United States Patent [19]

Desty et al.

[11] **3,840,320**

[45] **Oct. 8, 1974**

[54] **FLARESTACK COMBUSTION METHOD**

[76] Inventors: **Denis Henry Desty,** 17, Westdene Way, Weybridge, Surrey; **Christopher John Young,** "Baranduin", Bells Lane, Horton, Buckinghamshire, both of England

[22] Filed: **Apr. 19, 1972**

[21] Appl. No.: **245,369**

[30] **Foreign Application Priority Data**

Apr. 29, 1971 Great Britain 12068/71

[52] **U.S. Cl.** **431/4,** 431/5, 431/202, 239/424

[51] **Int. Cl.** **F23j 7/00**

[58] **Field of Search** ..... 431/4, 5, 202, 354; 239/416.5, 423, 424, 505, 506, 571, DIG. 7

[56] **References Cited**

UNITED STATES PATENTS

2,506,972	5/1950	Schellentrager et al.	431/202
3,319,692	5/1967	Reba et al.	239/DIG. 7
3,512,911	5/1970	Reed et al.	431/202
3,539,285	10/1970	Zink et al.	431/202
3,695,820	10/1972	Hawkes et al.	431/354
3,709,654	1/1973	Desty et al.	431/284

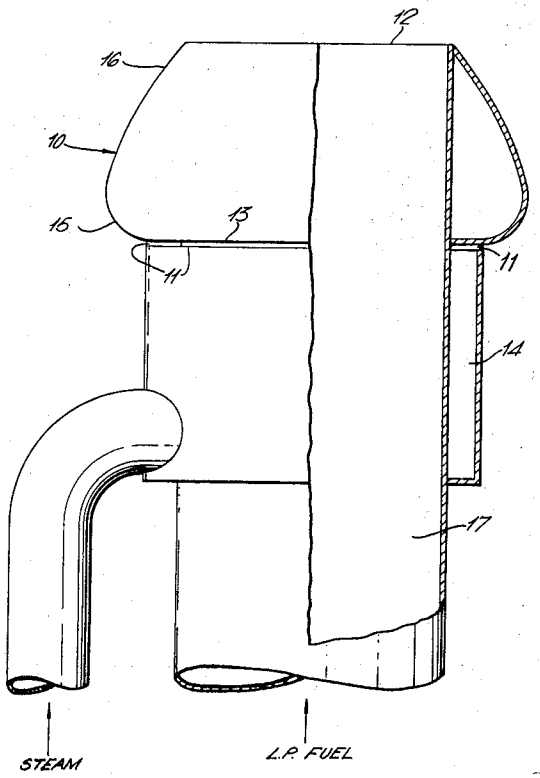
Primary Examiner—Carroll B. Dority, Jr.

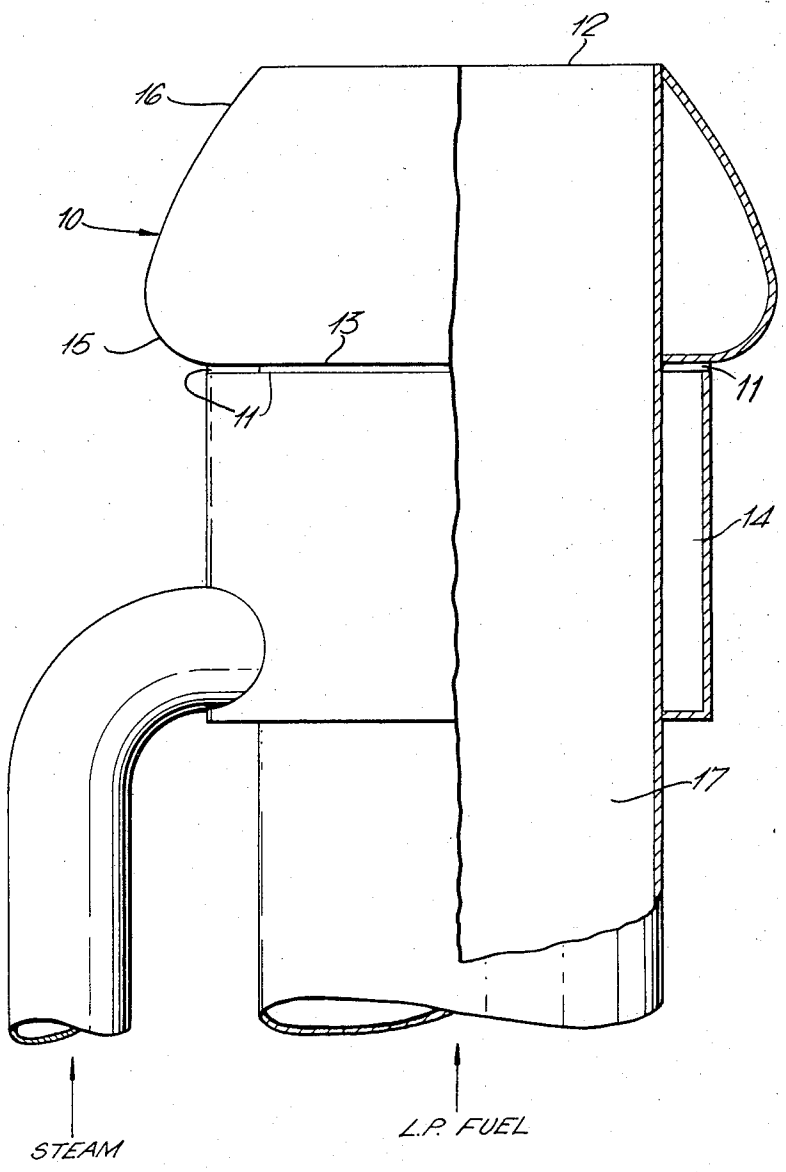
Attorney, Agent, or Firm—Morgan, Finnegan, Durham & Pine

[57] **ABSTRACT**

A burner for disposing of low pressure fuel gases with a steam inlet adapted to direct steam (originally at high pressure) to flow over a director surface so that entrainment of surrounding air occurs (Coanda effect) and towards a fuel gas inlet supplying low pressure fuel gas, the feed line for the fuel gas being an internal passage of the director body.

2 Claims, 1 Drawing Figure




12
16
10
15
13
11
11
14
17
STEAM
L.P. FUEL

FLARESTACK COMBUSTION METHOD

This invention relates to a burner for disposing of waste combustible gas, and in particular it relates to the disposal of refinery waste gases.

Refinery and chemical plant operation often requires that a vessel is vented through pressure relief valves into a vent system running at near atmospheric pressure. Gas from this low pressure vent system is then disposed of by flaring from an elevated stack so as to aid the dispersion of any oxides of sulphur that may be formed during combustion.

Since the low pressure of the gas precludes the use of air entrainment devices, and the possible sulphur content makes ground level flaring in a natural draught flare impracticable, often the only way to improve combustion and reduce the amount of smoke formed during such emergency flaring operations is to add steam to the flared gas, which then reacts with any carbon particles by undergoing a water gas reaction, thus preventing smoke formation.

It is an object of this invention to improve the method of injecting steam.

According to the invention a burner for disposing of low pressure fuel gas comprises a fuel gas inlet adapted to supply fuel gas (originally at low pressure) to a combustion zone, a director body at one end of which the fuel inlet is situated, the director body having an external director surface and an internal passage for conveying fuel gas to the fuel gas inlet, the burner also comprising a steam inlet adapted to direct a stream of steam (originally at high pressure) over the director surface towards the fuel gas inlet the director surface being curved so as to initiate the flow of steam and air towards the fuel gas inlet.

Suitably the steam is supplied at a pressure in the range 70 kN/m^2 to 300 kN/m^2.

It is known that a stream of gas will "stick" to a suitably shaped surface and a curved surface can deflect a stream of gas and thereby produce a low pressure zone. In the burner according to the invention the initial portion of the director surface is shaped so as to deflect the flow of steam and to produce a low pressure zone into which atmospheric air flows.

Preferably the burner comprises a director tube the outer surface of which is the director surface and the bore of which is a fuel gas channel which terminates at the fuel inlet.

Preferably the initial portion of the director surface is the surface of revolution formed by the rotation of a quadrant of a circle about the longitudinal axis of the director body, the curved section of the quadrant being tangential to the steam inlet.

Flame stabilisation can be improved by fitting a wind deflector. A suitable deflector is disclosed in British Pat. No. 795,664.

According to another aspect of the present invention there is provided a method for disposing of low pressure fuel gases which method comprises inducing steam (originally at high pressure) to flow over a director surface which is shaped so as to cause the steam flow to initiate flow of steam and air towards a fuel inlet which supplies fuel gas (originally at low pressure) into the flow of steam and air.

The invention will now be described by way of example with reference to the accompany drawing which

shows a burner according to the invention half in side view and half in cross section.

The burner shown comprises a director surface **10** which forms the outer surface of a director tube which has a steam inlet **11** for stream at its lower end and a secondary inlet **12** for fuel gas at its upper end. During use the steam flows over the director surface **10** and this flow initiates flow of steam and air towards the secondary inlet **12.**

The director tube has a flat base **13** and the steam inlet **11** takes the form of a circular slot formed between the wall of the steam line **14** and the flat base **13** so that the steam leaves the steam inlet **11** as a thin horizontal sheet.

The director surface **10** comprises two portions, namely a deflector portion **15** which turns the direction of flow of the steam from the horizontal to vertical, and the continuation of the portion **16** which maintains the flow of steam and air between the deflector portion **15** and the fuel gas inlet **12.** The purpose of this curved continuation **16** is to allow a suitable separation between the steam inlet **11** and the secondary inlet **12,** while maintaining the skin effect up to the secondary inlet **12.**

The shape of the deflector portion **15** is most conveniently specified as the surface of revolution formed by the rotation of a quadrant of a circle about the longitudinal axis of the director body, the curved section of the quadrant being tangential to the steam inlet; as shown in the drawing the distance between the axis of rotation and the centre of the quadrant is several times the radius of the quadrant. The continuation portion **16** is again a surface of revolution, but of an arc of larger radius than that of the quadrant, thus giving rise to a tapered portion.

As the steam flows around the deflector portion **15** its direction of flow is changed from (initially) horizontal to vertical. This induces a low pressure zone in the surrounding air and hence it induces movement of air as well as steam towards the secondary inlet **12.**

The fuel is conveyed to the secondary inlet by the fuel gas line **17** (which forms an annular configuration with the steam manifold **14**) and fuel which issues from the fuel line **17** meets the converging steam of steam and air moving over surface **16.**

What we claim is:

1. A method for disposing of low pressure fuel gases, comprising the steps of:

causing said low pressure fuel gases to flow in a stream;

passing a stream of high pressure steam over a deflector surface which comprises a surface of revolution formed by the rotation of a quadrant of a circle and an inwardly curved continuation about the axis of the direction of flow of said low pressure fuel gases,

whereby said stream of high pressure steam is directed in a first direction generally perpendicular to the direction of flow of said stream of low pressure fuel gases and is thereafter caused to flow in the same general direction as the direction of flow of said stream of low pressure fuel gases but angularly thereto so that said stream of high pressure steam and said stream of low pressure fuel gases converge,

the change in the direction of flow of said stream of high pressure steam inducing a low pressure

zone in the air surrounding said stream of high pressure steam to thereby entrain said surrounding air into said stream of high pressure steam, and

said steam, entrained air and fuel gases being mixed upon the respective streams of steam and fuel gases converging together; and

igniting and burning said mixture of steam, air and fuel gases.

2. A method as claimed in claim 1, wherein said steam is supplied at a pressure of between 70 and 300 kN/m^2.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,840,320 Dated October 8, 1974

Inventor(s) Denis Henry Desty and Christopher John Young

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 5, "stream" should read -- steam --.

Signed and sealed this 17th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents