Aug. 11, 1953 L. W. SCHRADER 2,648,376

FLARE STACK LIGHTER

Filed March 6, 1948

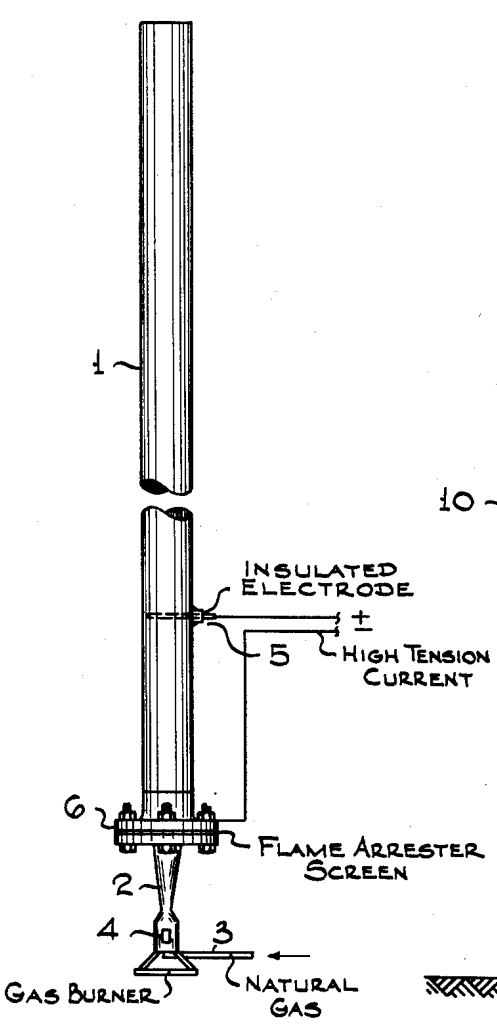

FIG.-1

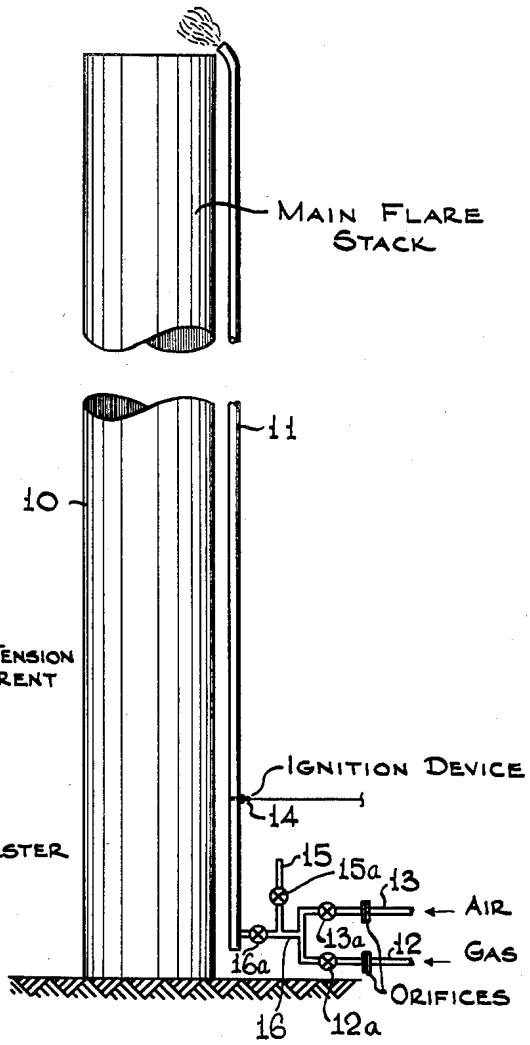

FIG.-2

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Patented Aug. 11, 1953

2,648,376

UNITED STATES PATENT OFFICE

2,648,376

FLARE STACK LIGHTER

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Application March 6, 1948, Serial No. 13,417

2 Claims. (Cl. 158—115)

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This invention relates to improvements in flare stack lighters.

In refining petroleum oil there are formed various gases which due to low fuel value or to the presence of various sulfur compounds are of no practical value and are at times disposed of by burning stacks. The stacks are of suitable height in order that the flares will not be a fire hazard. Up to the present, the flares were ignited by means of jet pipes and a slotted tube type of a lighter. In order to propagate flame to the top of the flare stack it has been found necessary at times to operate the lighter for long periods of time. This resulted in the evolution of large quantities of heat which badly distort the lighter equipment. In some cases due to high winds it has not been possible at times to light the flare even after prolonged operation of the lighting device. Another difficulty encountered was in obtaining sufficient flow in the upper jets of the lighter due to poor gas distribution. This resulted in a large flame enveloping the lower portion of the lighter with very little flame in the upper lengths. Another difficulty encountered was the clogging in the upper jet pipes due to corrosion.

It is an object of this invention to provide a lighting device that will light the flare at the top of the stack without interference from high winds and without any unnecessary heating effect in the lighter equipment at the lower portion of said equipment by means of a rising flame within a lighter pipe wherein combustion is propagated upwards in a combustible but not explosive mixture of air and gas ignited at the ground level by suitable means. This and other objects of the invention will be understood on reading the following description where with reference to the accompanying drawings:

Fig. 1 discloses one type of a lighter, and

Fig. 2 a modification of the first type of lighter.

Referring to Fig. 1, numeral 1 shows a pipe of 2 inches in diameter of the desired length which may be 30 or more feet high depending upon the height of the flare stacks. Into this pipe at the lower end is fitted a Meeker laboratory burner injector 2 into which is passed a hydrocarbon gas such as ethane, propane or pentane or other combustible volatile gas. An opening 4 for the admission of air or oxygen is also provided. A suitable diameter for the needle valve orifice through which hydrocarbon gas is passed into the upper part of the Meeker burner 2 and into pipe 1 may be of about .052 inch. The diameter of the Venturi throat is about .625 inch. Into this pipe at about 3 ft. above the lower end of the pipe is fitted a

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spark plug 5. This spark plug consists of a single insulated electrode which projects into the pipe through a hydraulic coupling welded to the pipe and forms a spark gap between the electrode point and the interior surface of the pipe wall. A high voltage current is supplied to the electrode, and the pipe wall serves as the ground connection. The high voltage current may be supplied by a scintilla magneto of the type commonly installed on compressor engines.

A screen 6 is installed at the point of the attachment of the Meeker burner to pipe 1 in order to prevent flash back of the gas in the tube to the burner 2.

The magneto drive shaft may be rotated by hand to obtain the desired electrode discharge between the electrode and the internal surface of the pipe. An inlet gas pressure of 35 pounds per square inch gauge was used to obtain a gas flow of 3 cubic feet per minute, while inspirated air flowed at a rate of about 27 cubic feet per minute. This gave an air gas ratio of 9:1 by volume, and the velocity of the air gas mixture in the tube pipe was calculated to be approximately 1375 feet per minute. Although after the gas was allowed to flow through the pipe and the air gas mixture ignited by means of the electrode, the flame velocity was found to be about 2560 feet per minute.

Referring to Figure 2, a main flare stack 10 is shown with an igniter pipe 11 attached to the flare stack wall by flanges not shown either inside or outside of the stack. A pipe having a diameter of 2 inches was found to be suitable although other pipes of smaller or greater diameter may be used. Into this pipe is passed a hydrocarbon gas such as ethane, propane or other combustible volatile gas by means of pipe 12 through valve 12a and air by means of pipe 13 through valve 13a and thence through line 16 by way of valve 16a. Where propane was used, it was fed at a pressure of 20 pounds per square inch gauge through an orifice approximately .50 inch in diameter and air at 20 pounds per square inch gauge was fed through an orifice approximately .153 inch in diameter. This mixture flowed at a rate of 300 cubic feet per hour and was fed into the igniter pipe 11. A spark plug 14 at about 3 ft. above the opening through which the air and gas are introduced is fitted into the igniter pipe and is provided with contacts for passing an electric current into the said electrode. Before turning on the electric current the mixture of gas and air was first turned on and the pipe was purged for about 20 seconds where a 40 ft. lighter pipe was

used and then the current was turned on and the flame passed to the top of the lighter tube and ignited any gas in the main flare stack 10.

In addition to the orifices, a visual mixture control can be used wherein the air and gas mixture is allowed to burn in a small pilot 15 ahead of igniter riser 11 and the mixture controlled by the flame characteristic. The pilot 15 is provided with a valve 15a and communicates with the conduit line 16 connecting with the pipes 12 and 13 to supply a combustible gas mixture to the igniter pipe 11. The valve 16a is provided in the line 16 intermediate the pilot 15 and the pipe 11. In use, valve 16a is closed, valve 15a is opened, and the valves in the gas and air lines 12 and 13 are opened to permit a mixture of gas and air to flow to the pilot. An operator can then attempt to light the pilot using a match, for example. On the first attempt it may be found that the mixture will not ignite or alternatively that the mixture is explosive. In the latter case, combustion will occur as one or more sharp detonations. In either event, the valves in the air and gas lines are adjusted until a combustible mixture is obtained which provides a clean persistent flame. The height of this flame may then be adjusted also to provide a suitable predetermined flow velocity to avoid flashback when the combustible mixture is supplied to the ignition tube. The pilot can be turned off after mixture adjustment and the flare ignited as before. Any volatile combustible gas can be used for ignition purposes.

The following is claimed.

1. In combination with a flare stack for burning waste combustible gaseous compounds, said stack having an outlet a considerable distance above the ground, an ignition means for said compounds, comprising a separate ignition tube of smaller diameter than the stack and coextensive therewith, a discharge end on said tube directed toward and over said stack, conduit means for supplying to said tube a proportioned mixture of an oxygen-containing gas and a combustible gaseous material, including separate conduits for each of said components of the mixture and flow control means therein, igniter means internally of said tube to ignite said gaseous mixture, and a pilot burner element supplied with said mixture from conduit means supplying said tube, separately ignitable to provide for visual inspection of the flame characteristics of said mixture when ignited, said control means being adjustable to permit the flame height at said pilot burner element to be varied to indicate when a pre-determined critical velocity for flame propagation has been reached in said ignition tube, whereby the said proportioned mixture when supplied to said ignition tube avoids introduction of an explosive mixture therein and prevents flash back in said tube.

2. In combination with a flare stack for burning waste combustible gaseous compounds, said stack having an outlet at a considerable distance above the ground, a means for igniting said compounds at the stack outlet, comprising a separate ignition tube of smaller diameter than the stack and co-extensive therewith a discharge end on said tube directed toward and over said stack, supply conduit means for introducing a proportioned mixture of an oxygen containing gas and a combustible gaseous material to said tube, including separate inlet conduits communicating with said supply conduit means for each of said components of the mixture and flow control means therein, igniter means internally of said tube to ignite said gaseous mixture, a pilot burner element communicating with said supply conduit means intermediate the tube and said inlet conduits, and control means disposed in said supply conduit means intermediate the pilot burner and the tube, whereby the mixture as supplied to said conduit means may be diverted to said pilot burner element and separately ignited to provide for visual inspection of the flame characteristics of said mixture, said control means being adjustable to permit the flame height at said pilot burner element to be varied to indicate when a pre-determined critical velocity for flame propagation has been reached in said ignition tube, whereby the said proportioned mixture when supplied to said ignition tube avoids introduction of an explosive mixture therein and prevents flash back in said tube.

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