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FLARE STACK STRUCTURE AND APPARATUS TREATING AND CONTROLLING FLOW OF GASES TO AND FROM STACK

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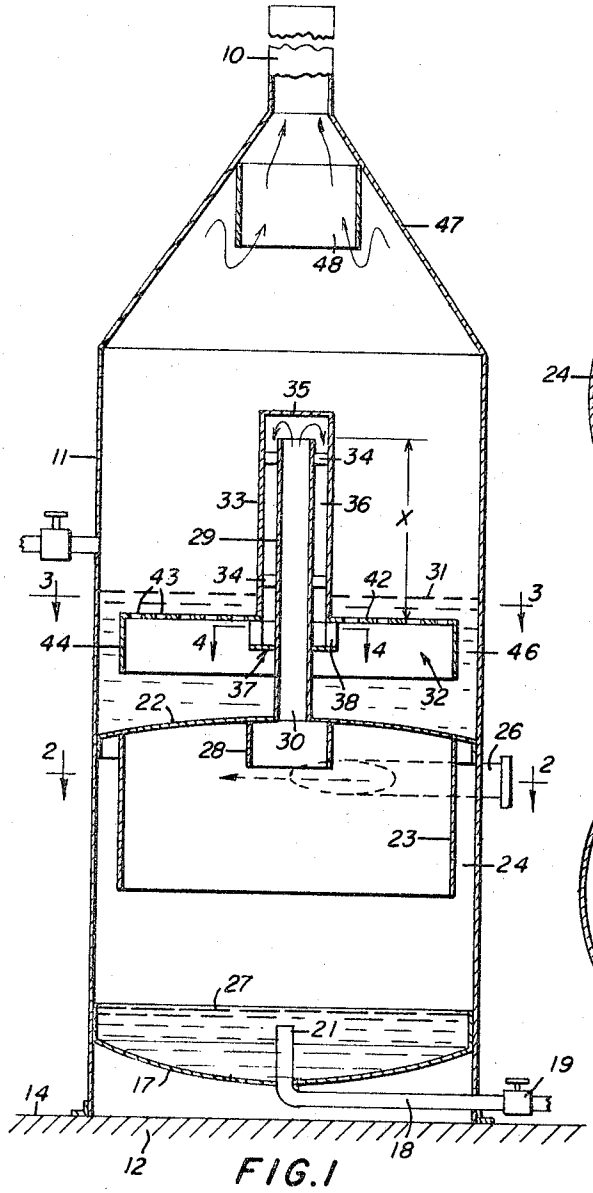


FIG. 1

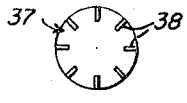


FIG. 4

FIG. 2

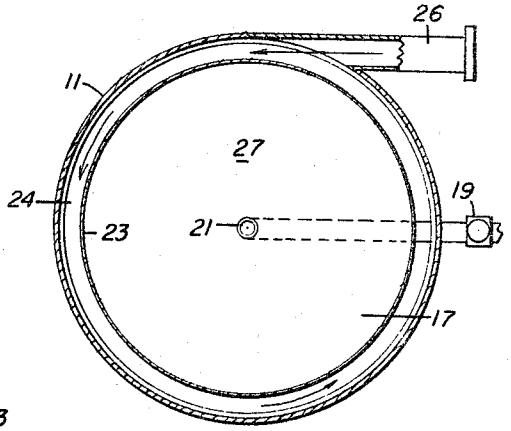
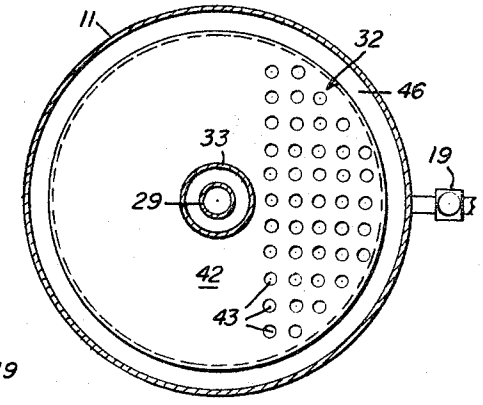


FIG. 3



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FLARE STACK STRUCTURE AND APPARATUS TREATING AND CONTROLLING FLOW OF GASES TO AND FROM STACK

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The present invention relates to a flare stack and the base structure thereof for venting gases such as hydrocarbons or inflammable gaseous materials to the atmosphere and which are usually burned at the upper end of the stack and to apparatus for removing liquids from such gases prior to delivering into the lower end of the stack and to apparatus for preventing reverse flow of gas from the stack.

It is a practice in process industries to provide vent stacks which extend into the atmosphere to significant elevations above the surrounding terrain for the disposal of dump gases. The upper end of such stacks are usually provided with burner elements for combustion of the gases. Liquids are often present in the gases which are to be discharged into the stack. High boiling point liquids are often vented through such stacks and in the gaseous phase which condense when cooled within the stack structure. Such liquids are often highly inflammable and the equipment must serve to prevent such liquids from being vented to atmosphere. It is accordingly one of the objects of the present invention to provide a base structure for a vent stack which houses means separating liquids from a liquid laden dump gas as it moves through such means and before the dump gas arrives in the lower end stack.

In the operation of a flare stack the gas being vented therethrough usually has a temperature above ambient temperatures. When the flow of the dump gases being fed to the stack is interrupted the aparatus is filled with hot gas. Some portions decant from the stack to atmosphere. The stack structure cools and the volume of gas remaining in the stack is reduced. These conditions develop pressures in the stack system which are below atmospheric pressure promoting an upstream or downward movement of air in the stack assembly. It is another object of the invention to provide means housed in and forming a part of the base structure of the stack preventing upstream movement of atmospheric air in the stack structure beyond a given zone therein.

Another object of the invention is to provide means for controlling the flow of gas within the base structure of a vent stack assembly which distributes the dump gas below the level of water or liquid whereby the dump gas bubbles upwardly through the liquid such as a column of water which is of such height as to prevent rearward movement of atmospheric air or upstream propagation of a flame through the apparatus.

Other objects and features of the invention will be appreciated and become apparent as the present disclosure proceeds and upon consideration of the following detailed description taken in conjunction with the annexed drawing wherein an embodiment of the invention is disclosed.

In the drawing:

FIG. 1 is a sectional view of the base structure of a vent stack and apparatus for handling gases admitted to the lower end of the stack.

FIG. 2 is a transverse plan sectional view taken on the line 2—2 of FIG. 1.

FIG. 3 is a similar transverse sectional view taken on the line 3—3 of FIG. 1.

FIG. 4 is a fragmentary sectional view taken on the line 4—4 of FIG. 1.

There is shown in FIG. 1 a tube **10** which is adapted to be erected in a substantially vertical position with the upper end positioned above adjacent buildings and at a significant level above the surrounding terrain. The tube **10** may be formed of sections and the stack structure may be of any desired height. The tube **10** forms a vent or flare stack through which dump gases are guided to the uper end thereof. A burner tip is often mounted on the upper end of the tube **10** to provide for the combustion of the gases high in the atmosphere. The tube **10** is supported by and extends upwardly from a housing **11** which is of larger cross sectional dimensions than the stack and the housing **11** serves as a wide base for the tube **10**. The lower end of the housing is supported on a footing **12** having a substantially horizontal upper surface **14**. The housing **11** encases equipment for treating and controlling the flow of gas to the stack and this auxiliary equipment is also supported by the housing on the footing **12**.

The housing **11** may be of cylindrical shape and a bottom wall **17** closes the lower end thereof. The bottom wall **17** has a concave inner upper face as shown in FIG. 1 and a drain conduit **18** equipped with a valve **19** is provided for removing liquid from the lower portion of the housing **11**. The inner end portion **21** of the conduit **18** extends above the bottom wall **17**. A partition wall **22** is disposed transversely of the housing **11** and the perimeter thereof is attached to the cylindrical wall of the housing **11** in a sealed relationship. A cylindrical baffle **23** of smaller diameter than the housing **11** depends from the partition wall **22** to provide an annular space **24** between the circumference of the baffle **23** and the annular wall of the housing **11**. A pipe **26** carried by the housing serves as an inlet for the gas. The axis of the pipe **26** is disposed tangentially of the housing **11**. The liquid laden dump gas enters the housing in a tangential relationship with respect to the baffle **23**. The dump gas is delivered to the annular space **24** at velocities which range from about fifty feet per second to about two hundred feet per second and at static pressures ranging from approximately 0.10 to about 25 pounds per square inch.

The liquid laden dump gas moves circumferentially within the annular space **24** as indicated by the arrows in FIG. 2. Centrifugal force is thus developed which acts on the droplets of liquid. The liquid components move radially outwardly into engagement with the inner annular surface of the housing **11**. The droplets of liquid on the inner surface of the cylindrical wall of the housing **11** flow downwardly and are collected within the housing above the wall **17**. The velocity energy of the incoming gas is virtually spent as the gaseous components with most of the liquid removed escapes through the lower end of the annular space **24**.

Any residual liquid retained in the gas as it escapes through the lower end of the annular space **24** is directed towards liquid accumulated and retained within the lower part of the housing where due to impact of any residual liquid droplets on the surface of the liquid body **27** insures substantially complete removal of the liquid from the gas. The extension **21** of the conduit **18** within the housing **11** insures that there will always be some liquid retained within the housing. The liquid removed from the gas when inflammable is safely collected in the lower portion of the housing **11** below the partition wall **22**.

The gas substantially free of liquid turns upwardly and enters the interior of the baffle **23**. The partition wall **22** has a concave under surface. A cylindrical shaped flange **28** depends from the partition wall **22** adjacent the axis of the housing **11** and in surrounding relationship to an exit opening **30**. Any liquid particles remaining in the gas engages the exterior of the flange **28** to drop

therefrom into the lower end of the housing and into the body of liquid **27**.

A tubular element **29** is connected to the partition wall **22** and extends upwardly therefrom. This tubular element registers with the opening **30** and guides the gas upwardly through a body of water or liquid and above its static level **31**. An inverted cup-shaped member **32** is supported within the housing **11** above the impervious partition wall **22** by means of a tubular member **33** which is of larger diameter than the tubular element **29**. A plurality of radially disposed arms **34** support the tubular member **33** on the tubular element **29**. The upper end of the tubular member **33** is closed by means of an end wall **35**. An annular passage **36** is thereby provided between the exterior of the tubular element **29** and the interior of the tubular member **33**. Thus the gas virtually free of liquid after moving upwardly within the tubular element **29** turns and moves downwardly in the annular passage **36** to escape under the inverted cup-shaped member **32**. A dispersion unit **37** mounted under the inverted cup-shaped member **32** is provided with radially disposed vanes **38** as best shown in FIG. 4 to distribute the gas throughout substantially all sectors of the inverted cup-shaped member **32**.

The liquid maintained within the housing **11** above the partition wall **22** has a static level at **31** and the horizontal disc **42** of the inverted cup-shaped member **32** is positioned below the surface of the water. The disc **42** is provided with ports **43** which are spaced from each other throughout the area of the horizontally disposed disc **42** which provide for the escape of the gas as bubbles moving upwardly through the liquid. The gas bubbles through the liquid and moves into the upper portion of the housing **11**. A depending flange **44** on the inverted cup-shaped member **32** has a diameter smaller than the housing **11** to provide an annular space **46** between the interior of the housing **11** and the exterior of the flange **44**. If there is a sudden increase in the volume of gas delivered through the tubular element **29** the excess gas escapes through the annular space **46** which then serves as an emergency spill area.

A conical shaped housing member **47** connects the upper end of the cylindrical housing **11** with the lower end of the tube **10** whereby the gas is guided into the lower end of the stack. A cylindrical shaped baffle **48** is supported within the conical housing member **47** in sealed relationship with respect to the conical wall. Any water particles that may be carried upwardly with the gas along the inner surface of the member **47** engages the exterior of the baffle **48** and drains back into the body of water to maintain the static level **31**. The gas moves into the lower end of the stack.

The structure above the partition wall **22** serves to prevent atmospheric air which may settle in the tube **10** from moving rearwardly beyond the upper end of the tubular element **29** and into the presence of inflammable liquid collected in the lower portion of the housing **11**. The vertical dimension indicated at X represents the height of a water column greater than atmospheric pressure so that it is impossible for air or a flame to propagate rearwardly through the apparatus beyond the free end of the tubular element **29**.

While the invention has been shown and described with reference to one assembly it will be appreciated that changes may be made in the overall organization as well as in the various elements. Other types of equipment insuring that the gas bubbles through the liquid and which prevents reversed flow of gas may be employed in the assembly. Such changes and other modifications may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

What we claim and desire to secure by Letters Patent is:

1. A base structure for a vent stack for treating gas moving towards the stack and preventing rearward movement of gas from the stack through the base structure comprising, a vertically disposed vent stack, a generally cylindrical shaped housing of larger cross sectional dimensions than the stack supporting and providing a base therefor, a bottom wall within said housing, a partition wall within the housing spaced upwardly from said bottom wall, a generally cylindrical shaped baffle depending from said partition wall providing an annular space between the perimeter thereof and the interior of said housing, an inlet pipe disposed to guide gas tangentially into said annular space, said partition wall having an opening therethrough within said baffle, a tubular element carried by the partition wall extending upwardly therefrom within said housing, said partition wall and said housing providing a receptacle containing a body of liquid within the housing having a static level below the upper end of said tubular element, a tubular member surrounding said tubular element providing an annular passage between the perimeter of the tubular element and the interior of the tubular member, means closing the upper end of said tubular member, means supporting the tubular member on said tubular element, a substantially horizontal disc supported by said tubular member below the static level of said liquid, said disc having spaced ports therethrough, dispersion unit means provided with a plurality of radially disposed vanes at the lower end of said tubular member for dispersing gas from said annular passages throughout the underside of said disc, an annular flange depending from said disc having a diameter smaller than said housing providing an annular space between said flange and the interior of the housing, a frusto-conical shaped housing member connecting said housing to the lower end of said stack, a cylindrical shaped baffle depending from said frusto-conical housing member around the lower end of said stack, the upper end of said tubular element being disposed above the static level of said liquid a distance sufficient to prevent gas at atmospheric pressure entering the housing from said stack and moving beyond the upper end of said tubular element, a pipe for draining liquid from the lower end of the housing, and said pipe having a vertically disposed portion which extends above the upper face of said bottom wall.

2. A base structure for a vent stack for treating gas moving into the stack and preventing rearward movement of gas from the stack through the base structure according to claim **1** wherein a cylindrical flange depends from said partition wall around said opening.

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