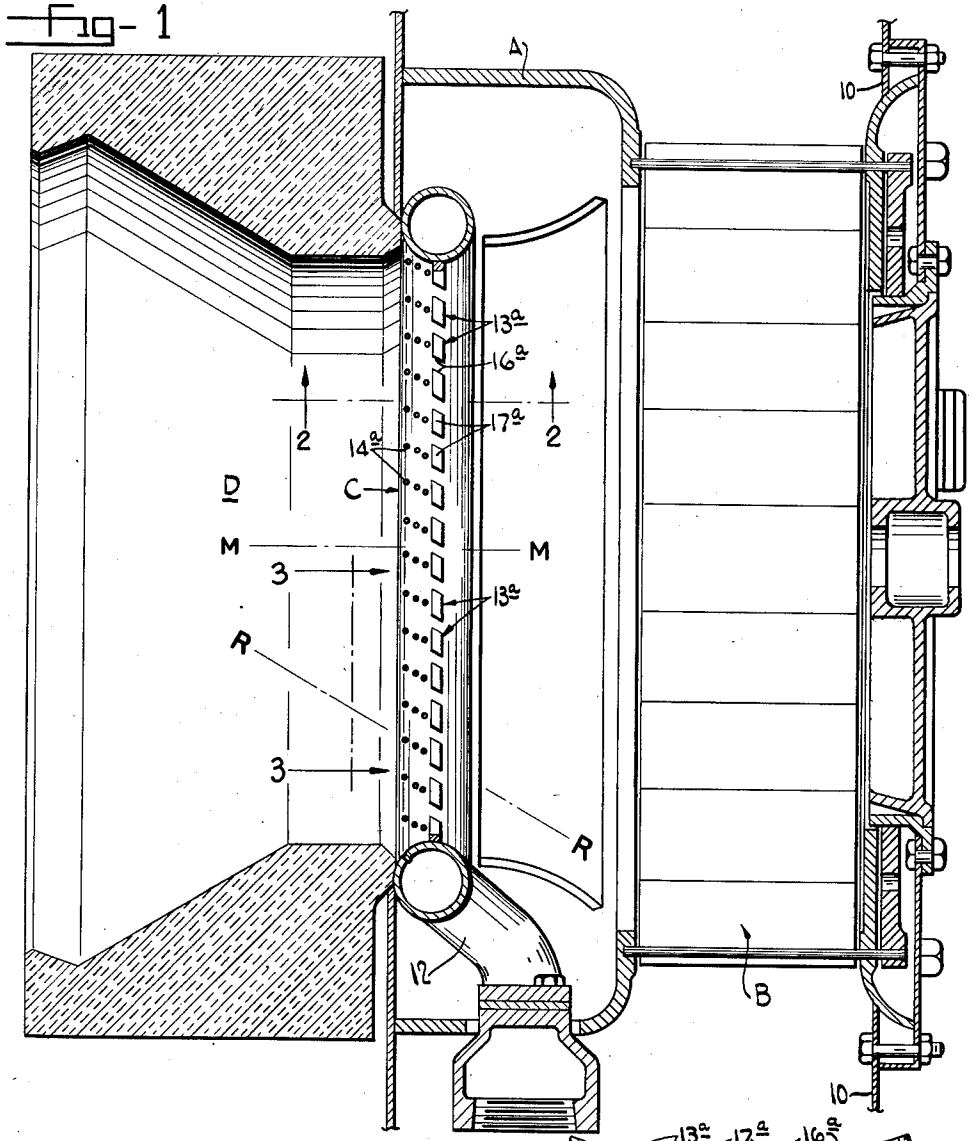
May 13, 1958 T. S. VOORHEIS 2,834,405

FLAME RETENTION MEANS FOR GAS BURNERS

Filed Oct. 22, 1954

Fig- 1



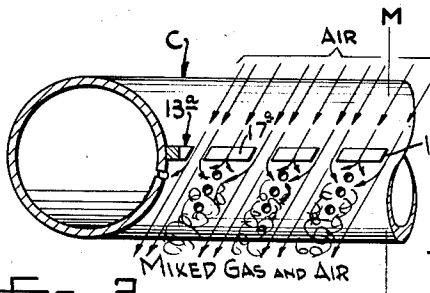


Fig- 2

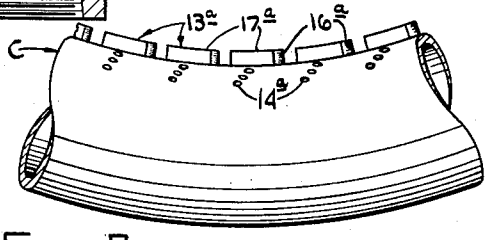


Fig- 3

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United States Patent Office 2,834,405 Patented May 13, 1958

2,834,405

FLAME RETENTION MEANS FOR GAS BURNERS

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Application October 22, 1954, Serial No. 463,922

1 Claim. (Cl. 158—7)

This invention relates generally to the art of gas burners and more particularly to novel flame retention means for gas burners.

In recent years there has been an increased tendency to construct gas and oil furnaces with a greater heat exchange area and with less area made of refractory material than was heretofore practiced.

There are a number of factors which contribute toward the establishment and maintenance of stable flame conditions within a combustion chamber some of which are: the ratio of air to fuel in mixture, the temperature of the chamber, and the nature and composition of the continuous flow or stream of the combined gas and air mixture into the chamber. In this latter regard, it is important to the maintenance of stable flame conditions of forced draft type burners to provide eddy currents or quiet zones of combustible mixture to anchor the flame front. More specifically, it is desirable to maintain eddy currents in the combustion chamber, and particularly adjacent the throat opening thereof, in order to reduce the danger of explosion that might result should the velocity of the air draft into the combustion chamber exceed the rate of propagation of the flame, in which case the flame front would be blown out into the furnace with resultant loss of ignition within the combustion chamber.

The problem of insuring flame retention in the combustion chamber is greater, generally speaking, in the more modern furnaces which characteristically comprise greater heat exchange areas and relatively less refractory surface areas than older types of furnaces. In short, the tendency in recent years has been toward making furnaces with less refractory surface area and with a greater black or heat exchange area than previously regarded as feasible and, this, in turn, accounts for the fact that more modern furnaces are, generally speaking, comparatively cooler than their predecessor counterparts. It is also generally true that the cooler the furnace temperature, the more difficult becomes the problem of maintaining safe and stable conditions of combustion, and hence the more important becomes the reason for providing means that will induce and insure retention of the flame front within the combustion chamber.

In general, the present invention which is illustrated in the drawings which will be described hereinafter in greater detail, comprises, in combination with a gas burner of the type incorporating a combustion chamber and a source of forced air draft to the chamber, an annular gas supply ring or pipe disposed adjacent the throat opening to the chamber between the air source and said chamber. The gas ring is formed with a plurality of gas jet openings spaced circumferentially around the inner periphery of the ring, and a plurality of baffles are provided which are also spaced around the inner circumference of the ring between the jet openings and the air source so as to project into the path of forced draft air flowing through the ring into the combustion chamber. As will more fully appear hereinafter, the arrangement of the

baffles, in the manner briefly above mentioned, establishes a plurality of riffles within the air stream which induce and create desired eddy currents of mixed gas and air. These eddy currents, in turn, establish relatively quiet zones of combustible mixture in which stable combustion can occur, and which function to retain or anchor the flame front within the combustion chamber.

A principal object, therefore, of the present invention is to provide novel means of the character above briefly mentioned and which function to induce and insure retention of the flame front within a gas burner combustion chamber.

Other numerous objects and advantages of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

In the drawings:

Fig. 1 is an enlarged fragmentary longitudinal sectional view of a burner unit incorporating an embodiment of the invention as a component part thereof.

Fig. 2 is an enlarged fragmentary view partially in section taken substantially on line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary view in front elevation of the gas ring unit viewed substantially in the plane of reference line 3—3 of Fig. 1.

Referring now more particularly to the drawings, the gas burner unit therein illustrated is shown as comprising generally a burner housing A, an air register B, a gas supply ring C and a combustion chamber D.

The construction and operation of the burner unit may be considered more or less conventional and, in general, air from the wind box indicated fragmentarily at **10** is directed into chamber D through the louvre type air register heretofore indicated generally at B. Gas is supplied via conduit **12** to ring C and combustion takes place, of course, in combustion chamber D.

Figs. 1, 2 and 3 illustrate an embodiment of the invention in which the specific arrangement of baffles **13a** are shown in conjunction with a preferred type of gas ring assembly in which the gas jet openings are arranged in circumferentially spaced echelon groups indicated at **14a**. This preferred echelon grouping of the jet openings is specifically disclosed and claimed in my copending application filed concurrently herewith and entitled "Gas Burner Ring Construction." It will suffice to remark herein that the primary purpose of arranging the gas jet openings in echelon formation as shown is to insure more rapid, thorough, and efficient mixing between air and gas in burner units of the type illustrated and in which the air is directed into the combustion chamber from a louvre type air register in a generally spiral or swirling motion. In short, the gas jet openings are arranged in echelon in which the lines of bearings (indicated by reference line R—R) of the echelon groups are all disposed parallel to one another but at an oblique angle relative to the axis of opening into the chamber, this being the angle at which the swirling air stream enters the chamber. As explained in my said copending application, the arrangement of the gas jet openings in echelon formation and on lines of bearing corresponding to the directional path of the air stream prevents screening of the air which, in turn, results in several advantages including better mixing between gas and air, reduction in air draft loss due to the screening of the air by the gas streams, and attainment of a more uniform flow of air to the combustion chamber.

In the specific echelon grouping of jet openings disclosed in my said copending application and in the accompanying drawings, each echelon group **14a** is disposed at approximately 15° angular displacement with respect to the medial axis of opening M—M of the com-

bustion chamber and with respect to the diametral plane of the gas ring C. It is appreciated, of course, that the specific angular displacement between the echelon groups and the axis opening to the combustion chamber might vary substantially between various gas burner units in view of the fact that the angular bearing of the echelon groups 14^a is made equal to the angle at which the forced draft air stream is directed into the combustion chamber from the particular type of louvre type air register utilized to control the air flow.

In the specific baffle arrangement shown in Figs. 1, 2 and 3, each of the baffles is formed in the nature of a rhomboid and with its parallel end surfaces 16^a disposed parallel to the lines of bearings of the echelon groups of jet openings 14^a. It is further observed that the spacing and arrangement of the baffles is such that one baffle is interposed between each said echelon group and the discharge end of the air register B. In short, the spacings between the baffles are in registry with the spacings between adjacent echelon groups of jet openings 14^a, although the distance or spacing between adjacent baffles is preferably made substantially less and preferably about one-third of the distance or spacing between adjacent echelon groups 14^a.

In operation, the swirling air from the air register in flowing over and around the end surfaces 16^a and the top surfaces 17^a of the baffles will result in formation of eddy currents which, in turn, establish relatively quiet zones of combustible mixture of gas and air which, as already explained, insures retention of the flame front within the combustion chamber.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be practiced within the spirit of the invention as limited only by the scope of the claim appended hereto.

I claim:

In a gas burner unit of the type having a combustion chamber, a forced draft air source for introducing air to said combustion chamber in a generally swirling motion disposed at an oblique angle relative to the medial axis of the said chamber, an annular gas pipe disposed adjacent the throat opening to said chamber between said chamber and said source through which air from said source passes into said chamber, a plurality of jet openings arranged in circumferentially spaced echelon groups around the inner circumference of said annular gas pipe with said echelon groups disposed along lines of bearing substantially paralleling the said oblique angle at which the swirling air enters said chamber, the improvement comprising: a plurality of baffles spaced circumferentially around the inner circumference of said gas pipe and projecting therefrom generally toward the center of said ring and into the path of swirling air flow from said source to said chamber; each said baffle disposed adjacent a respectively associated echelon group of jet openings and also disposed between and in approximate alignment with a said echelon group and said source to create eddy currents of mixed gas and air flowing into said combustion chamber; each baffle formed substantially rhomboidal in shape defining parallel end surfaces each lying within a plane extending parallel to the said oblique angle at which the swirling air flow enters said chamber.

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