Sept. 30, 1958 G. W. JENSEN 2,854,069

GAS BURNER CONSTRUCTION

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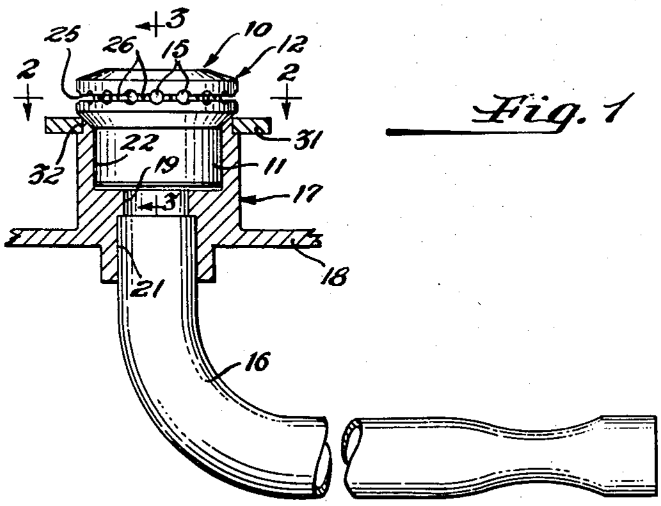
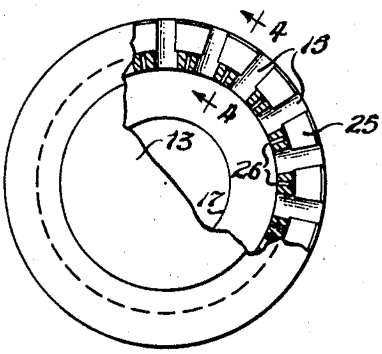


Fig. 1

Fig. 2



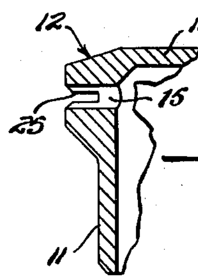


Fig. 3

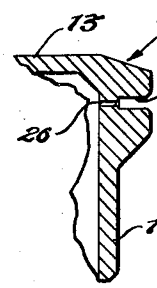


Fig. 4

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GAS BURNER CONSTRUCTION

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4 Claims. (Cl. 158—116)

This invention relates to gas burners and particularly to a top burner for a gas range or stove.

It is a desideratum in gas burners for stoves or ranges to provide a burner which is operative over a wide range from very low heat outputs to relatively high heat outputs so that a single burner may provide the entire range of cooking temperatures necessary for all types of cooking operations. The minimum gas which a burner will efficiently consume is dependent on the number and spacing of the main burner ports. A small number of burner ports spaced relatively close together will burn very low quantities of gas and if the number of ports is increased, the minimum flow of gas to the burner must be correspondingly increased to maintain a minimum gas flow from each burner port sufficient to sustain combustion thereat. If the spacing of the ports is increased, a problem is encountered in igniting each of the main burner ports from an adjacent burner port.

Small top burners have heretofore been provided to permit burning of relatively small quantities of gas for low temperature operations. However, such burners have not been entirely satisfactory for also burning large quantities of gas since, at high rates of flow of gas to the burner, the gas issuing from the relatively few main ports will flow at a velocity which exceeds the velocity of flame propagation. Under these conditions, the flames at the main burner ports tend to move away from the main burner to a point at which the velocity of the gas stream equals the velocity of flame propagation of the gas mixture. This produces an unstable flame which is easily extinguished. In order to overcome this difficulty, it has heretofore been proposed to utilize dual burners and a dual control valve therefor arranged so that only the small burner operates at low heat outputs and both burners operate at high heat outputs. This, however, greatly increases the complexity and cost of the burners and valves for a stove or range and is therefore not completely satisfactory.

An important object of this invention is to provide a novel single burner which is operative over the entire range of temperatures required for top burner cooking operations, from very low heat outputs to relatively high heat outputs.

Another object of this invention is to provide a burner construction having a groove formed in the periphery thereof and communicating with the main burner ports to spread the gas between the main burner ports at low heat outputs to thereby facilitate burning of very small quantities of gas which issue from the main burner.

Another object of this invention is to provide a burner having a groove formed in the periphery thereof communicating with each of the main burner ports and having auxiliary burner ports located intermediate the main burner ports for supplying a restricted flow of gas to the groove when the gas issues from the main burner ports at a high velocity to thereby maintain a flame at the periphery of the burner for igniting and for sustaining combustion of the several separate gas streams issuing from the main burner ports.

These, together with various ancillary objects and advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in connection with the accompanying drawings wherein:

Figure 1 is a side elevational view of the burner with parts shown in section to illustrate details of construction;

Fig. 2 is a top plan view of the burner partially broken away and shown in section along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary vertical sectional view taken on the plane 3—3 of Fig. 1; and

Fig. 4 is a fragmentary vertical sectional view taken on the plane 4—4 of Fig. 2.

The burner, designated generally by the numeral **10** is adapted primarily for use as a top burner in a gas stove, and comprises an annular body including a mounting sleeve **11**, an enlarged head **12** formed on the upper end of the mounting sleeve and extending radially outward therefrom, and a top wall **13** closing the upper end of the body. The body is formed with a relatively small outer diameter and has a plurality of radially extending main burner ports **15** formed in the head **12**.

Any suitable means may be provided for connecting the burner **10** to the mixer tube **16** and, as shown, there is provided a mounting base **17** having outwardly extending legs **18** adapted to be supported on the stove. A passage **19** extends upwardly through the base and is counterbored at **21** to receive the end of the mixer tube **16**. A counterbore **22** is formed at the opposite end of the passage and snugly receives the sleeve **11** on the burner. Gas is supplied to the burner under the control of a valve (not shown) of conventional construction and preferably of the type referred to as a constant velocity valve. In this type of valve, the orifice opening is varied to regulate the quantity of gas fed into the mixer while maintaining the velocity of the gas flow substantially constant to maintaining the percentage of primary air in the gas mixture substantially constant over the entire range of flows through the valve.

The number of main burner ports **15** utilized is the minimum necessary to prevent excessive flow rates through the ports at high heat outputs. In order to burn large quantities of gas in such small burners, it is necessary to utilize a relatively low percentage of primary air, of the order of 40% or less of the air required for complete combustion of the mixture, and to mix adequate secondary air with the gas issuing from the main burner ports to effect complete combustion. The ports **15** are therefore spaced sufficiently far apart to prevent merging of the gas streams for adjacent ports or robbing of the secondary air between the gas streams, so that each gas stream may entrain secondary air from all sides to assure proper combustion.

However, as the spacing between the ports is increased, the problem of igniting the separate main burner ports and maintaining the latter ignited, at very low heat outputs, is correspondingly increased. In accordance with the present invention, provision is made for improving ignition of the gas issuing from the burner ports at low heat outputs, to permit low "turn-down" of the burner, ad for also improving ignition of the gas streams issuing from the main burner ports at high flame levels, to stabilize the flames at the burner. For this purpose there is provided an annular groove **25** which extends completely around the main burner and intersects the main burner ports. The width of the groove is made less than the diameter of the main burner ports, and a plurality of auxiliary burner ports **25** having a diameter smaller than the main burner ports are formed in the head, intermediate each of the main burner ports, and communicate with the base of the groove **25**.

The groove **25** is made just wide enough to permit diffusion of the gas in the groove, at very low heat outputs, between adjacent main burner ports to provide a continuous sheet of flame at the open end of the channel instead of separate gas streams at each of the main burner ports. This greatly facilitates ignition of the gas issuing at each of the main burner ports, from an adjacent burner port at low heat outputs, and thereby permits low "turn-down" of the burner and minimizes the escape of unburned gas at very low heat outputs. The diameter of the flame retaining ports **26** is made small as compared to the diameter of the main ports so as to throttle the flow of gas therethrough at high heat outputs. The flow impedance of these retaining ports is relatively high as compared to the flow impedance of the main ports so that, at low heat outputs, negligible gas flows through the retaining ports into the channel. Consequently, the retaining ports do not materially increase the quantity of gas consumed by the burner, at low heat outputs.

At high heat outputs, the gas issues from the main burner ports in separate streams, at a velocity above the velocity of flame propagation of the gas mixture, and does not diffuse appreciably in the groove. At these high heat outputs, the auxiliary burner ports **26** pass gas into the channel and throttle the flow of gas to a velocity below the velocity of flame propagation. The gas from the auxiliary burner ports diffuses in the groove **25** and spreads between the adjacent main burner ports. The size of the ports is made sufficiently large to fill the groove between the adjacent main burner ports with gas at high flame levels to maintain a flame at the open end of the channel. Since the gas issues from the retaining ports at a velocity below the velocity of flame propagation, the flame produced by this gas at the open end of the channel is stable. This flame ignites the separate gas streams which issue from the main burner ports at a velocity above the velocity of flame propagation and thereby stabilize the flames at the main burner ports adjacent the burner head.

It has been found in practice that the width of the groove must be less than the diameter of the main burner ports and greater than the diameter of the flame retaining ports so as to be effective to both diffuse the gas from the main burner ports at low heat outputs and to also spread the gas from the retaining ports at high heat outputs. The depth of the groove **25** must be greater than the width thereof to assure spreading of the gas in the groove, at both low and high flame levels. In a burner having an outer diameter of 1¼ inches, and eighteen main burner ports formed with a No. 41 D. M. S. drill, it has been found that a groove having a width of .040 inch and a depth of .125 inch provides satisfactory operation at both low flame levels and high flame levels. The flame retaining ports **26** are made appreciably smaller than the width of the groove **25** and are formed with a drill size of from No. 60 D. M. S. to No. 75 D. M. S., depending upon the main port spacing. The larger size retaining ports are utilized with wider main port spacing to assure supplying an adequate quantity of gas at high heat outputs of the channel to fill the same between the main burner ports and provide a steady retaining flame at the opening of the channel.

It is also necessary to have the spacing between the main ports relatively small to effect diffusion of the gas, which issues from the main burner ports at low flow rates, into the groove between the ports to fill the latter and maintain a continuous flame at the open end of the channel. As is apparent from Fig. 2, the spacing between the main burner ports, at the base of the groove **25**, is relatively small, and preferably less than the depth of said groove. In the embodiment shown, the spacing between the ports at the base of the groove is approximately equal to the diameter of the main burner ports.

This provides a relatively short distance through which the gas issuing from the main burner ports must diffuse to fill the groove between the ports so that the burner maintains a continuous flame around the groove at very low heat outputs. However, the spacing between the ports at the open end of the groove is relatively greater, and since the gas issues in separate streams from the main burner ports at high heat outputs, the effective spacing between the ports is relatively greater under these conditions. In this manner, adequate spacing between the main burner ports is provided at high heat outputs to prevent merging of the separate gas streams and yet the effective port spacing at low heat outputs is sufficiently small to enable diffusion between the ports. The flame retaining ports **25** direct the gas issuing therefrom radially into the groove, which gas diffuses in the groove to maintain a flame at the open end of the groove. Thus, the gas streams from the retaining ports do not interfere with the main port streams and disrupt the flow of the latter.

It has been found advantageous, in some applications, to provide a baffle ring **31** spaced below the main burner ports to prevent the upwardly flowing currents of secondary air from blowing the flames away from the burner. Conveniently, the baffle ring may be mounted in a recess **32** formed in the body **17** adjacent its upper end.

I claim:

1. A gas burner comprising a body having a plurality of radially extending main burner ports, said body having vertically spaced upper and lower ledges formed therearound and defining an annular channel extending around said burner and communicating with said main burner ports, said main burner ports being circumferentially spaced apart at the base of said channel a distance less than twice a radial depth of said channel, said channel having a width less than the diameter of said main burner ports and sufficient to permit gas from the main burner ports to spread in the channel at low heat outputs to thereby maintain a continuous flame around the burner, said burner having a plurality of flame retaining ports formed therein and communicating with the base of said channel intermediate adjacent pairs of main burner ports for passing gas into said channel, said flame retaining ports having a diameter less than the width of said channel and large enough to supply a flow of gas to said channel sufficient to fill the channel between adjacent main burner ports at high heat outputs to thereby maintain a flame at the open end of the channel for igniting the gas from the main burner ports.

2. A gas burner comprising a body having a plurality of radially extending main burner ports, said body having vertically spaced upper and lower ledges extending therearound and defining an annular channel extending around said burner and intersecting said ports, said main burner ports being spaced apart at the base of said channel a distance less than the depth of said channel, said channel having a width less than the diameter of said ports and sufficient to permit the gas from said main ports to spread in said channel between adjacent ports at low heat outputs whereby to provide a continuous flame at the open end of the channel, said body having a plurality of flame retaining ports therein each communicating with the base of the channel between a pair of main burner ports, said flame retaining ports being smaller than the width of said channel to throttle the flow of gas into the channel at high heat outputs whereby to maintain a flame at the open end of the channel at high heat outputs to ignite the separate gas streams issuing from the main burner ports.

3. A gas burner comprising a body having a perimetric side wall and defining a chamber therein, said side wall having a plurality of spaced main burner ports formed therein each communicating with said chamber and opening at the outer face of said side wall, said side wall having a groove formed therearound intersecting the

outer ends of said main burner ports and defining spaced horizontally disposed upper and lower ledges extending around the body, said main burner ports being circumferentially spaced apart at the base of said groove a distance less than twice the radial depth of said groove, said ledges being spaced apart a distance less than the diameter of said main burner ports and sufficient to permit the gas from the main burner ports to spread in the channel between adjacent main burner ports when the gas issues from the ports at very low flow rates to thereby provide a continuous flame at the open end of the channel, said side wall having a plurality of flame retaining ports formed therein each communicating with the channel between an adjacent pair of main burner ports, said flame retaining ports being smaller than the width of said channel to throttle the flow of gas into the channel at high heat outputs to a rate of flow appreciably less than the rate of flow of gas through the main burner ports and below the rate of flame propagation of the gas mixture fed to the chamber to thereby provide a flame at the open end of the channel at high heat outputs for igniting the separate gas streams issuing from the main burner ports.

4. The combination of claim 3 wherein said channel has a depth greater than the width thereof.

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