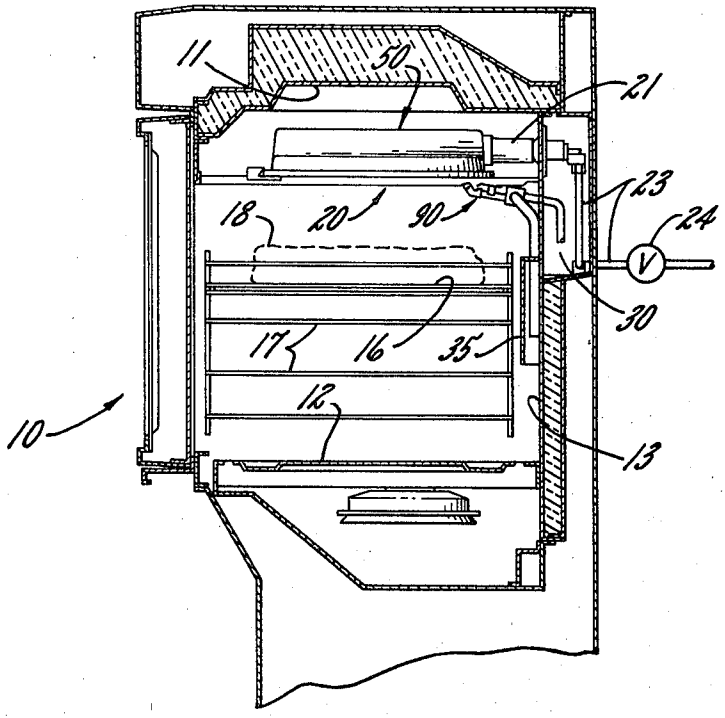
Jan. 21, 1969 J. C. WEISS 3,422,810

BROILER FOR GAS RANGE

Filed Sept. 8, 1967 Sheet 1 of 3

Fig. 1.



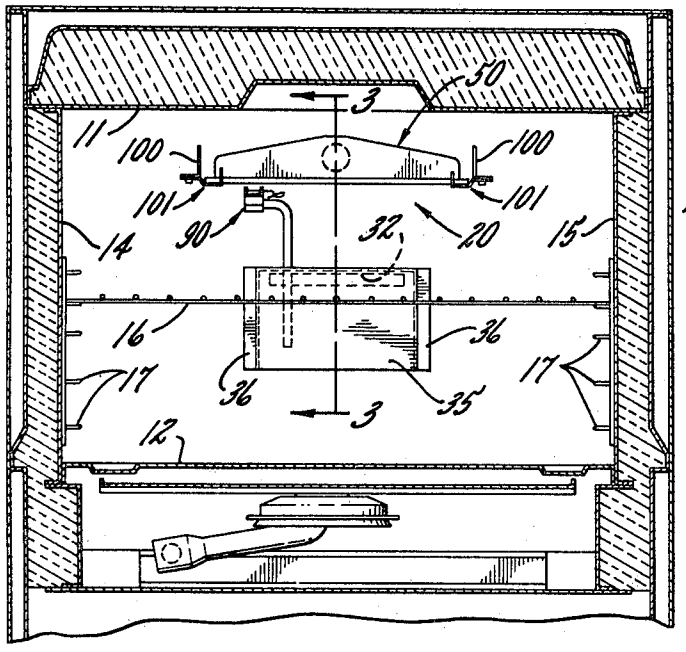


Fig. 2.

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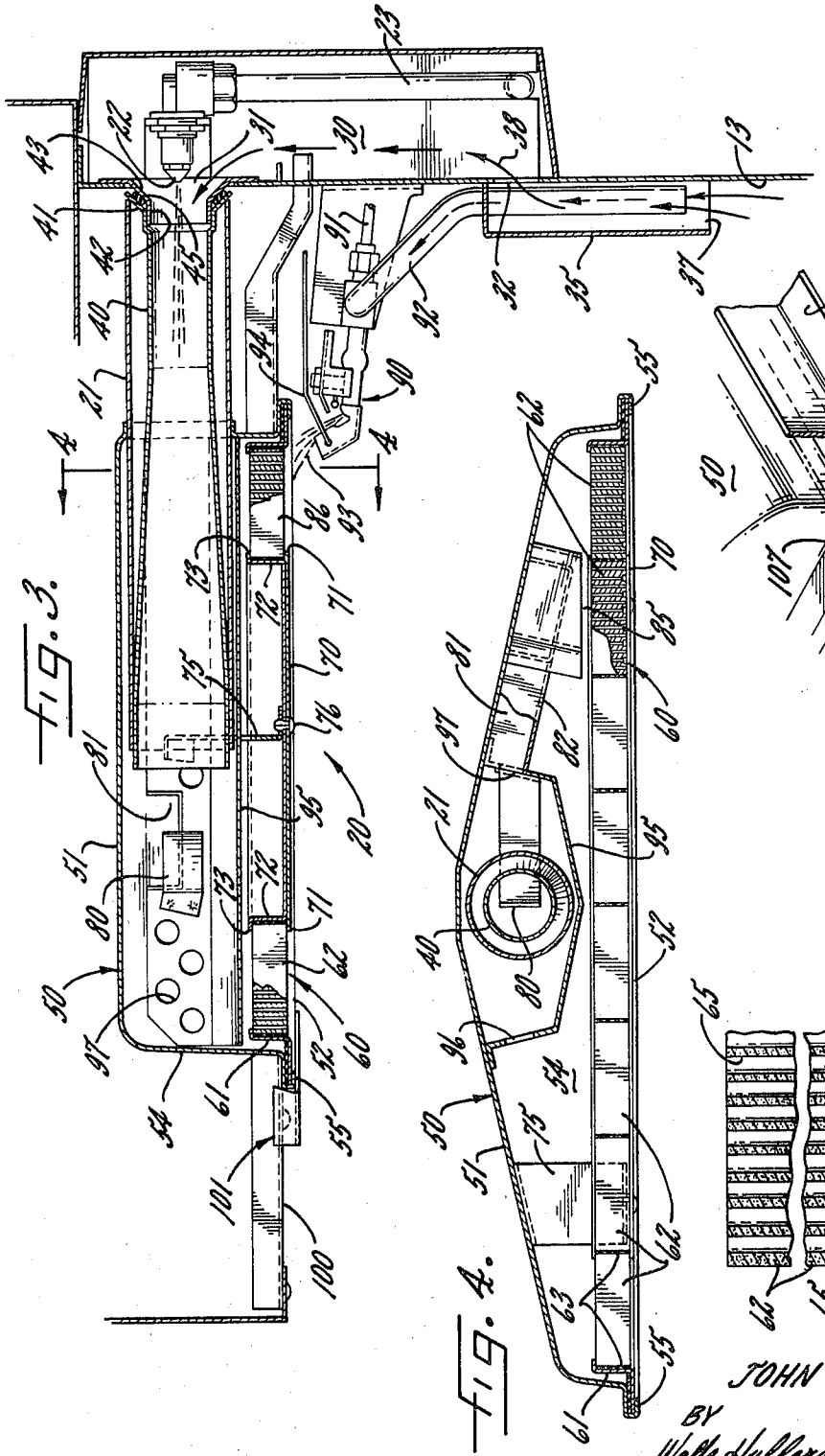

FIG. 3.

FIG. 4.

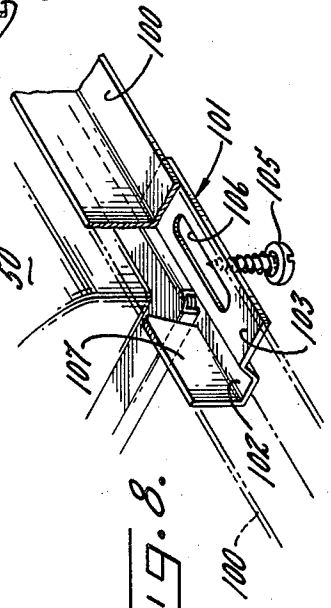

FIG. 8.

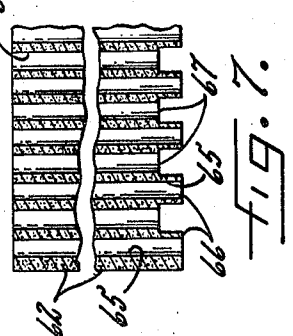

FIG. 7.

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Fig. 5.

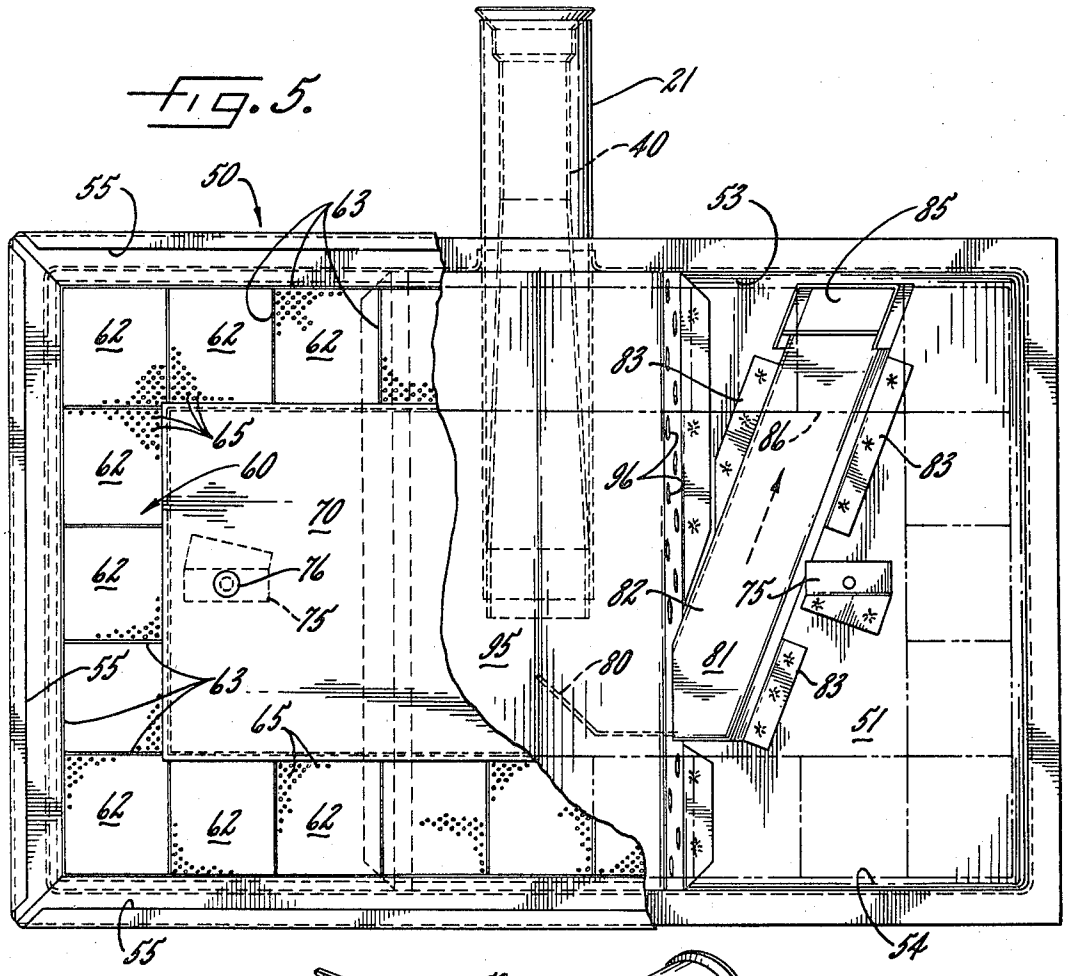
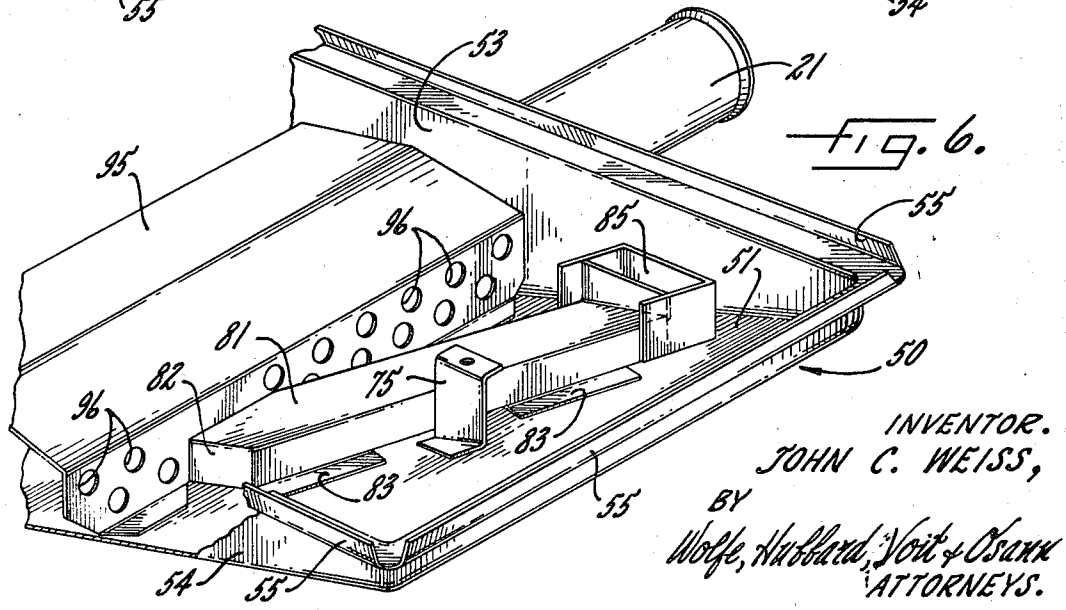


Fig. 6.



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3,422,810

BROILER FOR GAS RANGE

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Filed Sept. 8, 1967, Ser. No. 666,272
U.S. Cl. 126—41 7 Claims
Int. Cl. F24c 3/04; F23d 13/12

ABSTRACT OF THE DISCLOSURE

A broiler for a gas range utilizing an extensive layer of perforated incandescent material and having improved means for initiating combustion as well as an improved mounting and air supply.

It is an object of the present invention to provide an improved broiler for a gas range which is distinguished by high thermal efficiency and which utilizes incandescence to produce high temperature radiation at a low fuel rate. It is another object of the invention to provide a broiler which employs incandescent burner elements which have the characteristic of burning without visible tongues of flame and in which the radiant energy is distributed over a broad spectrum from the long infrared rays, which penetrate deeply into the foodstuff, to the shorter rays which tend to act upon the surface. It is a related object to provide a gas broiler which is particularly suited for broiling and charring steak and other cuts of meat but which provides an even distribution of the heat over the broiling area without hot spots or regions of concentration. The degree of surface charring is however under the complete control of the user, being variable from a maximum charring effect with the foodstuff spaced closely to the burner to complete lack of surface charring as the spacing is progressively increased. Closer spacings are possible without sacrificing the evenness of heat distribution than is the case with conventional gas broilers employing downwardly extending tongues of flame.

It is another object of the present invention to provide an incandescent gas burner employing rare earth oxides having a large total area and a large cumulative port area but requiring only a low rate of flow of the gas-air mix per unit area and with a correspondingly low back pressure. It is a related object to provide, in an incandescent broiler burner of this type, an improved means for insuring positive ignition. It is a more specific object to provide means for augmenting the pressure and rate of flow of the gas over a localized region on the burner surface, with the pilot located opposite this localized region for initiating combustion which thereupon spreads over the entire burner area.

It is a more detailed object to provide a broiler burner having a novel supply of primary air which is uncontaminated by the products of combustion and which prevents the products of combustion of a burner located in a lower range compartment from passing through the radiant burner when it is inoperative.

Finally it is an object to provide a burner of the incandescent type having a novel gas-supplying and supporting arrangement which enables plugging of the burner into an air-gas receptacle in the rear wall of the oven, permitting the burner itself to be of simple construction, easily and quickly installed or removed, and keeping the interior of the oven or broiling space clean and uncluttered.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a side elevation of an oven or broiling chamber in a range with the rear wall removed to reveal the broiler burner;

FIG. 2 is a front view corresponding to FIG. 1;

FIG. 3 is a vertical section taken longitudinally through the burner along the line 3—3 in FIG. 2;

FIG. 4 is an inner end section of the burner taken along the line 4—4 in FIG. 3;

FIG. 5 is a bottom view of the burner;

FIG. 6 is a perspective of a portion of the burner housing without the burner elements in place as viewed from the underside showing the auxiliary passageway for conducting gas-air mix to a localized region of the burner;

FIG. 7 is a fragmentary section taken through a typical burner element;

FIG. 8 is an exploded fragmentary perspective showing the clip used to clamp the burner in place.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to the drawings there is shown in FIGURES 1 and 2 range structure **10** defining a broiler or oven compartment having a top wall **11**, a bottom wall **12**, a rear wall **13** and side walls **14**, **15**. A rack **16** capable of being supported on guides **17** secured to the side walls serves to hold the foodstuff **18** as it is being broiled.

Arranged at the top of the broiling chamber is a broiler burner indicated generally at **20** having a conduit **21** which supplies air-gas mix. Gas is ejected from a jet **22** (see FIG. 3) having a supply line **23** which receives gas from a valve shown diagrammatically at **24**. In carrying out the invention the gas jet **22** is mounted in the back portion of the range surrounded by a primary air chamber from which air is induced by the gas jet and which has a primary air intake which is spaced downwardly from the burner by a substantial amount in order to avoid contaminating the primary air with the products of combustion from the burner. Thus to the rear of, and surrounding, the gas jet **22** I provide an air chamber **30** having an annular outlet **31** concentric with the jet **22** and having an inlet **32**. Secured over the inlet **32** is a baffle **35** of shallow rectangular or box shape having mounting flanges **36** and an open bottom edge **37** through which the air is admitted from the broiling compartment. The path of the air to the burner conduit is indicated by the arrow **38**.

For the purpose of defining a venturi in the region of the jet for aspiration of the primary air, the conduit **21** includes a venturi insert **40** (see FIG. 3). The insert is flared at its outer end **41**. For mating with and supporting the end of the conduit **21**, a receptacle is provided surrounding the gas jet in the back wall of the oven. In the present instance the receptacle is in the form of a short nipple **42** providing a tapered annular seat **43**. For the purpose of sealing the joint, a gasket **45** is provided between the seat **43** and the flare **41** of the venturi insert. The means for supporting the forward edge of the burner **20** and for maintaining the gasket **45** compressed to form a gas tight seal will be discussed at a later point.

In accordance with the present invention the broiler burner is formed of a hollow metallic housing providing a generally flat and extensive wall defining an air-gas plenum and with the wall being formed by a layer of incandescent rare earth oxide having a two-dimensional pattern of closely spaced perforations so that combustion occurs over the entire face of the oxide layer heating it to incandescence as a source of broiling heat free of any visible tongues of flame.

Thus referring to FIGS. 3–6 I provide a burner housing **50** which is of inverted pan shape having a top **51** and

open bottom surface **52**, a rear end wall **53** and a front end wall **54**. The rear end wall **53** is perforated by, and serves to mount, the conduit **21**. Integral with the side and end walls is a peripheral mounting flange **55**.

Secured by the mounting flange is a burner element assembly **60** having a metal frame **61** and mounting a plurality of ceramic blocks **62** which are of square configuration and of which the face portion preferably consists of a rare earth oxide, or mixture of oxides, capable of incandescence when in close proximity to oxidation of a combustible gas. As shown in FIG. 5, the incandescent blocks **62** are stacked side by side separated by a thin layer of high temperature gasketing material **63**, for example, asbestos paper. Each of the blocks **62** is provided with a two-dimensional pattern of through-openings **65**. Formed on the surface of each of the blocks is a pattern of ridges **66** defining intervening valleys **67**. As will be noted in FIG. 7 the rows of holes **65** alternately communicate with the ridges and valleys. Forming the surface in this way substantially increases the area of the active material and improves the combustion thereby to increase radiant efficiency. In a practical case each of the ceramic burner elements may measure approximately 1.75" by 1.50" with a thickness of 0.50". The communicating openings **65** each have a diameter on the order of 0.03125" and are spaced center to center in each direction by 0.0625". The ridges **66** preferably have a width and height on the order of 0.0625", although the ridges may be omitted, if desired, without departing from the invention.

In accordance with one of the features of the present invention the incandescent blocks are arranged only about the periphery of the radiant burner face while the central portion thereof is covered by a metal panel which is impervious to gas so that no combustion takes place in the central portion. This central panel, indicated at **70**, is of rectangular shape, having an edge **71** which overlies the edges of the ceramic blocks. Secured to the inside surface of the panel **70** is a retaining member **72** of shallow pan shape having a peripheral flange **73**, the panel and retainer being preferably spot welded together. The inner edge of each of the blocks is therefore snuggly confined between the edge **71** of the panel and the flange **73** of the retainer. To provide central support for the block and panel assembly, depending brackets **75** secured to the top wall of the housing (see FIG. 4) are provided. Blind rivets **76** extend through alined openings in the panel, retainer and bracket, thereby rigidifying the face of the burner.

It will be apparent, then, that when air-gas mix is supplied to the plenum within the burner it will flow through the numerous openings **65** with combustion taking place over the face area of the blocks. Since there is no combustion at the central portion of the burner there is no build-up of temperature at the center so that heat is applied evenly over the entire area of the foodstuff. Preferably, and as shown, the central non-radiating portion has an area which is a major fraction of the area of the peripheral radiating portion.

In accordance with one of the important aspects of the present invention means are provided for augmenting the flow of air-gas mix to a localized region of the burner face to increase the rate of flow in such region to a level which insures that combustion will be initiated by a pilot placed adjacent thereto. I prefer to bring about this augmentation by means of a scoop or diverter placed in the path of the gas flowing through the conduit **21** and by providing a cooperating auxiliary passageway for conducting the air-gas mix to a small burner block area at the periphery of the burner assembly. Thus referring to FIG. 3, it will be noted that the air-gas conduit **21** terminates well within the housing, preferably at the center thereof, so that no portion of the burner is particularly favored. In the path of movement of the air-gas mix exiting from the conduit is a diverter or scoop **80** which may be formed of a small piece of metal, angled as shown in FIG. 5, and spot welded or otherwise secured to the burner housing. Cooperating with the diverter, and defining an auxiliary passageway **81** is a channel **82** having mounting flanges **83** spot welded in place. The passageway **81** terminates in an orifice **85** at the back side of a selected burner block **86**.

Positioned at the front side of the burner block **86** is a pilot jet **90** having a thin flexible gas line **91** and a primary air supply tube **92**. In order to avoid contamination of the primary air to the pilot, the supply tube **92** extends within and substantially to the lower edge of the baffle **35** previously described. The pilot flame **93** is positioned to play over the portion **85** of the block **86** through which gas is discharged at an augmented rate. Also in the vicinity of the pilot flame **93** is a sensor **94**. The sensor and its associated control circuitry (not shown) is entirely conventional and is provided for the purpose of detecting the presence of a pilot flame, preventing flow of gas to the burner in the absence of a flame in the interest of safety.

In order to further equalize the distribution of gas pressure within the plenum, the conduit is surrounded by a distribution box **95** which is spot welded to the top of the burner housing and which provides a series of escape openings **96**, **97** along its sides. The distribution box is cut out as necessary to pass the air-gas mix which flows from the diverter **80** into the auxiliary passage **81**.

Accordingly when the valve **24** is operated to turn on the gas, assuming the pilot is lit, gas flows from the main gas jet **22** into the venturi **40**. By well known venturi action this induces a flow of primary air through the annular space **31** surrounding the jet, the air being intimately mixed with the gas during flow through the conduit. A portion of the air-gas mix exiting from the inner end of the conduit strikes the scoop **80** and is diverted thereby into the auxiliary passageway **1**. This causes the pressure, and hence rate of flow, to be slightly higher in the pilot region **85** than it is over the remainder of the burner face. Thus the air-gas mix exiting in the region **85** is positively ignited by the pilot flame. Once ignition is initiated combustion spreads over the entire active burner surface. It is found that in the absence of the augmentation described above, and in view of the low back pressure existing in the plenum, lighting is difficult and unreliable, with the rising products of combustion of the pilot tending to drive the air-gas mix backwardly through the orifices in the adjacent burner block.

The pilot is preferably of the aerated type having a separate source of primary air, thereby minimizing the consumption of oxygen at the pilot flame and insuring that there is, in the region of lighting, sufficient secondary air to facilitate ignition and spread of combustion.

Once combustion has spread to all portions of the burner it is found that burning occurs evenly, immediately raising the temperature over all of the active surface to the incandescent level. Combustion takes place even at the region **85** without any obvious "hot spot" or visible tongues of flame in this area, notwithstanding augmentation of the flow.

In a practical broiler burner of the present design intended for domestic use, the burner may have a face area on the order of 9" by 14" with the central panel approximately 5½" by 11", leaving a total active incandescent area on the order of 66 square inches. Since the orifices in the incandescent blocks are numerous and closely spaced they provide total cumulative port area of 26.5 square inches. With all of this area available for the exiting air-gas mix, the back pressure, at a heat rate of 18,000 B.t.u. per hour, is extremely low well below 1 (one) inch of water. Notwithstanding this low back pressure experience shows that combustion occurs reliably and with high efficiency over the entire active area and that the combustion is substantially proof against accidental blow-out by drafts, etc.

Since the incandescent temperatures of the burner blocks are below 2400° F., the blocks preferably consist of oxides of alumina, silica, calcium, or combinations thereof, rather than the more costly oxides of magnesium, thorium, or cerium, which are frequently employed at temperatures above 2400° F. The preferred oxides convert the energy of combustion to a wide spectrum of thermal radiation. Such radiation permits an even temperature to be achieved at the foodstuff which is substantially higher than that which can be achieved over the same area by an open flame at the same fuel rate. The present burner is thus particularly desirable where it is desired to sear or char meat, with the meat under such conditions being placed as close to the burner as may be desired. The searing and charring effect enhances the flavor while the longer rays penetrate deeply into the meat to insure that it is adequately "done" at the center in a minimum period of broiling time. Any spatter which strikes the burner under normal broiling conditions is immediately decomposed and vaporized at the high temperature at which combustion occurs. The central panel **70** and peripheral flange **55** acquire a sufficiently high temperature, on the order of 1050 to 1100 degrees F., so that they are also self-cleaning. Thus the burner not only operates smokelessly but is constantly self-cleaning and may be expected to last the entire life of the range in which it is installed.

In the event that it is desired to remove the burner for any purpose whatsoever this may be accomplished simply by loosening two clips along the opposite front edges of the burner, following which the burner may be pulled forwardly a short distance to disengage the nipple **42** at the back wall of the broiling chamber. Turning to FIG. 3, and as shown in detail in FIG. 8, the lateral flanges **55** of the burner housing are seated against rails **100** which run from front to back within the broiling chamber. Secured to each of the rails at the front of the broiler housing is a metal retaining clip **101** which is formed of a flat piece of metal bent into Z configuration having a supporting flange **102** and a mounting flange **103**, with the mounting flange being secured to the flat undersurface of the rail **100** by means of a screw **105**. The screw **105** is threaded into the rail and engages an elongated hole **106** in the clip. Integrally formed at the front portion of the mounting flange **102** is an upwardly bent tab **107** which engages the front edge of the flange on the burner housing.

During installation, then, the burner housing is lifted into place with the inlet end of the conduit engaging the nipple receptacle **42** at the receptacle at the rear of the chamber. The clips **101** are then fastened in place. Prior to tightening the screws **105**, the clips are pressed rearwardly, with the tabs **107** applying sufficient force to the burner housing in a rearward direction to insure compression of the sealing gasket **45** at the nipple.

The present burner construction not only improves the broiling process but due to the fact that the burner is characterized by an extensive flat undersurface the burner may be recessed in the top of the oven or broiling chamber thereby defining a smoothly continuous upper wall free of piping and avoiding the unsightly appearance of the conventional broiler burner. Moreover since the primary air passages to the main burner are integral with an concealed behind the rear wall of the chamber, such rear wall is also smoothly continuous except for the baffle **35** which is shallow construction and therefore does not substantially intrude upon the available space. Since the lower or inlet edge of the baffle **35** is well down from the broiler burner, the primary air which enters is fresh and uncontaminated by the products of combustion of the burner. This broiler burner air entry technique also prevents the products of combustion of any oven burner which may be located below the broiling cavity from passing through the broiler burner when inoperative. Suitable vents at the top of the range structure permit escape of the products of combustion from the broiler burner either into an external vent or into the room whichever is desired, the products in any event being clean and free of the smoke which is often associated with the broiling process.

It will be apparent to one skilled in the art that the present broiler burner is applicable to all domestic gas ranges whether of the free standing or the built-in type.

In the following claims the term "incandescent" is used as an adjective to denote a ceramic material capable of producing radiation in the visual and infra-red range when in the presence of gaseous combustion. A "ceramic" material includes any refractory which is capable of operating in the presence of combustion without substantial deterioration. The term "lower portion" of the chamber refers to any level substantially below the level of the burner.

I claim as my invention:

1. In a broiler burner for a gas range the combination comprising an extensive face formed of incandescent ceramic material having a two-dimensional pattern of closely spaced perforations, means defining a plenum chamber in back of the face in communication with the perforations, means defining a conduit for conducting air-gas mix under slight pressure to the plenum chamber, means defining an auxiliary passage interconnecting the conduit and a localized region of the face for causing the air-gas mix to be supplied to said localized region at a slightly higher pressure than exists over the remainder of the face, and pilot means at said localized region of the face for initiating combustion of the exiting air-gas mix for lighting of the burner.

2. In a broiler burner for a gas range the combination comprising a hollow burner housing, one wall of said housing being formed of incandescent ceramic material to form a heat-radiating face, said face having a two-dimensional pattern of closely spaced perforations, means including a conduit connected to a source of air and gas under slight pressure and terminating in the housing for admi ting air-gas mix to the housing for distribution and escape thereof through the perforations, means defining an auxiliary passage interconnecting the conduit and a localized region of the face including a diverter for diverting air-gas mix through said auxiliary passage so that the air-gas mix is forced through the perforations at the localized area at a slightly greater pressure and hence at a higher rate than is effective over the other areas of the face, and pilot means at said localized region for initiating combustion of the exiting air-gas mix for lighting of the burner.

3. In a broiler burner for a gas range the combination comprising a flat housing, a face on said housing formed of incandescent ceramic material having a two-dimensional pattern of closely spaced perforations, a tube extending into the housing parallel to the face thereof and having an inlet and an outlet, means for supplying air-gas mix under slight pressure to the inlet, means defining an auxiliary passage extending from the outlet of the tube to a localized region of perforations located at one edge of the face, and a diverter in the path of the air-gas mix as it exits from the tube for diverting a portion of the exiting mix into the auxiliary passageway so that the air-gas mix is supplied to the perforations at the localized area at augmented pressure, and pilot means adjacent the localized region for initiating combustion of the air-gas mix over the face of the burner.

4. In a broiler burner for a gas range the combination comprising a hollow burner housing defining a generally flat and extensvie wall, means for supplying air-gas mix to the housing, said wall having a peripheral portion and a central metal panel, the peripheral portion being faced with an incandescent ceramic material having a two-dimensional pattern of closely spaced perforations for conducting air-gas mix from the housing through the perforations for combustion at the face thereof, the central

panel being impervious to the flow of gas so that combustion takes place only about the peripheral portion of the burner for substantially even distribution of heat upon an extensive foodstuff arranged opposite the burner wall, the central metal panel having an area which is a major fraction of the area of the peripheral portion and contiguous to the peripheral portion so as to be heated therby when the burner is on.

5. In a broiler burner for a gas range the combination comprising a hollow burner housing of inverted pan shape having a generally flat and extensive wall on its underside, said wall having a peripheral portion and a central panel, the peripheral portion being faced with incandescent ceramic material having a two-dimensional pattern of closely spaced perforations, the central panel being impervious to the flow of gas so that combustion takes place only about the peripheral portion of the burner, a conduit for admitting air-gas mix to the housing and terminating well within the housing, and a distribution box extending parallel to the conduit and surrounding the same, said distribution box having openings distributed therealong for even distribution of the gas-air mix to all portions of the housing, the central panel being contiguous to the peripheral portion so as to be heated thereby when the burner is on.

6. In a broiler burner for a gas range the combination comprising means defining a broiling chamber, a generally flat burner housing having an extensive downwardly facing wall, said wall being comprised of incandescent ceramic material to form a heat radiating face, said face having a two-dimensional pattern of closely spaced perforations, a conduit extending rearwardly from the housing, means defining a receptacle in the rear wall of the broiling chamber, supports for said housing for holding the housing in broiling position with the condit extending into engagement with the receptacle, a gas jet in said receptacle and having a supply line, means defining a venturi at the jet for drawing in primary air, means defining a primary air passage in the rear wall of the broiling chamber for interconnectting the venturi with an opening in the rear wall, means including a pilot for igniting the air-gas mix flowing from a localized region of the burner face when the burner housing is in broiling position in the receptacle, and a baffle covering said opening and extending down to the lower portion of the chamber so that clean primary air is drawn from the lower portion of the chamber.

7. In a broiler burner for a gas range the combination comprising means defining a broiling chamber, a generally flat burner housing having an extensive downwardly facing wall, said wall being comprised of incandescent ceramic material to form a heat radiating face, said face having a two-dimensional pattern of closely spaced perforations, a conduit extending rearwardly from the housing, means defining a receptacle in the rear wall of the broiling chamber, supports for said housing for holding the housing in broiling position with the conduit extending into engagement with the receptacle, a gas jet in said receptacle and having a supply line, means defining a venturi at the jet for drawing in primary air, means defining a primary air passage in the rear wall of the broiling chamber for interconnecting the venturi with the lower portion of the chamber so that clean primary air is drawn from the lower portion of the chamber, a pilot jet having a supply line and mounted upon the rear wall of the broiling chamber for cooperating with a localized region of the burner face when the burner housing is in broiling position in the receptacle, and means for conducting primary air to the pilot jet from the bottom portion of the broiling chamber.

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EDWARD G. FAVORS, *Assistant Examiner.*

U.S. Cl. X.R.

431—328

Disclaimer

3,422,810.—*John C. Weiss*, Bourbonnais, Ill. BROILER FOR GAS RANGE. Patent dated Jan. 21, 1969. Disclaimer filed July 14, 1969, by the assignee, *Geo. D. Roper Corporation.*

Hereby enters this disclaimer to claims 1, 2, 3, 4 and 5 of said patent.

[*Official Gazette November 4, 1969.*]