burner ignition system for use with intermittently operating ignition means for assuring ignition of a main burner whenever the ignition means operates and the main burner receives gas.

Briefly, the above and other objects and advantages of the present invention are realized in one embodiment of the invention by the provision of a two burner or duplex oven system of the type including an oven cavity containing a broil burner and a bake burner together with broil and bake heater pilots. A gas distribution system or safety valve system includes a common inlet, a bake outlet connected to the bake burner and a broil outlet connected to the broil burner. A control is movable to a bake position in which gas can flow to the common inlet and to the bake heater pilot, whereupon a sensing element adjacent the bake heater pilot is heated and

causes the safety valve system to communicate the common inlet and the bake outlet. The control can be moved to a broil position in which gas flows to the broil heater pilot and to the common inlet, whereupon a sensing element adjacent the broil heater pilot is heated and communication is established between the common inlet and the broil outlet.

In order to ignite the bake and broil heater pilots when the control is moved to the bake position or the broil position, there is provided an intermittent ignition which operates briefly adjacent both the bake and broil heater pilots whenever the control is moved either to the bake or to the broil position. In this manner, the necessity for continuous standing pilots to achieve ignition is avoided.

In order to prevent the escape of unburned gas from the bake or broil burners when the control is moved between positions, a novel standby pilot system is provided for transferring ignition from the intermittent ignition to the bake and broil burners during the thermal delay period pending operation of the safety valve system.

Escape of unburned gas from the broil burner is prevented when the control is moved from broil to bake and during a thermal delay period when gas still flows to the broil burner by a broil standby pilot means adjacent the broil burner. When the control is moved from broil to bake, the ignition means operating at the broil burner ignites the broil standby pilot means which in turn ignites the broil burner. In accordance with a feature of the invention, the broil standby pilot means is supplied with gas whenever the broil burner is supplied with gas by virtue of being connected to the outlet side of the broil burner safety valve.

A bake standby pilot means is positioned adjacent the bake burner for transferring ignition from the intermittent ignition to the bake burner when the control is turned from bake to broil. This pilot means is supplied with gas whenever the oven control is not in the off position. The heater pilots and standby pilots may be separate pilots, or alternatively may take the form of single port, dual rate pilot bodies.

The above and other objects and advantages of the invention will appear from consideration of the following detailed description of certain embodiments of the invention taken together with the accompanying drawings in which:

FIG. 1 is a partly diagrammatic view of a double burner oven system constructed in accordance with the present invention; and

FIG. 2 is a view somewhat similar to FIG. 1 illustrating another embodiment of the invention.

Referring now to the drawings and initially to FIG. 1, there is illustrated a double burner oven system designated as a whole as **10** and constructed in accordance with the principles of the present invention. The system **10** includes a broil burner **12** and a bake burner **14** preferably disposed near the top and bottom respectively of an oven cavity (not shown). The system **10** controls the flow of gas to the broil burner **12** and the bake burner **14** for accomplishing broiling and baking cooking operations.

In general the system **10** includes a manually operated control **16** together with a gas distribution system or safety valve system including a broil safety or burner valve **18** and a bake safety or burner valve **20**. The safety valves **18** and **20** are controlled by flames at a broil heater or control pilot **22** and a bake heater or control pilot **24** which are selectively supplied with gas by the control **16** in order to carry out broil and bake operations.

In order to ignite the broil and bake heater pilots **22** and **24** without the gas consumption and heat loss associated with continuously burning pilot ignition such as disclosed in the above-identified copending application, there is provided an intermittently operating ignition means generally designated as **26**. The intermittently operating ignition means could take several forms, as will be readily understood by those skilled in the art, and in the illustrated embodiments of the invention comprises a spark discharge electrode **28** adjacent the broil heater pilot **22** and a spark discharge electrode **30** adjacent the bake heater pilot **24**. As is customary, the heater pilots **22** and **24** are grounded to the oven chassis as illustrated schematically so that a spark discharge may take place between the electrodes and the pilot bodies thereby to effect ignition of gas flowing from the pilots. Since the spark electrodes **28** and **30** are necessarily located adjacent the pilot bodies, they are not effective to ignite the bake and broil burners, this normally being accomplished by the heater pilots.

Operation of the ignition means **26** is controlled by means of a switch **32** coupled to a spark ignition circuit **34**. Whenever the control **16** is moved either to a bake position or to a broil position, the switch **32** is closed by means of a cam **36** associated with a control shaft **38** of the control **16**. Closure of the switch **32** results in the production of high voltage pulses in the secondary winding of an ignition transformer **40** having a primary winding coupled to the spark ignition circuit **34**.

The spark circuit **34** may be of any known construction and serves to produce sparks for a limited period of time, such as twenty seconds or so, whenever the switch **32** is closed. For example, the circuit **34** may include a known time delay automatic shut off circuit, or alternatively may include means responsive to ignition of a flame at one of the pilots **22** and **24** for discontinuing the sparking action. As will be apparent to those skilled in the art, any other type of intermittent ignition, such as a glow coil circuit or the like, may be substituted for the illustrated circuit **26**.

Safety valves or burner valves, such as the safety valves **18** and **20**, are subject to a thermal delay in operation due to the time required for heating and cooling of sensing elements adjacent the pilots **22** and **24**. As a result, when the control **16** is moved from bake to broil, thereby extinguishing the flame at the bake heater pilot **24** and producing a flame at the broil heater pilot **22**, a period of time elapses during which gas flows to the bake burner. However, since the bake heater pilot **24** does not receive gas and the bake spark electrode **30** is ineffective to ignite the bake burner, a problem arises in assuring that the bake burner is ignited during this period. Similarly, when the control **16** is moved from broil to bake, the broil heater pilot **22** is extinguished and it is desirable to assure that the broil burner is ignited during the thermal delay period while it continues to receive gas.

In accordance with important features of the present invention, there are provided novel standby or ignition transfer pilot means for insuring that the bake and broil burners **12** and **14** are ignited during such thermal time delay periods. In the embodiment of the invention illustrated in FIG. 1, a separate bake ignition transfer or standby pilot **42** and a separate broil ignition transfer or standby pilot **44** are located adjacent the bake burner **14** and the broil burner **12** respectively to produce ignition of the burners from the spark discharge electrodes **28** and **30** even though the heater pilots **22** or **24** are not supplied with gas. As described in more detail below, the standby pilots **42** and **44** receive gas whenever the respective burner is supplied with gas to the end that there is positive proof of ignition at all times.

Proceeding now to a more detailed description of the construction and operation of the double burner oven system **10** and its components, the system is illustrated in FIG. 1 in the off condition in which no gas is supplied to the system. A single control knob **46** connected to the control shaft **38** is movable from a central off position in one direction to a range of bake positions and in the other direction to one or more broil positions in order to control the operation of the control **16** and therefore of the system **10**. Gas for the system is supplied from a

manifold 48 through a conduit 50 to an inlet passageway 52 in a housing 54 of the control 16. The passageway 52 terminates at a valving surface 56, and in the illustrated off condition the passageway 52 is blocked by a cooperating surface on a rotor valve member 58. As a result, no gas is supplied by the control 16 to the broil burner 12, the bake burner 14, the broil heater pilot 22, or to the bake heater pilot 24.

In order to produce a baking operation, the knob 46 is turned from the off position to a bake position, and as a result, gas is supplied to the bake control pilot 24 where it is ignited by a spark discharge at the electrode 30. Accordingly, the bake safety valve 20 is opened to supply gas to the bake burner 14 for ignition by the flame at the bake heater pilot 24.

More specifically, when the knob 46 is rotated to a bake position, the rotor valve 58 is rotated by the control shaft 38 to a bake position wherein the gas inlet passageway 52 is intercommunicated with a passageway 60 introducing gas into an internal cavity 62 of the housing 54. From the chamber 62, gas flows through a main outlet 64 and a conduit 66 to an inlet chamber 68 of the bake safety valve 20.

Rotation of the control shaft 38 also results in movement of a pivot 70 and a pair of levers 72 and 74 to open a bake pilot gas valve 76, whereupon gas flows through a passageway 78 and a conduit 80 to the bake heater pilot 24. Gas issuing from the bake heater pilot 24 is ignited by spark discharge from the spark electrode 30 produced by the spark ignition circuit 34 in response to the closing of switch 32. The heater flame produced at the pilot 24 then heats a sensing element 82 located adjacent the pilot 24. The sensing element 82 comprises a mercury filled vessel communicating by way of a capillary conduit 84 with an expansible diaphragm (not shown) associated with the bake safety valve 20. The sensing element 82 is positioned so that it is heated by the heater pilot 24, but is not appreciably heated by the bake burner 14 or the pilot 42. Thus admission of gas to the bake burner 14 is controlled only by the heater pilot 24.

After the mercury filled vessel 82 is heated to a sufficient extent, expansion of the diaphragm operates a lever 86 to move a valve member 88 away from a valve seat 90 thereby to intercommunicate the inlet chamber 68 and a bake outlet chamber 92. Gas then flows from the safety valve 20 by way of a conduit 94 to the bake burner 14 where it emerges from burner ports 96 and is ignited by the flame at the bake heater pilot 24.

In order to perform a broiling operation, and assuming that the oven control system 10 is in the off condition illustrated in FIG. 1, the knob is moved from the off position to a broil position. As a result, the control 16 supplies gas to provide a heater flame at the broil heater pilot 22 and simultaneously supplies gas to the broil safety valve 18 which is subsequently opened in response to the presence of a heater flame at the heater pilot 22.

More specifically, when the knob 46 is rotated to a broil position, the gas inlet passageway 52 is communicated by the rotor valve 58 with the internal chamber 62 via the passageway 60, and gas flows through the outlet 64 and the conduit 66 to the inlet chamber 68 of the bake safety valve 20. Since the bake safety valve member 88 is in the position illustrated in FIG. 1, gas flows through a conduit 100 to an inlet chamber 102 of the broil safety valve 18.

Movement of the knob 46 to a broil position also moves the pivot 70 to a position in which the bake heater pilot valve 76 is closed, and simultaneously movement of the rotor valve 58 intercommunicates the inlet passageway 52 with a normally closed broil heater pilot passageway 104 for supplying gas to the broil heater pilot 22 by way of a conduit 106. Gas emerging from the pilot 22 is ignited by a spark discharge from the spark electrode 28 produced in response to closure of the switch 32.

A sensing element in the form of a mercury filled vessel 108 is heated by the flame at the broil heater pilot 22. The sensing element 108 is positioned to be heated by a flame at the heater pilot 22 only, and is not appreciably heated by flame at the pilot 44 or at the broil burner 12. The sensing element 108 communicates with a diaphragm (not shown) associated with the broil safety valve 18 by way of a capillary conduit 110. Expansion of the diaphragm a period of time after ignition of the flame at the broil heater pilot 22 results in movement of a lever 112 to move a valve member 114 away from a seat 116 thereby to intercommunicate the inlet chamber 102 with a broil outlet chamber 117. Gas flows from the chamber 117 through a conduit 118 to the broil burner 12 where it emerges from burner ports 120 and is ignited by the flame at the broil control pilot 22.

In order to prevent the flow of gas simultaneously to both the bake and broil burners, and as described in more detail in the above-identified copending application, the bake safety valve 20 includes an additional valve seat 98 cooperating with the valve member 88 in order to permit gas to flow from the inlet chamber 68 only to one of the bake and broil burners. Thus the valve member 88 seats against the seat valve 90 or the valve seat 98, depending upon whether or not a heater flame is present at the bake heater pilot 94. It would be possible to eliminate the valve seat 98 so the inlet chambers of both safety valves always communicate with the outlet 64, but the provision of one safety valve performing a dual function has certain substantial advantages, as discussed in more detail in the above-identified application.

Since the broil and bake safety valves 18 and 20 are controlled in accordance with the heating and cooling of the sensing elements 82 and 108, it will be appreciated that a thermal delay takes place in the operation of the valves since a period of time is required for a flame to heat the mercury in the vessels and also in order to permit the mercury to cool when the flame is discontinued. For example, in known devices the thermal delay in operation of a mercury controlled valve may be in the neighborhood of from 15 to 30 seconds or so.

In view of the fact that the system 10 uses an intermittent ignition rather than continuously burning pilot ignition, the presence of the thermal delay in operation of the valves 18 and 20 creates a problem in assuring that the burners 12 and 14 are always ignited when they are receiving gas. For example, if the system has been carrying out a bake operation and the control knob is moved from bake to broil, gas continues to flow to the bake burner 14 for a period of time after the control pilot 24 is extinguished as the sensing element 82 cools and the sensing element 108 is heated. Since the spark discharge electrode 30 is positioned for ignition of the heater pilot 24 and not for ignition of the bake burner 14, the electrical ignition apparatus is not effective in assuring ignition of gas flowing to the bake burner 14 during this thermal delay period.

In accordance with one feature of the present invention, the standby pilot or ignition transfer pilot 42 is provided adjacent the bake burner 14 and also adjacent the spark electrode 30. The standby pilot 42 receives gas from the internal chamber 62 of the control 16 by way of a conduit 122 so that gas emerges from the pilot 42 whenever the control 16 is set in any position other than the off position. As result, if the knob is moved from bake to broil, gas is supplied to the pilot 42 throughout the thermal delay period, even though the control is in a broil position. This gas is ignited by spark discharge from the spark electrode 30 and in turn serves to ignite gas flowing from the bake burner 14 during the thermal delay period until the bake safety valve 20 closes and the broil safety valve 18 opens. The pilot 42 is preferably arranged so that the ignition transfer flame at the pilot does not heat the sensing element 82 and prolong the thermal delay period. The provision of the pilot 42 in accordance with

the invention assures that no unburned gas escapes from the bake burner **14**.

The control **16** of the illustrated system **10** produces a cycling operation of the broil burner in order to maintain a selected bake temperature within the oven. Accordingly, the control **16** is provided with a thermostat assembly including a fluid filled bulb **124** positioned within the oven cavity and communicating with an expansible diaphragm **126** by means of a conduit **128**. When the oven is first set for a baking operation as described above, the pivot **70** is moved to a particular position corresponding to the selected temperature. As the oven approaches the desired temperature, expansion of the diaphragm **126** operates the levers **72** and **74** and closes the bake pilot valve **76** to extinguish the heater pilot **24**. As the oven temperature falls below the selected level, the valve **76** is reopened and gas flows to the heater pilot. Due to the provision of the standby pilot **42** supplied directly from the internal chamber **62**, the heater pilot is reignited by the pilot **42** without the necessity of reoperation of the intermittent ignition **26**. The heater pilot again produces opening of the bake safety valve **20** and a cycling operation ensues to maintain a selected baking temperature within the oven.

The problem of emission of unburned gas also arises when the system **10** has been producing a broiling operation and the control **16** is changed from broil to bake. When the knob **46** is moved from the broil position to a bake position, the broil pilot passageway **104** is closed by the rotor valve **58** and the flame at the broil heater pilot **22** is extinguished. However, during a thermal delay period until the broil safety valve **18** closes or until the bake safety valve **20** opens to close the valve seat **98**, gas continues to flow to the broil burner **12**. Since the spark ignition electrode **28** is positioned to ignite the broil heater pilot **22**, the spark ignition is not effective in igniting the broil burner **12**.

In accordance with a feature of the invention, and in order to assure that gas escaping from the broil burner **12** is ignited even though there is no flame at the broil heater pilot **22**, the broil standby or ignition transfer pilot **44** is provided. The pilot **44** is supplied with gas whenever gas is supplied to the broil burner **12** since it is communicated, in accordance with a feature of the invention, by means of a conduit **130** directly with the outlet chamber **117** of the safety valve **18**. Accordingly, during the thermal delay period when gas is supplied to the broil burner **12**, gas also flows by way of the conduit **130** to the standby pilot **44**. The pilot is ignited by the discharge from the sparking electrode **28** and in turn ignites the gas flowing from the broil burner **12**.

It should be noted that the broil standby pilot **44** is supplied with gas in a novel and convenient manner directly from the outlet side of the broil burner safety valve **18**. In a double burner oven when the lower bake burner is operating, the upper regions of the oven may lack the desired atmosphere for reliably maintaining ignition at a pilot burner. Supplying the standby pilot **44** from the outlet of the broil safety valve **18** not ony results in a compact, simple and efficient arrangement, but also assures that gas is supplied to the pilot only when the lower bake burner **14** is not operating. Thus there is no necessity for supplying uncontaminated air to the pilot **44**.

The spark electrodes are capable of igniting both the heater pilots and the standby pilots. This may be assured in any desirable manner, as by locating the pilots sufficiently close to one another, or by arranging the circuit so that sparking takes place at both pilots.

The control **16** is provided with a valve **132** cooperating with the outlet **64** for controlling the oven temperature in broil operations as well as in so-called "runaway" situations when the bake burner **14** operates continuously due to a malfunction in the system. The valve **132** is coupled to the diaphragm **126** to throttle the flow of gas through the outlet **64** when the oven temperature approaches a selected maximum. The control **16** is also capable of operating the oven in a low temperature broil or "rotisserie" mode wherein the broil burner **12** operates continuously at a low rate. When the knob **46** is moved to the low broil position, the passage **60** is blocked and the inlet passage **52** communicates with the chamber **62** only by way of a restricted passageway **134**.

The control **16** as well as the safety or burner valves **18** and **20** may be identical to the control and valves disclosed in the above-identified copending application. Reference may be had to that application for a more detailed description of their construction and operation.

The operation of the system **10** and particularly the functions of the standby or ignition transfer pilots **42** and **44** will be apparent in view of the preceding description. Briefly reviewing this operation, when the system is producing a bake operation, a heater flame is present at the bake heater pilot **24**, the bake safety valve **20** is open and gas flows to the bake burner **14**. If the knob **46** is turned to a broil position, the bake heater pilot **24** is extinguished and gas is supplied to the broil heater pilot **22**, where it is ignited by the spark electrode **28**. During a thermal delay period while the bake sensing element **82** cools and the broil sensing element **108** is heated, gas continues to flow to the bake burner **14**. The spark electrode **30** is not effective to ignite gas flowing from the bake burner.

During the thermal delay period, the bake standby or ignition transfer pilot **42** reignites or positively maintains the ignition of the bake burner **14**. The pilot **42** receives gas during the thermal delay period from the control **16** via the conduit **122**, and this gas is ignited by the spark electrode **30**. The flame at the pilot **42** is capable of igniting the bake burner **14** even though the bake heater pilot **24** is extinguished.

The broil standby or ignition transfer pilot **44** performs a similar function when the control is moved from broil to bake. In broil operation, a heater flame exists at the broil heater pilot **22**, and the broil burner **12** receives gas through the open safety valve **18**. If the knob **46** is moved from a broil position to a bake position, the broil heater pilot **22** is extinguished and a heater flame is produced at the bake heater pilot **24**. During a thermal delay period while the broil sensing element **108** cools and the bake sensing element **82** is heated, gas flows to the broil burner **12** but is not capable of being ignited by the spark electrode **28**.

During the thermal delay period, the broil standby pilot **44** is supplied with gas from the outlet side of the broil safety valve **18** through the conduit **130**. The pilot **44** is ignited by the spark electrode **28** and serves to positively maintain the ignition of or to reignite the broil burner **12**.

Having reference now to FIG. 2 of the drawings, there is illustrated a two burner oven system generally designated as **140** comprising an alternative embodiment of the invention. Since the system **140** is similar in many respects to the system **10** shown in FIG. 1, the same reference numerals have been used to designate those elements of the systems which are identical. In addition, since the controls and safety valves of the two systems are similar, they are shown only in outline form in FIG. 2.

The system **140** differs from the system **10** of FIG. 1 in that rather than using separate heater and standby or ignition transfer pilots at the bake and broil burners, these have been replaced with a single dual rate pilot at each burner. Accordingly both the heater pilot function and the standby pilot function at the bake burner **14** of the system **140** are accomplished by a dual rate pilot **142**. Similarly the heating pilot function and standby pilot function at the broil burner **12** are accomplished by a dual rate pilot **144**.

The pilots **142** and **144** may be of any known type commonly referred to as "dual rate" or "single port" pilots. Each includes a single inlet **146** communicating

through a tube **148** with a single outlet port **150**. When a relatively large flow of gas is supplied to the pilot, the flame produced is sufficient to heat the corresponding sensing element **82** or **108**, each being supported by a bracket **152** beneath the outlet port **150**. The gas from the outlet port **150** is directed against the flame sensing element by a deflector **154**. Conversely when a relatively small amount of gas is supplied to the pilot, the flame is insufficient to heat the corresponding sensing element but is sufficient for ignition of the main burner.

The dual rate pilot **142** of the bake burner **14** receives gas from a conduit **156** connected in common to the conduit **78** communicating with the bake heater pilot valve, and to the interior chamber **62** of the control **16**. Suitable adjustment means (not shown) are provided so that the flow from the internal chamber **62** alone produces a relatively small flame insufficient to heat the sensing element **82** when the bake heater pilot valve is closed. When gas flows through the passage **78**, the increased flow to the pilot **142** is sufficient to heat the bake sensing element **82** and produce opening of the bake safety valve **20**. When the bake heater pilot valve is closed, and no gas flows through passage **78**, the reduced flow to the pilot **142** produces a standby flame serving the same purposes as the standby pilot **42** of FIG. 1.

The dual rate pilot burner **144** adjacent the broil burner **12** receives gas from a conduit **158** connected to a T fitting **160** communicating with the control **16** through the conduit **106**. The fitting also communicates with the outlet side of the broil safety valve **18** through the conduit **130**. An adjustment screw **162** provides a restriction to flow through the conduit **130** to the end that a reduced flow is produced when the pilot **144** is supplied only from the conduit **130**. This reduced flow produces a relatively small flame incapable of heating the sensing element **108** and serving the same purpose as the standby pilot **44** of FIG. 1. The restriction to flow through the conduit **130** also assures that when gas flows to the pilot **144** through the conduit **106**, the flow is not diverted into the safety valve **18** and a relatively large flame is produced for heating the sensing element **108**, thereby to open the broil safety valve **18**.

The operation of the system **140** is similar to the operation of the system **10** illustrated in FIG. 1. When the system is producing a baking operation, a relatively large heater flame is present at the pilot **142** and the bake burner **14** receives gas through the open bake safety valve **20**. If the knob **46** is moved to a broil position, the relatively large flame is discontinued and a heater flame is produced at the broil pilot **144**. During the thermal delay period while the bake sensing element cools and the broil sensing element **108** is heated, gas continues to flow to the bake burner **14**. The spark electrode is not effective to ignite gas flowing from the bake burner.

The pilot **142** receives a relatively small flow of gas during the thermal delay period from the internal cavity **62** of the control **16**. This gas is ignited by the spark electrode **30**, and produces a relatively small flame capable of igniting or maintaining the ignition of the bake burner **14**.

When the system **140** is operating in a broil mode, a relatively large flame is produced at the pilot **144**, and the broil burner receives gas through the open safety valve **18**. If the knob **46** is turned from broil to bake, the relatively large flame is discontinued while a heater flame is produced at the bake pilot **142**. However, the broil burner **12** continues to receive gas during a thermal delay period pending operation of the broil safety valve **18** or the bake safety valve **20**.

During the thermal delay period, the pilot **144** receives a relatively small flow of gas from the outlet side of the broil safety valve **18**. This gas is ignited by the spark electrode **28** and serves to ignite or maintain the ignition of gas flowing from the broil burner **12**.

Although the present invention has been described in connection with details of particular embodiments thereof, it should be understood that many other modifications and embodiments may be devised by those skilled in the art. It should be understood that the details of the described embodiments should not be taken to limit the spirit and scope of the invention as set forth in the accompanying claims.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. Apparatus for use with a main burner in a system including a plurality of main burners, said apparatus comprising:

a safety valve connected to control the flow of gas to the main burner;

a heater pilot means adjacent the main burner;

control means connected to said heater pilot means, said control means being movable to a first position wherein gas flows to said heater pilot means and to a second position wherein gas is prevented from flowing to said heater pilot means;

ignition means operable to produce an ignition condition adjacent said heater pilot means in response to movement of said control means to said first position and to said second position;

sensing means in heat sensing relation with said heater pilot means for opening said safety valve when heated by a flame at said heater pilot means;

said sensing means and safety valve being characterized by a thermal delay in operation;

an additional pilot means disposed in ignition transfer relation between said ignition means and the main burner;

and means for supplying gas to said additional pilot means during a thermal delay period following movement of said control means from said first to said second position while said sensing means cools to close said safety valve.

2. The apparatus of claim **1**, said heater pilot means and said additional pilot means comprising first and second pilot bodies each having an inlet and being disposed adjacent one another.

3. The apparatus of claim **1**, said heater pilot means and said additional pilot means comprising a single pilot body having a single inlet.

4. The apparatus of claim **3**, said single inlet being connected to both said control means and the outlet side of said safety valve.

5. The apparatus of claim **1**, said supplying means comprising a conduit extending between the outlet side of said safety valve and said additional pilot means.

6. In a gas oven system of the type including: a bake burner and a broil burner; a bake pilot means located adjacent the bake burner and a broil pilot means located adjacent the broil burner; a safety valve system having a common inlet, a bake outlet connected to the bake burner, and a broil outlet connected to the broil burner; a control adapted to communicate with a supply of gas and connected to said common inlet and to said bake and broil pilot means; said control being movable to a bake position for supplying gas to said common inlet and for supplying a flow of gas for a heating flame to said bake pilot means; said control being movable to a broil position for supplying gas to said common inlet and for supplying a flow of gas for a heating flame to said broil pilot means; said safety valve system including a bake sensing means located adjacent said bake pilot means for communicating said common inlet and said bake outlet in response to a heating flame at said bake pilot means; said safety valve system including a broil sensing means located adjacent said broil pilot means for communicating said common inlet and said broil outlet in response to a heating flame at said broil pilot means; and said safety valve system having a thermal delay in operation;

the improvement comprising:

intermittent ignition means disposed adjacent both said bake and broil pilot means;

means for operating said ignition means in response to movement of said control to said bake position and to said broil position for igniting the bake and broil pilot means when the control is moved to the bake and broil positions respectively;

said bake pilot means including bake ignition transfer pilot means adjacent said ignition means and adjacent said bake burner;

and means for supplying gas to said bake ignition transfer pilot means during a thermal delay period after said control is moved from the bake position to the broil position while said common inlet remains communicated with said bake outlet.

7. The improvement of claim **6**, said supplying means comprising a conduit intercommunicating said common inlet and said bake ignition transfer pilot means.

8. In a gas oven system of the type including: a bake burner and a broil burner; a bake pilot means located adjacent the bake burner and a broil pilot means located adjacent the broil burner; a safety valve system having a common inlet, a bake outlet connected to the bake burner, and a broil outlet connected to the broil burner; a control adapted to communicate with a supply of gas and connected to said common inlet and to said bake and broil pilot means; said control being movable to a bake position for supplying gas to said common inlet and for supplying a flow of gas for a heating flame to said bake pilot means; said control being movable to a broil position for supplying gas to said common inlet and for supplying a flow of gas for a heating flame to said broil pilot means; said safety valve system including a bake sensing means located adjacent said bake pilot means for communicating said common inlet and said bake outlet in response to a heating flame at said bake pilot means; said safety valve system including a broil sensing means located adjacent said broil pilot means for communicating said common inlet and said broil outlet in response to a heating flame at said broil pilot means; and said safety valve system having a thermal delay in operation;

the improvement comprising:

intermittent ignition means disposed adjacent both said bake and broil pilot means;

means for operating said ignition means in response to movement of said control to said bake position and to said broil position for igniting the bake and broil pilot means when the control is moved to the bake and broil positions respectively;

said broil pilot means including broil ignition transfer pilot means adjacent said ignition means and adjacent said broil burner;

and means for supplying gas to said broil ignition transfer pilot means during a thermal delay period after said control is moved from the broil position to the bake position while said common inlet remains communicated with said bake outlet.

9. The improvement of claim **8**, said supplying means comprising a conduit extending from said broil outlet to said broil ignition transfer pilot means.

10. The improvement of claim **8**,

said bake pilot means including bake ignition transfer pilot means adjacent said ignition means and adjacent said bake burner;

and means for supplying gas to said bake ignition transfer pilot means during a thermal delay period after said control is moved from the bake position to the broil position while said common inlet remains communicated with said bake outlet.

11. A method of assuring ignition of the broil burner in a two burner range of the type wherein gas flows to the broil burner safety valve and is prevented from flowing to the broil heater pilot during a thermal delay period after the control is moved from a broil position to a bake position, said method comprising the steps of channeling a flow of gas from the outlet of the safety valve to a pilot burner adjacent the broil burner, and igniting the pilot burner when the control is moved from the broil position to the bake position.

12. A burner ignition system comprising a main burner, a valve controlling the admission of gas to the main burner, a heater pilot in igniting relation to the main burner, a sensing element adjacent the heater pilot for opening said valve when heated by a flame at said heater pilot, intermittent ignition means for igniting said heater pilot when gas is supplied thereto, an additional pilot in ignition transfer relation between said ignition means and said main burner, and a conduit connected between said additional pilot and the outlet of said valve for supplying a flow of gas to said additional pilot whenever gas flows to said burner.

13. In combination with a gas burner:

an intermittently operable ignition means spaced from the gas burner;

a first valve having an outlet connected to the gas burner and controlling the admission of gas thereto;

a second valve for controlling the supply of gas to said first valve and movable between closed and open positions;

means for operating said ignition means in response to movement of said second valve to said open position;

and a pilot means disposed between said ignition means and the burner and receiving gas from said outlet of said first valve for transferring ignition from said ignition means to the gas burner.

14. A valve for maintaining ignition of an upper broil burner in a two burner oven system of the type including an intermittent ignition means, an ignition transfer pilot means disposed in ignition transfer relation between the ignition means and the upper broil burner, and a control pilot means, said valve comprising: a valve housing defining an internal cavity, means including a valve seat dividing said cavity into inlet and outlet chambers, an inlet passage in said housing communicating with said inlet chamber and adapted to communicate with a supply of fuel, a first relatively unrestricted outlet passage in said housing communicating with said outlet chamber and adapted to supply fuel to said upper broil burner, a valve member movable into and out of sealing engagement with said valve seat, valve operating means including flame responsive means adapted to be disposed in heat sensing relation with the control pilot means for opening said valve in response to a flame indication at the control pilot means, and a relatively restricted second outlet passage in said housing communicating with said outlet chamber and adapted to communicate with the ignition transfer pilot means.

15. The valve of claim **14** further comprising a flow restriction defining means disposed in series flow relation with said second outlet passage.

16. The valve of claim **15**, said flow restriction defining means being adjustable.

References Cited

UNITED STATES PATENTS

3,232,534	2/1966	Branson	236—15
3,312,397	4/1967	Willson	236—15

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