July 11, 1967 C. W. MISNER 3,330,485

GAS BURNER HAVING AN AIR DEFLECTOR PLATE

Filed June 28, 1965 2 Sheets-Sheet 1

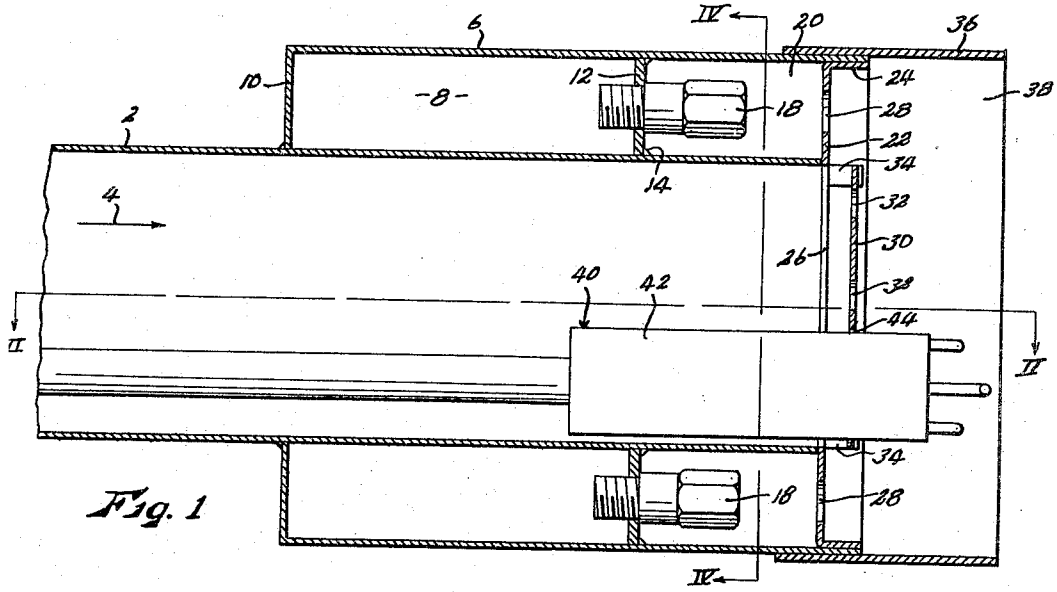


Fig. 1

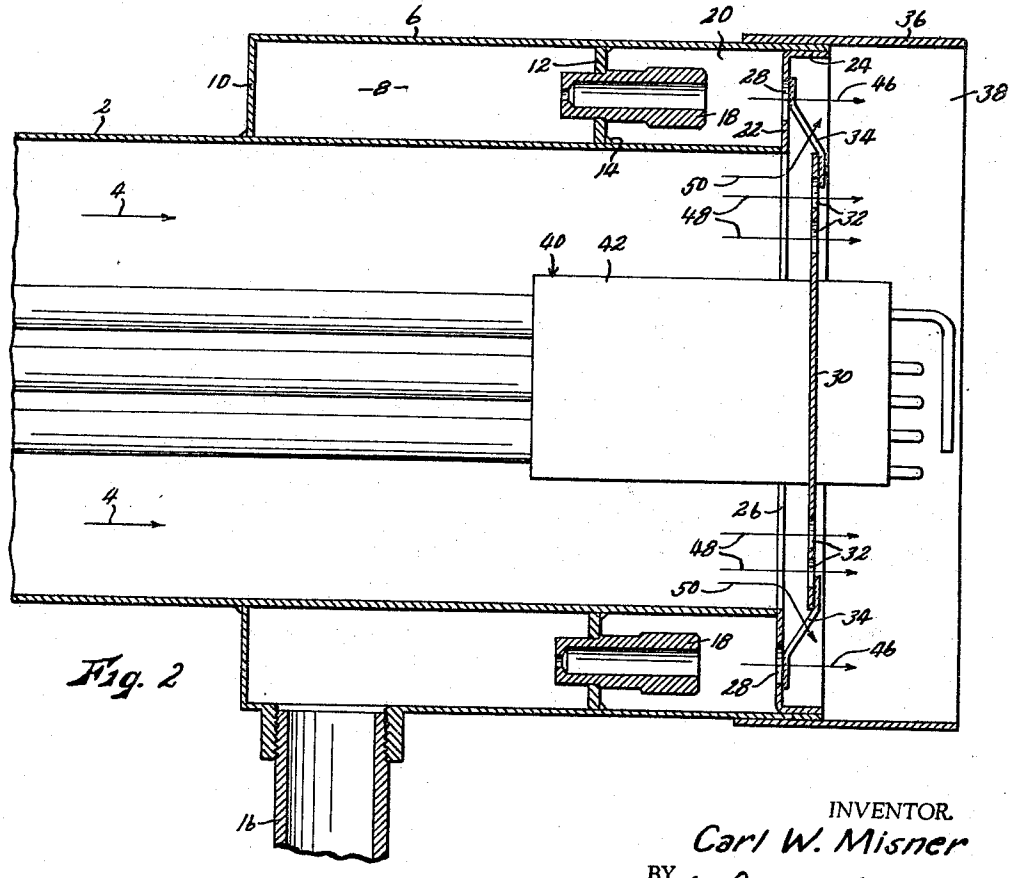


Fig. 2

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GAS BURNER HAVING AN AIR DEFLECTOR PLATE

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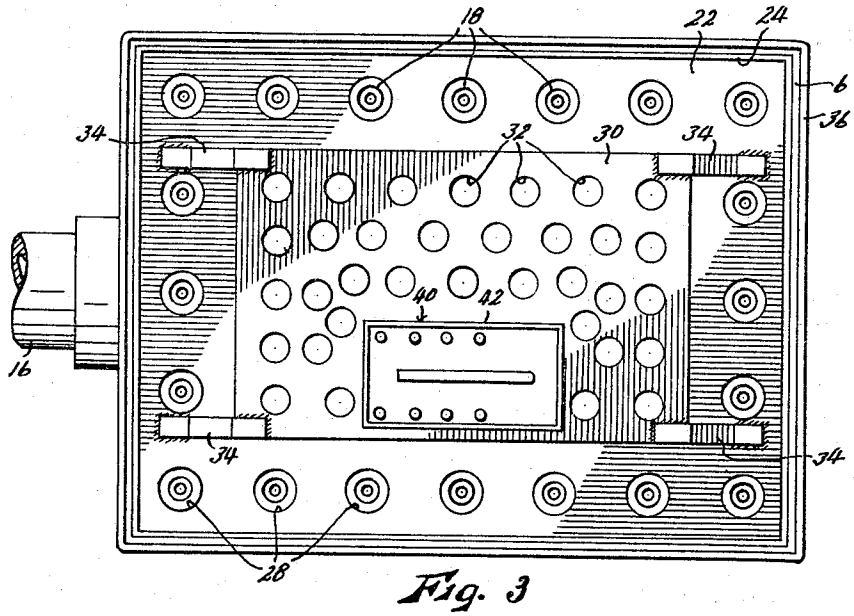


Fig. 3

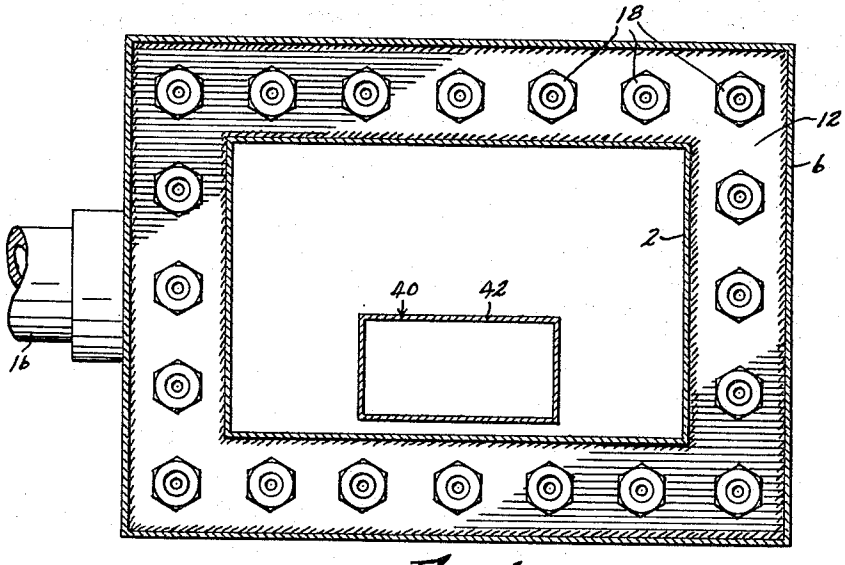


Fig. 4

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United States Patent Office 3,330,485
Patented July 11, 1967

3,330,485

GAS BURNER HAVING AN AIR DEFLECTOR PLATE

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Filed June 28, 1965, Ser. No. 467,230
4 Claims. (Cl. 239—419)

ABSTRACT OF THE DISCLOSURE

This application discloses a gas burner in which jets of pure gas are delivered into a chamber having an open side constituting the face of the burner, and having means for delivering a single supply of air into and through said chamber in such a manner that the major portion of said air does not intermix with the gas within said chamber, and having deflector or baffle means whereby a relatively small proportion of said air is caused to intermix with the gas in the chamber, to form a primary air-gas mixture within said chamber, while the major undeflected portion of the air provides ample secondary air supply for complete combustion outwardly from the burner face.

This invention relates to new and useful improvements in gas burners, and has particular reference to the means for providing proper and efficient intermixture of air and gas within such a burner prior to and during actual combustion.

The overall object of the present invention is the provision of a gas burner wherein the usual two-step intermixture of air and gas, consisting of the premixture of a relatively small quantity of primary air with the gas prior to combustion, and the intermixture of a relatively large quantity of secondary air therewith during combustion, is provided without the usual expensive apparatus commonly employed for this purpose. The most commonly used apparatus for providing this primary-secondary intermixture is perhaps a Venturi tube in the gas line ahead of each gas jet nozzle, said Venturi tube functioning to draw a small quantity of primary air into the gas line and to intermix it with the gas, said air-gas mixture then being ejected through the jet nozzle into a larger supply of secondary air, where combustion occurs. Such two-step intermixture, by whatever means provided, is generally accepted as necessary for efficient combustion. Various types of "single-mix" burners have heretofore been produced, in which the nozzle jets deliver pure gas into a zone of air in which the entire mixing process is supposed to occur in a single operation. However, while structurally economical, such "single-mix" burners have been found to be of generally low efficiency, due to poor and incomplete intermixture of the air and gas at the burner face where combustion commences. Such incomplete intermixture results in poor and incomplete combustion, as reflected by unduly high concentration of carbon monoxide in the gaseous products of combustion, and also usually causes fluctuation or pulsation of the flame alternately toward and away from the burner face. Depending on its frequency and intensity, such pulsation may simply result in an annoying fluttering noise, or may cause a structurally destructive pounding vibration in the burner itself. The burner as contemplated by the present

invention has the advantages of economy of a single-mix burner, while at the same time providing a two-step primary-secondary intermixture of air and gas leading to highly efficient, quiet combustion.

Generally, this object is accomplished by the provision of a gas burner in which jets of pure gas are delivered into a chamber having an open side constituting the face of the burner, and having means for delivering a single supply of air into and through said chamber in such a manner that the major portion of said air does not intermix with the gas within said chamber, and having deflector or baffle means whereby a relatively small proportion of said air is caused to intermix with the gas in the chamber. Said deflected air portion may be termed primary air, intermixture thereof with the gas occurring within the chamber, while the major undeflected portion of the air provides ample secondary air supply for complete combustion outwardly from the burner face.

Other objects are extreme simplicity and economy of construction, and efficiency and dependability of operation.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the accompanying drawing, wherein:

FIG. 1 is a longitudinal vertical sectional view through the head portion of a gas burner embodying the present invention, with parts left in elevation,

FIG. 2 is a sectional view taken on line II—II of FIG. 1, with parts left in elevation,

FIG. 3 is a front elevational view of the burner, and

FIG. 4 is a sectional view taken on line IV—IV of FIG. 1, with parts omitted.

Like reference numerals apply to similar parts throughout the several views, and the numeral **2** applies to the air blast tube of the burner, said blast tube being disposed horizontally, of rectangular cross-sectional contour, and being adapted to be interconnected at its rearward end to a blower or the like operable to force air therethrough toward its open forward end, in the direction of arrows **4** in FIGS. 1 and 2. The specific details of said blower, however, form no part of the present invention, and said blower is therefore not shown. Surrounding the forward end portion of the blast tube is a rectangular housing **6**, said housing having larger dimensions than said blast tube whereby to form a gas chamber **8** therebetween, and extending slightly forwardly from the open end of said blast tube. The rearward end of chamber **8** is closed by end wall **10**, and the forward end of said chamber is formed by a partition wall **12** disposed at right angles to the burner axis and filling the space between the blast tube and housing **6** and being joined to these members as by a gas-tight weld **14**. Said partition wall is disposed rearwardly from the forward end of the blast tube. Gas enters chamber **8** through a pipe **16** interconnected therewith through housing **6**. The apparatus for regulating and controlling the flow of gas is also common and well known, and is therefore not shown. The partition wall is drilled and tapped to receive a series of gas jet nozzles **18** therein, said nozzles being generally regularly spaced about the periphery of the blast tube and each adapted to direct a jet of gas from chamber **8** forwardly in a direction parallel to the burner axis, into a retention chamber **20** between the blast tube and housing **6**. The exit faces of said nozzles are well behind the forward end of the blast tube.

A retention plate 22 at right angles to the burner axis is disposed in housing 6 ahead of the blast tube and engaging the forward end thereof, said retention plate filling the forward end of housing 6 and having a peripheral flange 24 fitted frictionally into said housing. Said retention plate has a central orifice 26 formed therein of the same size as and coincident with the interior dimensions of blast tube 2, and a small circular hole 28 formed therein in axial alignment with each of gas nozzles 18. Spaced slightly forwardly from retention plate 22 is a deflector plate 30 which is parallel to said retention plate and has a series of holes 32 formed therethrough in generally regularly spaced relation throughout its area. Said deflector plate has generally the same dimensions as, and is coincident with, central aperture 26 of the retention plate, though spaced forwardly therefrom, and is rigidly affixed to said retention plate by a narrow connector bar 34 welded therebetween at each corner thereof.

Also included is an open-ended extension tube 36 telescoped slidably over the forward end of housing 6 and extending forwardly therefrom to form a mixing chamber 38 ahead of the retention-deflector plate assembly but behind the face of the burner as defined by the forward end plane of the extension tube. The axial length of said mixing chamber can of course be adjusted by sliding the extension tube along housing 6. Finally, the burner includes a pilot burner assembly 40 which is elongated and extends longitudinally through blast tube 2, including a housing 42 extending through a closely fitting hole 44 provided therefor in deflector plate 30 (see FIG. 1). Said pilot assembly is operable to ignite the air-gas mixture ahead of the burner in the usual manner, but the specific structural details of said assembly form no part of the present invention, and are therefore not shown.

In operation, it will be seen first that gas flows through nozzles 18 into chamber 20, and thence through holes 28 of retention plate 22 into mixing chamber 38, as indicated by arrows 46 in FIG. 2. Holes 28 are of sufficently small diameter to maintain a slight back pressure of gas in chamber 20, thereby preventing entry of air into said chamber through said holes and preventing combustion therein. This prevents possible "flash-back" of flame to the nozzles, which would be damaging to the nozzles, and could be dangerous as well. As the gas passes from holes 28 through mixing chamber 38, it has a largely streamline flow, being confined principally to the peripheral edge zones of housing extension 36. At the same time, air flowing forwardly through blast tube 2 impinges against deflector plate 30. The holes 32 of said deflector plate are of such combined area that the major portion of the air delivered by the blast tube passes therethrough and forwardly through mixing chamber 38 in a largely streamline flow confined within the "sheath" of gas emanating from holes 28 of the retention plate, without intermixing with said gas, as indicated by arrows 48 in FIG. 2. This air constitutes the secondary air supply, and will remain largely unmixed with the gas for a considerable distance forwardly of the deflector plate, ideally to about the forward end of housing extension 36. However, deflector plate 30 also forms a sufficient restriction to the flow of air therethrough that it builds up a slight static pressure head in the blast tube therebehind, with the result that a minor proportion of the air, instead of passing through holes 32 of the deflector plate with a streamline flow, is deflected laterally outwardly past the edges of said deflector plate, as indicated by arrows 50 in FIG. 2, and is thereby caused to impinge against the jets of gas emerging from holes 28 and to intermix therewith. This deflected air is of course the primary air supply, mixing thereof with the gas occurring during the time the air and gas traverse the axial length of chamber 38.

Thus if deflector plate 30 is properly designed and positioned to divide the air supply into primary and secondary supplies in the proper proportions, and if extension 36 is set at the proper length, the flame will burn quietly from the exit face of the extension tube without pulsation or "popping," and will burn efficiently, as reflected by high CO_2 content and low CO content of the gaseous products of combustion. The design and disposition of the plate 30 as shown has been thoroughly tested and found highly effective in a wide variety of conditions, and is not particularly sensitive, for example, to changes of rate of fuel consumption within normal ranges for a given burner. Also, the adjustment of housing extension 36 is not particularly critical, and can be left at an average setting with good results. However, ideally its outer end face should be at a point at which primary mixture has been completed but before secondary mixture has been accomplished to any substantial degree, so that burning will occur directly from the burner face for quieter operation. Thus the extension setting is somewhat dependent in a given burner, on the rate of fuel consumption and air supply, and better operation can be obtained by lengthening the degree of extension for high fuel consumption rates, and shortening it for low fuel consumption rates.

While a particular embodiment of the invention has been shown and described, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claims.

What is claimed as new, and desired to be protected by Letters Patent is:

1. A gas burner comprising:
   (a) an elongated horizontal blast tube having rearward and forward ends and being adapted to receive air under pressure at the rearward end thereof and to deliver said air through the open forward end thereof,
   (b) a tubular housing disposed coaxially around the forward end portion of said blast tube and extending forwardly therefrom, said housing being closed at its rearward end, open at its forward end, and having a partition wall spaced behind the forward end of the blast tube to form a gas chamber in said housing behind said partition wall,
   (c) means for delivering gas under pressure to said gas chamber,
   (d) a series of gas jet nozzles mounted in said partition wall and operable to direct jets of gas from said gas chamber forwardly past the open end of said blast tube in a direction parallel to the axis of said tube, said nozzles being disposed in spaced relation about the periphery of said blast tube in laterally outwardly spaced relation therefrom, and
   (e) deflector means carried within said housing behind the forward end thereof and in front of the forward end of said blast tube, and operable to deflect a minor portion of the air discharged from said blast tube laterally outwardly to intermix with said jets of gas within said housing.

2. A gas burner as recited in claim 1 wherein said housing is adjustable to vary the degree of extension thereof forwardly from the open end of said blast tube.

3. A gas burner as recited in claim 1 wherein said housing includes a retention chamber disposed intermediate said partition wall and the forward end of said blast tube, and into which gas is discharged by said nozzles, and with the addition of a wall dividing said retention chamber from that portion of the housing extending forwardly from said blast tube, said last named wall having a hole formed therethrough in alignment with each of said nozzles, said holes constituting a slight restriction to the flow of gas therethrough.

4. A gas burner as recited in claim 1 wherein said deflector means comprises a plate disposed normally to the axis of the blast tube and overlying the open end of said blast tube in spaced apart relation therefrom, said

plate being disposed rearwardly of the open forward end of said housing and having a series of perforations formed therethrough.

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