Feb. 9, 1971 F. RIEHL 3,561,896

PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

Filed Jan. 14, 1969 7 Sheets-Sheet 1

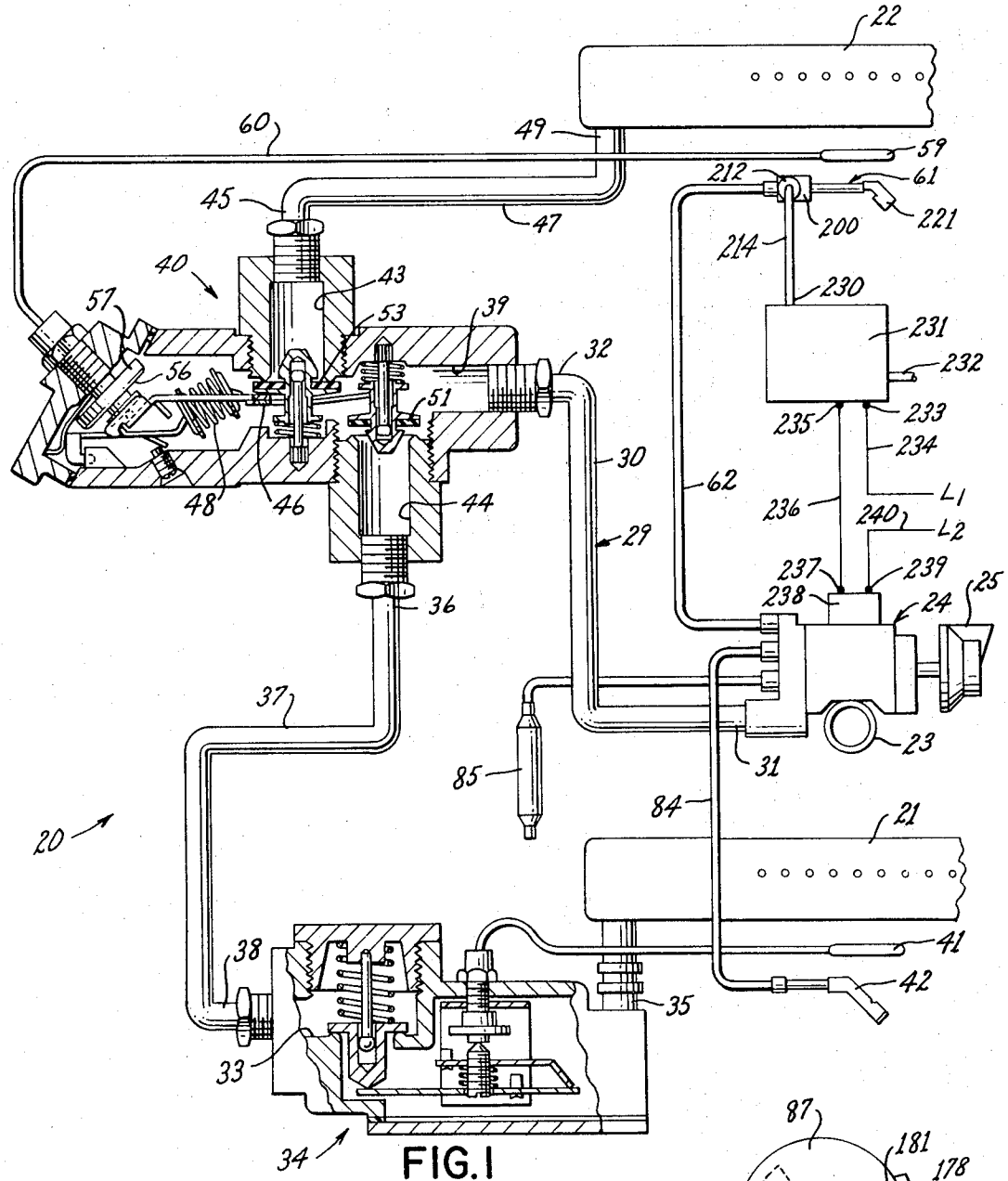

FIG. 1

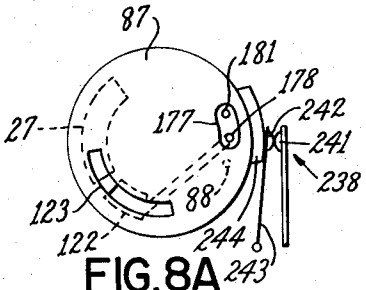

FIG. 8A

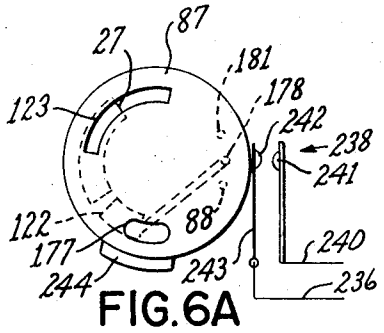

FIG. 6A

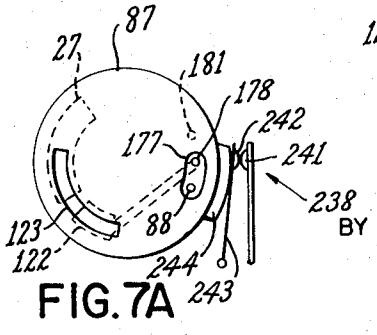

FIG. 7A

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PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

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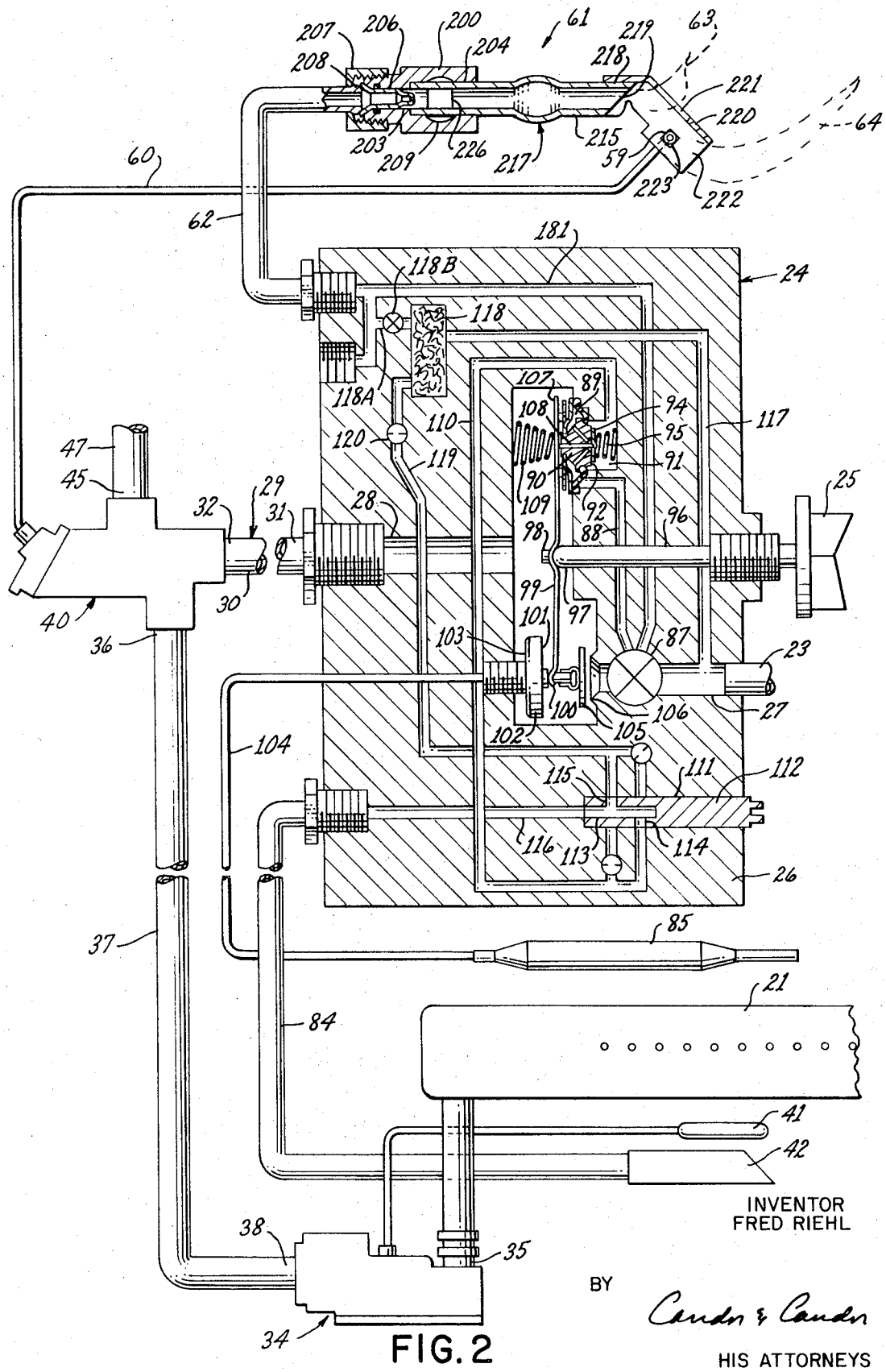

FIG. 2

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PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

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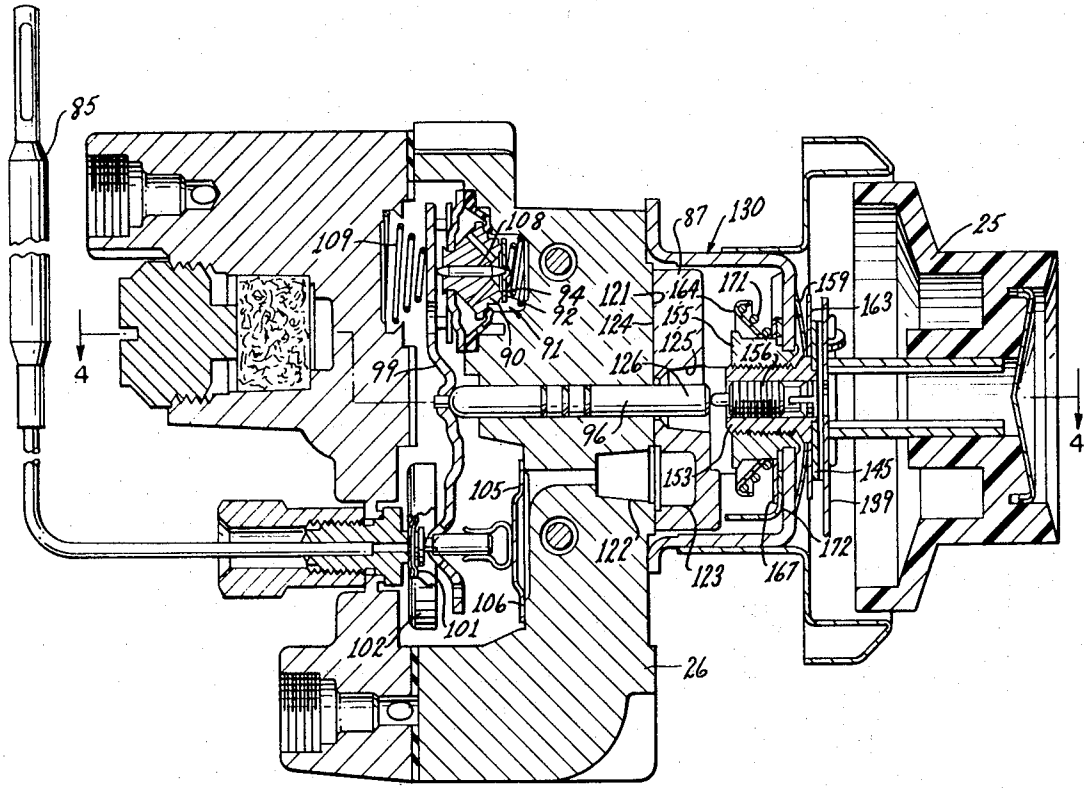

FIG.3

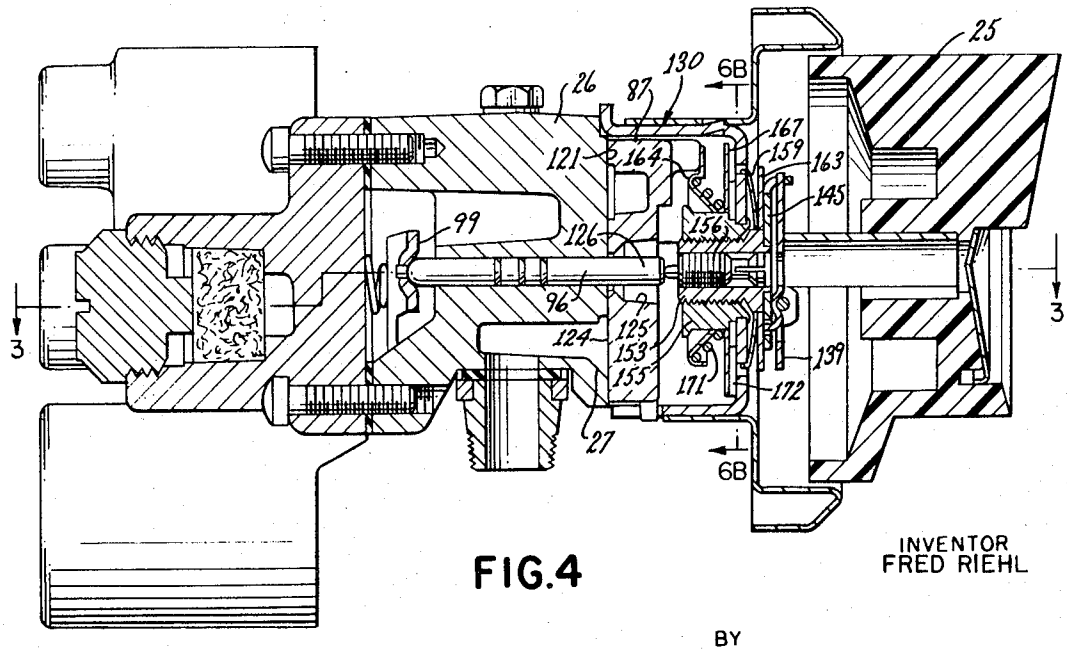

FIG.4

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PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

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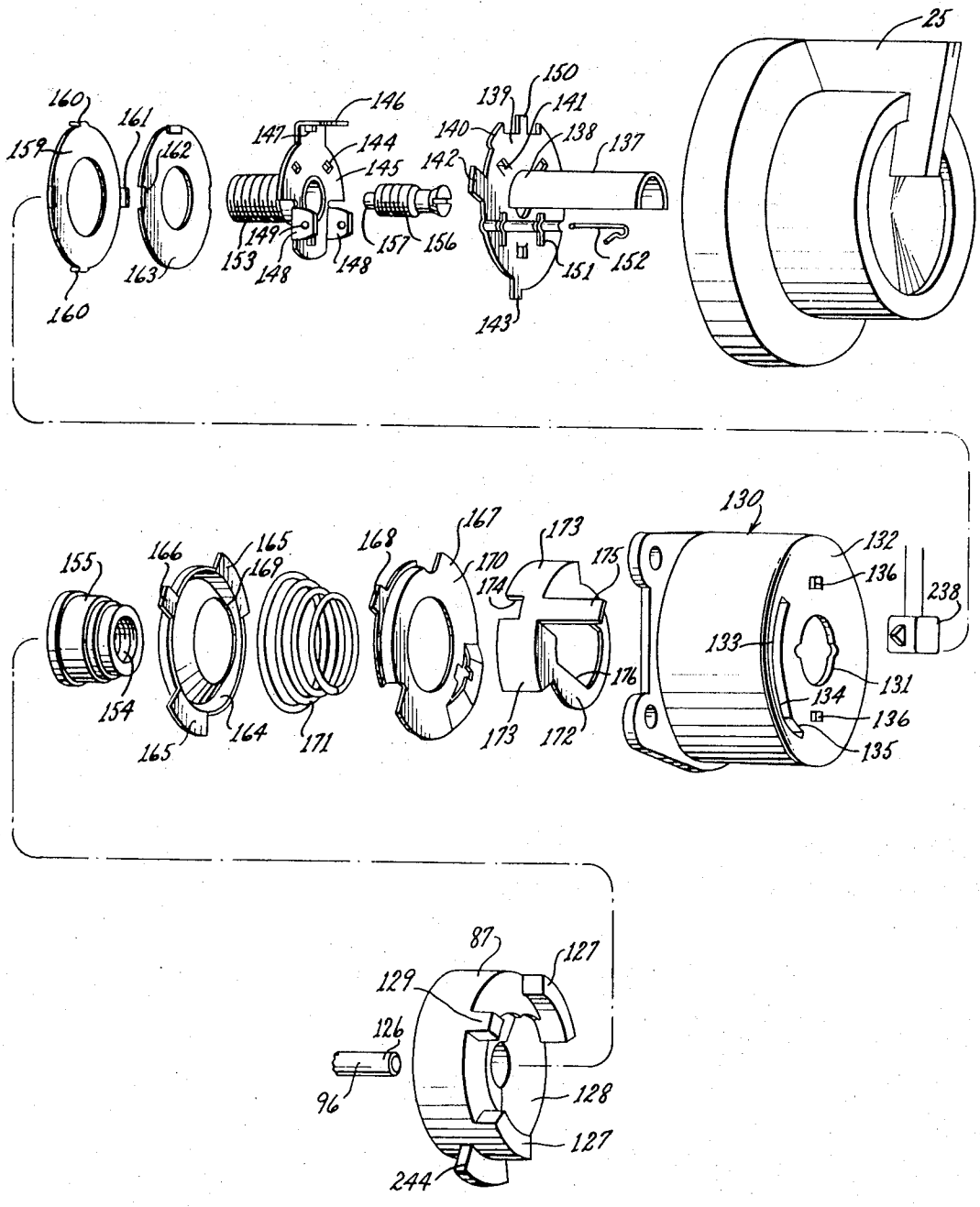

FIG.5

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PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME
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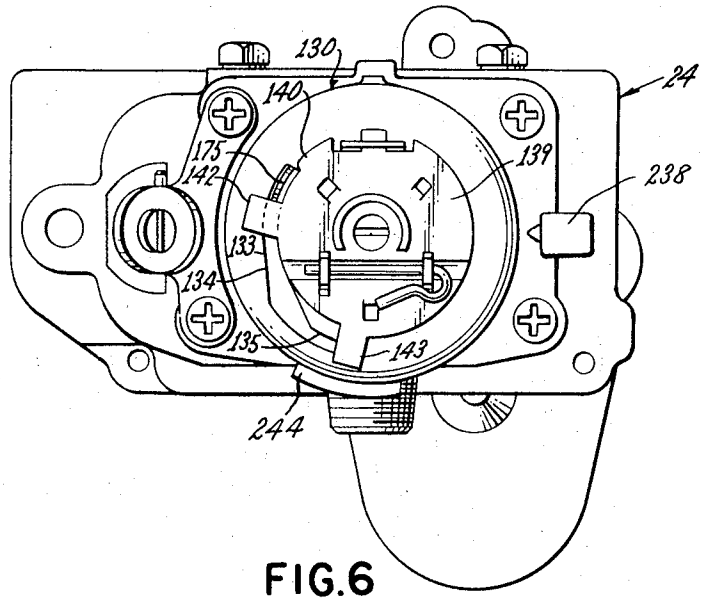

FIG.6

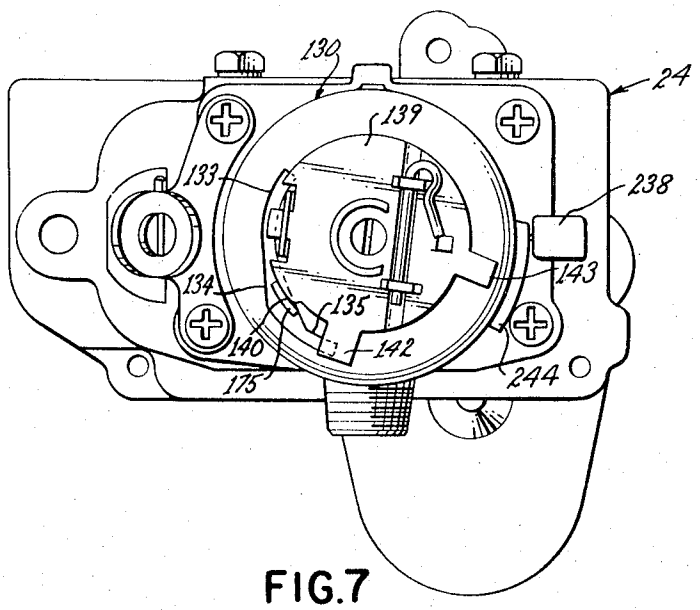

FIG.7

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Feb. 9, 1971 F. RIEHL 3,561,896

PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

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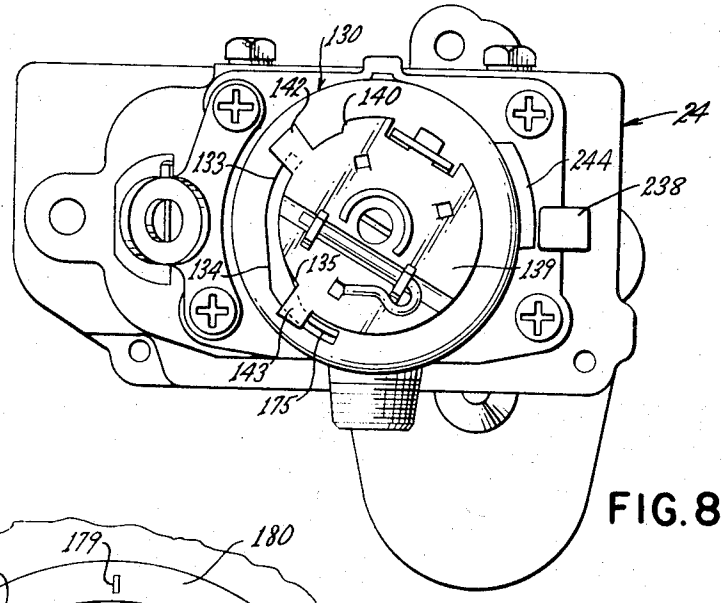

FIG. 8

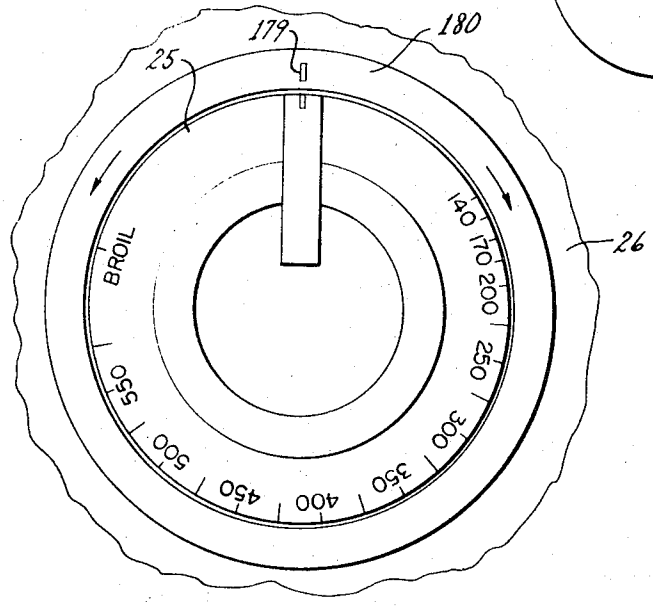

FIG. 9

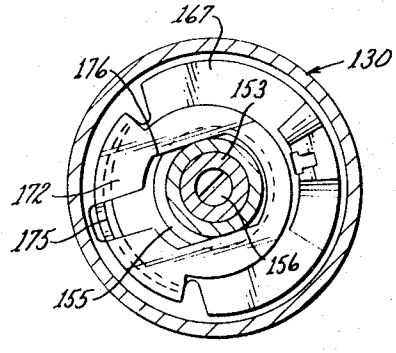

FIG. 7B

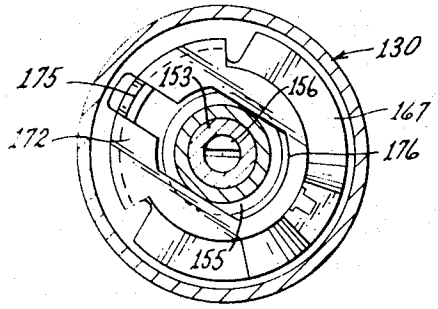

FIG. 6B

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Feb. 9, 1971 F. RIEHL 3,561,896

PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

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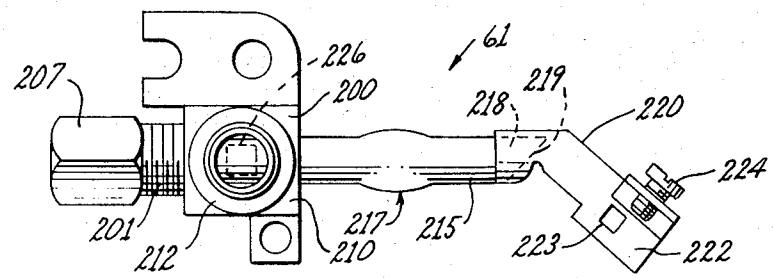

FIG. 10

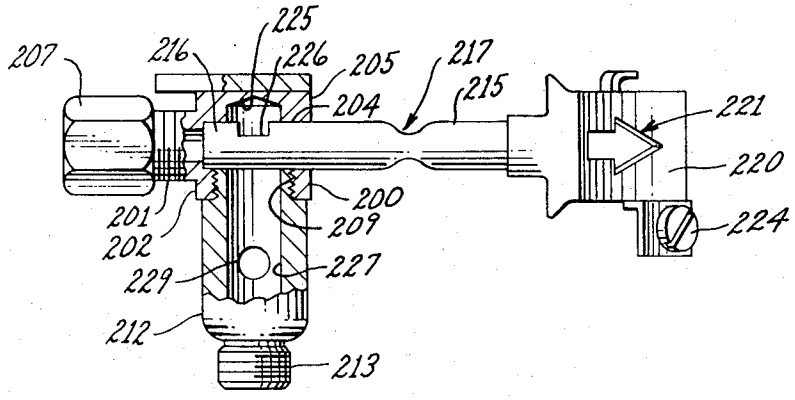

FIG. 11

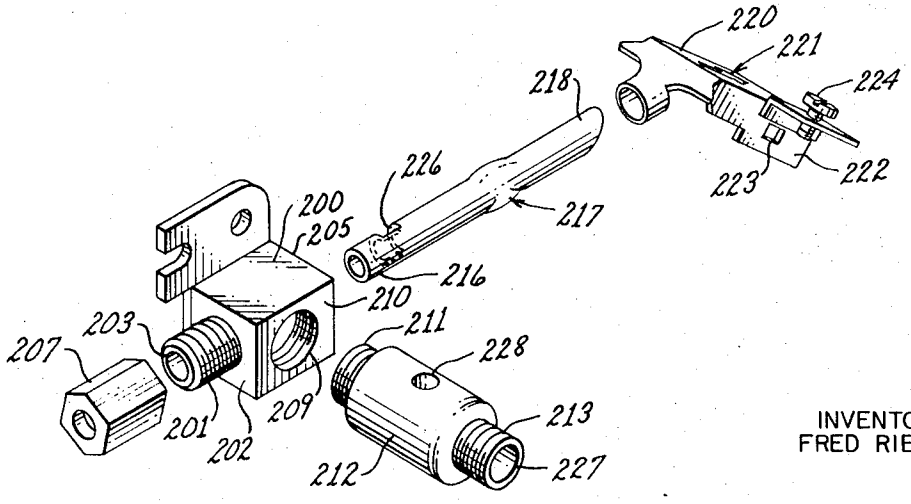

FIG. 12

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United States Patent Office 3,561,896 Patented Feb. 9, 1971

3,561,896

PILOT BURNER CONTROL SYSTEM FOR A DOUBLE BURNER OVEN OR THE LIKE AND METHOD OF OPERATING THE SAME

Fred Riehl, Greensburg, Pa., assignor to Robertshaw Controls Company, Richmond, Va., a corporation of Delaware

Filed Jan. 14, 1969, Ser. No. 791,009
Int. Cl. F23n
U.S. Cl. 431—12 28 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a pilot burner control system for a broil burner of a domestic oven or the like wherein the broil burner and the bake burner are disposed in a single oven cavity that has a control device that is adapted to selectively interconnect a source of fuel to either the bake burner or the broil burner. The pilot burner for the broil burner is adapted to be continuously supplied fuel from the source of fuel and when the control device is set in a position to operate either the bake burner or the broil burner, an air pumping device is energized to force primary air that is not contaminated with combustion products created in the single cavity of the oven directly to the pilot burner to be entrained in the fuel flowing thereto so as to insure that flame means will always exist at the pilot burner means for the broil burner and will not be snuffed out by combustion products during the use of the oven.

This invention relates to an improved pilot burner control system for a double burner oven arrangement or the like and to improved methods for operating such a control system or the like.

It is well known that fuel control systems have been provided for effectively directing a flow of fuel to either a bake burner or to a broil burner respectively disposed in a single oven cooking cavity or chamber, depending upon the position of a selector knob of a control device of the system. However, in the past, the pilot burner means for igniting the broil burner required an expensive electrical ignition means to be operated each time the broil burner is to be operated in order to insure ignition of the pilot burner means for the broil burner because during the normal use of the oven for a baking operation the combustion products produced during such a baking operation tended to snuff out the pilot burner means for the broil burner, as the same is located above the bake burner in the single cavity of the oven. Alternately, a complicated snorkel tube arrangement was provided to tend to direct fresh primary air to the pilot burner for the broil burner through an aspiration process caused by the flow of fuel passing to the pilot burner for the broil burner.

However, it has been found, according to the teachings of this invention, that primary air that is free of the contaminants of the combustion products of the oven can be forced by an air pumping means directly to the pilot burner for the broil burner only during the operation of the oven and that when the oven is not operating the primary air could be supplied to the pilot burner for the broil burner from the oven cavity itself.

In particular, one embodiment of this invention provides a pilot burner means for the broil burner wherein a first conduit means is adapted to continuously supply fuel from a source of fuel to the broil pilot burner to create certain flame means at the outlet end of the pilot burner means. A second conduit means of the pilot burner is so constructed and arranged that the same is in fluid communication with the first conduit means and is interconnected to an air pumping device which when operated

will force primary air from a region that is free of contaminants of the oven to the pilot burner to be entrained in the fuel being directed thereto assure continuous burning of the pilot burner means during the operation of the oven. However, the second conduit means has opening means formed therein in such a manner that when the air pumping device is not operating because the oven is in an off condition thereof, the flow of fuel to the pilot burner, through an aspiration effect, draws primary air through the opening means in the second conduit means to be entrained in the fuel for maintaining combustion at the broil pilot burner.

Accordingly, it is an object of this invention to provide an improved pilot burner control system for a double burner oven arrangement or the like, the control system of this invention having one or more of the novel features set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved method for operating such a pilot burner control system, the method of this invention having one or more of the novel features set forth above or hereinafter shown or described.

Other objects, uses and advantages of this invention are apparent from a reading of this description, which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a schematic view illustrating the improved control system of this invention.

FIG. 2 is an enlarged schematic view of part of the control system illustrated in FIG. 1 and illustrates schematically the control device utilized with the system of FIG. 1.

FIG. 3 is a cross-sectional view of the control device of the system of FIG. 1 and is taken on line 3—3 of FIG. 4.

FIG. 4 is a cross-sectional view of the control device of FIG. 3 and is taken on line 4—4 thereof.

FIG. 5 is an exploded perspective view of various parts of the control device of FIGS. 3 and 4.

FIG. 6 is a front view of the control device of FIGS. 3 and 4 with the selector knob and cooperating means removed to illustrate the control device in its off position.

FIG. 6A is a schematic view illustrating the disc valve member of the control device of FIGS. 3 and 4 when disposed in the off position of FIG. 6.

FIG. 6B is a cross-sectional view taken on lines 6B—6B of FIG. 4 to illustrate the clutching member of the control device when the control device is set in its off position of FIG. 6.

FIG. 7 is a view similar to FIG. 6 and illustrates the control device in a baking position thereof.

FIG. 7A is a view similar to FIG. 6A and illustrates the disc valve set in the baking position of FIG. 7.

FIG. 7B is a view similar to FIG. 6B and illustrates the clutching member of the control device when set in the baking position of FIG. 7.

FIG. 8 is a view similar to FIG. 6 and illustrates the control device of FIGS. 3 and 4 set in its broiling position.

FIG. 8A is a view similar to FIG. 6A and illustrates the disc valve member set in the broiling position of FIG. 8.

FIG. 9 is an enlarged front view of the control knob means for the control device of FIGS. 3 and 4.

FIG. 10 is a side view of the improved pilot burner of this invention.

FIG. 11 is a top view of the pilot burner illustrated in FIG. 10 with certain parts thereof being broken away.

FIG. 12 is an exploded perspective view of the pilot burner of FIG. 10.

While the various features of this invention are here-

inafter described and illustrated as being particularly adaptable to provide a pilot burner control system for a double burner domestic oven or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide pilot burner means for operating other control systems or the like.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1 and 2, an improved control system of this invention is generally indicated by the reference numeral **20** and includes a bake burner **21** and a broil burner **22** adapted to be disposed in a domestic cooking apparatus or the like to effect the cooking operation of a single cooking cavity or chamber by having a source of fuel **23** selectively directed thereto by a control device **24** of this invention in a manner hereinafter described.

As illustrated in FIGS. 1 and 2, the control device **24** includes a housing **26** having an inlet means **27** adapted to be fluidly interconnected to the fuel supply manifold **23** in any suitable manner and has an outlet means **28** interconnected to a conduit means **29** leading to the bake burner **21** and broil burner **22**.

In particular, the conduit means **29** includes a first conduit **30** having one end **31** fluidly interconnected to the outlet **28** of the control device **24** and the other end **32** interconnected to an inlet **39** of a diverter valve means **40**. An outlet means **44** of the diverter valve means **40** is interconnected to one end **36** of another conduit **37** of the conduit means **29** which has its other end **38** interconnected to an inlet **33** of a safety valve means **34**.

The safety valve means **34** can be of the type disclosed in U.S. patent to Branson et al., No. 3,233,830, wherein the valve means **34** prevents fluid communication between its inlet means **33** and its outlet means **35** that is fluidly interconnected to the bake burner **21** when a flame detector means **41** senses that a certain flame means does not exist at a bake pilot burner means **42** for the bake burner **21**. For example, the bake pilot burner means **42** can be of the type disclosed in the aforementioned U.S. patent to Branson et al. or of the type disclosed in the U.S. patent to Riehl, No. 3,308,871, wherein the same is adapted to be continuously supplied a small amount of fuel from the control device **24** through a conduit means **84** to maintain a continuously burning small standby flame which is not sensed by the detector means **41**. However, when the bake pilot burner means **42** is additionally supplied fuel by the control device **24** through the conduit means **84** in a manner hereinafter described, the bake pilot burner means **42** creates a large heater flame that is detected by the detector means **41** to cause the safety valve **34** to open and remain open as long as such heater flame exists at the bake pilot burner means **42** to fluidly interconnect the conduit **37** with the bake burner **21**.

The diverter valve means **40** has a pair of outlets **43** and **44** respectively interconnected to ends **45** and **36** of conduits **47** and **37** forming part of the previously described conduit means **29** and respectively having the other ends **49** and **38** thereof fluidly interconnected to the broil burner **22** and to the safety valve **34** for the bake burner **21**.

The diverter valve means **40** is so constructed and arranged that a first valve member **51** is operated by a lever **46** and is normally biased to an open position thereof by a spring **48** to maintain the outlet means **44** normally opened. A second valve member **53** is also operated by the lever **46** and is normally biased by the spring **48** to be in a closed position to normally close the outlet means **43**.

A movable wall **56** of a power element **57** for the diverter valve **40** is so constructed and arranged that when the same is in a collapsed condition, as illustrated in FIG. **1**, the same, through the spring **48** and lever **46**, permits

the valve member **51** to be in an open position and the valve member **53** to be in a closed position. However, when the power element **57** is expanded for a broiling operation in a manner hereinafter described, the movable wall **56** thereof moves downwardly to first cause closing of the valve member **51** against the outlet means **44** before the movable wall **56** will cause opening movement of the valve member **53** away from the outlet means **43** for a purpose hereinafter described.

The interior of the power element **57** is interconnected to a bulb **59** by a capillary tube **60** so that when the bulb **59** senses that no certain flame means exists at a broil pilot burner means **61** for the broil burner **22**, the power element **57** collapses and has the movable wall **56** thereof moved upwardly in FIG. 1 a sufficient distance so that the spring means **48** and lever **46** of the diverter valve means **40** will cause the valve member **51** to completely close the outlet means **43** of the diverter valve **40** and fully open the outlet means **44** thereof. However, when the certain flame means exists at the broil pilot burner means **61**, the bulb **59** causes the power element **57** to expand in such a manner that movable wall **56** thereof moves downwardly to first cause the valve member **51** to fully close the outlet means **44** of the diverter valve means **40** and, thereafter, cause the valve member **53** to move downwardly and fully open the outlet means **43**.

The control device **24** of this invention is so constructed and arranged in a manner hereinafter set forth, that the control device continuously directs a small amount of fuel from the fuel source **23** to the pilot burner **61** through a conduit **62** to maintain a small flame **63** (FIG. 2) at the pilot burner **61**. However, when the selector means **25** is set in a position for a broiling operation, the control device **24** directs an additional amount of fuel through the conduit means **62** leading to the broil pilot burner means **61** to create a large heater flame **64** in addition to the flame **63** at the pilot burner **61**.

The general operation of the control system **20** illustrated in FIG. 1 will now be described.

When the selector means **25** of the control device **24** is disposed in its off position, the control device **24** prevents the source of fuel **23** from being interconnected to the conduit **30** of the conduit means **29** and also prevents any additional amount of fuel from being directed to the bake pilot burner means **42** through the conduit means **84** to create the previously described larger heater flame at the bake pilot burner means **42** whereby the safety valve means **34** is in a closed position to prevent fluid communication between the inlet means **33** and outlet means **35** thereof even though a small standby flame is continuously burning at the bake pilot burner means **42**. Also, when the selector means **25** of the control device **24** is disposed in its off position, no additional amount of fuel is directed by the control device **24** through the conduit means **62** leading to the burner pilot means **61** to create the previously described large heater flame **64** at the broil pilot burner **61** whereby the detector **59** causes the diverter valve **40** to be disposed and maintained in the position illustrated in FIG. 1 wherein the valve means **53** closes off the outlet means **43** leading to the broil burner **22** and fully opens the outlet means **44** leading to the bake burner **21** even though no fuel is issuing thereto.

When the selector means **25** is moved to a position for a baking operation in a manner hereinafter described, the control device **24** does not supply any additional amount of fuel to the broil pilot burner means **61** whereby the diverter valve means **40** will remain in the position illustrated in FIG. 1. However, since the temperature in the oven is below the temperature selected by the selector means **25**, the control device **24**, in a manner hereinafter described, supplies an additional amount of fuel through the conduit **84** to create the previously described large heater flame at the bake pilot burner means **42** to be detected by the detector means **41** which will open the safety valve means **34** to interconnect the inlet means **33**

thereof with the outlet means 35. Also, when the selector knob 25 is set at any on oposition, the same interconnects the source of fuel 23 with the conduit means 30 whereby fuel now can pass through to opened outlet 44 of the diverter valve 40 and through the opened safety valve means 34 to the bake burner 21 to be ignited by the bake pilot burner means 42.

The control device 24 continuously supplies fuel to the bake burner 21 to heat the oven until a temperature sensing bulb 85 of the control device 24 determines that the temperature of oven is at or above the temperature selected by the knob 25 whereby the control device 24, in a manner hereinafter described, will terminate the flow of the additional fuel through the conduit 84 leading to the bake pilot burner means 42 so that the heater flame at the bake pilot burner means 42 will no longer exist. Thus, the detector 41 will close the safety valve 34 to prevent fuel from being directed to the bake burner 21. However, when the temperature in the oven falls below the temperature selected by the knob 25, the bulb means 85 will again cause the control device 24 to create the large heater flame at the bake pilot burner means 42 to open the safety valve 34 in the manner previously described to permit fuel to again issue from the main burner means 21 and be ignited by the bake pilot burner means 42.

Thus, it can be seen that in any baking operation selected by the selector means 25 of the control device 24, the bake burner means 21 will be cycled on and off by the control device 24 to tend to maintain the temperature effect in the oven at the temperature effect selected by the selector knob 25, such baking operation not effecting the operation of the broil burner 22.

When the housewife or the like desires to utilize the control system 20 for a boiling operation, the housewife sets the selector knob 25 in a boiling position thereof in a manner hereinafter described whereby no additional amount of fuel is supplied by the control device 24 through the conduit means 84 to create the heater flame at the bake pilot burner means 42 to open the safety valve 34. However, an additional amount of fuel is directed by the control device 24 through the conduit 62 to the pilot burner 61 to create the large heater flame 64. The now continuously burning large heater flame 64 at the broil pilot burner means 61 is detected by the detector means 59 to cause the movable wall 56 of the power element 57 to move downwardly in FIG. 1 and first close the outlet means 44 thereof before opening the outlet means 43 whereby the fuel being directed to the diverter valve means 40 by the control device 24 can only be directed by the diverter valve means 40 to the broil burner 22 and not to the bake burner 21.

Thus, the fuel issuing from the broil burner 22 by the diverter valve means 40 will be ignited by the broil pilot burner means 61 and will be continuously supplied fuel by the control device 24 to provide a continuous flame broiling operation.

The particular details of the control device 24 for effecting the above operation of the control system 20 will now be described.

The control device 24 includes a disc valve member 87, FIG. 2, interconnected to the selector means 25 so that when the selector means is moved to any "on" bake position thereof in a manner hereinafter described, the disc valve 87 not only interconnects the inlet 27 with the outlet 28, but also interconnects the inlet 27 with a passage means 88 leading to a chamber 89 defined by a valve seat member 90 carried by the housing 26. The chamber 89 is separated from a chamber 91 by a valve seat 92 on the valve seat member 90, the valve seat 92 being opened and closed by a valve member 94 urged to the closed position by a compression spring 95.

An axially movable fulcrum pin 96 is carried by the housing 26 in such a manner that the axial position of the fulcrum pin 96 relative to the housing 26 is controlled by the selector or control knob 25 in a manner hereinafter described. The fulcrum pin 96 has a rounded end 97 provided with a cylindrical projection 98 passing through a suitable aperture in a lever 99 whereby the lever 99 is fulcrumed on the end 97 of the fulcrum pin 96.

One end 100 of the lever 99 bears against a movable wall 101 of an expansible and contractible element 102 having a wall 103 fixed to the housing 26, the interior of the expansible and contractible element 102 being interconnected to the oven temperature sensing bulb 85 by a conduit 104. The movable wall 101 of the expansible and contractible element 102 carries a valve member 105 for opening and closing a valve seat 106 in a manner hereinafter described.

The other end 107 of the lever 99 is adapted to engage a plunger 108 carried by the valve seat member 90 and engaging the valve member 94, the end 107 of the lever 99 being urged in a clockwise direction in FIG. 2 by a compression spring 109. Thus, the opening and closing of the valve member 94 is controlled by the lever 99 in relation to the temperature sensed by the bulb 85 and the axial position of the fulcrum pin 96 in a manner hereinafter described.

The chamber 91 of the housing 26 is interconnected to a passage means 110 leading to a bore 111 in the housing 26, an adjusting key 112 being rotatably disposed in the bore 111 and having a longitudinal bore 113 interconnected to the exterior of the key 112 by transverse bores 114 and 115. The longitudinal bore 113 of the adjusting key 112 is disposed in communication with a passage 116 leading to the conduit 84 interconnected to the bake pilot burner means 42.

Another passage 117 is formed in the housing 26 and is interconnected with the inlet passage 27 at a point upstream from the disc valve 87 as well as to a filter chamber 118. The filter chamber 118 is interconnected to a passage 119 leading to the bore 111 in the manner illustrated in FIG. 2, the passage 119 having an orifice 120 therein. The filter chamber 118 is also interconnected by a passage 113A having an adjusting key 118B therein to the conduit means 62 leading to the broil pilot burner 61.

Thus, it can be seen that when the adjusting key 112 is disposed in the "on" position, as illustrated in FIG. 2, fuel from the supply conduit 23 is adapted to pass through the passages 117 and 119 to the passage 115 of the adjusting key 112 and, thus, to the bake pilot burner means 42 to provide the previously mentioned small standby flame, which does not affect the safety valve means 34. Also, fuel is continuously supplied through the passage 117, passage 118A and conduit means 62 to provide the previously mentioned small standby flame 63 at the broil pilot burner 61 which does not affect the diverter valve 40.

However, when the disc valve 87 is moved to an opened position for a baking operation and the valve member 94 is moved to an opened position in a manner hereinafter described, the additional fuel being supplied through the passage 110 to the passage 114 of the adjusting key 112 causes the bake pilot burner means 42 to provide the previously described large heater flame which is sensed by the bulb 41 and causes the safety valve means 34 to open. However, when the valve member 94 closes, the additional supply of fuel to the pilot burner 42 is terminated whereby the large heater flame ceases to exist, even though the small standby flame continues, whereby the safety valve 34 will close.

Thus, as the valve member 94 cycles between its opened and closed positions in a manner hereinafter described, the safety valve means 34 is cycled on and off to maintain the temperature of the oven at a temperature selected by the control knob 25 in the manner previously described.

As illustrated in FIGS. 4, 5 and 6A the housing means **26** defines a flat valve surface **121**, interrupted by the spaced inlet **27** and an outlet **122** adapted to be interconnected together by a groove **123** in the disc valve **87**.

In particular, the groove **123** in the disc valve **87** interrupts a valve surface **124** thereof with the valve surface **124** being disposed in sealing and sliding contact with the valve seat surface **121** of the housing **26**, the disc valve **87** having an opening **125** passing therethrough and loosely receiving the end **126** of the fulcrum pin **96**.

As illustrated in FIG. 5, the disc valve **87** has a pair of spaced arcuate embossments **127** formed on the side **128** thereof and a smaller substantially rectangular embossment **129** intermediate the embossments **127** for a purpose hereinafter described.

A cup-shaped member **130** forms part of the housing means **26** and is telescopically disposed over the disc valve **87**, the member **130** having an aperture **131** passing therethrough in the closed end **132** thereof. The closed end **132** has a cam slot **133** formed therein and defining opposed camming edges **134** and **135** best illustrated in FIGS. 6 and 7. In addition, a pair of apertures **136** pass through the wall **132**.

A C-shaped shaft **137** has one end **138** thereof interconnected to a plate member **139** having three outwardly projecting tangs **140**, **143** and **142**. In addition, rearwardly directed tangs **141** are formed in the plate member **139** and are adapted to register with apertures **144** formed on another plate member **145**.

The plate member **145** has a bent over tang **146** provided with a slot **147** and a pair of ears **148** having apertures **149** passing therethrough. The members **139** and **145** are adapted to be assembled together with another tang **150** of the member **139** received in the slot **147** of the member **145** and with the ears **148** of the member **145** passing through slots **151** of the plate member **139** and pinned thereto by a pin means **152** passing through the apertures **149**. In this manner, rotation of the shaft **137** by the control knob **25** causes like rotation of the plate member **145**.

The plate member **145** carries a tubular extension **153** both internally and externally threaded, the tubular extension **153** adapted to be threadedly received in a threaded bore **154** of a member **155** fixed in the aperture **131** of the housing part **130**.

An adjusting screw **156** is threaded in the tubular part **153** of the plate **145** and has an end **157** adapted to abut the end **126** of the fulcrum pin **96**.

Thus, rotation of the control knob **25** fastened on the other end **158** of the C-shaped shaft **137** causes the member **153** to be threaded into or out of the fixed threaded member **155** to adjust the axial position of the fulcrum pin **96**.

A bowed spring-like washer **159** is provided and has tangs **160** adapted to register in the apertures **136** of the housing part **130**, the spring means **159** having reversely directed tangs **161** adapted to be received in notches **162** in a washer-like member **163**, the spring member **159** and washer-like member **163** being disposed between the closed wall **132** of the housing part **130** and the plate member **145** to place an outward force on the plate-like member **145**, and, thus, provide "feel" in adjusting the rotational position of the knob **25** relative to the housing **26**.

A spring retainer **164** is provided and has outwardly directed tangs **165** adapted to rest on the embossments **127** of the disc valve **87** and another tang **166**. Another spring retainer **167** is provided and has an outwardly directed tang **168** similar to tang **166** of the spring retainer **164**, retainers **164** and **167** respectively having openings **169** and **170** passing therethrough so that the same can be telescoped on the fixed threaded member **155**. A compression spring **171** is adapted to be disposed between the spring retainers **164** and **167** to compact a

clutch member **172** against the inside surface of the wall **132** of the housing part **130**.

The clutch part **172** has a pair of depending flanges **173** defining a notch **174** therebetween adapted to not only receive the tangs **168** and **166** of the spring retainers **167** and **164**, but to also receive the rectangular embossment **129** of the disc valve **87**. In addition, the clutch member **172** has an outwardly directed tang **175** adapted to pass through the cam slot **133** of the housing part **130**, the clutch part or drive member **172** having an aperture **176** passing therethrough to loosely receive the fixed member **155**.

The operation of the control device **24** as utilized in the system **20** of this invention, with the parts heretofore described, will now be described.

Assuming that the control knob **25** is disposed in its "off" position as illustrated in FIGS. 2, 6, 6A and 6B, the groove **123** of the disc valve **87** is in such a position that the same does not interconnect the inlet **27** with the outlet **122** nor the inlet **27** with the passage means **88** whereby no fuel issues from the bake burner **21** and only small standby flames exist at the broil pilot burner means **61** and at the bake pilot burner means **42** as the adjusting key **112** is normally disposed in the "on" position as illustrated in FIG. 2.

When the operator desires to turn on the oven for a set baking temperature thereof, the operator graps the knob **25** and rotates the same in a counterclockwise direction as illustrated in FIG. 7 whereby rotation of the knob **25** causes like rotation of the plate **139** whereby the tang **140** of plate **139** bears agains the tang **175** of the drive member **172** to cause like rotation therewith. As the drive member **172** is being rotated, the same, through the notch **174** thereof, rotates the spring retainers **167** and **164** as well as the disc valve **87** to bring the groove **123** of the disc valve **87** in such a position that the same fully interconnects the inlet **27** with the outlet **122**, as well as to have a groove **177** of the valve member **87** interconnect a branch inlet port **178** of the housing **26** to the passage **88** as illustrated in FIG. 7A.

However, when the disc valve **87** is rotated to its fully "on" position, it can be seen that the edge **135** of the cam slot **133** slides the drive member **172** radially outwardly to the position illustrated in FIGS. 7 and 7B whereby the tang **140** of the plate member **139** is no longer in engagement with the tang **175** of the drive member **172** so that the control knob **25**, when further rotated in a counterwlockwise direction for setting the desired baking temperature does not further rotate the disc valve **87** from its fully "on" position as illustrated in FIGS. 7, 7A and 7B. Thus, the sliding movement of the drive member **172** declutches the disc valve **87** from the control knob or manipulator means **25**.

During the rotational movement of the control knob **25** from its position to a set baking temperature position thereof, the threaded member **153** of the plate **145** is backed out of the fixed threaded member **155** in such a manner that the fulcrum pin **96** is adjusted to a new position thereof to the right in FIGS. 2, 3 and 4 as selected by the temperature setting of the control knob **25**.

This axial movement of the pin **96** from its "off" position to its selected baking temperature position permits the compression spring **109** to pivot the lever **99** on the fulcrum pin **96** in such a manner that the pin **108** carried by the valve seat member **90** is moved to the right in FIG. 2 to open the valve member **94** away from the valve seat **92** so that fuel in the passage **88** is now adapted to pass into the chamber **91** and, thus, to the bake pilot burner means **42** to create the large heater flame at the bake pilot burner means **42** whereby the bake burner **21** will be operated in the manner previously described.

Should a malfunction occur in the control device **24** of this invention, so that the valve member **94** will not close whereby the bake burner **21** remains on in a runaway condition, the increased temperature in the oven

will cause the movable wall **101** of the power element **102** to further move to the right in FIG. 2 to bring the valve member **105** closer to the valve seat **106** to throttle the flow of fuel to the bake burner **21** in such a manner that the bake burner **21** cannot produce a temperature in the oven above a predetermined safe temperature. Such safety feature also applies for the broiling operation hereinafter described.

When it is desired to turn off the system **20** of this invention, the operator rotates the control knob **25** back to the "off" position illustrated in FIG. 6. As the plate **139** is being rotated to its "off" position, the tang **142** thereof engages the tang **175** of the drive member **172** and rotates the drive member **172** therewith, whereby the disc valve **87** is rotated back to its "off" position, the drive mmeber **172** sliding radially inwardly relative to the disc valve **87** by means of the edge **134** of the cam slot **133** in the housing part **130** from the position illustrated in FIGS. 7 and 7A back to the position illustrated in FIGS. 6 and 6A. As the control knob **25** is rotated back to its "off" position, the tang **175** on the drive member **172** engages the end of the slot **133** when the control knob is disposed in its "off" position whereby the cam slot **133** determines the "off" position of the control knob **25**.

When it is desired to utilize the control system **20** of this invention for a broiling operation, the housewife or the like turns the selector means or control knob **25** in a counterclockwise direction in the manner previously described through the bake range until the control knob **25** as illustrated in FIG. 9 has the "broil" setting thereof placed adjacent the mark **179** on an outer stationary ring **180** of the housing means **26**. As the control knob **25** is being slowly rotated and as the same approaches the "broil" setting thereof, it can be seen in FIGS. 8 and 8A that the tang **143** of the member **139** engages the tang **175** of the drive member **172** to rotate the same in a counterclockwise direction until the tang **175** engages the lower end of the cam slot **133** which is the "broil" position of the control knob **25**. This further rotation of the drive member **172** causes further like rotation of the valve member **87** whereby the groove **177** of the valve member **87** only interconnects the branch inlet port **178** of the housing **26** with a passage means **181** in the housing means **26** that leads to the conduit **62** for the broil pilot burner means **61** to supply the additional amount of fuel to the broil pilot burner **61** to create the large heater flame **64**.

The diverter valve **40** is now under the control of the large heater flame **64** of the broil pilot burner means **61** to divert the flow of fuel from the control device **24** to only the broil burner **22** to be operated in the manner previously described.

Since a normal broiling operation takes place at approximately 625° F. or the like, and since it is desired to produce a continuous flame broiling operation by the broil burner **22**, should the temperature sensing bulb **85** sense that the temperature in the oven is exceeding the aforementioned 625° F. or the like, the movable wall **101** of the power element **102** moves to the right in FIG. 2 to cause the valve member **105** to produce a throttling down or modulating action on the flow of fuel passing through the valve seat **106** so that the flame at the broil burner **22** will not go out and will not tend to exceed the aforementioned 625° F. temperature in the oven for the system **20**.

Therefore, it can be seen that this invention provides an improved control system for a double burner oven or the like as well as improved parts and method for such system or the like.

In addition, the system **20** overcomes a particular disadvantage of prior known all gas systems where both burners become operating under conditions of loss of control during a baking operation, such as by a broken temperature sensing bulb means **85** or the like.

In particular, the system **20** overcomes the above disadvantage while still providing the single dial operation for the bake and broil temperature settings in a manner not provided by prior known systems.

For example, under conditions of loss of control, such as by a broken thermostat bulb **85** during a baking operation, only the bake burner **21** will be operated as the rise in temperature in the oven will not cause operation of the broil burner **22** as in prior known systems wherein a thermally operated broil safety valve will open when the oven temperature reaches a temperature sufficient to cause the flame detector for the broil safety valve to open whereby for this prior known type of system, a separate main flow broil selector cock is normally required in addition to a selector cock for a baking operation.

However, in the control system **20**, when such a high temperature is reached, the diverter valve **40** acts first to reduce or modulate the input flow of fuel to the bake burner **21** because, as the movable wall **56** of the power element **57** moves downwardly, the valve member **51** approaches the outlet means **44** with a modulating or throttling action so that the temperature cannot rise sufficiently in the oven to cause the power element **57** to open the valve member **53** and permit fuel to be directed to the broil burner **22**.

With the above description of the parts and operation of the system **20** in mind, the improved broil pilot burner means **61** of this invention will now be described.

In particular, it has been found that when the broil pilot burner means **61** has the small standby flame **63** continuously burning in the top part of the single cavity of the oven containing the main burners **21** and **22**, a subsequent operation of the bake burner **21** or of the broil burner **22** for a cooking operation or the like creates sufficient combustion products in the oven that will tend to snuff out the small standby flame **63** of the broil pilot burner **61** whereby when the housewife or the like subsequently desires to provide a broiling operation a broiling operation cannot take place, as the diverter valve **40** will not permit fuel to flow to the broil burner **22** in a broiling position of the selector knob **25** since the pilot burner means **61** is not ignited.

Therefore, the broil pilot burner means **61** of this invention is formed in the manner illustrated in FIGS. 2 and 10–12 wherein a housing member **200** is provided and has an externally threaded tubular member **201** extending from one side **202** thereof with the tubular extension **201** having a passage means **203** passing therethrough and being fluidly interconnected to another passage means **204** of larger diameter that interrupts the opposed side **205** thereof. An orifice cup **206**, FIG. 2, is disposed in the passage **203** of the tubular extension **201** and a threaded fastening member **207** is utilized to couple the end **208** of the conduit means **62** to the passage **203** of the tubular extension **201** in the manner illustrated in FIG. 2.

A transverse bore **209** is formed in the side **210** of the housing member **200** and is internally threaded to receive a threaded extension **211** of a fitting **212** that has another extension **213** adapted to fluidly interconnect a conduit means **214**, FIG. 1, thereto for a purpose hereinafter described.

A conduit **215** has one end **216** thereof secured in the opening means **204** of the housing **200** so as to be in fluid communication with the passage **203** thereof downstream from the orifice cup **206**, the conduit **215** being inwardly depressed at **217** to provide a restriction therein intermediate the end **216** and the other end **218** thereof which defines an outlet means **219** for the pilot burner means **61**. A flame shield arrangement **220** is secured to the end **218** of the conduit **215** and has an opening **221** therein and through which the small standby flame **63** of the pilot burner means **61** can project and burn for subsequent igniting of the broil burner **22** when the same receives fuel from the diverter valve means **40** in the manner

previously described. In addition, the flame shield **220** has downwardly projecting ears **222** provided with suitable opening means **223** therein which receive the detector bulb **59** for the diverter valve **40**, the ears **222** being so constructed and arranged that the detector **59** is not influenced by the small standby flame **63**, but will be disposed in the path of the large heater flame **64** when the control device **24** directs the additional amount of fuel to the pilot burner means **61** in the manner previously described for a broiling operation of the system **20**, the flame shield **220** carrying a suitable fastening member **224** for securing the detector **59** in the openings **223** of the ears **222** thereof.

The bore **209** in the housing **200** is so constructed and arranged that the closed end **225** thereof extends beyond the conduit **215** as illustrated in FIG. 11. The end **216** of the conduit **215** is provided with an opening **226** therein that faces the closed end **225** of the bore **209** so that any air passing through the passage means **227** of the fittings **212** into the bore **209** of the housing **200** must pass around the end **216** of the conduit **215** in a direction transverse to the axis of the conduit **215** to enter into the flow passage of the conduit **215** at the opening **226** thereof so as to provide turbulence to such air movement before the same reaches the interior of the conduit **215** to be entrained in the fuel passing through the conduit **215** and being supplied thereto through the passage **203** of the housing **200** from the previously described conduit means **62**.

The fitting **212** has a pair of openings **228** and **229** passing transversely therethrough to interconnect the exterior of the fitting **212** to the passage **227** thereof, the openings **228** and **229** being vertically aligned when the pilot burner means **61** is arranged in a position illustrated in FIG. 1 for a purpose hereinafter described.

As illustrated in FIG. 1, the conduit **214** that is interconnected to the fitting **212** of the broil pilot burner means **61** has its inlet end **230** interconnected to the outlet of an electrically operated air pumping device **231** that has its inlet **232** disposed in a location to be interconnected to a primary air source that is not subject to be contaminated by the combustion products created by either the bake burner **21** or the broil burner **22**. For example, the inlet **232** of the air pumping device **231** can be connected to a primary air source that is outside of the oven cavity that contains the bake burner **21** and broil burner **22**.

The electrically operated air pump **231** has one side **233** thereof interconnected by lead **234** to a power source lead L_1, the other side **235** of the air pumping device **231** being interconnected by a lead **236** to one side **237** of a normally open electrical switch **238**. The other side **239** of the electrical switch **238** is interconnected by lead **240** to the other power source lead L_2.

The electrical switch **238** can be so constructed and arranged that the same can be pressure operated to its closed position so that when any fuel is issuing into the outlet **28** of the control device **24** because of the selector knob **25** being in any on position thereof, the electrical switch **238** will close to place the air pumping device **231** across the power source leads L_1 and L_2 so that the air pumping device **231** will be continuously operating when the selector knob **25** is arranged in any on position thereof.

Alternately, and as illustrated in FIGS. 6A, 7A and 8A, the electrical switch **238** can be mechanically operated by the disc valve member **87** of the control device **24**.

For example, the electrical switch **238** as illustrated in FIG. 6A can have a fixed contact **241** interconnected to the lead **240** and a movable contact **242** carried on a spring blade **243** that is electrically interconnected to the lead **236** and has a natural bias to hold the contact **242** away from the contact **241** as illustrated in FIG. 6A. However, the disc valve member **87** of the control device **24** has a cam means **244** on the side thereof so that when the disc valve member **87** is rotated to any bake position of the control device **24** by the control knob **25** in the manner previously described, the cam means **244** cams against the spring blade **243** to move the same as illustrated in FIG. 7A to place the movable contact **242** into electrical contact with the fixed contact **241** so that the air pumping device **231** will be placed across the valve source leads L_1 and L_2 and continuously operate as long as the control device **24** is set in any baking position thereof. Similarly, as illustrated in FIG. 8, even when the disc valve member **87** is moved to a broiling position thereof, the cam means **244** maintains the movable contact **242** in electrical contact with the fixed contact **241** to continuously operate the air pumping device **231** during the entire broiling operation.

The operation of the broil pilot burner means **61** of this invention will now be described.

With the control device **24** set in the off position thereof, no combustion products are being created in the oven containing the bake and broil burners **21** and **22** which would tend to snuff out the continously burning small standby flame **63** of the broil pilot burner **61** whereby it is not necessary that the air pumping device **231** be operating. Thus, with the control device **24** set in the off position as illustrated in FIG. 6A, the electrical switch **238** is in an open position so that the air pumping device **231** is not energized.

However, since a small amount of fuel is being continuously directed through the conduit **62** to the broil pilot burner means **61**, such flow of fuel through the conduit **215** causes primary air adjacent the fitting **212** to be drawn through the openings **228** and **229** of the fitting **212** through the bore **209** of the housing **200** to the opening **226** of the conduit **215** to be entrained in the fuel passing through the conduit **215** to supply sufficient primary air to be mixed with the fuel to sustain combustion at the outlet end **219** of the conduit **215** whereby the continuously burning small standby flame **63** will be provided for the pilot burner means **61**.

However when the selector knob **25** of the control device **24** is set in any on position thereof, the switch **238** is closed in the manner previously described so that the air pumping device **231** is continuously operating and forcing primary air that is not contaminated with any combustion products of the oven containing the burner means **21** and **22** into the conduit means **214** under pressure so that the same is forced into the fitting **212** at the end **213** thereof to be forced into the opening **209** of the housing **200** and be fed to the opening **226** in the conduit **215** to be entrained in the fuel passing therethrough to supply sufficient primary air to maintain the small standby flame **63** of the broil pilot burner means **61** or the large heater flame **64** thereof even though the secondary air being supplied to the end **219** of the conduit **215** is now contaminated with combustion products in the oven of the cooking apparatus, the force of the primary air by the air pumping device **231** through the fitting **212** creating an air pressure in the fitting **212** greater than the air pressure surrounding the fitting **212** so that no combustion products adjacent the fitting **212** can enter the openings **228** and **229** thereof to contaminate the primary air being fed to the pilot burner means **61** by the air pumping device **231**. For example, the air pumping device **231** can supply primary air at a rate of .1 inch WC for the above purpose.

Therefore, it can be seen that the pilot burner control means of this invention insures that during any on condition of the oven, the broil pilot burner means **61** will be supplied sufficient primary air to maintain combustion at the pilot burner means **61** and that when the oven is in an off condition, sufficient primary air is still supplied thereto to sustain combustion at the broil pilot burner means **61**.

Accordingly, it can be seen that this invention not only provides an improved pilot burner control system or the

like, but also this invention provides an improved method of operating such a pilot burner control system or the like.

What is claimed is:

1. In a fuel control system having a source of fuel and control means for selectively interconnecting said source of fuel to a bake burner and a broil burner respectively disposed in the same oven cavity or the like, the improvement comprising a pilot burner for igniting said broil burner, means for continuously interconnecting said source of fuel to said pilot burner, and means for interconnecting a primary air source that is not contaminated with combustion products of said oven to said pilot burner to entrain with the fuel therefor only when said control means is directing said source of fuel to at least one of said bake burner and said broil burner to produce combustion products in said oven.

2. In a fuel control system as set forth in claim 1, the further improvement wherein said means for interconnecting said primary air source to said pilot burner comprises an air pumping device.

3. In a fuel control system as set forth in claim 2, the further improvement wherein said air pumping device is electrically operated, said control means having electrical switch means which energizes said air pumping device to deliver said primary air when said control means is set for delivering fuel to at least one of said bake burner and said broil burner.

4. In a fuel control system as set forth in claim 1, the further improvement wherein said means for interconnecting said primary air source to said pilot burner interconnects said pirmary air source to said pilot burner when said control means directs said fuel source to either said bake burner or said broil burner.

5. In a fuel control system as set forth in claim 1, the further improvement wherein said means for continuously interconnecting said source of fuel to said pilot burner creates a small standby flame at said pilot burner.

6. In a fuel control system as set forth in claim 5, the further improvement wherein said control means has means for supplying an additional amount of fuel from said source of fuel to said pilot burner to produce larger flame means at said pilot burner when said control means is set to deliver fuel to said broil burner.

7. In a fuel control system as set forth in claim 1, the further improvement wherein said pilot burner has first conduit means for receiving said fuel from said means for continuously interconnecting said source of fuel to said pilot burner, said first conduit means having outlet means for creating flame means by the burning of said fuel issuing therefrom, said means for interconnecting said primary air source to said pilot burner means comprising second conduit means fluidly interconnected to said first conduit means.

8. In a fuel control system as set forth in claim 7, the further improvement wherein said second conduit means has opening means therein to interconnect the atmosphere in said oven cavity to said second conduit means.

9. In a fuel control system as set forth in claim 8, the further improvement wherein said opening means in said second conduit means are so constructed and arranged that said opening means deliver primary air to said first conduit means to be entrained in said fuel being delivered by said means continuously interconnecting said source of fuel to said pilot burner only when said means for interconnecting said primary air source to said pilot burner is not interconnecting said primary air source to said pilot burner.

10. In a fuel control system as set forth in claim 9, the further improvement wherein said means for interconnecting said primary air source to said pilot burner comprises means for creating a primary air pressure in said second conduit means greater than the air pressure in said oven cavity whereby said primary air pressure in said second conduit means prevents the atmosphere in said oven cavity from entering said opening means of said second conduit means when said primary air source is interconnected to said pilot burner.

11. In combination, a pilot burner for igniting a main burner associated with said pilot burner, a main burner, first conduit means interconnected to said pilot burner adapted to continuously supply fuel to said pilot burner for creating certain flame means at said pilot burner, second conduit means interconnected to said pilot burner, selector means for interconnecting a fuel source to said main burner and for disconnecting said fuel source from said main burner, and means adapted to force primary air into said second conduit means to be entrained in the fuel being supplied to said pilot burner, said last-named means and said selector means being so constructed and arranged that said last-named means only forces air into said second conduit means when said selector means is in an "on" condition thereof.

12. A combination as set forth in claim 11 wherein said means adapted to force primary air into said second conduit means comprises an air pumping device.

13. A combination as set forth in claim 11 wherein said second conduit means is disposed in fluid communication with said first conduit means.

14. A combination as set forth in claim 13 wherein said second conduit means has opening means therein to interconnect the atmosphere to said second conduit means.

15. In combination, a pilot burner for igniting a main burner associated with said pilot burner, first conduit means interconnected to said pilot burner adapted to continuously supply fuel to said pilot burner for creating certain flame means at said pilot burner, second conduit means interconnected to said pilot burner, and means adapted to force primary air into said second conduit means to be entrained in the fuel being supplied to said pilot burner, said second conduit means being disposed in fluid communication with said first conduit means, said second conduit means having opening means therein to interconnect the atmosphere to said second conduit means, said opening means in said second conduit means being so constructed and arranged that said opening means delivers primary air to said first conduit means to be entrained in the fuel being delivered to the pilot burner by the first conduit means only when said means for forcing primary air into said second conduit means is not forcing primary air into said conduit means.

16. A combination as set forth in claim 15 wherein said means for forcing primary air into said second conduit means creates a pressure in said second conduit means greater than the pressure of the air surrounding the exterior of said opening means whereby said air pressure in said second conduit means prevents the air exterior to said opening means from entering said opening means when said means forces primary air into said second conduit means.

17. In a method for controlling the flow of fuel from a source of fuel to a bake burner and a broil burner respectively disposed in the same oven cavity or the like, the improvement comprising the steps of continuously directing said source of fuel to a pilot burner for the broil burner to provide continuous flame means at the pilot burner, and directing a primary air source that is not contaminated with combustion products of said oven to said pilot burner to entrain with the fuel therefor only when said source of fuel is being directed to at least one of said bake burner and said broil burner to produce combustion products in said oven.

18. In a method as set forth in claim 17, the further improvement wherein said step of directing said primary air source to said pilot burner comprises the step of pumping said primary air to said pilot burner.

19. In a method as set forth in claim 17, the further improvement wherein said step of continuously directing

said source of fuel to said pilot burner comprises the step of directing said source of fuel to said pilot burner through a first conduit means that has an outlet means for creating said flame means by the burning of said fuel issuing therefrom, and wherein said step of directing said primary air to said pilot burner means comprises the step of directing said primary air through a second conduit means that is fluid interconnected to said first conduit means.

20. In a method as set forth in claim **19**, the further improvement comprising the step of forming opening means in said second conduit means to interconnect the atmosphere in said oven cavity to said second conduit means.

21. In a method as set forth in claim **20**, the further improvement wherein said step of forming said opening means in said second conduit means forms said opening means in such a manner that said opening means deliver primary air to said first conduit means to be entrained in said fuel being delivered to said pilot burner only when said primary air source is not being interconnected to said second conduit means.

22. In a method as set forth in claim **21**, the further improvement wherein said step of interconnecting said primary air source to said second conduit means comprises the step of creating a primary air pressure in said second conduit means greater than the air pressure in said oven cavity whereby said primary air pressure in said second conduit means prevents the atmosphere in said oven cavity from entering said opening means of said second conduit means when said primary air source is interconnected to said pilot burner.

23. A method for controlling a pilot burner that is utilized for igniting a main burner associated with said pilot burner, said method comprising the steps of continuously supplying fuel to said pilot burner through a a first conduit means for creating certain flame means at said pilot burner, and forcing primary air into a second conduit means leading to said pilot burner so that said primary air will be entrained in the fuel being supplied to said pilot burner by said first conduit means, said last-named step only taking place when a selector means for interconnecting a fuel source to said main burner and for disconnecting said fuel source from said main burner is in an "on" condition thereof.

24. A method as set forth in claim **23** wherein said step of forcing primary air into said second conduit means comprises the step of forcing said primary air into said conduit means by an air pumping device.

25. A method as set forth in claim **23** and including the step of disposing said second conduit means in fluid communication with said first conduit means.

26. A method as set forth in claim **25** and including the step of forming opening means in said second conduit means to interconnect the atmosphere to said second conduit means.

27. A method for controlling a pilot burner that is utilized for igniting a main burner associated with said pilot burner, said method comprising the steps of continuously supplying fuel to said pilot burner through a first conduit means for creating certain flame means at said pilot burner, forcing primary air into a second conduit means leading to said pilot burner so that said primary air will be entrained in the fuel being supplied to said pilot burner by said first conduit means, disposing said second conduit means in fluid communication with said first conduit means, and forming opening means in said second conduit means to interconnect the atmosphere to said second conduit means, said step of forming said opening means in said second conduit means causing said opening means to be so constructed and arranged that said opening means delivers primary air to said first conduit means to be entrained in the fuel being delivered to the pilot burner by the first conduit means only when said primary air is not being forced into said second conduit means.

28. A method as set forth in claim **27** wherein said step of forcing primary air into said second conduit means creates a pressure in said second conduit means greater than the pressure of the air surrounding the exterior of said opening means whereby said air pressure in said second conduit means prevents the air exterior to said opening means from entering said opening means when said primary air is being forced into said second conduit means.

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