May 23, 1967 B. G. CRANNELL ET AL 3,320,943

PILOT BURNERS

Filed Sept. 30, 1964 3 Sheets-Sheet 1

Fig. 1

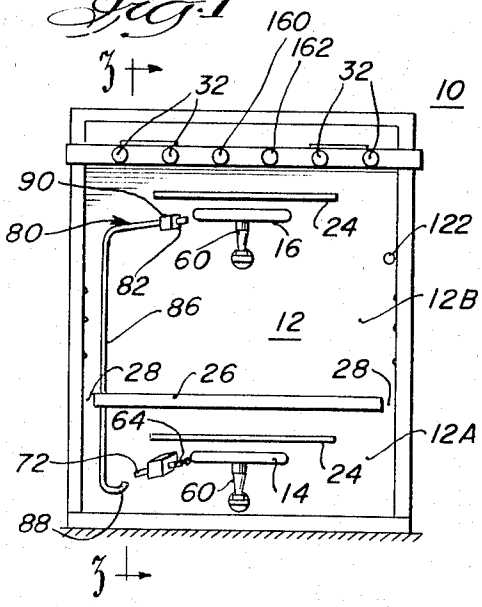


Fig. 6

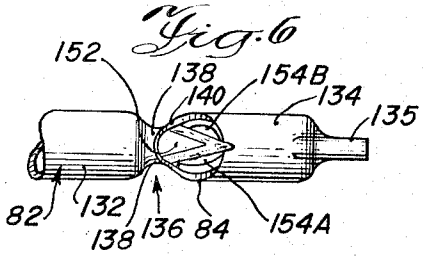
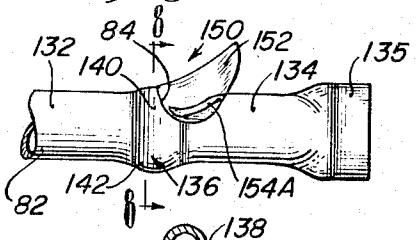


Fig. 7



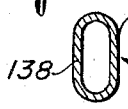
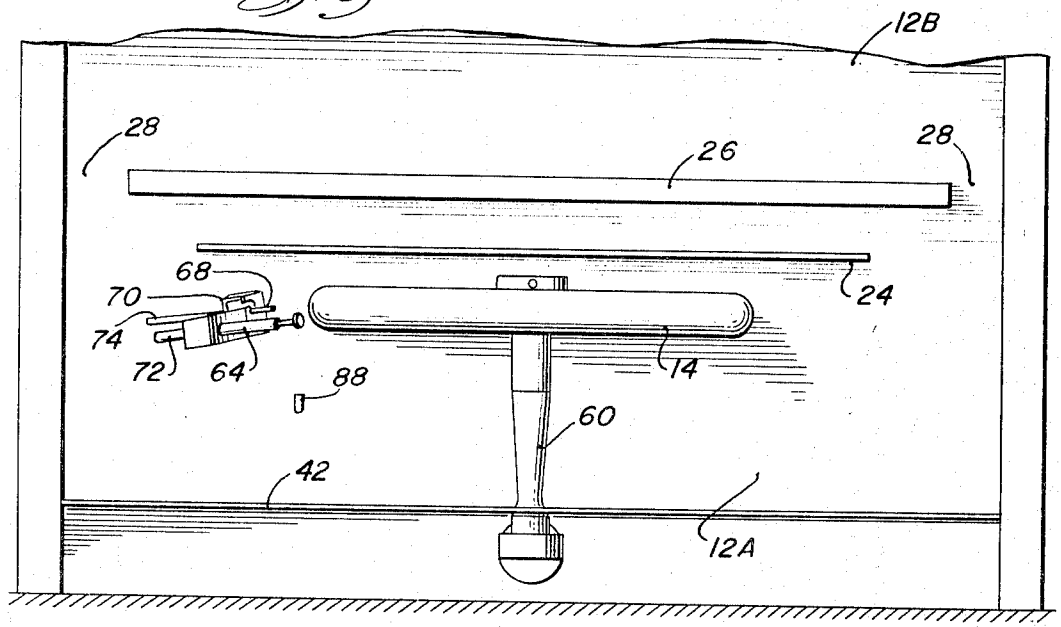


Fig. 8

Fig. 2



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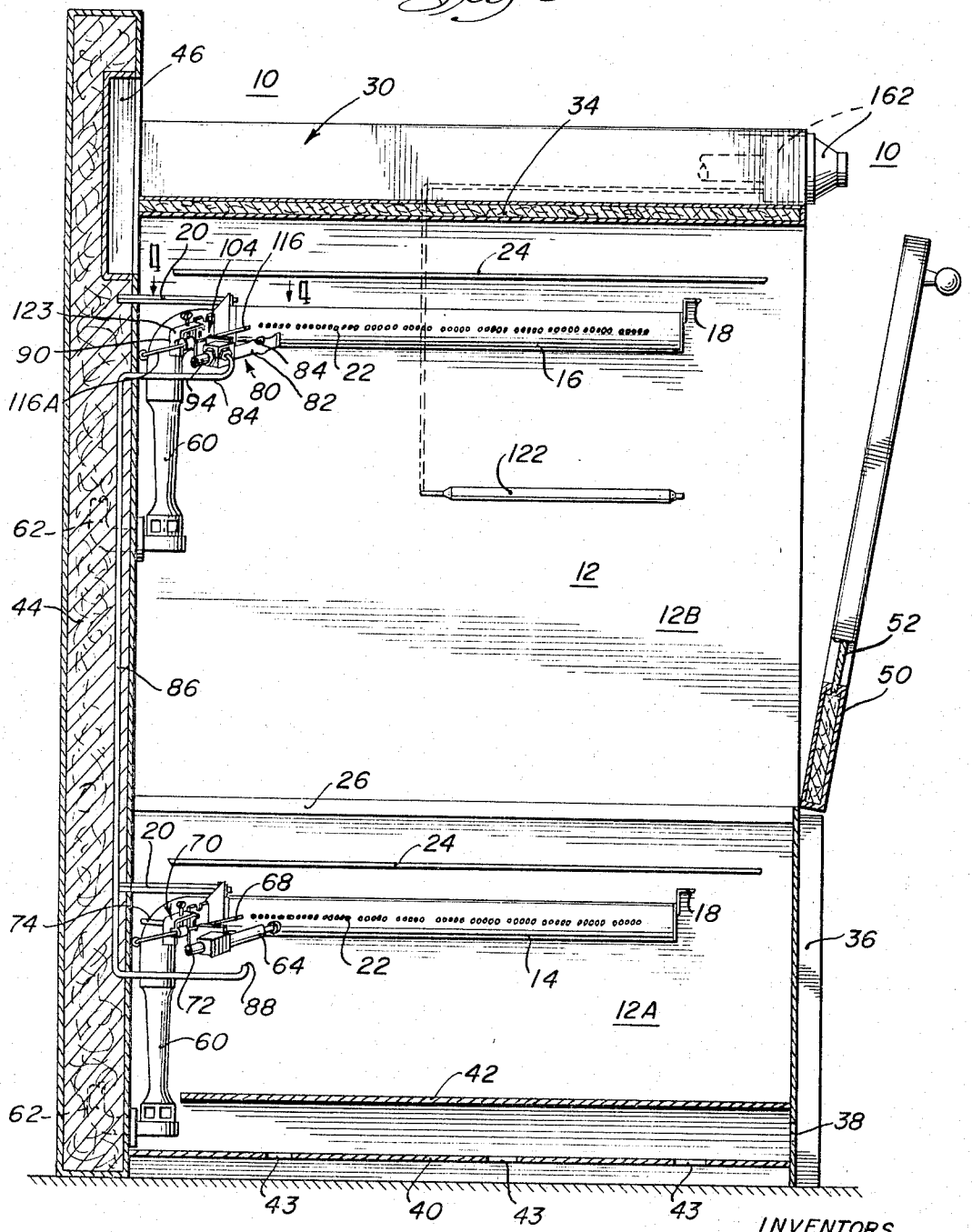
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PILOT BURNERS

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Fig. 3



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PILOT BURNERS

Filed Sept. 30, 1964

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Fig. 4

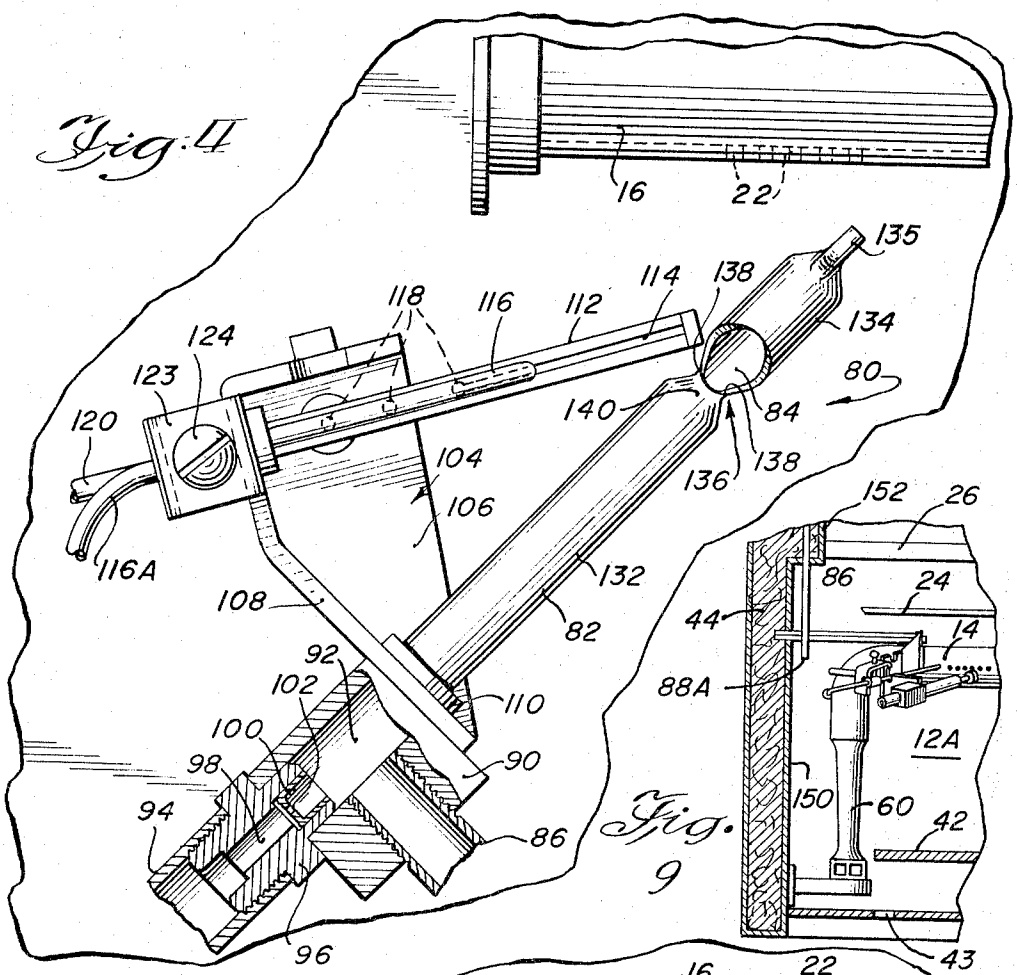


Fig. 9

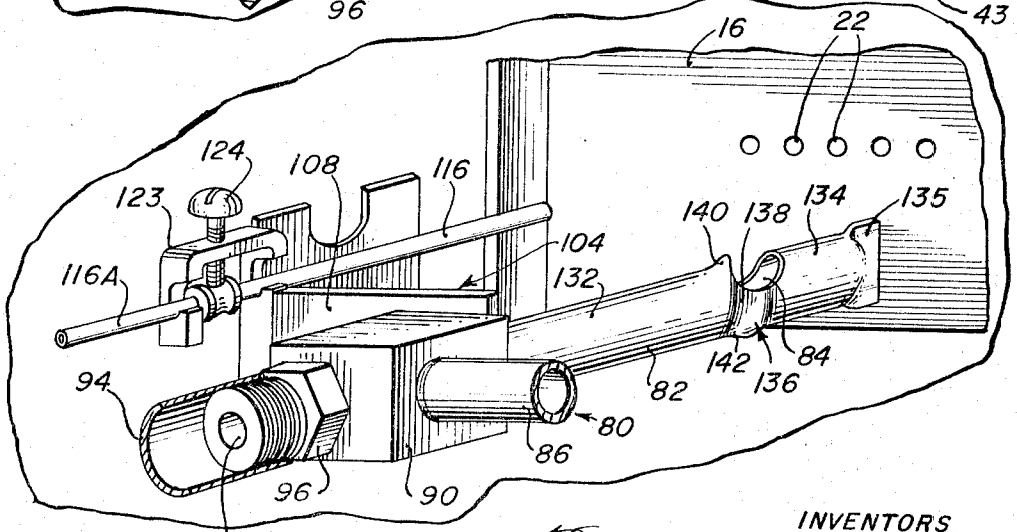


Fig. 5

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PILOT BURNERS

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Filed Sept. 30, 1964, Ser. No. 400,525
9 Claims. (Cl. 126—39)

The present invention relates to pilot burners for gas ranges equipped with oven and broiler burners and has for its primary object the provision of a new and improved standing (or standby or continuous) gas pilot burner for a range having a single compartment with a broiler burner above another burner, such as an oven burner.

Domestic gas ranges with a single bake-broil compartment have recently become quite popular. There are several reasons for this popularity. One is the more economical construction resulting from the use of a single compartment or cavity, which eliminates the conventional broiler drawer below the bake burner. Another is a greater flexibility in design because the compartment can be located above the top burners. Also, two bake-broil units can readily be built into the range. Furthermore, the broil burner can be located at the upper side of the oven compartment, where it is more readily accessible for visual observation as through a window in the door.

Heretofore, ranges equipped with a single compartment and having a broil burner above the bake burner required either manual or electric ignition, with the attendant disadvantages of inconvenience, complexity and added cost.

Attempts to use standing or continuous gas pilots with an upper broil burner heretofore have been unsuccessful because of extinction of the pilot burner flame resulting from contamination of combustion supporting air byproducts of combustion from the lower bake burner and from an air pressure or concussion wave when the oven door was closed or slammed. This extinction most likely occurred during the oven warm up period, prior to establishment of good flue action.

The present invention provides a new and improved standing gas pilot burner for the upper broiler burner located in the same compartment above an oven burner in which ignition is maintained despite the presence of contaminating combustion products and concussion resulting from door slam. The pilot burner is of the primary aerated type. It obtains the required primary air from an air inlet located in a region communicating with the compartment and spaced from the oven burner flame combustion products where the air is substantially uncontaminated and where the air inlet is subjected to much the same air pressure wave and fluctuations as the pilot burner and the construction of the burner is such that ignition is adequately and effectively maintained.

Accordingly, it is a further object of the present invention to provide a new and improved standing gas pilot burner for the ignition of a broiler burner located at the upper side of a compartment at the lower side of which is located a bake burner and which is supplied with primary air for aeration from a region remote from the bake burner flame combustion products but communicating with the compartment and which is so constructed and arranged that it will not be extinguished by contaminating products of combustion and pressure of concussion waves resulting from closing or slamming of the compartment door.

The inlet region most conveniently may be in the oven compartment below the bake burner flames or at the rear of and at about the level of the bake burner flames.

Another object of the present invention is the provision of a new and improved standing gas pilot burner which is characterized by a stable and well maintained ignition flame under adverse conditions such as caused by a pressure or concussion wave occurring upon slamming of an oven door.

A further object of the present invention is the provision of a new and improved pilot burner of the type described above characterized by a tubular construction with a pinched portion adjacent a gas discharge opening at a point intermediate the ends of the burner whereby there is produced a well aerated good solid and hard flame having opposed self-impinging portions, one of which is in the nature of a tongue extending into and dividing an opposed portion into two parts.

In brief, the standing or continuous pilot burner of the present invention is of the primary aerated type and which is located in ignition relation with a broiler burner located at the upper side of a domestic gas range compartment at the lower side of which is located a bake burner. The primary air for the pilot burner is obtained from a region where the air is substantially uncontaminated by products of combustion emanating from the bake burner, this region being remote from the bake burner flame combustion products and one having communication with the compartment. One such region can be, for example, below the level of the flames or it can be otherwise located as near the level of the flames but where an adequate supply of uncontaminated air is available during the heat-up period. The communication insures that it will be subject to a pressure wave or concussion created by the closing or slamming of the compartment or oven door substantially the same as the one acting upon the standing pilot burner. The arrangement is such that both the air inlet and the burner are acted upon by the pressure wave whereby the effects of the pressure wave are substantially neutralized and the pilot burner flame is maintained. Furthermore, the pilot burner is of a novel construction comprising a tube of substantially uniform diameter having a pinched portion between its ends and at the downstream end of the pinched portion there is provided an opening through which the gas is discharged and the flame is maintained. The configuration is such that there is a primary flow of gas from the inlet and other tube through the opening, which flow is substantially central of the tube because of the pinched construction. There is also another and opposed flow of gas from the outer end of the tube, which is closed, so that there is a wider flow of gas opposed to the central tongue-like portion. The result is a flame, having in effect opposing parts one of which is a single central tongue and the other of which is an opposed flame forked by the first. As a result, a hard solid and well aerated flame with excellent flame maintenance and stability is achieved so that the standing pilot remains ignited in spite of its being located in a region in which products of combustion from the lower bake burner may be present and which is subject to a pressure wave occurring upon closure of the oven door.

Other objects and advantages of the present invention will become apparent from the ensuing description of an illustrative embodiment in the course of which reference is had to the accompanying drawings:

FIG. 1 is a front elevational view of a domestic gas range (with door and front panel omitted) having a single compartment with a lower bake burner and an upper broiler burner and equipped with ignition means including the standing or continuous pilot burner of the present invention;

FIG. 2 is an enlarged fragmentary view of the lower part of the range illustrated in FIG. 1 and depicting the bake burner;

FIG. 3 is an enlarged vertical cross sectional view, partly broken away, and taken along the line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary horizontal cross sectional view, partly in section, taken along the line 4—4 of FIG. 3 and illustrating the standing pilot burner of the present invention;

FIG. 5 is a perspective view of the standing pilot burner;

FIG. 6 is a fragmentary top plan view of a portion of the standing pilot burner and illustrating the nature of the ignition flame provided by the pilot burner;

FIG. 7 is a side elevational view of the flame shown in FIG. 6;

FIG. 8 is a transverse cross sectional view along the line 8—8 of FIG. 7; and

FIG. 9 is a fragmentary view similar to a portion of FIG. 3, illustrating a different location of the air inlet.

Referring now to the drawings, the invention has been illustrated in conjunction with a domestic gas range indicated as a whole by reference character **10**. The range is characterized by the provision of a single cavity or compartment **12** at the lower region or side **12A** of which is mounted a bake burner **14** and at the upper region of the oven cavity **12B** of which is provided a broil burner **16**. These burners may be of conventional construction and mounted in suitable manner in the compartment as by the supports **18** at the front ends of the burners and supports **20** at the rear. The burners are provided with conventional laterally disposed discharge ports **22**. Above each burner is a flame shield **24** (suitably supported, in a manner not shown) and the compartment is also provided with an oven bottom **26** which is spaced from the sides of the oven as by the spaces or openings **28**, see FIG. 2, or by a series of spaced apertures so that the region **12A** underneath the oven burner is in good communication with the upper part and will be subject to substantially the same pressure that exists in the oven cavity portion **12B** above the bottom **26** as well as being subject to the same pressure fluctuations and concussion or pressure waves.

The range includes a top burner section **30** including a number of top burners (not shown) having individual controls **32** accessible at the upper portion of the front of the range. The top burner section is isolated from the compartment **12** by heat insulating wall panel **34**.

The range has a lower front panel **36** that is either detachably or permanently secured in place. The panel has a plurality of air vents **38** at its lower side disposed above the bottom wall **40** and below a false bottom **42** spaced a short distance above the bottom **40**, which may have a plurality of air vents **43** therein.

The range also has an insulated rear panel **44** having a flue opening **46** therein at its upper end providing communication from the upper end of the compartment **12** to atmosphere.

The range is also provided with a bottom hinged door **50** having a glass panel **52** therein. The door is mounted in conventional manner above the lower front panel **36** and provides access to the interior of compartment **12** and the panel enables the user to view the interior of the oven. The compartment may be provided with a series of adjustably mounted shelves in known manner but which have not been illustrated and which are used for supporting goods to be baked or broiled.

Gas is supplied to the burners **14** and **16** through mixing tubes **60** and conduits **62** in conventionl manner. The lower bake burner **14** has associated with it a conventional non-aerated standing pilot **64**, a thermostat controlled heater pilot (not shown, but corresponding to a heater pilot associated with the broil burner and which will be described later) and a thermocouple **68**, all supported on a bracket **70**. The standing pilot is supplied with gas through conduit **72** and the heater pilot through conduit **74**.

In accordance with the present invention, the upper broil burner **16** has associated with it the novel standing primary aerated pilot burner assembly of the invention, indicated as a whole by reference character **80**, and

including a tube **82** having a novel port structure **84** and supplied with primary air through conduit **86** having an air inlet **88** at a region supplied with uncontaminated air from below the bake burner **14** as from the lower compartment region **12A** and as best shown in FIG. 3, which region is subject to the substantially same pressure fluctuations and concussion waves as the flame at the pilot burner port **84**

The location of the inlet end **88** of the primary air conducting tube **82** is of importance and varies in different ranges. However, it should generally be located below the level of the bake burner flames and in a region having good communication with the region **12B** of the oven cavity. The good communication is effected as by the spaces or openings **28** in the oven bottom **26**, or otherwise.

As indicated, tthe primary air supplying conduit **86** extends into and has its inlet **88** in the compartment portion **12A** below the level of the flames issuing from a bake burner **14**. The conduit **86** is illustrated in FIGS. 2 and 3 as extending downwardly through the insulated wall panel **44** but it may be located otherwise, as in the oven as shown in FIG. 1.

Referring now more particularly to FIGS. 4 to 8, it will be noted that the pilot burner assembly **80** includes the tube **82** which is mounted in a body **90** having a chamber or opening **92** into which the air supply tube **86** extends, and in which the tubing is secured in suitable manner, as by a press fit or a threaded fitting of conventional construction, not shown.

Gas is supplied to the standing pilot through the conduit **94** attached to an orifice fitting **96** having a through passageway **98** leading to an orifice cup **100** with an orifice **102** therein through which the gas is discharged at a high velocity, thereby to draw uncontaminated air from the lower region **12A** through tube **86** for mixture with the gas in the opening or chamber **92** for discharge into the standing pilot burner tube **82**.

The pilot burner tube is supported in ignition relation to the broiler burner **16** by a bracket, indicated as a whole by reference character **104** having a generally triangular base portion **106** and an upstanding diagonal portion **108** to which the body **90** is secured as by a nut **110**.

The standing pilot burner of the present invention may be used alone, if desired. In the illustrated arrangement it is used in known manner with a thermostatically controlled heater pilot **112** to which gas is supplied by suitable control means when the broiler is to be used and having a port **114** through which gas is discharged for transfer of flame from the standing pilot port **84** to the broiler burner **16**. The standing pilot tube **82** is disposed substantially horizontally and at an angle of about 60° relative to the broil burner and the heater pilot **112** is disposed between the broil burner and standing pilot burner **82**, also in substantially horizontal position. Above the heater pilot is a thermostatic fluid containing thermosensitive tube **116** heated by flames issuing from the elongated port **114** and circular ports **118** also provided on the heater pilot. Gas is supplied to the heater pilot through a gas supply conduit **120** and the thermosensitive element **116** has a portion **116A** leading to control apparatus controlling the flow of gas to the broil burner and effective to do so when the thermostatic element is sufficiently heated by the heater pilot **112**. In other words, the control is of such character that the standing pilot **80** is continuously ignited, gas is supplied to the heater pilot under a call for gas by thermostatic control means, such as the oven thermostatic bulb **122** in the oven and gas is supplied to the broil burner under the control of the thermostatic element **116**. This type of control is utilized also with the bake burner, although the latter uses a non-aerated pilot burner as previously described.

The heater pilot is supported on the mounting bracket **104** by a part of the upstanding portion **108** and the thermostatic element is supported by a generally U-shaped

part **123** formed integral with the upstanding portion **108** and by an associated clamping screw **124**.

The burner tube **82** has an inlet or upstream end **132** and a relatively short downstream reservoir end **134**, which has a closed pinched end **135**.

The port **84** is formed by cutting the tube near its downstream end with a cutter to provide a semicircular opening at one side of an extending to the centerline of the tube. The tube is then pinched immediately adjacent the upstream end of the port to provide a restricted portion of reduced width **136** constituted by relatively short, axially, and closely spaced parallel walls **138**. The pinching of the tube expands it laterally at oppositely located portions of the tube immediately upstream of the port. One of the expanded portions, indicated by reference character **140**, is located immediately upstream of the port and constitutes a relatively narrow upstream facing discharge channel from the inlet end **132** of the tube to the port. The opposite expanded portion **142** constitutes a downstream gas flow channel from the inlet end to the closed reservoir **134** of the tube.

The novel standing pilot burner of the present invention provides a flame **150**, see FIGS. 6 and 7, having opposed self-impinging portions **152** and **154A**, **154B** enabling it to remain ignited during operation of the oven burner and in the presence of air pressure or concussion waves resulting from door slam. The flame portion **152** is in the form of a central upwardly extending tongue and the portion **154** comprises two forks **154A** and **154B** formed by the tongue portion **152**.

In an embodiment of the invention that has been constructed and used, the pilot burner tube has an outside diameter of one-quarter inch, a length of 2.563" and the port **84** has been constructed on a centerline .1938" from the downstream end. The port is cut in the unpinched tube with a cutter having a radius of .156" and down to the centerline of the tube. After the port has been cut, the tube is pinched at the region **136** at the upstream edge of the port so that the outer walls of the tube are spaced apart .125" to provide a space of .062" between the inner surfaces of the walls **138** through which the gas flows. The pinching is effected by tools providing a radius of .094" at the outside of the tube. The blending of the pinched part with the upstream and downstream ends of the tube is effected by rounding a one-half inch radius.

The range is provided at its upper front portion with additional control means for selectively making effective either the bake burner or the broil burner and means for adjusting the temperature. The means for selecting the burner includes a control knob **160** and the temperature control includes a knob **162**.

The control may be of known type and it actually constitutes no part of the present invention in view of the fact that the pilot burner ignition of the present invention may be used alone or with various types of controls. In a conventional control, gas may be continuously supplied to the standing pilots **64** and **82** through the conduits **74** and **94**, respectively. The thermostatic adjustment includes a valve associated with temperature control knob **162** and controlled by the oven thermostatic bulb **122** which valve, when open, supplies gas to the selector valve **160** and through the latter to the selected bake or broiler burner. The selector valve also selectively supplies gas to the bake or broil burner; although the ultimate control of gas to such selected burner is under the control of a valve operated by the thermostatic element **116**, in the case of the broil burner, and the thermosensitive element **68** in the case of the bake burner. Thus, when the oven thermostat calls for heat, gas is supplied to the heater igniter and the latter is ignited from the standing pilot. After a short period of time, the thermosensitive element, such as **116**, associated with broil burner **16** heats up and opens a valve to supply gas to the broil burner and the latter is ignited from the igniter burner. However, as previously indicated, this type of control need not necessarily be used as the standing pilot could be used directly to ignite the broil burner.

The standing pilot burner tube **82** has been illustrated with the port **84** facing upwardly. If desired, the port may face downwardly.

It is believed that the operation of the standing or continuous gas pilot burner assembly **80** of the present invention will be apparent from the detailed foregoing description. In brief, it may be noted that the burner itself can be readily made as a part of a control assembly and that can be mounted in igniting relationship to a broil burner located at the upper side of the oven compartment. The standing pilot burner **80** operates when surrounded by an atmosphere including products of combustion, that will not support the combustion of a non-aerated pilot or even a primary aerated pilot that draws its air from the atmosphere. It draws substantially fresh primary air through tube **86** from a location **12A** remote from the combustion product below the level of the bake burner flames and a region where the pressure is substantially the same and subject to the same fluctuations as the pilot burner. The pilot burner **82** itself is of generally tubular shape with its axis mounted generally horizontally and having a single transverse notched port **84** generally facing upwardly but which could face downwardly. The notched port is formed as by a cylindrical cutter at a right angle to the tube centerline with its edge intersecting the centerline. The tube is then pressed or pinched at its centerline, region **136**, at the upstream side of the port to provide short generally parallel walls **138** providing reduced cross section for flow of the air-gas mixture, with the tube becoming cylindrical again within the length of the port and continuing on the downstream and with a cylindrical section the end of which is closed to provide a reservoir **134** for air-gas mixture. The mixture in this reservoir assists in retention of flame at the port **84** in spite of a concussion wave such as caused by slamming of the oven door. The parallel walls upstream of the port, in combination with the notch give a target flame effect with a turbulent self-impinging flow pattern with good flame retention in spite of high primary aeration.

In the modification of the invention illustrated fragmentarily in FIG. 9, the air inlet tube **86** is shown with an inlet end **88A** in a different location but one whereat it obtains a supply of substantially uncontaminated primary air remote from the products of combustion from the bake burner and whereat it is in communication with the oven compartment so that substantially uncontaminated primary air is supplied to the pilot burner and whereat the inlet is subjected to the same pressure fluctuations as the pilot burner. Referring now more particularly to FIG. 9, it will be seen that the lower oven compartment **12A** has a rear panel **150** that is inset from the upper portion **152** of the panel. The air inlet tube **86** extends generally to the level of the burner and the inlet end **88A** is to the rear of the burner, whereat there is available a supply of substantially uncontaminated air sufficient to maintain the pilot burner **80** ignited during the heat-up period of the lower burner at **14**.

While the present invention has been described in connection with the details of embodiments thereof, it should be understood that such details are not intended to be limitative of the invention except insofar as set forth in the claims.

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

1. In a gas range, a compartment having a door, a lower bake burner and a higher broiler burner wherein combustion products from the bake burner rise at least to the level of the broiler burner, a region of substantially uncontaminated fresh air spaced from the products of combustion from the bake burner communicating with and subject to pressure fluctuations in the compartment, a primary aerated continuous gas pilot burner in the com-

partment in ignition relation to the broiler burner, and conduit means communicating with the pilot burner and having an air inlet at said region of fresh air for supplying substantially uncontaminated primary air to said pilot burner.

2. In a gas range as claimed in claim 1, wherein said air inlet is in the compartment located at about the level of and to the rear of the bake burner.

3. In a gas range as claimed in claim 1, wherein said air inlet is in the compartment located below the level of the bake burner.

4. In a gas range as claimed in claim 1, wherein said pilot burner includes a port discharging gas in opposed impinging streams which, when ignited provide opposed impinging tongues of flame.

5. In a gas range as claimed in claim 1, wherein said pilot burner includes an orifice through which gas is discharged and draws the air through said conduit and includes a discharge port through which gas is discharged in opposed impinging streams which when ignited, provide opposed impinging tongues of flame.

6. In a gas range as claimed in claim 1, wherein said pilot burner includes a tube with an inlet portion at its upstream end, a closed downstream end constituting a gas reservoir section, and a discharge port between said inlet portion and closed end through which gas is discharged in opposed impinging streams which, when ignited, provide opposed impinging tongues of flame.

7. In a gas range as claimed in claim 6, wherein said pilot burner tube includes a pinched portion immediately adjacent the upstream side of and in line with the port.

8. A gas pilot burner comprising an elongated tube adapted to be mounted with its axis generally horizontal and having an upstream inlet end and a closed downstream end, a gas discharge port having an initial substantially hemispherical configuration at right angles to and extending substantially to the tube centerline, said port being located a short distance from the closed downstream end of the tube where the closed end of the tube constitutes a gas reservoir, said tubes having a short pinched portion adjacent the upstream end of said port and in line with the port, thereby to provide short generally parallel and fairly closely spaced walls and two laterally expanded and oppositely located portions of the tube immediately upstream of the port, the one expanded portion adjacent the port constituting a discharge channel from the inlet end to the port and the other and opposite expanded portion constituting a gas flow channel from the inlet end to the closed end of the tube, whereby gas discharges from the port in two opposed and self-impinging streams, one stream being an outwardly and upwardly extending tongue-like portion from the discharge channel and the other being an opposed inwardly extending portion from the closed reservoir end of the tube forked by the tongue-like portion.

9. In a gas range, a compartment having a door and a lower bake burner and a higher broil burner, a gas pilot burner in ignition relation to the broil burner, said pilot burner comprising an elongated tubular element adapted to be mounted with its axis generally horizontal and having an upstream inlet end and a closed downstream end, a gas discharge port having an initial substantially hemispherical configuration at right angles to and extending substantially to the tube centerline, said port being located a short distance from the closed downstream end of the tube whereby the closed end of the tube constitutes a gas reservoir, said tube having a short pinched portion adjacent the upstream end of said port and in line with the port, thereby to provide short generally parallel and fairly closely spaced walls and two laterally expanded and oppositely located portions of the tube immediately upstream of the port, the one expanded portion adjacent the port constituting a discharge channel from the inlet end to the port and the other and opposite expanded portion constituting a gas flow channel from the inlet end to the closed end of the tube, whereby gas discharges from the port in two opposed and self-impinging streams, one stream being an outwardly and upwardly extending tongue-like portion from the discharge channel and the other being on opposed inwardly extending portion from the closed reservoir end of the tube forked by the tongue-like portion, and conduit means having an air inlet below the level of the bake burner flame for supplying primary air to the pilot burner.

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