

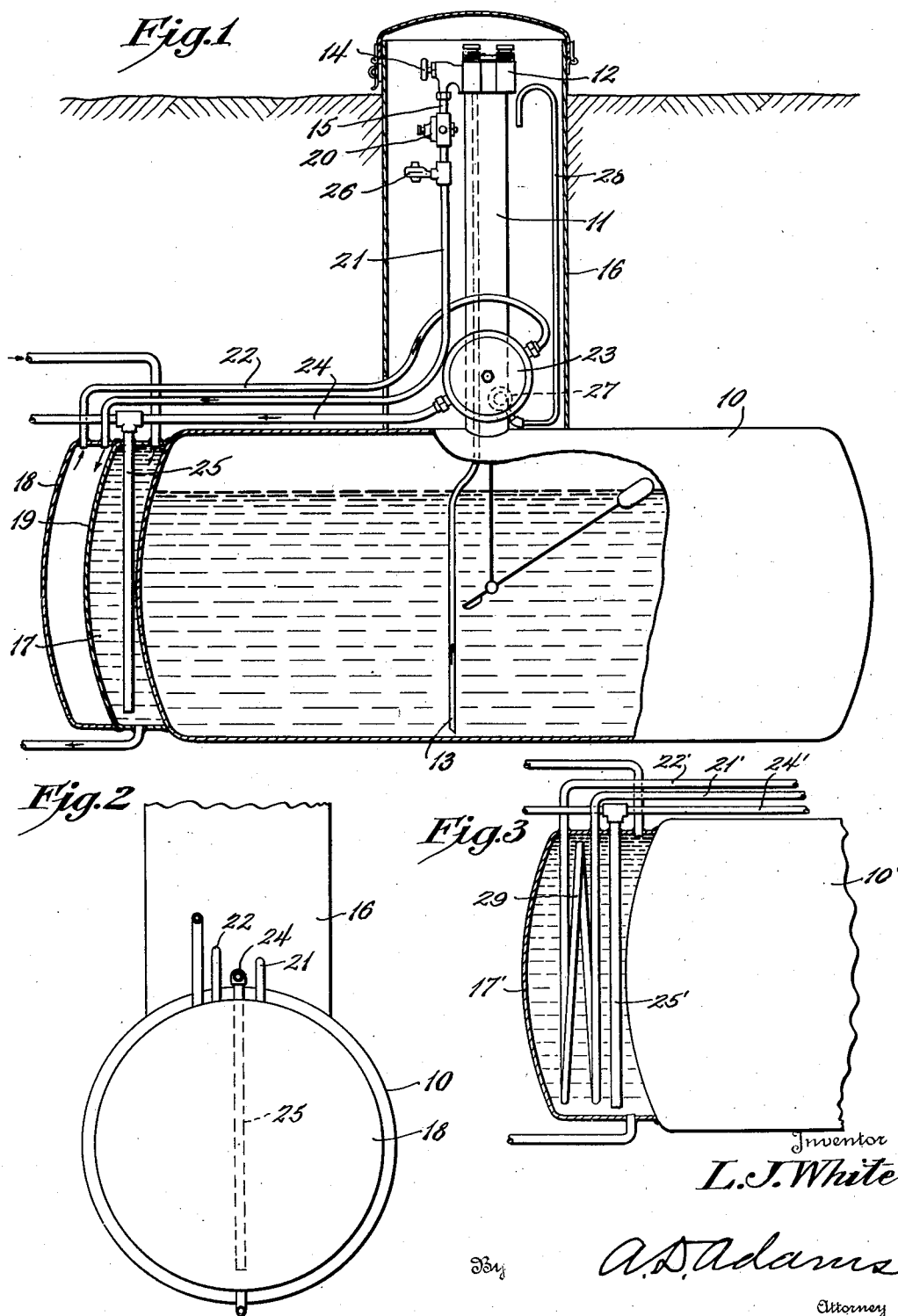
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LIQUEFIED PETROLEUM GAS DISPENSING SYSTEM

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LIQUEFIED PETROLEUM GAS DISPENSING SYSTEM

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10 Claims. (Cl. 62—1)

This invention relates to liquefied petroleum gas systems for storing and generating liquefied petroleum gases, such as mixtures of butane, isobutane, propane and other more or less volatile petroleum constituents and, among other objects, aims to provide a greatly improved underground system of the general type disclosed in Patent No. 2,176,829, wherein the gas is delivered in the liquid phase from a pressure storage tank and is vaporized after a first stage pressure reduction and the gas vapor is then subjected to a second stage pressure reduction, ready for consumption in the usual gas appliances. The main idea is to provide in a liquid education system of this type a novel heat exchanger in the delivery conduit between two pressure reducing regulators and associated with the storage tank acting as a flash gas generator to insure a continuous supply of dry gas of uniform heating value, regardless of the amount of fuel in the tank. Another aim of the invention is to provide a composite two-stage pressure reduction system of this type adapted to be factory assembled and having heat exchanging means on the tank for supplementing the heat of the earth in vaporizing the contents of the tank to create the liquid education pressure, and also acting as a flash vapor generator for the liquefied gas after it passes through the first stage pressure regulator, as well as to re-vaporize any condensate which may be formed in the gas service pipe.

Other aims and advantages of the invention will appear in the specification, when considered in connection with the accompanying drawing, wherein:

Fig. 1 is a vertical sectional view, partly in elevation, showing a system embodying the invention; and

Fig. 2 is a left end elevation of Fig. 1; and
Fig. 3 is a fragmentary view of a modified form of heat exchanger.

In underground systems of the type which dispense liquefied gas in the gas phase from the storage tank by "batch" vaporization therein, it is well known that there is an appreciable difference between the B. t. u. content of the gas coming from a full tank and a nearly empty tank because the more volatile components of the mixture, such as propane, vaporize more rapidly than butane, isobutane and the other less volatile components. When the fuel mixture contains 20% or more of propane, for example, the variation in the B. t. u. content of the generated gas between a full and a nearly empty

tank is so great that uniform and the most efficient combination cannot be obtained without adjusting the air supply to the burners. The present invention overcomes this and other difficulties by providing a greatly improved, compact, liquid education system which delivers dry gas of substantially uniform heating value at all times, regardless of the mixture used and the liquid level in the tank.

Referring more particularly to the drawing, the system, there shown, embodies an underground pressure storage tank 10 having a standpipe 11, to the top of which is connected a unitary valved fitting 12, a liquid education pipe 13 passing through the standpipe and being connected to the fitting to discharge liquefied gas through a cutoff valve 14 to an outlet nipple 15, all arranged in a protecting casing 16 and being the same as disclosed in the aforesaid patent.

In this instance, a cup-shaped water heat exchanger 17, preferably like that shown in my copending application Ser. No. 276,024, filed May 26, 1939, is connected to one end of the tank 10 to supplement the vaporizing heat of the earth and thereby create a vapor pressure in the tank which forces the liquid out of the tank. Associated with the heat exchanger is a cup-shaped flash chamber or generator 18 preferably of the same size as and forming a continuation of the heat exchanger 17 so that the end wall 19 of the heat exchanger separates it from the flash chamber and the heat is thus transferred from one to the other.

The liquefied gas delivered through the outlet nipple 15 passes through a first stage pressure regulator 20 and a pipe 21 to the flash chamber 18, the regulator 20 being preferably set to reduce the pressure to about 5 pounds. The liquid is quickly converted into vapor in the flash chamber due to the contained heat at the lower pressure and the rapid absorption of additional heat from both the heat exchanger and the surrounding earth. From the chamber 18, the gas vapor passes through a pipe 22 carrying a second stage regulator 23 of the usual type arranged within the protecting casing 16 which delivers the gas at a pressure of about 6 ounces to the service conduit 24 leading underground to the point of use. The service pipe is shown as passing over the heat exchanger and has a depending re-vaporizing spur tube or condensate trap 25 extending into the heat exchanger as disclosed in the aforesaid copending application.

To relieve any excessive pressure which may develop in the pipe 21 between the regulators, there is shown an ordinary pressure relief valve 26 within the casing to discharge through it to the atmosphere. Also, the second stage regulator 23 is shown as having the usual pressure relief valve 27 on the low pressure side vented through a vent tube 28 leading to a point near the top of the casing.

In Fig. 3, there is shown a modified form of gas generator placed in the water heat exchanger. In this example, the water chamber 17' is shown as being larger than the chamber 17 and the pipes 21' and 22' are connected to a coil 29 submerged in the water within the chamber 17'. The coil serves the same purpose as the flash generator or chamber 18 in Fig. 1.

From the foregoing description, it will be seen that the improved system is very compact in design and can be assembled complete and tested at the factory at a relatively low cost. It is easy to install and does not require any expert gas fitter to connect and adjust regulators and other appurtenances when the installation is made. It has fully demonstrated that it will overcome objectionable variations in richness of gas generated from blends or mixtures of butane, propane and other volatile petroleum constituents.

Obviously, the present invention is not restricted to the particular embodiment thereof herein shown and described. Moreover, it is not indispensable that all the features of the invention be used conjointly, since they may be employed advantageously in various combinations and sub-combinations.

What is claimed is:

1. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; an external heat exchanger adjacent to and in heat exchanging relation with the tank and employing a liquid heat medium; a liquid eduction pipe connected to and leading from the bottom of the tank; a pressure reducing valve in the liquid eduction pipe; and an underground vapor generator associated with said heat exchanger connected to vaporize the liquefied gas at the reduced pressure and deliver it to a service pipe.

2. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; a liquid eduction pipe connected to and leading from the bottom of the storage tank; an external water heat exchanger secured to the tank to supply supplemental heat to the tank and maintain liquid eduction vapor pressure therein; a flash vapor generator connected to the eduction pipe and associated with the heat exchanger; a pressure reducing valve in the eduction pipe between the tank and the flash generator; and a vapor conduit leading from the flash generator.

3. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; an external heat exchanger assembled on the tank; a liquid eduction pipe connected to and leading from the bottom of the storage tank; a pressure reducing valve in the liquid eduction pipe; a vapor generator associated with said heat exchanger connected to vaporize the liquefied gas at the reduced pressure and deliver it to a service pipe; and a pressure reducing regulator connected to the service pipe.

4. In an underground liquefied gas dispensing system, a pressure storage tank buried in the

ground below the frost line; an external heat exchanger associated with the tank; a liquid eduction pipe connected to and leading from the bottom of the storage tank; a pressure reducing valve in the liquid eduction pipe; a vapor generator associated with said heat exchanger connected to vaporize the liquefied gas at the reduced pressure and deliver it to a service pipe; a pressure reducing regulator connected to the service pipe; and a casing above the tank housing both the pressure reducing valve and the pressure regulator.

5. In an underground liquefied gas dispensing system, a cylindrical pressure storage tank buried horizontally in the ground below the frost line; a heat exchanger integrally connected to one end of the tank; a liquid eduction pipe connected to and leading from the bottom of the storage tank; a pressure reducing valve in the liquid eduction pipe; a vapor generator associated with said heat exchanger connected to vaporize the liquefied gas at the reduced pressure and deliver it to a service pipe; a pressure reducing regulator connected to the service pipe; a casing above the tank housing both the pressure reducing valve and the pressure regulator; and pressure relief valves on the low pressure sides of the pressure reducing valve and the regulator also arranged within said casing.

6. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; a liquid eduction pipe connected to and leading from the bottom of the storage tank; an external water heat exchanger secured to the tank to supply supplemental heat to the tank and maintain liquid eduction vapor pressure therein; a flash vapor generator connected to the eduction pipe and associated with the heat exchanger; a pressure reducing valve in the eduction pipe between the tank and the flash generator; a vapor conduit leading from the flash generator; and a pressure reducing regulator in the vapor conduit adjacent to the tank.

7. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; a cup-shaped heat exchanger secured to one end of the tank and carrying a heating medium; a liquid eduction pipe connected to and leading from the bottom of the tank; a cup-shaped extension on the heat exchanger providing a flash generating chamber connected to the liquid eduction pipe; a pressure reducing valve in the liquid eduction pipe; a gas delivering pipe connected to the generating chamber; and a pressure reducing regulator in the gas delivery pipe.

8. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; a cup-shaped heat exchanger secured to one end of the tank and carrying a heating medium; a liquid eduction pipe connected to and leading from the bottom of the tank; a cup-shaped extension on the heat exchanger providing a flash generating chamber connected to the liquid eduction pipe; a pressure reducing valve in the liquid eduction pipe; a gas delivering pipe connected to the generating chamber; a pressure reducing regulator in the gas delivery pipe; and re-vaporizing means connected to the gas delivery pipe beyond the regulator and associated with the heat exchanger.

9. In an underground liquefied gas dispensing system, a pressure storage tank buried in

the ground below the frost line; a cup-shaped heat exchanger secured to one end of the tank and carrying a heating medium; a liquid eduction pipe connected to and leading from the bottom of the tank; a vapor generating coil in said heat exchanger connected to the liquid eduction pipe; a gas delivery pipe also connected to the coil; and pressure reducing regulators in both the liquid eduction and gas delivery pipes.

10. In an underground liquefied gas dispensing system, a pressure storage tank buried in the ground below the frost line; a cup-shaped heat

exchanger secured to one end of the tank and carrying a liquid heating medium; a liquid eduction pipe connected to and leading from the bottom of the tank; a vapor generating coil in said heat exchanger connected to the liquid eduction pipe; a gas delivery pipe also connected to the coil; pressure reducing regulators in both the liquid eduction and gas delivery pipes; and a casing above the tank housing both of said regulators.

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