Nov. 10, 1970 J. S. ZINK ET AL 3,539,285

FLARE STACK BURNER ASSEMBLY

Filed March 20, 1969 2 Sheets-Sheet 1

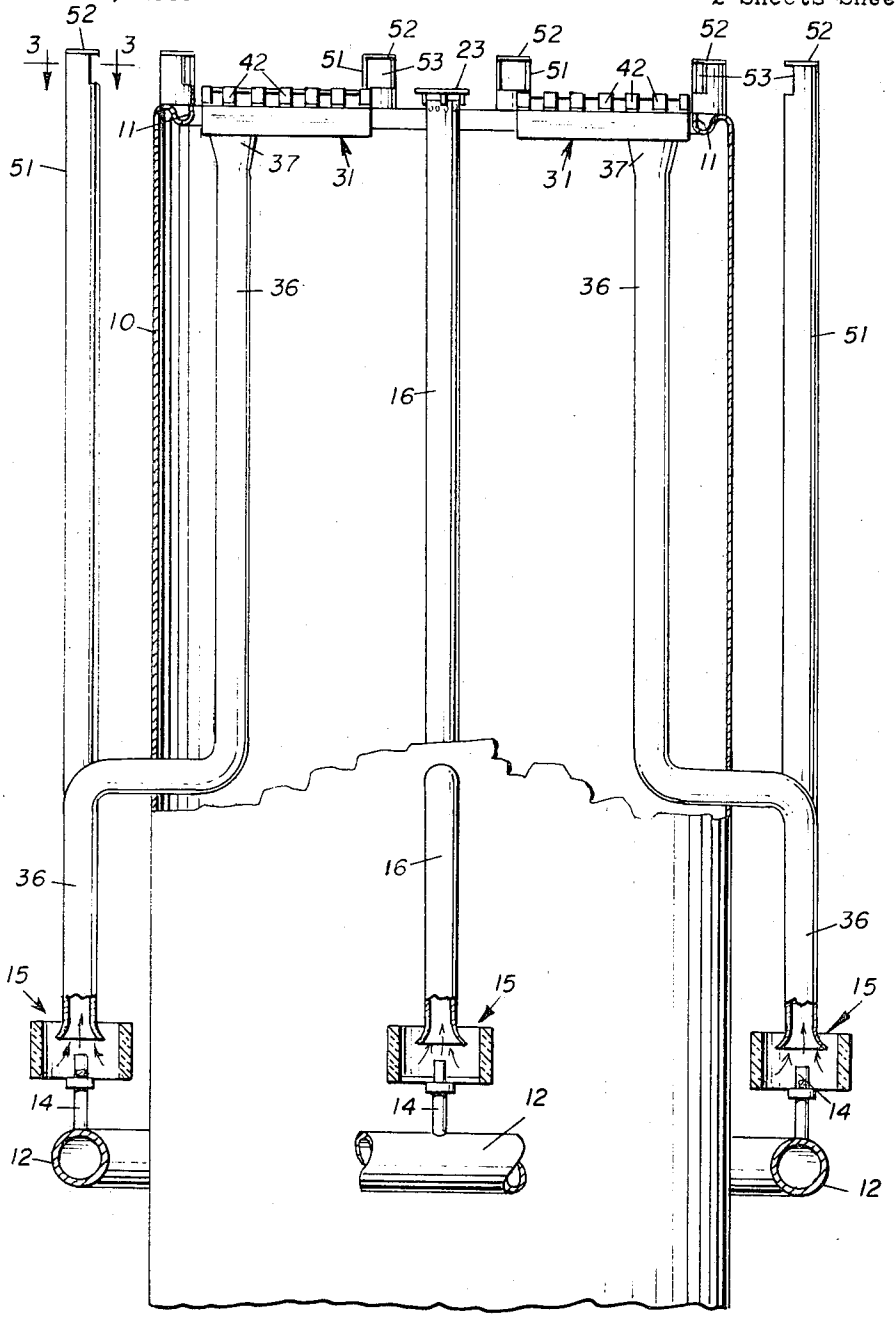

FIG. 1

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FIG. 2

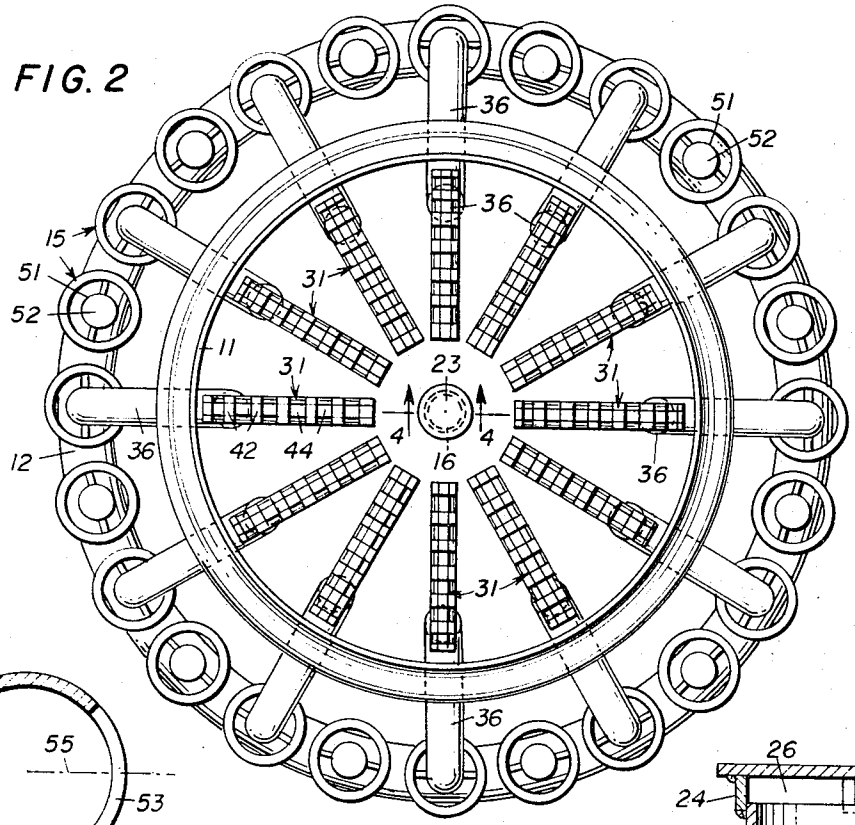

FIG. 3

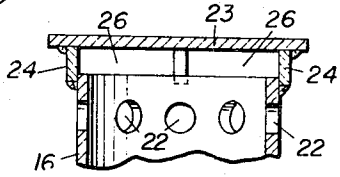

FIG. 4

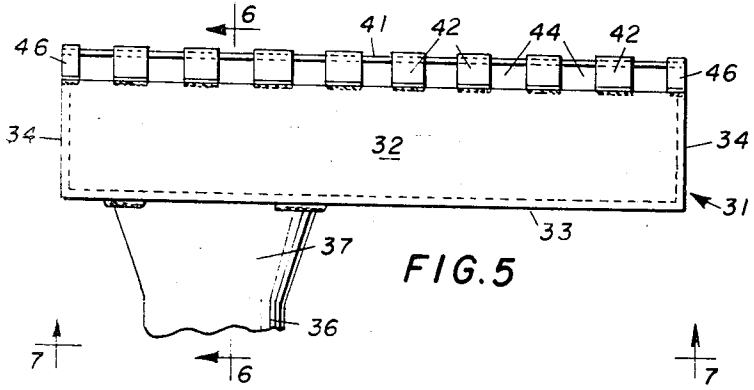

FIG. 5

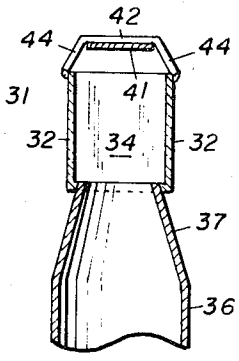

FIG. 6

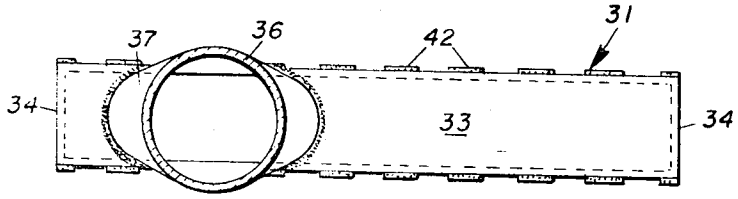

FIG. 7

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United States Patent Office 3,539,285 Patented Nov. 10, 1970

3,539,285

FLARE STACK BURNER ASSEMBLY

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Filed Mar. 20, 1969, Ser. No. 808,880
Int. Cl. F23b 5/00; F23c 9/00
U.S. Cl. 431—202 2 Claims

ABSTRACT OF THE DISCLOSURE

A burner assembly for the combustion of waste gases at the upper end of a flare stack. Steam is employed to induce air to be mixed therewith and this mixture is delivered to the combustion zone from a plurality of zones so that the mixture of steam and air is distributed throughout the flared gas to promote the thorough mixing of steam and air with the waste gases to provide for substantially smokeless combustion.

The present invention relates to a burner assembly for the combustion of gases at an elevated location and the invention more specifically pertains to structural elements in association with a flare stack to deliver steam and air throughout the waste gases at the upper end of the stack to insure mixing of the steam and air with virtually all portions of the dump gases in the combustion zone and to provide substantially smoke-free burning of the flared gases.

Steam has employed in the burning of waste or dump gases at the upper end of a flare stack in effort to promote smokeless combustion. A flare stack is usually of circular construction and it is an object of the present invention to provide nozzle structures for delivering a mixture of steam and air throughout the circular cross-section of the stack and at the upper end thereof and to deliver the steam and air mixture in quantities related to the quantity of flared gas moving upwardly in the various sectors of the stack.

Another object of the present invention is to provide nozzle structures which more fully utilizes the port energy of the streams of the smoke suppressant so that the mixture of steam and air penetrates the flared gas stream to thereby avoid the flared gas stream from overpowering the streams of smoke suppressant and to insure a more thorough mixing of the smoke suppressant with all portions of the flared gas.

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 following detailed description taken in conjunction with the accompanying drawings wherein an embodiment of the invention is disclosed.

In the drawings:

FIG. 1 is an elevational view of the upper end portion of a flare stack embodying the invention and with portions shown in section.

FIG. 2 is a plan view of the burner assembly.

FIG. 3 is a sectional view on a larger scale and taken on the line 3—3 of FIG. 1.

FIG. 4 is an enlarged fragmentary sectional view taken on the line 4—4 of FIG. 2.

FIG. 5 is a side elevational view of one of the nozzle structures for distributing a mixture of steam and air to the flared gas within the stack.

FIG. 6 is a transverse sectional view taken on the line 6—6 of FIG. 5.

FIG. 7 is an inverted plan view of the nozzle structure shown in FIG. 5 with a portion of the conduit line

leading thereto shown in section and taken on the line 7—7 of FIG. 5.

The invention pertains to a flare stack equipped at its upper end with nozzle structures which provides for projection of a smoke suppressant throughout the flared gas and in the zone where combustion is to take place. In the embodiment shown in the drawing an upper portion of the flare stack is indicated at **10** having a generally cylindrical shape and a substantially circular opening **11** at the upper end thereof. The stack **10** may be fabricated to have any desired height so that the combustion of the dump gases adjacent the opening **11** takes place at the desired elevation above the surrounding terrain.

The manifold **12** may be mounted on the stack **10** below the upper end thereof into which steam is supplied. The steam is used as a smoke suppressant and also supplies energy for aspirating devices **15** which induce air to be mixed with the steam. A tube **14** guides steam from the manifold **12** for release through a port and for delivery into a conduit **16**. The steam escaping from the port at the upper end of the tube **14** creates a low pressure condition and air is drawn into the conduit **16** for mixture with the steam. Such an aspirating assembly **15** is associated with each of the conduits which extend to the upper end portion of the stack. The conduit **16** extends through the wall of the stack **10** and upwardly along the axis thereof and terminates adjacent the upper end of the stack. The upper end of the conduit **16** is provided with a plurality of circumferentially spaced ports **22** as shown in FIG. 4 with their axes disposed in a substantially horizontal plane. A disc **23** overlies the upper end of the conduit and a plurality of circumferentially spaced lugs **24** maintain the disc **23** above the upper end of the conduit **16** so that open areas **26** are provided under the disc between the lugs **24**. The lugs **24** may be welded to the disc **23** and to the conduit **16**. The structure at the upper end of the conduit **16** provides a central discharge device and steam and air guided upwardly by the conduit **16** moves outward through the ports **22** and outwardly through the open areas **26**.

A feature of the invention pertains to the structure of steam and air distributing devices **31** mounted within the stack **10** adjacent the upper end thereof. These steam and air distributing devices are designed for discharging the smoke suppressant throughout the larger diameter portion of the stack **10**. The distributing devices **31** are of elongated shape and are disposed with their major dimensions in radial positions as will be apparent from a consideration of FIGS. 1 and 2. Each distributing device **31** has substantially parallel generally vertical side walls **32** as shown in FIGS. 5 and 6. End walls **34** close the areas between the side walls **32** and abottom wall **33** closes the space between the end and side walls.

A conduit **36** associated with one of the aspirating devices **15** extends through the wall of the stack **10** and upwardly therin as shown in FIG. 1. The conduit **36** has an elliptical shaped upper end portion **37** where it is connected to one of the distributing devices **31**. The flattened inverted conical shape portion **37** may be welded to the bottom wall **33** near the radially outer end thereof and a mixture of steam and air is thus delivered into the distributing device **31**. An elongated plate **41** (FIGS. 5 and 6) is supported in spaced relationship above the upper edges of the side walls **32**. The plate **41** extends from one end wall **34** to the other end wall. The plate **41** is maintained in position by a plurality of arched brackets **42** which are spaced from each other as best shown in FIG. 5. These brackets may be welded to the side walls **32** and to the plate **41** and they provide apertures **44** through

which steam and air may escape. The end portions of the plate **41** may be supported by brackets **46**.

There is a conduit **36** for each distributing device **31** and each conduit **36** supplies a mixture of steam and air at high velocity into the associated distributing device **31** near the outer end thereof and adjacent the wall of the stack **10**. The steam and air impacts against the plate **41** and the greatest pressure developed in each distributing device **31** is in the zone directly above its conduit **36**. Thus the steam and air escaping through the apertures **44** immediately above the conduit **36** provides that the greatest volume of the steam and air will be delivered into the dump gases adjacent the wall of the stack **10** and where the circumferential spacing of the outer end portions of the distributing devices is large. In proceeding radially inwardly of each distributing device **31** and towards the axis of the stack **10**, there will be less steam and air delivered for mixture with a smaller volume of the dump gases moving upwardly between the distributing devices **31**. The air and steam discharged through the apertures **44** is in directions which slope upwardly from a horizontal plane of the upper end of the stack **10**. The volume of steam and air discharged into the flared gas is at a maximum near the wall of the stack **10** and lesser amounts are discharged in proceeding towards the axis of the stack **10** and the volume varies in general in proportion to the volume of the flared gas moving upwardly between the distributing device **31**.

A plurality of vertically disposed pipes **51** receive steam and air from the respective aspirating devices **15** associated with the manifold **12**. The pipes **51** are disposed outside the stack **10** as shown in FIGS. 1 and 2. The upper ends of the pipes **51** are arranged between the conduits **36**. A disc **52** closes the upper end of each pipe **51**. The pipes **51** terminate above the distributing devices **31**. Each pipe **51** has an opening **53** (FIG. 1) in the perimeter thereof and each opening **53** extends throughout about ninety degrees of the assocated pipe. The center line **55** (FIG. 3) of each opening **53** is disposed to release the steam and air from within each pipe **51** in a radially inward direction between each pair of distributing devices **31**. In one embodiment the openings **53** each have an area of approximately three inches. The energy of the escaping smoke suppressant is spent at a distance of about sixty inches from the opening **53**, and there is a projection of the steam and air in a generally horizontal direction from each pipe **51** for a distance of approximately fifteen inches. Such projection of the steam and air includes sufficient energy so that the upward movement of the flared gas will not overpower the streams of the smoke suppressant escaping through the openings **53** to provide thorough mixing of the steam and air with the flared gas.

The smoke suppressant is thus distributed throughout all of the dump gas moving upwardly through the stack **10** and the distributing devices **31** together with the conduit **16** and the pipes **51** to provide for a thorough mixing of the smoke suppressant with virtually all portions of the dump gases in the area of opening **11** at the upper end of the flare stack.

While the invention has been shown and described with reference to particular structural elements in association with a flare stack, it will be appreciated that changes may be made in the elements as well as the overall assembly. 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 is claimed and desired to be secured by Letters Patent is:

1. In a flare stack burner, a generally vertical stack having an opening at the upper end through which gas may escape, a central discharge device within said opening substantially at the axis of the stack, means guiding a mixture of steam and air into said discharge device, said discharge device having ports for radially outward escape of the steam and air mixture, a plurality of elongated distributing devices arranged with their lengths in generally radial positions within said opening, said distributing devices having apertures spaced therealong, and means for guiding a mixture of steam and air into the outer end portion of each elongated distributing device whereby a larger volume of the mixture of steam and air escapes through the apertures adjacent outer end of each distributing device than the volume which escapes from the apertures near the inner end of each distributing device.

2. In a flare stack burner according to claim **1** including a plurality of pipes having upper end portions disposed outside said stack with each of said pipes arranged in a position between lines projecting radially outward from two adjacent elongated distributing devices, means for supplying a mixture of steam and air into each pipe, and each of said pipes having a discharge opening for the escape of the steam and air mixture in a direction towards the axis of said stack.

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U.S. Cl. X.R.

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