

[54] **GROUND FLARE**

[72] Inventor: **John F. Straitz, III**, Cheltenham, Pa.

[73] Assignee: **Combustion Unlimited, Incorporated**, Elkins Park, Pa.

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[52] U.S. Cl. **431/202**

[51] Int. Cl. **F23d**

[58] Field of Search **431/353, 285, 202, 179**

[56] **References Cited**

UNITED STATES PATENTS

2,971,605	2/1961	Frost et al.	431/202
3,501,255	3/1970	Greene	431/202
3,463,602	8/1969	Bitterlich et al.	431/188

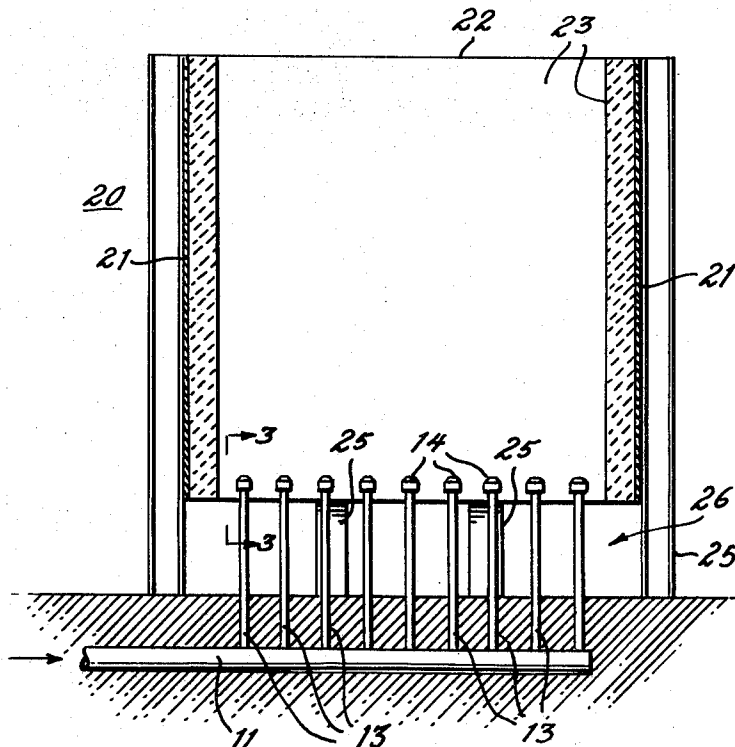
1,807,977 6/1931 Frank 431/179

Primary Examiner—Carroll B. Dority, Jr.
Attorney—Zachary T. Wobensmith, 2nd

[57] **ABSTRACT**

A ground flare is provided for incinerating waste combustible gas from refineries and the like in which the waste gases are conducted underground to and through horizontal gas supply pipes on which vertical gas supply pipes having nozzles at their upper ends are mounted. The nozzles deliver the gases for burning within a refractory lined vertical rectangular enclosure to which air is admitted at the bottom and the products of combustion discharged at the top, the flare being free from operating difficulties heretofore encountered.

6 Claims, 3 Drawing Figures



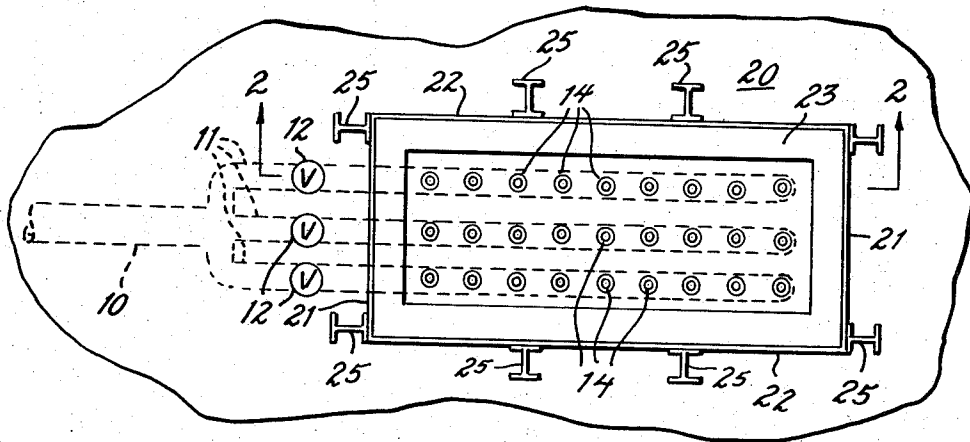


Fig. 1.

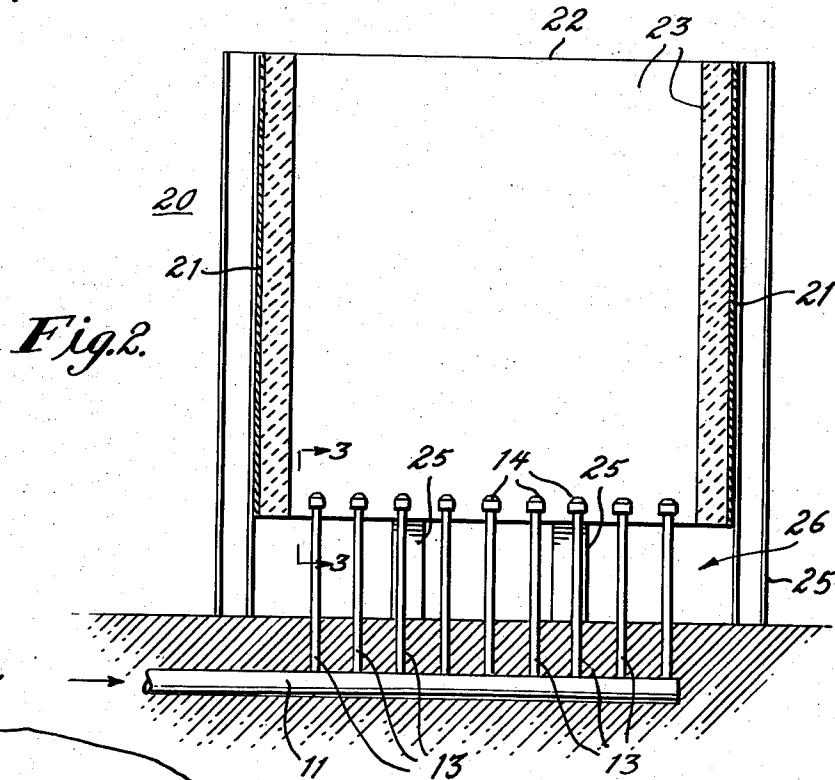


Fig. 2.

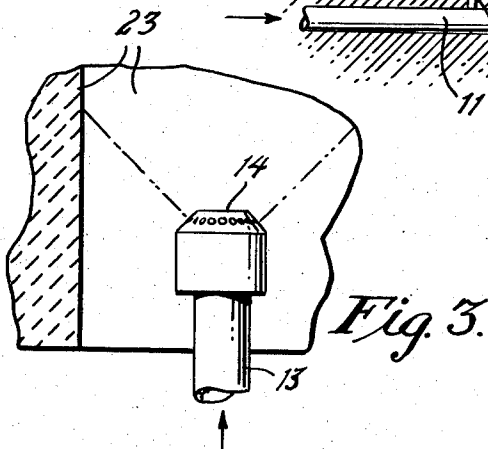


Fig. 3.

INVENTOR.
JOHN F. STRAITZ III
BY *J. T. Wobensmith*
ATTORNEY.

GROUND FLARE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a ground flare and more specifically to apparatus for the incineration of combustible waste gas from oil refineries and the like.

2. Description of the Prior Art

It has heretofore been proposed to burn the waste gas from refineries and the like. A commonly used structure for this purpose comprised a central gas pipe of a diameter in the range from 24 to 30 inches, surrounded by a large insulated cylinder of the order of 30 feet in diameter and from 15 to 30 feet in height. The major objection to this design is that the gas being burned is concentrated in one central area with inadequate surface area for mixing air for combustion with the gas. The diffusion of the gas and air has a great effect upon the surface area of the flame and this was not taken into account with the structure referred to. Diffusion is also dependent upon the Reynolds number, that is whether it is a laminar or turbulent type of mixing.

It has also been proposed to provide a multi-jet ground flare in which a series of smaller gas delivery pipes, of about 2 inch diameter on 6 inch centers, connected to one or more manifolds and enclosed within an insulated cylindrical enclosure carrier on supporting legs, with flame retention rods above the upper end of each of the gas delivery pipes. With this structure, serious mechanical problems arise because of thermal expansion. The stainless steel gas manifold that feeds the smaller gas nozzle is adversely effected by radiation on the top of the manifold which passes through the insulation, and it tends to heat up the top of the pipe. The lower section of the manifold has no thermal radiation from it so that differential expansion occurs and the manifold tends to bow. The use of insulation on the manifold has not proven to be effective.

The flame retention rods referred to above are usually of a length of 30 to 40 feet. These rods have a very short life because of their tendency to burn up and involve difficulties as to their mounting and support and their tendency to bow because of thermal expansion.

SUMMARY OF THE INVENTION

A ground flare is provided for incinerating combustible waste gases from refineries and the like which is free from difficulties encountered with prior systems, which eliminates the mechanical problems attendant upon thermal expansion, which provides effective incineration of the waste gas over a wide operating range and which is simple in construction. For this purpose the waste gas is conducted underground through a plurality of horizontal gas supply pipes which are provided with vertical gas delivery pipes each having a burner head thereon. The burner heads are within a refractory lined vertical rectangular enclosure open at the bottom for the supplying of air for combustion and open at the top for discharge of burned gases.

It is the principal object of the invention to provide a ground flare which is simple in construction, effective in its operation, and which will be free from the thermal expansion and other operating difficulties previously encountered.

It is a further object of the present invention to provide a ground flare for incineration of waste gas which does not project flame into the air to great heights as previously carried out.

Other objects and advantageous features of the invention will be apparent from the description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The nature and characteristic features of the invention will be more readily understood from the following description taken in connection with the accompanying drawings forming part thereof, in which:

FIG. 1 is a top plan view of a ground flare in accordance with the invention, parts being shown schematically;

FIG. 2 is a vertical sectional view taken approximately on the line 2—2 of FIG. 1; and

FIG. 3 is a fragmentary sectional view, enlarged, taken approximately on the line 3—3 of FIG. 2.

It should, of course, be understood that the description and drawings herein are illustrative merely and that various modifications and changes can be made in the structure disclosed without departing from the spirit of the invention.

Like numerals refer to like parts throughout the several views.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, a waste gas supply pipe 10 is preferably buried underground at a depth of about 1 to 2 feet and which has connected thereto horizontal branch pipes 11, each controlled, if desired, by a valve 12 and preferably disposed at the same depth as the pipe 10.

Each branch pipe 11 has connected thereto and extending vertically upwardly therefrom a plurality of spaced partially buried nozzle supply pipes 13, extending above ground a distance of the order of more than 2 feet and carrying nozzles 14 on their upper ends.

The nozzles 14 can be of any suitable type but it has been found advantageous to employ nozzles as disclosed in Bitterlich, U.S. Pat. No. 3,463,602, and with which the gas is discharged through ports inclined with respect to the vertical longitudinal axis and at an angle to the horizontal radius through the burner head.

The nozzles 14, in a specific embodiment, can be in rows and columns and on 6-inch centers.

A rectangular enclosure 20 is provided preferably having opposite pairs of vertical metal end and side walls 21 and 22 with ceramic refractory linings 23.

The end walls 21 can range in length from 4 to 50 feet and the side walls 22 can range in length from 8 to 100 feet depending upon the required capacity of the installation.

The enclosure 20 is supported on legs 25 which may be part of the framing of the walls 21 and 22, to provide openings 26 of the order of 2 feet high for access of air for combustion.

The enclosure 20 for the range of dimensions stated for the walls 21 and 22 may be of a height of the order of 20 feet.

The mode of use will now be pointed out.

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Combustible waste gas is delivered through the gas supply pipe 10, and the branch pipes 11 and the nozzle supply pipes 13 to the nozzles 14 and therefrom through the nozzles 14 in a whirling upwardly directed pattern for burning. Air induced through the bottom openings 26 supports the combustion which is effected turbulently with excellent mixing of the combustible gas and air by reason of the action of the nozzles 14 and the shape of the enclosure 20 which provides good internal air distribution. At the same time the gas for combustion is spread over a relatively large area, horizontally considered.

The combustion is rapidly effected so that the flame is contained within the enclosure 20 and thermal radiation from the flame is confined thereby reducing heat and light delivery.

The ground flare, by reason of its construction, can be operated over a wide range of capacities with better turndown ratio and higher stability.

I claim:

1. A ground flare for use on the ground comprising a supply pipe disposed beneath the surface of the ground,
- a plurality of horizontally disposed branch pipes disposed beneath the surface of the ground and connected to said supply pipe,
- a plurality of nozzle supporting pipes extending upwardly from each of said branch pipes and with

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upper portions extending above the surface of the ground and disposed in rows,
a gas delivery nozzle on the upper end of each of said supporting pipes, and

an enclosure having vertical walls with their lower ends spaced above the ground for access of air to the interior and being open at the top for discharge of products of combustion,

said nozzles being disposed within said enclosure for delivering said gas for admixture with said air for combustion within said enclosure.

2. A ground flare as defined in claim 1 in which said enclosure is rectangular in horizontal cross section.

3. A ground flare as defined in claim 1 in which said nozzles are disposed in rows and columns.

4. A ground flare as defined in claim 1 in which said nozzles having nozzle openings to discharge said gas upwardly and outwardly in a conical pattern for admixture with the interior air.

5. A ground flare as defined in claim 1 in which said walls are metallic with interior ceramic refractory linings.

6. A ground flare as defined in claim 1 in which said nozzles are disposed above the lower ends of said vertical walls.

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