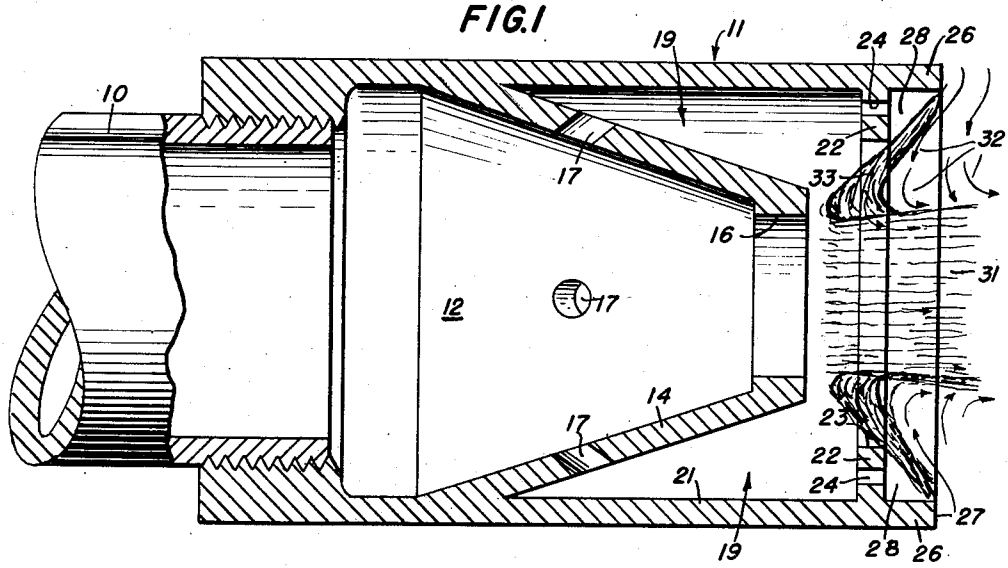
Feb. 25, 1958 R. D. REED 2,824,604

FLAME RETENTION NOZZLES FOR GAS BURNERS

Filed Nov. 8, 1954

FIG.1



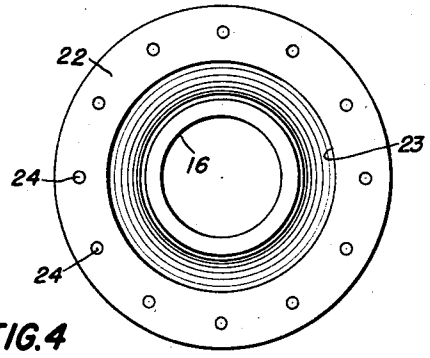


FIG.4

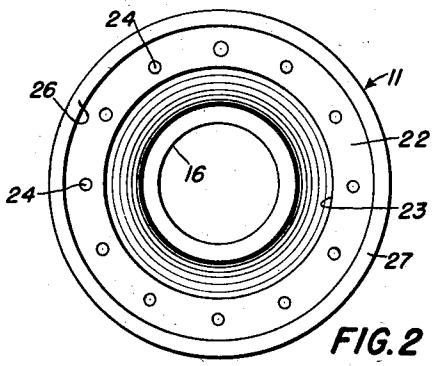


FIG.2

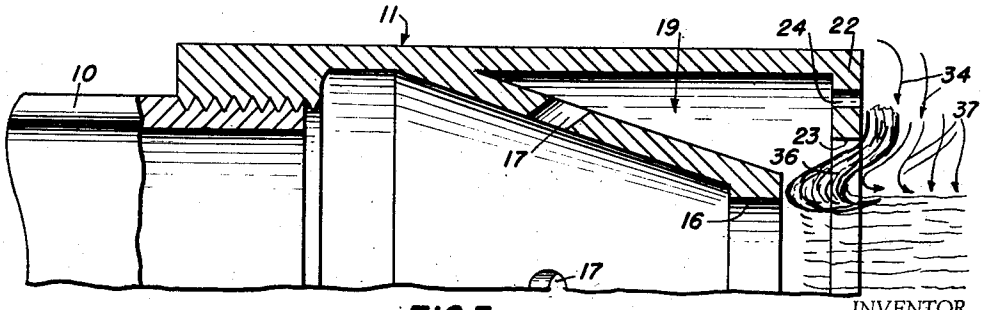


FIG.3

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FLAME RETENTION NOZZLES FOR GAS BURNERS

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Application November 8, 1954, Serial No. 467,398

2 Claims. (Cl. 158—116)

The present invention relates to burner nozzles used for the combustion of gaseous and similar fuels mixed with air and the invention pertains to structural features of the tip portion to prevent inadvertent interruption of combustion at the discharge end of the burner.

In the combustion of gaseous fuel an air-gas mixture is supplied into the nozzle at pressures greater than the pressure into which the fuel mixture is discharged. The air-gas mixture flows from the nozzle because of a drop in pressure from the inner portion of the nozzle to the atmosphere into which the fuel mixture is discharged. The velocity of the stream is proportional to the square root of the difference in pressure between the interior of the nozzle and the pressure of the atmosphere into which the fuel is discharged. As the fuel mixture is discharged the stream sets up a condition of pressure which is less than that of the atmosphere at the periphery of the fuel stream. Thus atmospheric air is drawn into the stream as a result of the low pressure condition surrounding the fuel jet. The low pressure condition is proportional to the velocity of the stream. As the velocity increases the difference in pressure between the periphery of the stream and the atmosphere increases in direct ratio to the velocity of the stream. It is this tendency for the atmosphere surrounding the discharge end of the burner nozzle to rush into the presence of the fuel stream flowing from the burner tip that imposes limitations on the operation of the nozzle. The velocity of the discharge from the tip must not be greater than that at which stable ignition is maintained. The present invention is directed to nozzle structures which provide for stable ignition of the fuel mixture which escapes from the burner tip at greater velocities than have been possible with nozzles of the prior art.

In order to maintain stable ignition of the fuel issuing at the discharge end of the nozzle it is necessary that enough oxygen be present to permit exothermic oxidation of the fuel mixture. There must be enough heat present at or near the point of discharge to elevate the temperature of the stream or the periphery of the stream to the kindling temperature of the fuel being burned. If either of these conditions are not satisfied stable ignition is not obtained. Burner tips of the known types provide suitable quantities of kindling heat until the velocity of discharge draws in a quantity of the atmosphere such that the amount of kindling heat is no longer able to elevate the temperature of the gas-air stream plus the indraft of the atmosphere to the kindling temperature of the fuel gas. When the amount of kindling heat becomes inadequate ignition is lost and combustion is interrupted. Such a condition is hazardous. In apparatus where an aspirator supplies the gas-air mixture to the nozzle and where the amount of air aspirated per unit volume of gas is proportional to the square root of the fuel gas supply pressure the gas supply pressure cannot exceed approximately fourteen pounds because a higher gas pressure causes a greater amount of air to be

inspirated. The greater volume of air per unit volume of gas results in greater velocity of discharge from the nozzle. Thus in the past the burners have provided stable burning and are safe only at gas pressures below about fourteen pounds.

An object of the present invention is to provide means for diverting the secondary air forwardly as it tends to rush radially inwardly over the downstream end of the burner and into the presence of the fuel mixture issuing from the burner nozzle to thereby avoid cooling of the zone around the periphery of the burning fuel mixture to dangerously low temperature levels.

Another object of the invention is to provide means for diverting the inrushing air forwardly of the burner by discharging minor quantities of the fuel mixture forward of the burner after which the fuel turns inwardly and burns to furnish heat immediately surrounding the escaping fuel mixture equal to or in excess of the amount of heat necessary to provide stable burning of the fuel issuing from the main discharge orifice.

A further object of the invention is to provide an axially extending flange structure at the discharge end of the nozzle to provide for diverting the inrushing of air and to provide fuel discharge ports in association with the flange structure for adding minor portions of the fuel mixture to the inrushing air which further diverts the inrushing air and supplies additional heat around fuel mixture issuing through the main discharge port.

A still further object of the invention is to provide ports circumferentially spaced about the main discharge orifice of the nozzle so that the fuel mixture escaping through these ports lengthens the path of air moving into the presence of the fuel mixture escaping through the main discharge orifice and the fuel escaping through the kindling ports burns to add heat to the air moving towards the main discharge jet.

Other objects and features of the invention will be appreciated and become apparent to those skilled in the art as the present disclosure proceeds and upon consideration of the accompanying drawing and the following detailed description wherein several embodiments of the invention are disclosed.

In the drawing:

Fig. 1 is a longitudinal vertical sectional view of a burner exhibiting the invention.

Fig. 2 is an end elevational view of the structure shown in Fig. 1.

Fig. 3 is a fragmentary longitudinal sectional view of a modified burner.

Fig. 4 is an end elevational view of the burner structure shown in Fig. 3.

Referring to the drawing there is shown at **10** a conduit or a portion of an aspirator through which a gas-air mixture is supplied into the burner **11**. The burner head may be provided with internal threads for connection to the forward end of the conduit **10**. The gas-air mixture is supplied into a chamber **12** which is in part defined by a frusto-conical wall **14**. A main discharge orifice **16** is located centrally of the burner at the forward or apex portion of the frusto-conical wall **14** so that the major port of the fuel mixture escapes through the orifice **16**. The frusto-conical wall **14** is provided with a plurality of weep ports **17** so that minor portions of the fuel mixture may escape therethrough to fill the annular chamber **19** provided between the cylindrical wall **21** and the frusto-conical wall **14**. A radially disposed flange **22** extends inward from the cylindrical wall **21** beyond the tip of the orifice **16** and is provided with a central opening **23** which is of larger diameter than the discharge orifice **16**.

The structure thus far described is known in the art

and while being useful is of limited utility for flame retention purposes. The atmospheric air beyond the cylindrical wall **21** rushes radially inwardly and the heat developed near the periphery of the gas-air mixture issuing through the main discharge orifice is subject to considerable quenching which brings about extinguishment of the main flame particularly when the discharge velocity of the fuel mixture through the orifice **16** is at a high rate.

The present invention provides improvements over the prior art and includes the provision of a plurality of kindling ports **24** which are of relatively small diameter and arranged at circumferentially spaced intervals about the inturned flange **22**. The fuel mixture from the annular chamber **19** escapes through the kindling ports **24**. The improvements further include an axially extending flange **26** which projects beyond the inturned flange **22** and may be formed as a continuation of the cylindrical wall **21**. The end edge **27** of the flange **26** is positioned downstream of the flange **22**. The axial extending flange **26** provides a barrier or diversion member for retarding the inrushing air and provides a pocket **28** for accommodating some of the fuel mixture issuing through the kindling ports **24**.

In operation the fuel mixture issuing through the main discharge orifice **16** provides a flame as represented at **31** in Fig. 1. The gas-air mixture escaping through the kindling ports **24** provides a plurality of small jets which diverts the secondary air forwardly of the burner head. The inrushing air moves in the direction of the arrows **32** which is longer and a more indirect path than that of the air when the flange **26** is not present. The fuel mixture also fills the pocket **28** under the flange **26**. The inrushing air carries the fuel mixture from the pocket **28** inwardly towards the tip of the main discharge orifice **16** so that a condition of stable burning exists in area **33**. The burning of the fuel escaping from the ports **24** after turning inward preheats the incoming air. The fuel mixture escaping through the kindling ports **24** tends to divert the secondary air forwardly which in addition to the axial flange **26** serves to retard the admission of cold air to the forward end of the orifice **16** and supplies heat about the periphery of the main discharge stream to maintain kindling thereof.

In the modification shown in Figs. 3 and 4 the axial extending flange **26** is omitted but the inrushing air is diverted outwardly in the annular area as indicated by the arrows **34** by the fuel mixture issuing through the kindling ports **24**. The fuel escaping through these ports burns in the area represented at **36** and inrushing air in general follow the arrows **37**. Stable combustion in the annular area **36** adds additional heat to the periphery of the main discharge fuel stream issuing through the central orifice **16**.

In both forms of the invention the inrushing air is diverted further forwardly of the main discharge orifice **16** and while permitting sufficient oxygen to be supplied about the periphery of the main flame retards the access of air to the zone immediately forward of the tip of the orifice **16** and thus avoids reduction of the temperature at the periphery of the flame to dangerously low levels. In

the embodiment shown in Figs. 1 and 2 the fuel mixture issuing through the kindling ports **24** plus the action of the flange **26** divert the incoming air forwardly. In the modification shown in Figs. 3 and 4 the fuel issuing through the ports **24** diverts the inrushing air forwardly of the nozzle.

While the invention has been described with reference to specific structural features it will be appreciated that changes may be made in the details as well as in the general organization. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What I claim and desire to secure by Letters Patent is:

1. In a burner for gaseous fuel, a burner head having a cylindrical wall, a frusto-conical wall within said cylindrical wall forming an annular chamber therebetween, said frusto-conical wall having a discharge orifice at an apex end thereof with the frusto-conical wall tapering toward said discharge orifice, said frusto-conical wall having weep ports therethrough, an inturned radially disposed flange carried by an end of said cylindrical wall spaced downstream from said discharge orifice and having an opening therein axially aligned with the discharge orifice and of a larger diameter than the discharge orifice, means supplying a mixture of gas and air into the burner head within the frusto-conical wall for discharge through said orifice and through said weep ports into said annular chamber, said inturned flange having kindling ports therethrough arranged axially of the burner head at circumferentially spaced intervals for the escape of the air-gas mixture through said inturned flange adjacent the periphery of the burner head for diverting air downstream of the burner head as it rushes inwardly towards the periphery of the fuel mixture escaping through the discharge orifice.

2. In a burner for gaseous fuel, a burner head having a cylindrical peripheral wall, a frusto-conical wall within said cylindrical wall forming an annular chamber therebetween, said frusto-conical wall having a relatively large discharge orifice at an apex end thereof with the frusto-conical wall tapering toward said discharge orifice, said frusto-conical wall having weep ports therethrough, an inturned radially disposed flange carried by an end of said cylindrical wall spaced downstream beyond said discharge orifice and said apex end and having an opening therein axially aligned with the discharge orifice and of a larger diameter than the discharge orifice, means supplying a mixture of gas and air within the frusto-conical wall for discharge through said orifice and through said weep ports into said annular chamber, said inturned flange having kindling ports extending therethrough at circumferentially spaced intervals for the escape of minor portions of the air-gas mixture through said inturned flange adjacent the periphery of the burner, and a flange forming a continuation of the cylindrical wall extending forwardly of the burner head beyond said inturned flange.

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