Oct. 2, 1951 A. J. BURKLIN 2,569,514

SINGLE AXIAL PORT GAS BURNER WITH TWO-STAGE MIXING

Filed Oct. 29, 1946

FIG-1-

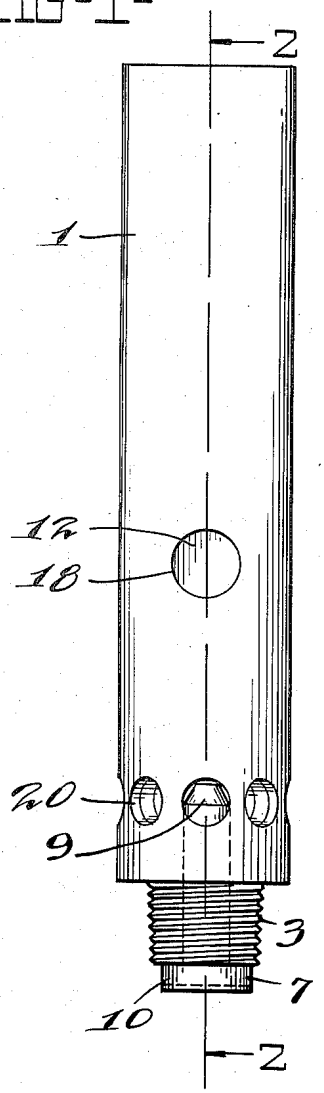
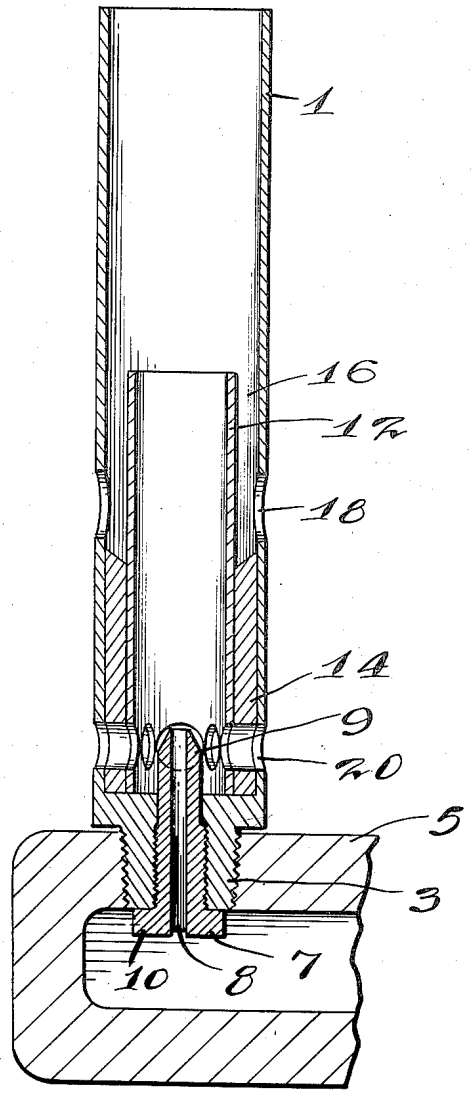


FIG-2-



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2,569,514

SINGLE AXIAL PORT GAS BURNER WITH TWO-STAGE MIXING

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1 Claim. (Cl. 158—99)

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This invention relates to gas burners and has for its primary object to provide a burner capable of efficient operation over a wide range of fuel input.

It has heretofore been proposed to provide a gas burner in which air is mixed with the fuel in more than one stage to assure complete combustion. Such devices have been complicated of construction and have been characterized by an inability to burn fuel over a wide range without flashing back so that combustion takes place within the burner itself. Thus, devices having a plurality of primary air stages have been so constructed that at low fuel input sufficient air has been present to provide a completely combustible mixture after the first mixing stage so that a burner, once lighted and subsequently turned down, would have its flame recede to the point where the combustible mixture first was formed. This point was usually within the burner itself and the presence of flame inside the unit has frequently been sufficient to destroy the burner tube.

It is also known that air can be mixed with gas in proper proportions by porting a tube adjacent the point of gas inlet. Thus, in the well known Bunsen burner, the quantity of primary air entering the lower ports depends, for the most part, on the rate at which gas is supplied to the burner since this volume is directly reflected in a reduction in pressure at the air ports resulting in an inwardly directed flow of air. Secondary air is added at the top of the burner tube and the mixture becomes combustible for the first time at that point. Bunsen burners are restricted in their range of operation, however, as the flame will move away from the burner tube at high level operation and thus become very unstable. At very low level operation, particularly with a carbureted water gas, burners of this type have sufficient air available at the gas spud to support combustion so that flash-back into the tube is possible. In most Bunsen burners, provision is made for reducing the port area through which primary air flows during low level operation. In commercial burners such adjustment is not feasible.

The present invention provides a burner in which primary air is added in successive stages and the volume of the burner increased at each stage in such a manner that at low level the proper velocity of flow is maintained to prevent combustion within the burner. At the same time, high level operation is obtained without danger of the flame becoming unstable.

An important object of the present invention is

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to provide a burner in which the parts are so related mechanically that uniform performance is assured since relative displacement of the parts is highly unlikely.

Still another object of the invention is to provide a burner in which flash-back is prevented at low level operation by the existence of a path of low resistance for a receding flame front which leads the flame away from the burner spud.

Other objects and advantages of the invention will become apparent from the following specification, reference being had to the accompanying drawings in which:

Fig. 1 is a side elevation of a burner embodying the present invention; and Fig. 2 is a central vertical sectional view taken on line 2—2 of Fig. 1.

Referring to the drawings, the burner comprises an elongated outer tube 1 having an externally and internally threaded nipple 3 at its lower end. The external threads engage a gas manifold 5 of any suitable form, while the internal threads receive a burner spud 7 having a central gas passage 8 therethrough. The burner spud 7 has a tapered upper end 9 and a headed lower portion 10 which seats against the base of the nipple 3. It is thus possible to establish an accurate axial disposition of the discharge end of the burner spud since the spud itself can be accurately machined as to length and the parts seated firmly together.

An inner burner tube 12 is provided which is spaced centrally of the outer tube 1 by a cylindrical sleeve 14. Sleeve 14 not only serves to position the parts radially and to hold them in assembled relation, but also completely fills the annular space against the passage of gas. The inner tube 12 extends above the sleeve 14 for a predetermined distance to form an annular air chamber 16 to which air is supplied from ports 18 in the wall of the outer tube. Primary air ports 20 are formed in the lower end of the outer burner tube and extend through sleeve 14 and inner tube 12.

The primary air ports 20 are so disposed that air entering the inner burner tube mixes with gas issuing from the burner spud at a level above the diametral plane of the air orifices. Thus the inner tube 12 forms a relatively restricted first mixing chamber. The quantity of air drawn into the mixture at this point is insufficient to support combustion. Additional air is supplied to the mixture from the second set of primary air ports 18, mixing taking place above the end of the inner burner tube and within the mixing chamber formed by the outer tube 1. The mixture be-

comes combustible, under even the lowest contemplated burning load, with the addition of secondary air at the top of the outer burner tube 1.

As the load decreases, it will be apparent that the velocity of the gas issuing from the burner spud passage 8 is reduced. Thus the reduction of pressure caused by the flow of gas past the primary air ports 20 is likewise reduced, less air is available for mixing with the gas, and the resulting mixture remains non-combustible. The fact that the tip of the spud is at or above the diametral plane of the adjacent air orifices contributes to this result. Further, it will be seen that the upper end of the burner spud restricts the interior of tube 12 and forces the primary air to enter as a relatively smooth, non-turbulent stream around the tapered tip of the spud.

Burners of the Bunsen type have a tendency to flash back and burn at the spud when the gas supply is suddenly reduced unless the primary air ports are cut off. In the present burner it has been found that the receding flame front never enters the inner burner tube 12, but passes around that tube to issue from the second set of primary air ports 18. It is probable that the resistance to flow is less over this path than over the path inside the tube 12, since the resistance in this latter path is largely created by the flow of gas issuing from the spud even though the volume has been reduced. Obviously the flame is extinguished upon passing out of the ports 18, so that no burning takes place within the burner, and no destructive effect is encountered.

While the invention has been disclosed in connection with a specific form and disposition of the parts, it will be apparent that various modifications and changes may be made without departing from the scope of the invention as defined in the appended claims.

What I claim is:

A burner for gaseous fuels having primary air supplied in successive stages which comprises, a pair of concentric tubular members with the inner member radially spaced throughout its length from the outer member and of shorter length than the outer member, a plurality of circumferentially spaced orifices extending through said inner and outer tubular members adjacent one end thereof for initial entry of primary air into the inner tubular member, a third tubular member extending into said inner member from a source of gas to a line substantially at a level above the diametrical plane of said orifices to restrict the orifices and limit the air drawn in through the same upon discharge of gas from said third tubular member, and a second set of primary air orifices in the outer tubular member inwardly removed from the discharge end of said inner tubular member and closed off from said first set of primary air orifices to supply additional primary air into the mixing chamber of the outer tubular member to make the mixture combustible at discharge from the outer tubular member into contact with secondary air.

ADOLF J. BURKLIN.

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