(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 145 381**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **84308113.4**

(22) Date of filing: **22.11.84**

(51) Int. Cl.⁴: **F 23 D 14/48**, F 23 D 14/24
// F23D17/00

(30) Priority: **22.11.83 GB 8331127**

(43) Date of publication of application: **19.06.85**
Bulletin 85/25

(84) Designated Contracting States: **DE FR GB IT NL**

(71) Applicant: **Babcock Power Limited, Maypole House 128-132, Borough High Street, London SE1 4YB (GB)**

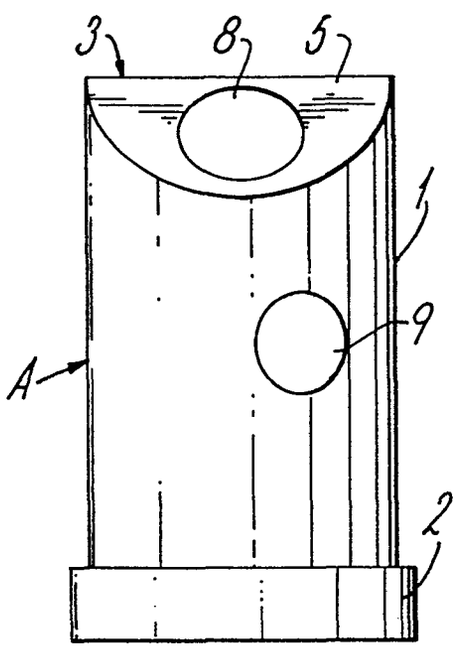
(72) Inventor: **Wharmby, John Stephen, 40 Grosvenor Gardens, Oakwood London N14 4TX (GB)**

(74) Representative: **Sinnett, Richard Albert Edward, Babcock International plc Cleveland House 19 St. James's Square, London SW1Y 4LN (GB)**

(54) Improvements in or relating to burner tips.

(57) The invention provides a gas burner tip A in the form of a cylindrical barrel (1) closed at its outer end except for an opening (8) in an end wall (5) that is oblique to the cylindrical surfaces. The cylindrical surface also contains a further opening (9), smaller than the opening (8).

In a furnace burner, a plurality of similar tips A may be arranged uniformly disposed around a ring past which swirling air is directed. The tips are similarly orientated and the discharge of gas through them is effective to restrain aberrations in the swirl of the air. These tips may be interspersed with other similar tips orientated similarly to each other but differently orientated with respect to the first.



EP 0 145 381 A2

"Improvements in or relating to Burner Tips"

DESCRIPTION

This invention relates to gas burner tips.

There are furnace burner arrangements in which combustion air is discharged in a vortex through a ring of burner tips from which combustion gas is discharged. Frequently, this vortex is unstable in that it precesses about the axis resulting in circumferential variations in air flow. A consequence is that the combination of the gas with air is not regular, resulting in combustion pulsations. If the acoustic frequency of the furnace is such that Rayleigh's criterion is satisfied, then the combustion pulsations may be sustained, leading to excessive furnace vibrations.

The present invention arose from a consideration of this problem and of ways in which more regular combustion might be obtained.

According to the present invention, there is provided a gas burner tip in the form of a cylinder closed at one end except for an opening in an end wall that is oblique to the cylindrical surface and having an opening of smaller area lying wholly in the part of the cylindrical wall that is defined by a diametrical plane across which the end wall lies symmetrically.

An embodiment of the invention will now be described with reference to the accompanying drawings in which

Figure 1 shows a gas burner tip in side view;

Figure 2 shown the burner tip of Figure 1 from above; and

Figure 3 illustrates an end view, from inside the furnace, of a burner mounted at an opening in a furnace wall.

The tip A shown in Figure 1 has a barrel 1 of which the outer diameter is about 27mm. Its length is about 70mm and at the lower end is a mounting flange 2. Centrally, at its upper end, there is a ridge 3 about 8mm wide and flat end walls 4 and 5 slope down symmetrically from the sides of the ridge 3 at about 45^{o}.

In one of the end walls 5 is a circular opening 8 of just over 20mm diameter. A circular opening 9 of smaller diameter, 15mm, is formed in the cylindrical wall of the barrel about half way between the ridge 3 and the top of the flange 2. The diametrical plane of the barrel 1 that contains the centre of the opening 8 is displaced from that which contains the centre of the opening 9 by $22\frac{1}{2}^{o}$. The opening 9 thus lies wholly within the diametrical plane of the barrel 1 that bisects the ridge 3 and across which the end wall 5 lies symmetrically.

Figure 3, shows six burner tips mounted in the opening 10 in the wall of a furnace. The boundary of the opening 10 tapers from a circle 11 in the inner face of the wall to a circle 12 in the outer face. Ourwardly from the outer face of the furnace wall there extends a duct

(not shown) through which air can flow to discharge through the opening 10 with a swirl in the anti-clockwise direction. An oil burner 13 is arranged to discharge centrally through the opening 10, the outlet end of the burner 14 being about mid-way between the faces of the furnace wall.

A group of six gas burner tips A,connected to a common main (not shown) lying outside the furnace, are disposed equi-spaced around a circle that is concentric with the burner 14, the leading ends of the burner tips A lying forward of the oil burner 14 but rearwardly of the inner face of the furnace wall. Three of the tips, A1, are so arranged that gas discharging from the upper opening, 8, is discharged approximately towards the axis, but at a slight angle so that the gas has a swirl in the clockwise direction. Gas discharging from the lower openings 9 will be more oblique to the axis but will also swirl in the clockwise direction.

The other three tips, A2, are each disposed between two of the tips A1 and are arranged so that gas discharging from both the openings of each will have an anticlockwise direction of rotation and flow past, outwardly of, the tips A1.

An effect of the rotation of the gas will be to tend to constrain the air to flow symmetrically about the axis of the burner and so tend to decouple the zone in which gas and air is mixed and burned from the aerodynamically unstable region. The combustion zone will tend better to resemble the combustion produced by an axial oil burner so that gas and oil may

be burned together to give a dual firing burner i.e. a burner in which the two fuels may be burnt.

Since the combustion in the pure gas burner is similar to the oil flame, mixed firing - with neighbouring burners using only gas and only oil - is easily attained. Also, the detailed residual pulsation levels of the burners firing only gas and only oil are not enhanced by burner interaction and hence the residual pulsation levels are lower than for single-fuel firing. Dual firing broadens the air-fuel delay time involved in the combustion, effectively dampening any tendencies to pulsate, but the periphery of the flame is predominantly gas controlled still producing some burner interaction. The residual pulsation levels for dual firing therefore lie between the single fuel and mixed firing uses.

In use of the tips that have been described,the flame will tend to be removed from the point of fuel injection so that the stabilising discs that are often provided on gas spuds may be dispensable. A benefit of this would be the resultant lower air velocities.

In modifications of the burner tip, it is envisaged that the opening 9 may be replaced by two or more openings in the part of the wall that is defined by a diametrical plane across which the end wall 5 lies symmetrically.

Other arrangements of the tips are also envisaged. In particular, all tips in a ring may be similarly orientated in the way that the tips A1 are orientated. Whilst gas from these tips is directed inwardly, none is directed directly to the axis, but at an angle such as to tend to induce orderly swirl.

Claims:

1. A gas burner tip in the form of a cylinder closed at one end except for an opening in an end wall that is oblique to the cylindrical surface and having an opening of smaller area lying wholly in the part of the cylindrical wall that is defined by a diametrical plane across which the end wall lies symmetrically.

2. A gas burner tip as claimed in claim 1 in which the holes are both circular and the diametrical plane containing the centre diametrical plane containing the centre of the hole in the end wall is displaced from the diametrical plane containing the centre of the hole in the cylindrical wall.

3 A gas burner tip as claimed in claim 2 in which the angle between the planes is $22\frac{1}{2}^{o}$.

4. A gas burner comprising a cylindrical duct and means associated with the duct by which air can be caused to flow along the duct with a swirling motion, and a plurality of gas tips as claimed in any of claims 1 to 3 disposed concentrically around the axis of the duct, uniformly spaced from each other and all similarly orientated so that the gas from both openings of each is directed counter to the direction of swirl of the air.

5. A gas burner as claimed in claim 4 in which there is interspersed with the tips specified in claim 4 another set of tips, each disposed mid-way between an adjacent pair of the tips specified in claim 4, the

tips of the second set being all similarly orientated so that gas from both openings of each is directed past, outwardly of the tips specified in claim 4, and in the direction of the swirl of the air.

Fig.1.

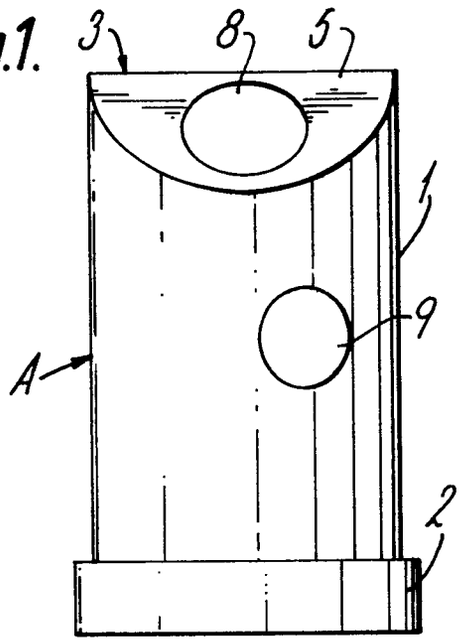


Fig.2.

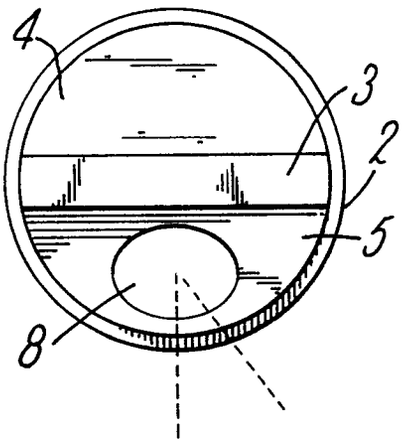


Fig.3.