May 10, 1932. W. A. BECKETT 1,857,525

GAS BURNING APPARATUS

Filed March 24, 1930 3 Sheets-Sheet 1

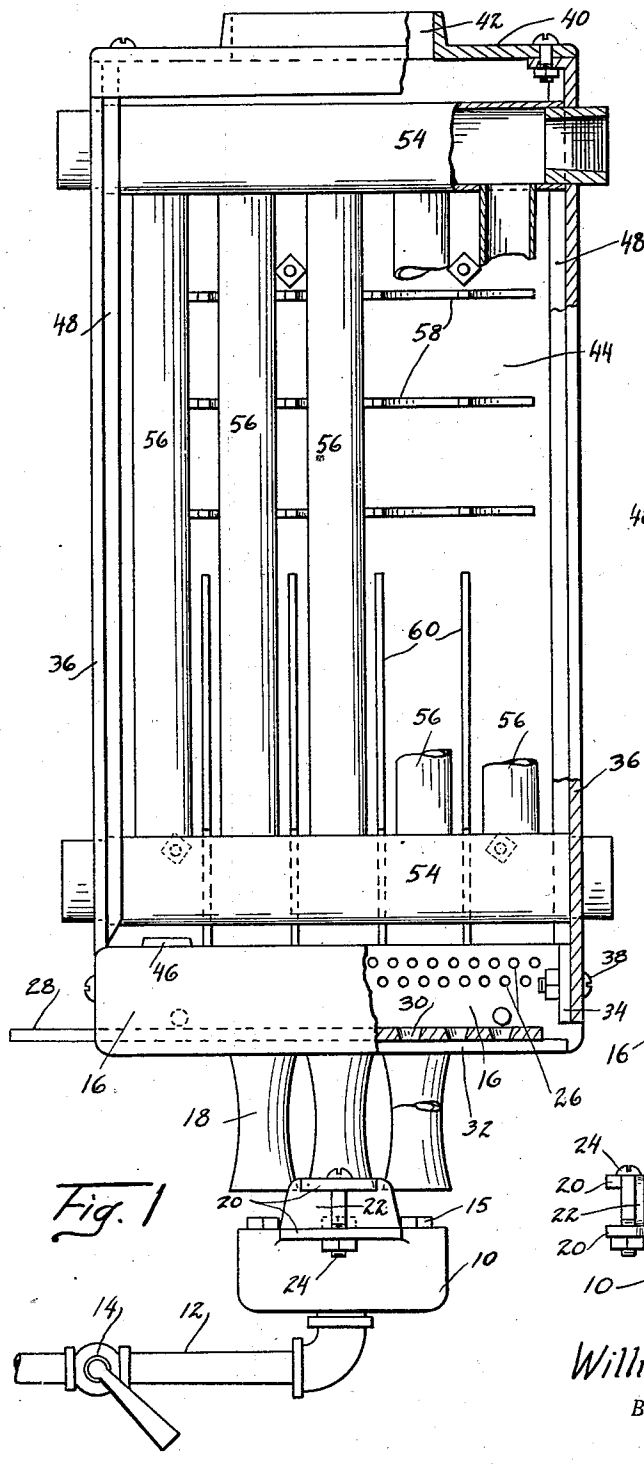


Fig. 1

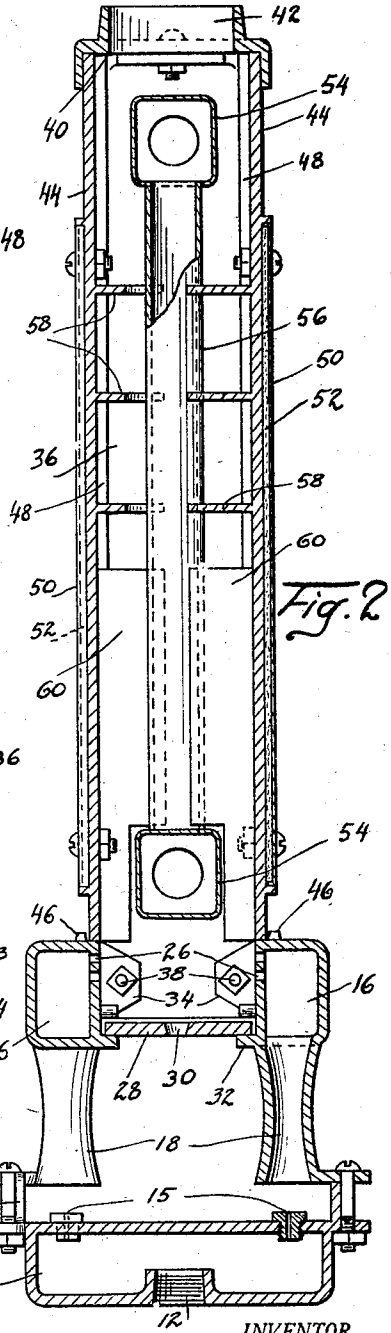


Fig. 2

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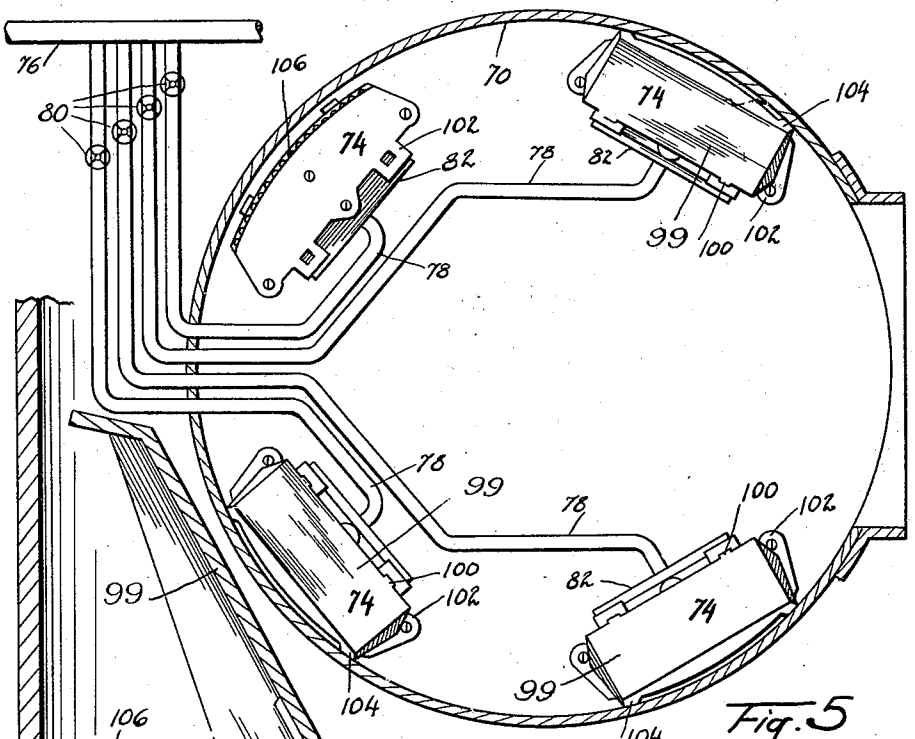


Fig. 5

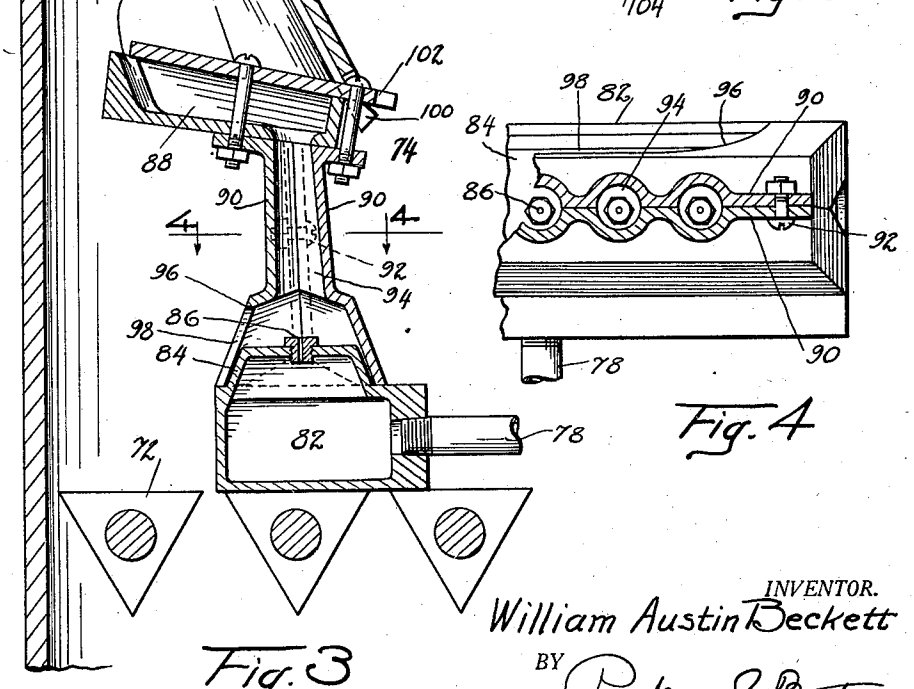


Fig. 4

Fig. 3

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GAS BURNING APPARATUS

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Fig. 6

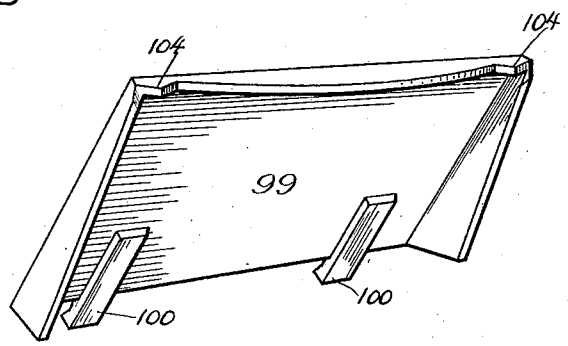



Fig. 7

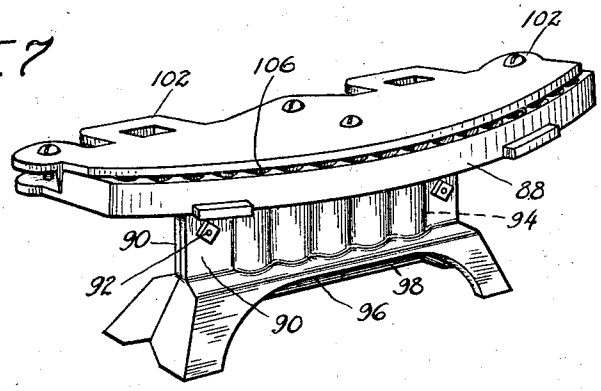
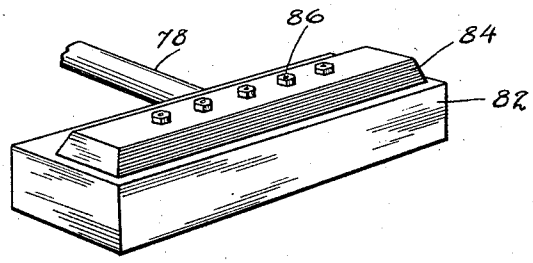



Fig. 8

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# UNITED STATES PATENT OFFICE

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## GAS BURNING APPARATUS

Application filed March 24, 1930. Serial No. 438,379.

My invention relates to improvements in gas burners adapted to employ either natural or manufactured gas and arranged and constructed to accomplish substantially complete combustion of the gas with the maximum efficiency upon the minimum use of fuel.

One particular and important embodiment relates to a combined gas burner and water heater. Another particular and important embodiment relates to the combination of my improved gas burner with the conventional furnace normally adapted for burning coal.

An object of my invention is the provision of a gas burner which achieves a high degree of efficiency and produces substantially complete combustion free from the collection of a deposit, in combination with heating mechanism such as a water heater or the fire pot of a furnace. The heater and combustion chamber are so relatively arranged that the heat is most effectively used and developed to be applied to the heater.

Another object is the provision of a combined gas burner and water heater of simple design, inexpensive construction, and high efficiency which is so put together as to be readily disassembled for cleaning purposes or substitution of various heating elements.

Another object is the provision in a furnace of conventional design of an adaptation of my improved burner, which effectively heats the furnace wall as desired, and wherein a plurality of gas burners may be supplied in individually controlled units.

A meritorious characteristic of my improved gas burner is that I provide a manifold which receives gas fuel through a suitably controlled intake and discharges the same through a plurality of minute nozzles, in combination with a mixing chamber which receives the fuel mixture through a series of Venturi intake tubes corresponding in number to the discharge nozzles in the manifold and arranged directly thereover but spaced therefrom to admit air into the fuel stream to enter the mixing chamber, and wherein the mixing chamber is suitably provided with outlet orifices for the fuel mixture which lead into a combustion chamber.

In one preferred form of my construction embodying a water heater the intake manifold has two spaced apart rows of discharge outlets and the mixing chamber is divided into two sections, one section positioned above one row of outlets and the other section positioned above the other row of outlets. Each section is spaced above the manifold and is provided with a series of tubular intake elements corresponding in number to the discharge outlets of the manifold and arranged directly thereover but spaced therefrom to receive the fuel therefrom and to establish a suction to intake air with the fuel.

The combustion chamber or space is arranged between the two sections of the mixing chamber and each section has fuel mixture discharge outlets leading into the combustion chamber space and opening toward the other section and the burning fuel jets resulting therefrom serve to heat the opposite section. In the water heater embodiment, the heating element, here shown in the form of a series of upright water tubes, is positioned directly above the combustion chamber space and the enclosure about said heating element rises upwardly from the two sections of the mixing chamber.

In the furnace embodiment, a plurality of individually controlled segmental gas burners are arranged in spaced apart relationship circumferentially around the circular wall of the fire pot in the conventional furnace, whether steam or hot air, and these may be supported upon the usual grate bars. These burners do not interfere with the use of coal on the grate bars in the ordinary manner. The products of combustion are projected against the wall of the fire pot. The mixing chamber of each burner becomes very hot due to its proximity to the combustion zone. Gas fuel mixed with air is drawn upwardly through the intake conduit openings into the mixing chamber and this mixture highly heated is discharged into the combustion space.

Other important features and advantages of my invention will appear from the following description, appended claims, and accompanying drawings wherein:

Fig. 1 illustrates a side elevation, partly

broken away, of a structure embodying my invention,

Fig. 2 illustrates a view taken at right angles to the view of Fig. 1 and showing a section through the structure shown in section in Fig. 1,

Fig. 3 illustrates a fragmentary sectional view through a furnace fire pot with one of my improved burners adapted for furnace use installed therein,

Fig. 4 is a horizontal cross section taken on the line 4—4 of Fig. 3,

Fig. 5 is a horizontal sectional view through a furnace fire pot showing a plurality of my individually controlled burner units arranged circumferentially therein, and the baffle plate removed from one unit.

Figs. 6, 7, and 8 are perspectives of the baffle plate, mixing chamber and manifold, respectively, of my improved burner separated from each other.

In the embodiment shown in Figs. 1 and 2 the burner proper comprises a manifold 10 having an inlet 12 provided with a control valve 14 through which gas fuel enters the manifold. This manifold is provided with two rows of discharge apertures spaced apart as indicated in Fig. 2 and comprising a series of nozzles 15 having minute outlet openings. In the views here shown each row consists of three nozzle elements.

The mixing chamber here shown consists of two sections each indicated by the numeral 16 and each provided with a series of Venturi tube intake elements 18. A tubular intake element 18 is provided for each discharge nozzle 15 and the mixing chamber sections are supported so that the tubular intakes are positioned above the discharge nozzles and in Figs. 1 and 2 the mixing chamber sections and the manifold are shown as provided with flanges 20 between which are positioned spacer elements 22 and the assembly is held together by bolts 24.

The combustion chamber space or zone is between the two sections 16 of the mixing chamber and the fuel mixture enters this space through discharge orifices 26, a plurality of which are provided in the opposite faces of these mixing chamber sections. Auxiliary air is permitted to enter the combustion chamber space in any amount desired through the use of the perforated slide valve plate 28 which has apertures 30 arranged therealong. This slide valve is disposed to travel over flanges 32 formed on the opposite faces of the mixing chamber sections 16.

The mixing chamber sections are provided at the ends with ears or flanges 34 which extend partially across the combustion chamber space as indicated in Fig. 2 and end plates 36 are secured thereto by bolts 38 and extend upwardly therefrom to support a top plate 40 which has an outlet 42 for the products of combustion and forms with the side plates 44 an enclosure about one or more heating elements. The two side plates are removable and are merely inserted at the top underneath the side flanges formed on the top plate 40 and on the bottom inside of ears 46 formed on the mixing chamber sections and rest against flanges 48 formed on the inner opposite faces of the end plates 36. Each side plate is here shown as having a removable finish plate 50 on the outside and an asbestos sheet 52 positioned between the finish plate and the body portion of the plate 44.

The heating element is here indicated as comprising upper and lower header elements 54 communicating with each other through vertical water tubes 56. The side plates are shown as provided with baffle elements 58 which partially embrace the water tubes and with heat retaining vertical fins 60 extending between the water tubes.

In the operation of the structure the gas fuel is discharged through the nozzles 15 from the manifold and passes upwardly through the intake tubes 18 into the two sections of the mixing chamber and is there mixed with air which is taken in through the tubes 18 and this fuel mixture discharges into the combustion chamber space between the two sections of the mixing chamber and additional air is admitted into such space through manipulation of the slide valve 28 and the products of combustion pass upwardly into the enclosure formed by the end and side walls heretofore described to be suitably exhausted. The mixing chamber sections become substantially red hot during combustion and the fins 60 likewise become very hot and the combustion operation is thorough and complete and a high degree of efficiency is attained. It will be apparent that though a water tube heating element is here shown that it would be possible to employ an air heating element if desired.

In the embodiment of my invention for furnace use the circular wall of the fire pot is indicated at 70 and the usual grate bars at 72, and in Fig. 5 I have shown a plurality of my improved gas burner units located in substantially spaced apart relationship and supported on the grate bars 72. Four units are here shown and each unit indicated in the assembly at 74 is connected with a gas supply pipe 76 through an individual inlet pipe 78 which is individually controlled through valves 80.

Each gas burner unit comprises an intake manifold 82 having an upwardly extending ridge portion 84 which is provided with a plurality of minute fuel discharge nozzles 86.

Positioned above the manifold is a mixing chamber. The mixing chamber comprises a mixing chamber portion proper indicated as 88 and which communicates with the manifold to receive fuel therefrom through a portion formed by two complementary castings

90 held together by bolts 92 and adapted, as shown in Figs. 3 and 4, to straddle the ridge 84 of the manifold to be removably supported on the manifold. These two castings 90 when coupled together provide a series of tubular passageways 94, one for each discharge nozzle of the manifold positioned thereabove to receive fuel therefrom and that casting which is opposite the furnace wall 70 is cut away as at 96 providing an air inlet 98 wherein air is drawn to enter the fuel stream to pass upwardly through the passageways 94 into the mixing chamber 88.

The mixing chamber supports a baffle plate 99 which is provided with two prongs, or lugs, 100 that extend through apertures provided in the top wall of the mixing chamber to support the baffle plate and is provided with wings 102 at the ends and with lugs, or projections, 104 one at each end extending toward the wall of the furnace to support the baffle plate thereagainst. The baffle plate has an upper margin which is curved as shown in Fig. 5 of the drawings but is spaced from the furnace wall. This baffle plate is movably supported as described upon the mixing chamber so that it may be taken off to facilitate cleaning of the discharge nozzles of the mixing chamber.

The mixing chamber has a curved face arranged opposite the wall of the furnace and a series of discharge nozzles 106 through which the fuel mixture is discharged toward the wall of the furnace and into the space between the baffle plate and the furnace wall. It is deflected by the baffle plate toward the furnace wall to maintain the same in a highly heated condition.

In a construction of this type it is apparent that each burner may be operated individually and apart from every other burner so that only that amount of fuel need be used depending upon the amount of heat desired to be produced and that that portion of the furnace wall which is heated will be highly heated and the combustion will be substantially complete.

The fuel is drawn into the mixing chamber through the tubular intakes and mixed with air entering through the inlet 98 which is also drawn upwardly into the mixing chamber and the highly heated condition of the mixing chamber facilitates this operation. The mixing chamber becomes very hot during the function of the burner and the resulting combustion is highly efficient.

The burner unit is here shown as supported on the grate bars spaced from the furnace wall and there is an air inlet through the grate bars between the manifold and the furnace wall.

In Figs. 6, 7, and 8 my improved burner is shown in its three separate parts which assembled comprise the unit. The manifold shown in Fig. 8 supports the mixing chamber shown in Fig. 7 and the mixing chamber in turn supports the baffle plate shown in Fig. 6. The mixing chamber is removably mounted upon the manifold and the lower forked portion straddles the ridge on the upper face of the manifold to position itself thereon. The baffle plate has lugs which are received in recesses formed adjacent to the rear edge of the mixing chamber in its upper face and is therefore removably supported upon the mixing chamber. This type of construction facilitates the assembling and disassembling of the unit which makes the cleaning of the same more easy.

It is apparent that the air which rises up through the grate bars and passes along the furnace wall and over the manifold and mixing chamber becomes very hot before it enters the combustion space proper and it is obvious that the air which enters the fuel stream and is drawn up into the mixing chamber with the fuel is, together with the fuel, superheated to a high degree before it is discharged from the mixing chamber into the combustion space. It is likewise apparent that the wall of the furnace or fire pot is rapidly heated to a high degree at the combustion zone and that the efficiency of my combined burner and heater is very high.

What I claim:

1. In combination with a fire pot of a conventional furnace provided with grate bars, a plurality of individual gas burner units having individual fuel inlets individually controlled supported upon the grate bars in circumferentially spaced apart relationship about the fire pot, each unit comprising an intake manifold provided with a gas fuel inlet and with a plurality of minute fuel discharge nozzles, a mixing chamber positioned spaced above said manifold and having a plurality of tubular intakes, one intake for each nozzle of the manifold positioned spaced above said nozzle to admit air into the fuel stream, said mixing chamber provided with fuel mixture discharge nozzles adapted to direct the fuel mixture toward the wall of the furnace.

2. In combination with a fire pot of a conventional furnace provided with grate bars, a plurality of individual gas burner units having individual fuel inlets individually controlled supported upon the grate bars in circumferentially spaced apart relationship about the fire pot, each unit having an intake manifold provided with a gas fuel inlet and with a plurality of minute fuel discharge nozzles, a mixing chamber positioned spaced above said manifold and having a plurality of tubular intakes, one intake for each nozzle of the manifold positioned spaced above said nozzle to admit air into the fuel stream, a baffle plate extending upwardly from the mixing chamber projecting toward the furnace wall, said mixing chamber provided with fuel mixture discharge nozzles

adapted to direct the fuel mixture toward the furnace wall into the space between the furnace wall and the baffle plate.

3. In combination with a fire pot of a conventional furnace, a plurality of individual gas burner units arranged in circumferentially spaced apart relationship thereabout adjacent to the fire pot wall, each burner unit having a manifold provided with an individual fuel inlet individually controlled, said manifold provided with a plurality of fuel discharge nozzles, a mixing chamber positioned above the manifold having an arcuate face arranged opposite but spaced from the fire pot wall, said mixing chamber provided with a tubular intake extending upwardly from each nozzle of the intake manifold but spaced therefrom to admit air into the fuel stream, a baffle plate for each mixing chamber extending upwardly therefrom toward the fire pot wall supported at its upper end thereby but spaced therefrom.

4. In combination with a fire pot of a conventional furnace, a plurality of individual gas burner units arranged in circumferentially spaced apart relationship thereabout adjacent to the fire pot wall, each burner unit having a manifold provided with an individual fuel inlet individually controlled, said manifold provided with an upwardly extending ridge having a plurality of minute discharge nozzles, a mixing chamber having a part adapted to removably straddle the ridge of the manifold to support the mixing chamber thereupon and having a plurality of tubular intakes, one for each discharged nozzle of the manifold arranged spaced thereabout and extending upwardly therefrom, a baffle plate removably supported on the mixing chamber to extend upwardly therefrom toward the fire pot wall supported at its upper end thereagainst but spaced therefrom, said mixing chamber having an arcuate face arranged opposite but spaced from the fire pot wall and provided with a plurality of fuel mixture discharge nozzles adapted to project the fuel mixture into the space between the baffle plate and the fire pot wall, said mixing chamber having an air inlet into that portion adjacent to the lower end of the tubular intakes.

5. A gas burner comprising, in combination, a manifold having an inlet and a crown portion provided with a plurality of outlets, a mixing chamber having a horizontal portion provided with fuel discharge outlets and a vertical portion consisting of grooved complementary plates secured together to form tubular depending inlets into the mixing chamber, said plates flared apart at their base to straddle the crown of the manifold to removably support the mixing chamber over the manifold with the tubular inlets of the mixing chamber surmounting the outlets of the manifold.

6. A gas burner comprising, in combination, a manifold having an inlet and a crown portion provided with a plurality of outlets, a mixing chamber supported above said manifold by complementary vertically grooved plates secured together and forming tubular passageways leading from the outlets of the manifold into the mixing chamber, said plates seated upon said manifold upon opposite sides of the crown to support the mixing chamber thereabove.

7. A gas burner comprising, in combination, a manifold having an inlet and a crown portion provided with a plurality of outlets and an angular mixing chamber having a vertical portion provided with a plurality of tubular passageways one for each outlet of the manifold and a horizontal portion into which the tubular passageways lead, said horizontal portion having a plurality of outlets, and said vertical portion being adapted to straddle the crown of the manifold to be supported thereover.

In testimony whereof, I, WILLIAM AUSTIN BECKETT, sign this specification.

WILLIAM AUSTIN BECKETT.