VAPOURIZING BURNER FOR PRESSURIZED LIQUID FUELS

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ABSTRACT OF THE DISCLOSURE

Vapourising burner, for pressurized liquid fuels, such as propane, having a series of concentric cylinders, giving a primary combustion zone and at least two secondary air supplies, the rate at which fuel is supplied and burned causing secondary air to be drawn through a first of the secondary air supplies, increase in fuel supply, and combustion rate bringing into operation a further secondary air supply. There is provided a required air-gas ratio over a very wide range of operation. A vapourising coil is wound round the outside of the outermost concentric cylinder. The various stages of secondary air supply also provides for variable shielding of the vapourising coil. At low flame conditions, the reduced shielding by low secondary air flow permits high heat flows to the coil for correct vapourisation. At high flame conditions and high combustion rates, the additional secondary air flow shields the vapouriser coil and prevents overheating and breakdown of the gas.

BACKGROUND OF THE INVENTION

Field of the invention

Vapourising for pressurized liquid fuels such as liquid propane.

Description of the prior art

Vapourising burners are available in which the heat from the flame acts on a vapourising coil, but to ensure satisfactory vapourisation of the fuel at low flame conditions, the burners are provided to form high heat transfer to the coil. Moreover, at high flame conditions too much heat is transferred to the vapourising coil and breakdown of the vapour occurs with the deposit of carbon in the burner orifice. Flame stability is also a source of trouble in present burners. Generally only a single secondary air supply is provided and as this has to meet all variations from low flame conditions to high flame conditions, a compromise in dimensions is necessary, resulting in undesirable variations in the air-gas ratio. At other than the optimum air-gas ratio, the stability of the flame decreases and under extreme flame conditions severe instability occurs.

SUMMARY OF THE INVENTION

The invention provides a vapourising burner for pressurized liquid fuels, such as liquid propane, the burner comprising a plurality of secondary air supplies, the secondary air supplies being brought into effect sequentially as the rate of combustion increases, to reduce variations in actual air-gas ratio, from a desired value, to a minimum, the secondary air supplies also acting as shields for the vapourising coil to prevent overheating of the coil at high combustion rates, but to permit satisfactory heating of the coil at low combustion rates.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a cross-section through a burner assembly on the longitudinal axis thereof;
FIGURE 2 is a cross-section on the line 2—2 of FIGURE 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The burner assembly illustrated in FIGURES 1 and 2 comprises a series of coaxial, concentric, tubular members 10, 11 and 12. Inner tubular member 10 has a tubular extension 13 on its upstream end, which forms a tubular housing for the acceptance of the burner head 14. Intermediate tubular member 11 extends substantially from the upstream extremity of the extension 13 to beyond the end that is the downstream end of inner tubular member 10. An annular member 15 is secured, as by welding, to the upstream ends of the tubular member 11 and the extension 13 to close the annular gap therebetween. The annular member 15 also aids in supporting the tubular member 11 on the extension 13. Holes 16 are formed in the intermediate tubular member 11, spaced a short distance from the upstream end.

Outer tubular member 12 extends from a position slightly downstream of the holes 16, to a position slightly downstream of the downstream end of intermediate tubular member 11. The tubular member 12 is supported on tubular member 11 by rods 17.

A vapourising coil 18 is wound round the circumference of the outer tubular member 12. Liquid fuel under pressure is fed to the downstream end of the coil 18 through pipe 19 from a pressure control valve, not shown. The vapourised fuel is fed from the upstream end of the coil 18 through pipe 20 to the burner head 14. The burner head comprises a tapered bore 21 ending in an ejection orifice 22. From the orifice 22 the vapour is ejected into the mixing chamber 23. In the wall of the mixing chamber is a hole 24, forming a primary air inlet.

The holes 16 in intermediate tubular member 11 form a first secondary air supply inlet. An annular opening 25 is formed between the upstream end of the outer tubular member 12 and the periphery of intermediate tubular member 11, and this annular opening 25 forms a further secondary air supply inlet.

In operation, the vapourised fuel ejected through orifice 22 mixes with primary air drawn in through hole 24, the mixture flowing through mixing chamber 23 and also through inner tubular member 10. Combustion occurs at the end of the inner tubular member 10, the combustion drawing in secondary air through holes 16. At low flame conditions, the combustion draws most of the secondary air in through the holes 16, very little air being drawn in through annular opening 25.

With little flow of air between the intermediate tubular member 11 and outer tubular member 12, heat is transferred across to the vapourising coil very easily to provide sufficient heat for vapourisation.

As the pressure of the fuel supply, and thus the amount of fuel, is increased, combustion extends further from the end of the inner tubular member 10. Increased combustion increases flow through holes 16, and also increases flow through the annular opening 25. This additional secondary air supply assists in maintaining the correct air-gas ratio and stabilizes the flame.

Increase of air flow through the space between intermediate tubular member 11 and outer tubular member 12, shields the vapourising coil 18. Thus, although increased heat is being produced in the unit, the heat actually transferred across to the vapourising coil is maintained at a desirable level.

By the provision of the plurality of secondary air supplies, and by providing for the secondary air supplies to be available at different positions, and by arranging for the secondary air supplies to be brought sequentially into effect on increase in combustion rate, the air-gas ratio can be maintained much closer to optimum at all combustion rates, than in prior apparatus. Furthermore, the plurality of secondary air supplies sequentially brought into effect provides variable shielding of the vapourising
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coil, avoiding overheating or underheating of the coil. An extremely stable flame is obtained and blocking of
the burner orifice by carbon as a result of vapour breakdown, at least substantially reduced.

I claim:

1. Vapourizing burner for pressurized liquid fuels, comprising: a burner head, a plurality of coaxial tubular
members and a vapourizing coil; means for supplying liquid fuel to one end of the coil and for feeding vapour-
ized fuel from the other end of the coil to the burner head, the tubular members spaced apart to form annular
air spaces and comprising inner, intermediate and outer members, each having upstream and downstream ends,
the vapourizing coil wound around the outside of the outer member, the upstream ends of the inner and inter-
mediate members being joined to close off entrance to the annular space therebetween, a series of holes at the
upstream end of the intermediate member forming a first secondary air inlet, the upstream end of the outer member
defining, with the intermediate member, a further secondary air inlet, means mounting the burner head on the
upstream end of the inner member, the burner head in-
cluding an ejection orifice and a primary air inlet down-
stream of the orifice, the downstream ends of the tubular
members extending sequentially, the intermediate member
extending beyond the inner member and the outer mem-
ber extending beyond the intermediate member, whereby,
in operation, combustion of the fuel at low combustion
rates draws air initially through the first secondary air inlet and through the annular space between inner and
intermediate members, and on increased combustion rate
increasingly draws air through said further secondary air
inlet and through the annular space between the inter-
mediate and outer members.

2. A burner as claimed in claim 1, wherein the holes
forming said first secondary air inlet are in the inter-
mediate member and adjacent the upstream end thereof,
the upstream end of the outer member positioned down-
stream of the holes.

3. A burner as claimed in claim 1 including a plurality
of spacing members extending in an axial direction, be-
tween the intermediate and outer members and in con-
tact therewith.

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