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April 27, 1926.

H. C. CALDWELL

1,582,634

GAS BURNER

Filed May 19, 1924

2 Sheets-Sheet 1

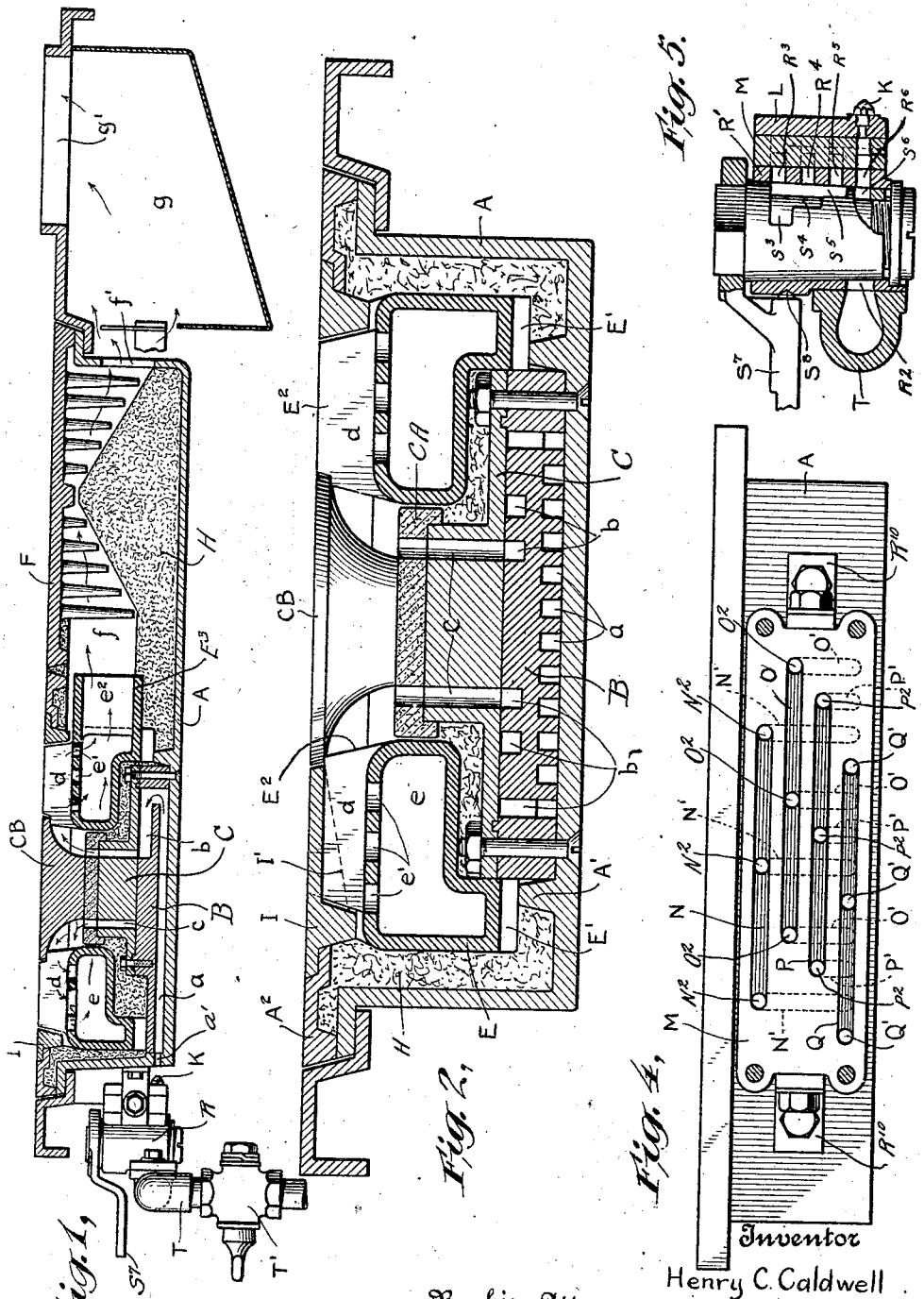


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Inventor
Henry C. Caldwell

By his Attorney
John E. Bubbell

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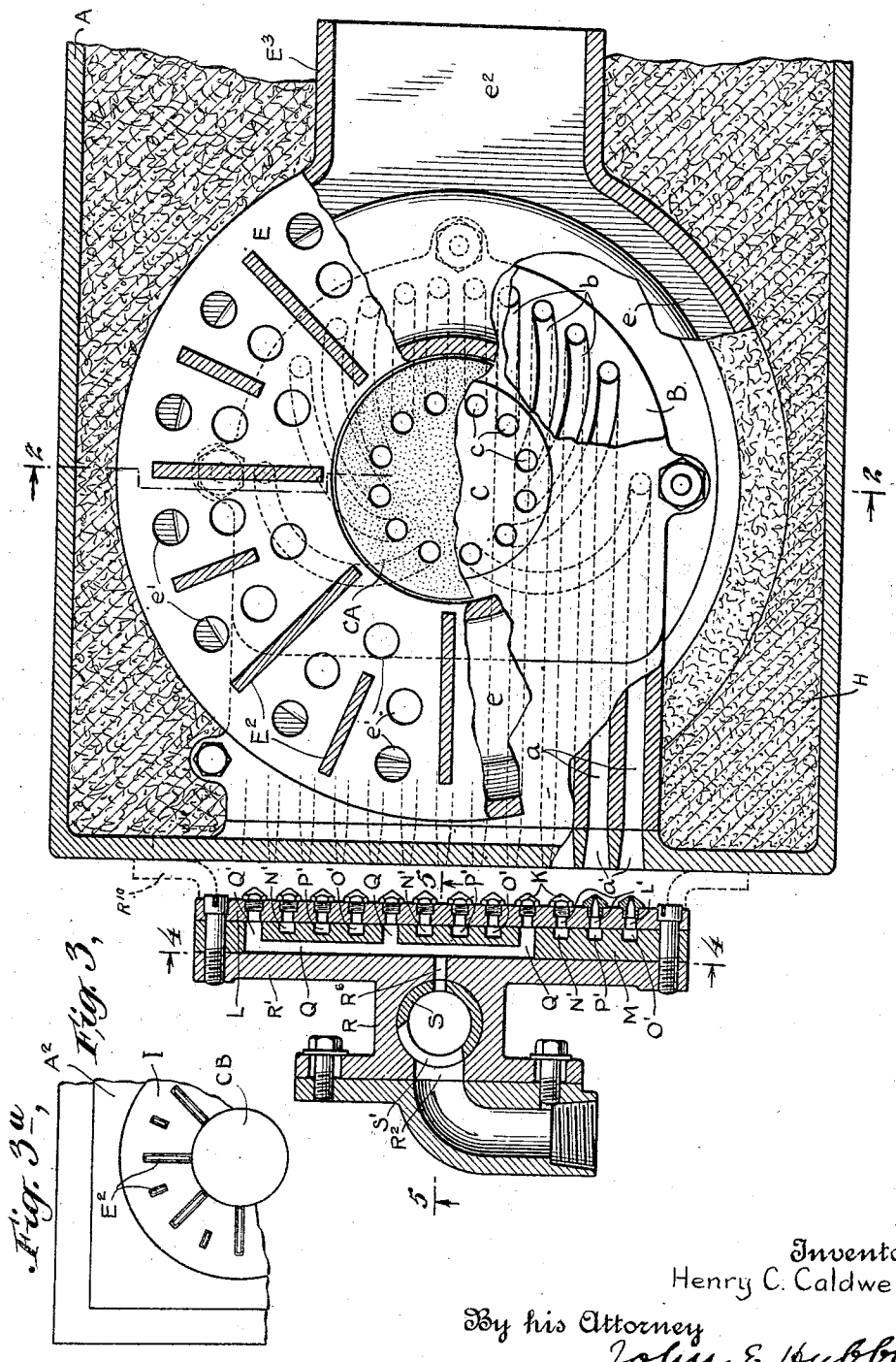


Fig. 3a, Fig. 3,

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UNITED STATES PATENT OFFICE.

HENRY C. CALDWELL, OF BUFFALO, NEW YORK.

GAS BURNER.

Application filed May 19, 1924. Serial No. 714,313.

To all whom it may concern:

Be it known that I, HENRY C. CALDWELL, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Gas Burners, of which the following is a specification.

The primary object of my present invention is to provide improved means for burning gas. My invention may advantageously be employed in gas burners used for various purposes, as in heaters, drying and baking ovens, and the like, but was primarily devised, and is especially adapted for use in a gas range or cooking stove and particularly in gas ranges of the type used in hotel kitchens, and the invention consists in part in a novel combination of the burner proper with other parts of a gas range.

At the present time there are two types of gas burning ranges in common use, namely: the open top type and the closed top type. In the open top range the gas flames contact directly with the kettle, pot, or other object to be heated, and the products of combustion escape directly into the atmosphere, while in the closed top range the gas is burned in an enclosure from which the products of combustion are withdrawn ordinarily by connection to a chimney and through the wall of which the heat transmitted to the object heated must be conducted. It is a matter of common knowledge and experience that the heat of combustion is more effectively utilized in the open top type of range than in the closed top type, and primarily for this reason the open top type of range is in much more general use than the closed top type stove though the objections to discharging the products of combustion directly into the atmosphere are well recognized, and it is also known that in the closed top type of range it is possible to obtain a better regulation of combustion, and to obtain higher combustion temperatures than is possible with the ordinary open type burner.

My present invention was devised with the general object in view of obtaining characteristic advantages of both the open type and closed type burners while at the same time avoiding or minimizing characteristic disadvantages of both of these prior types of burners. The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages and specific objects obtained with it, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described a preferred embodiment of the invention.

Of the drawings:

Fig. 1 is a sectional elevation of a range top;

Fig. 2 is a section on the line 2—2 of Fig. 3;

Fig. 3 is a plan view of a portion of the range top shown in Fig. 1 with parts broken away and in section;

Fig. 3ª is a small scale plan of a portion of the range top;

Fig. 4 is an elevation taken at right angles to Fig. 1 with a portion of the gas supply provisions removed; and

Fig. 5 is a section on the line 5—5 of Fig. 3.

In the drawings I have illustrated my invention in connection with a cooking range of the type employed in hotel kitchens. The range top as shown, is formed of one or more sections, each of which comprises a cast iron pan-like member A, shown as generally rectangular in cross section, with a burner located in the front portion of the pan, and with the rear portion of the pan covered by a warming plate F. The burner proper in the form shown comprises a plurality of channels located adjacent the bottom of the member A, and each receiving gas for its combustion through a corresponding port a' in the member A. The air and gas mixture passes from the inner end of each channel a into a corresponding channel b, which delivers the mixture to a corresponding vertical channel c which opens at its upper end into a combustion chamber or chambers d from which the burning gases and products of combustion pass downward through ports e' into an annular off-take channel e having an outlet e^2 at its rear side opening into the chamber f which is closed at its top by the warming plate F. The chamber f opens through a port f' into a flue g having an outlet port g'

which may be damper controlled, and through which connection is made to a stack or chimney (not shown).

In the particular construction shown, the channels *a* are in the form of a row of parallel grooves formed in the under side of a metallic member B, the grooves *a* being closed at their lower ends by the bottom wall of member A. The body portions of the channels *b* are in the form of grooves or channels in the upper side of the member B, the upper edges of the channels *b* being closed by a metallic member C detachably secured against the member B. The channels *c* are formed in part by vertical passages in a metallic member C and registering vertical passages through a disk-like brick or like refractory body CA resting on the member C. The channels *c* are arranged in a circular series about the vertical axis of the burner, and the channels *b* are suitably curved to connect each channel *c* to the corresponding channel *a*, the width of the group of channels *a* being substantially greater than the diameter of the circle in which the channels *c* are arranged. Preferably, the channels *a* are all of equal length and cross section, and preferably this is the case also with the channels *b* and the channels *c*. Furthermore, the bends in each flow path formed by a channel *b* and the channels *a* and *c* connected to its ends are all so relatively shaped and disposed so that each of these flow paths offers practically the same resistance to flow therethrough as does each of the other flow paths. In consequence, with any given gas supply pressure the same amounts of gas will flow through the various channels *a* and the channels *b* and *c* connected thereto, provided the suction effect is the same at the discharge ends of the various channels *c*. This uniform suction effect is secured notwithstanding the decreased draft suction at the ports *e'* more remote from the outlet e^2 of the chamber *e* as compared with the suction on the ports *e* less remote from the outlet by making the ports *e'* of a size varying in inverse correspondence with the draft suction to which they are subjected. This mode of regulating the flow resistance from the various gas inlet ports *a'* to the outlet port e^2 so as to secure uniform flow through the various channels *a* and thence into the combustion chamber through the channels *c*, is advantageous because of the comparative ease with which the ports *e'* can be reamed when necessary to make them of the proper relative sizes.

The walls of the chamber *e* are formed by a hollow annular member E of cast iron provided with radial lugs E' at its under side which rest upon the pan lugs A', and is formed at its upper side with radially disposed ribs or lugs E^2 which in effect divide the combustion chamber *d* into a plurality of separate compartments each receiving the combustible mixture from one or more passages *c* and each passing products of combustion through a plurality of ports *e'* into the chamber *e*. The member E is formed with a spout-like extension E^3 at its rear side which forms the wall of the port e^2.

Mounted on the top of the refractory member CA is a flame spreader and heat equalizing member CB advantageously formed of cast iron or other suitably refractory metal and circular in horizontal cross section and of general conical form with its diameter increasing from bottom to top in such manner as to form a smooth curved flame deflecting and guiding surface for deflecting the combustible mixture horizontally into the combustion chamber. As shown, the upper end of the member CB engages the inner ends of some of the ribs E^2 on the member E. As shown, the top of the combustion chamber is closed by a lid I removably seated in an aperture in the range top cover A^2, and formed with a central opening surrounding the member CB and slotted to receive the upper ends of the ribs E^2. The lid member I may be stiffened and its heat absorbing capacity is increased by integral radially extending ribs I' on its under side. Advantageously, as shown, the member E is in effect embedded in refractory cement or analogous heat insulating material H which fills all portions in the pan A not occupied by the solid parts and channels or passages previously described. As shown, the heat insulating material H is shaped to give the bottom wall of the passage *f* the form of a flat cone, and the under side of the metallic warming plate F is formed with integral ribs or fingers which extend down into the space *f* and increase the heat absorption by the plate F.

The means provided for supplying gas to the channels *a* through the ports *a'* comprise gas discharge nozzles K, one co-axial with each of the ports *a'* and separated from the outer end thereof by a short distance so that the gas jet discharged by the nozzle will carry with it into the corresponding port *a'* the proper amount of primary air drawn from the atmosphere. The nozzles K form a part of a gas supply mechanism advantageously secured to the range top member A as by means of brackets R^3 secured to the ends of a plate-like portion R' of a valve body or casing member R formed with a conical valve chamber in which is mounted a hollow rotatable valve member S of conical form. The valve member S is formed with an inlet port S' through which gas passes to the interior of the valve member S from the inlet port R^2 of the valve casing member R. The valve

member S is formed with a plurality of outlet ports S^3, S^4, S^5, and S^6 distributed along the length of the valve member and each adapted to be brought into register with a corresponding outlet port R^3, R^4, R^5, and R^6 formed in the casing member and opening at the side of the plate portion R′ of the casing body adjacent the range top. As shown, the valve outlet ports S^3, S^4, S^5, and S^6 are in the form of a series of arc-shaped slots of progressively increasing length so that, as the valve S is rotated in successive steps from its closed position, gas will first be discharged through the ports S^3 and R^3, and then through the ports S^3, R^3, and S^4, R^4, and then through the ports S^3, R^3, S^4, R^4, and S^5, R^5, and finally through all of the ports S^3, R^3, S^4, R^4, S^5, R^5, S^6, and R^6. The ports in the channels of the valve mechanism serve the purpose of measuring orifices and may advantageously be so sized that each of the ports R^3, R^4, R^5, and R^6 will discharge the same amount of gas when all are open, and as the valve is progressively opened, it will pass first one-quarter, then one-half and then three-quarters of the full amount of gas discharged when the valve is in the position in which it permits the discharge of gas through all of the ports R^3, R^4, R^5, and R^6. Secured against the plate portion R′ of the valve member is a central distributing plate M formed at its outer side with longitudinal channels N, O, P, and Q, into which the ports R^3, R^4, R^5, and R^6 respectively, open. Ports Q′ extending through the plate member M and open at their front ends to the channel Q, open at their rear ends to corresponding passages or ports L′ in a plate-like member L secured against the rear side of the member M and formed with a series of ports L′ in the outer end of each of which is mounted a corresponding gas nozzle K. As shown, the ports L′ in alignment with the first, fifth and ninth of the channels *a*, measured from the top as seen in Fig. 3, communicate with the channel Q through ports Q′ in the member M. The ports L′ in alignment with the second, sixth and tenth channels *a*, measured from the top of Fig. 3, communicate through transverse channels N′ in the rear face of the member M and ports N^2 extending through the member M with the channel N. Similarly, the ports L′ in alignment with the third, seventh and eleventh channels *a*, measured from the top of Fig. 3, communicate through transverse channels P′, P^2 in the rear side of the member M and ports P^2 with the channel P, and the remaining ports L′ communicate through transverse channels O′ in the front face of the member M and ports O^2 with the channel O. With the described arrangement in one setting of the valve member S, only three of the channels *a* are supplied with gas, and it will be observed that these three channels open to the combustion chamber *d* at points approximately equally spaced about the axis of the burner. In the second setting of the valve S, gas is supplied to three or more of the channels *a* which open to the combustion chamber *d* at points between those at which the first mentioned channels *a* open. Similarly, as the valve is adjusted to supply first three-quarters and then the full amount of the maximum capacity, all the gas supplied with either adjustment is distributed with substantial uniformity about the axis of the burner.

As shown, gas is supplied to the inlet port R^2 of the distributing valve through an individual supply pipe T, including a cock T′ by which the gas supply to the distributing valve may be cut off or throttled. It will be understood that if the range comprises a plurality of top sections A and burners, the supply valves T for the different burners may be connected in the usual manner to a suitable main gas supply pipe for the range. The valve S is provided with a suitable handle S^7 by which it may be adjusted, and advantageously this handle is provided with a spring pressed detent S^8, or the like, adapted to seat in sockets R^9 formed in the valve body R in position to yieldingly maintain the proper setting of the valve S in its different closed positions.

With the described construction, it is possible to regulate the supply of combustible gas and air to each section of the combustion chamber *d* receiving combustible mixture from a single passage *c*, so as to insure a short flame and relatively high flame velocity at the outlet end of each channel *c*, thus insuring a very high rate of heat transfer from the combustion chamber to a pot or kettle on the top of the stove through the heat absorbing and equalizing member CB, the ribs E^2, and the plate I if the latter be used, and, if it be omitted, directly from the combustion chamber. With the character of combustion thus provided and with the metallic burner parts arranged and insulated by the material H, as described, a high temperature in the combustion chamber is maintained, thus insuring efficient combustion and a large transfer of heat by radiation, as well as conduction from the bottom walls of the combustion chamber and other parts of the burner structure relatively remote from the upper surface. Ignition occurs and combustion is completed in close proximity to the object to be heated and this result is secured as well when the quantity of gas being burned is small as well as when the burner is operating at maximum capacity. The large amount of hot metallic surface in direct contact with the flame insures a rapid absorption of heat by contact with and con-

duction from the burning gases as well as by radiation from the latter, and, when there is no object in position to absorb this heat by conduction, the heat is largely stored in the metallic burner parts, which then gradually increase in temperature. The products of combustion are all drawn into the stack or chimney B. By means of a suitable chimney damper or the like (not shown), it is easy to regulate the chimney suction at the outlet port g' from the flue g, as may be desirable. The normal operation of the burner with varying rates of combustion does not require any adjustment of the air to gas ratio by the operator, thus avoiding the maladjustments frequently resulting, when such adjustments are required or may readily be made by the operator. The continuous stack-pull on the burner contributes to uniform flame jet velocity and perfect ignition under varying conditions of load. There is small possibility of the flame being extinguished by side drafts both because of the relatively high flame jet velocity as well as by the protection against drafts due to extraneous causes. The provision of a multiplicity of combustible mixture supply channels a, and their continuations b, and c, permits each of these channels to be made small enough to insure an effective mixture of the air and gas and to minimize or eliminate any tendency to back-firing, and large enough to avoid unduly great friction draft losses or accidental clogging. The available heat in the products of combustion leaving the chamber e may be effectively utilized by the warming top plate F. The foregoing advantages are obtained, moreover, with a construction which is inherently simple and may readily be adapted to use in cooking ranges of different types, as well as in drying ovens, baking ovens, heating stoves, etc. The described construction facilitates the manufacture of the apparatus from cast metal parts which is relatively simple in form and well adapted for their production by casting and with a minimum of machining.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus dislosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

While for convenience I refer herein and in the claims to the burner structure and the location of the combustion chamber d above the outlet chamber e, as will ordinarily be the arrangement in the case of a range top burner, it is to be understood that such references are made for convenience to fix the relative disposition of the parts. The burner shown would operate equally well if turned upside down, or with the burner axis horizontal, or otherwise inclined to the vertical, when conditions make this desirable.

Having now described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In a gas burner, the combination with an annular combustion chamber of means for supplying gas to said chamber at its inner edge, an off-take chamber beneath the combustion chamber and ports opening through the bottom wall of the combustion chamber connecting the latter to said off-take chamber.

2. In a gas burner, the combination with an annular combustion chamber of means for supplying gas and air for the combustion of the gas to said chamber at its inner edge, an off-take chamber beneath the combustion chamber and ports opening through the bottom wall of the combustion chamber and connecting the latter to said off-take chamber.

3. In a gas burner, the combination with an annular combustion chamber of means for supplying gas to said chamber at distributed points around its inner edge, an off-take chamber beneath the combustion chamber and ports opening through the bottom wall of the combustion chamber connecting the latter to said outlet chamber, said outlet chamber having an outlet port adapted to be connected to a draft inducing device.

4. In a gas burner, the improvement which consists in an annular combustion chamber, channels supplying gas to said combustion chamber at points distributed around the inner edge of the latter, an annular off-take chamber beneath the combustion chamber and ports distributed along the bottom wall of the combustion chamber connecting the latter to said off-take chamber, and gas supply means selectively adjustable to supply gas to all or a predetermined number of said channels.

5. In a gas burner, the improvement which consists in an annular combustion chamber, channels supplying gas to said combustion chamber at distributed points, an off-take chamber beneath the combustion chamber, ports distributed along the bottom wall of the combustion chamber connecting the latter to said off-take chamber, and means selectively adjustable to supply gas and air for its combustion to all or a predetermined number of said channels.

6. In a range top, the combination with a hollow off-take member having distributed openings in its top wall, of means co-operating therewith to define a combustion cham-

ber above said member, and means for supplying combustible gas to said combustion chamber at the inner edge of the latter.

7. In a range top, the combination with a hollow off-take member having radially and circumferentially distributed openings in its top wall, of means co-operating therewith to define a combustion chamber above said member, and provisions for supplying combustible gas to said combustion chamber.

8. In a range top, the combination with an annular off-take member having distributed ports formed in its top wall, of a body centrally disposed with respect to and passing through said off-take member and having its upper end shaped to form an outwardly flared gas deflecting surface and formed with gas channels opening at their upper ends to the space which surrounds said central body portion and is located above the top wall of said off-take member.

9. An improved gas burner construction comprising a central body defining the inner edge of an annular combustion chamber and formed with gas supply channels opening to said combustion chamber at points distributed around the inner edge of the latter, an off-take chamber surrounding said member and located beneath said combustion chamber, and a ported wall between said chambers.

10. An improved heating device, comprising a pan-like metallic supporting part and metallic burner parts mounted therein, said parts being shaped to provide an annular combustion chamber, a central body formed with a circular series of vertically disposed gas supply channels opening at their upper ends to said chamber, a horizontal series of gas supply channels separately connected each to a corresponding one of the first mentioned channels, and an off-take chamber surrounding said central body beneath said combustion chamber and separated from the latter by a ported wall.

11. An improved gas burner comprising a pan-like metallic supporting part and metallic burner parts mounted therein, said parts being shaped to provide an annular combustion chamber, a central body formed with a circular series of vertically disposed gas supply channels opening at their upper ends to said chamber, a horizontal series of gas supply channels separately connected each to a corresponding one of the first mentioned channels, and an off-take chamber surrounding said central body beneath said combustion chamber and separated from the latter by a ported wall, and refractory material in which said burner parts are embedded.

12. An improved gas burner comprising a multiplicity of gas supply channels having open upper ends arranged at intervals in a circle surrounding the burner axis and gas supply channels horizontally disposed and arranged side by side and communicating each with a corresponding one of the first channels, an annular combustion chamber to which the first mentioned channels open, and off-take chamber beneath the combustion chamber and separated therefrom by a ported horizontal wall.

13. A gas burner comprising a combustion chamber, a multiplicity of gas supply channels opening to said combustion chamber at distributed points therein, means for separately controlling the supply of gas to different groups of said channels, the channels in one of such groups opening to said chamber at points alternating with the points in which the channels in other groups open to the chamber.

14. A gas burner comprising an off-take chamber, with a gas outlet at one side of the burner axis, a combustion chamber connected to said off-take chamber by ports distributed about said axis, and a multiplicity of gas supply channels opening to said combustion chamber at points distributed about said axis, said parts and elements forming paths so relatively proportioned that such of those paths which open to said off-take chamber at points remote from said outlet offer less resistance to gas flow therethrough than do the paths opening to said chamber nearer to said outlet.

15. A gas burner comprising an off-take chamber and means for withdrawing burned gases from said chamber, tending to withdraw such gases more rapidly from one side than from an opposite side of said chamber, a combustion chamber, ports connecting said chambers at distributed points which are smaller at said one side of the off-take chamber than at the opposite side of that chamber, and a multiplicity of gas supply channels opening to said combustion chamber at distributed points therein and relatively proportioned and arranged to offer substantially uniform resistance of gas flow therethrough.

16. In a range top, the combination with a hollow circular off-take member formed of metal and having radial ribs on its upper surface of means cooperating therewith to define an annular combustion chamber above said member and means for supplying combustible gas to said combustion chamber at points distributed about its inner edge.

17. In a range top, an off-take chamber having heat insulating material at its under and outer side, a ported top wall of metal, means cooperating with said top wall to define a combustion chamber above said off-take chamber and means for supplying air and gas to said combustion chamber at distributed points therein to effect short intense flame combustion therein.

18. In a range top, an off-take chamber having heat insulating material at its un-

der and outer side, a ported top wall of metal, means cooperating with said top wall to define a combustion chamber above said off-take chamber with metallic parts distributed through said combustion chamber for supporting and conducting heat to an object supported thereon, and means for supplying air and gas to said combustion chamber at distributed points therein to effect short intense flame combustion therein.

Signed at Buffalo in the county of Erie and State of New York this 13 day of May A. D. 1924.

HENRY C. CALDWELL.