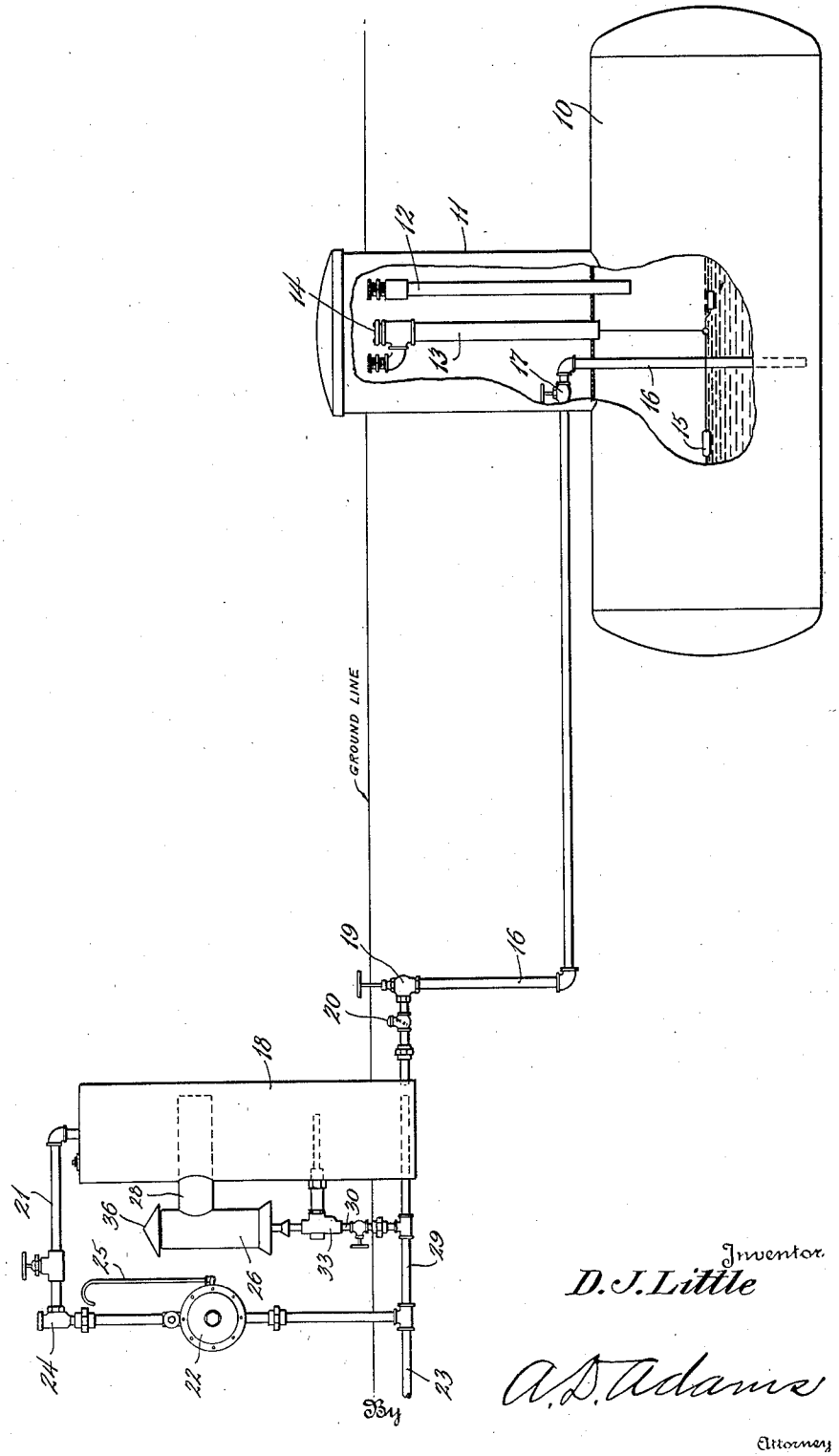
July 18, 1939. D. J. LITTLE 2,166,914

LIQUEFIED HYDROCARBON GAS STORAGE AND DISPENSING SYSTEM

Original Filed May 28, 1937 2 Sheets-Sheet 1

Fig. 1



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Fig. 2

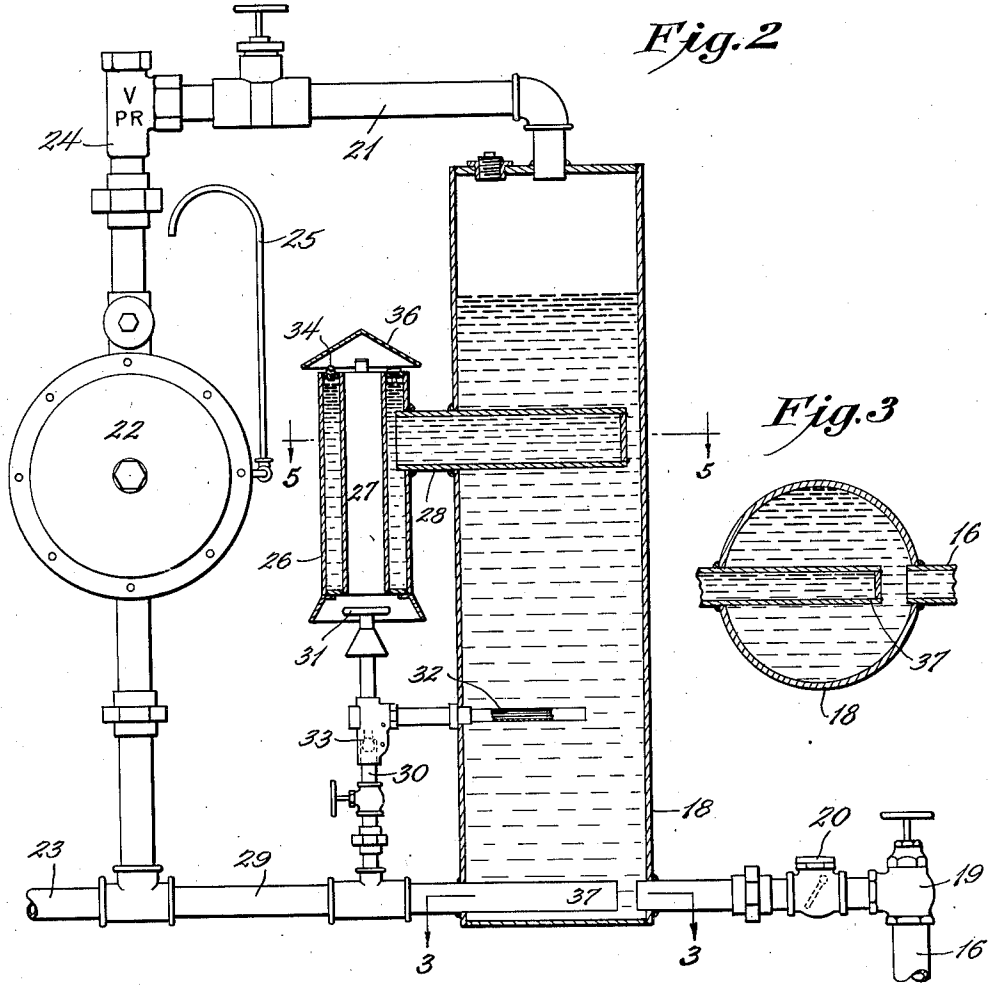


Fig. 3

Fig. 4

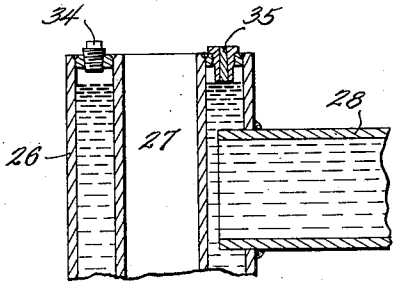
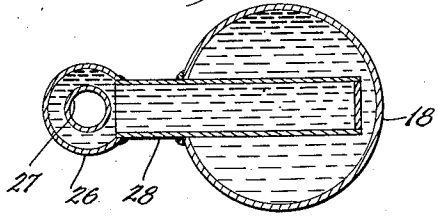


Fig. 5



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2,166,914

LIQUEFIED HYDROCARBON GAS STORAGE AND DISPENSING SYSTEM

David J. Little, San Antonio, Tex., assignor to Southern Steel Company, a corporation of Texas

Application May 28, 1937, Serial No. 145,390
Renewed March 22, 1939

11 Claims. (Cl. 62—1)

This invention relates to liquefied gas storage and dispensing systems and, among other objects, aims to provide certain improvements in the system disclosed in my application Ser. No. 136,489, filed April 12, 1937. The main idea is to provide an improved gas generator comprising a water tank or container in which the water is maintained at a substantially constant temperature and through which the liquefied gas is discharged to be cleansed and the gas entrains a small amount of water vapor. Also, the idea is to use the heated water to revaporize any condensate in the gas service main.

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

Fig. 1 is a side elevation of a system embodying the invention;

Fig. 2 is an enlarged sectional view of the gasifier or generator shown in Fig. 1, parts being shown in elevation;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view on a further enlarged scale of a water heater shown in Fig. 2; and

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 2.

Referring particularly to the drawings, the system shown for illustrative purposes is adapted to generate gas for domestic and commercial use from volatile constituents of petroleum or mixtures of liquefied hydrocarbon gases, such as butane, iso-butane, etc. In this instance. a pressure storage tank 10 is shown as being buried in the ground below the frost line in heat exchanging relation with the surrounding earth fill. This tank is adapted to be partially filled with the liquefied gas and is shown as having a protecting casing 11 projecting upwardly above the ground level. A valved gas vent pipe 12 and a combined valved filling and gauge pipe 13 are connected to the top of the tank and project into the casing so that the pipes may be connected to a service truck tank when the storage tank is to be filled, it being understood that the displaced gas in the tank will discharge through the pipe 12 into the gas space of the service truck tank. The level of the liquefied gas in the storage tank will be indicated by an ordinary gauge 14 which is operated by a float 15 in the tank. The vent pipe projects downwardly into the storage tank to approximately the desired maximum level of the liquefied gas so that the tank cannot be overfilled.

It will be understood that some of the highly volatile constituents of the liquefied gas in the storage tank will be vaporized in the tank due to the exchange of heat with the surrounding earth fill and thereby maintain a pressure in the tank. In this example, the pressure of the gas above the liquid level in the storage tank is utilized to discharge liquefied gas and deliver it to the gas generator or gasifier. Herein, a discharge pipe 16 extends approximately to the bottom of the storage tank and upwardly through the lower portion of the casing 11 where it is provided with a cut off valve 17. It is shown as being buried in the ground at a substantial depth and is connected to discharge into the bottom portion of a vertical stand pipe or water tank 18 which is partially filled with water through a plugged filling opening at the top, the arrangement being such that the liquefied gas vaporizes by being heated in the tank and bubbles up through the water. A cut off valve 19 and a check valve 20 are provided in the pipe 16 near the ground level. The check valve prevents water in the tank 18 from draining into the storage tank.

The gas is generated in the water tank 18 which is indirectly heated to a constant temperature and discharges from the top of the tank through a valved pipe 21 and the usual pressure regulator or reducing valve 22 to a gas main 23 shown as being buried in the ground at approximately the same level as the bottom of the water tank 18. An excess pressure relief valve 24 is provided in the pipe line 21 and a vent pipe 25 is connected to the pressure regulator or pressure reducing valve 22.

In this instance, a portion of the generated gas is used to heat the water in the tank 18. For this purpose, there is shown a flue type water heater 26 having a vertical flue 27 and a conduit 28 extending into the tank 18 for circulating the heated water and exchanging heat with the water in the tank. The heater is separated from the tank to avoid danger of an explosion. A branch pipe 29 is connected to the gas main 23 to supply gas through a valved gas pipe 30 to a small burner 31 at the bottom of the water heater 26. The burner is shown as being controlled automatically by a thermostat 32 extending into the water tank 18 and arranged to operate a valve 33 in the burner supply pipe 30. The arrangement is such that the heater maintains the temperature of the water in the tank 18 substantially constant. It is to be understood, however, that other well known thermally controlled valves may be employed for this purpose. The water heater

is adapted to be filled or partially filled with water through a filling opening closed by a filling plug 34. To prevent the heater from exploding due to excessive pressure in case the thermostatic valve does not function properly, there is shown a fusible plug 35 in the top which is adapted to melt at, say, 212° and permit some of the water or steam to escape from the heater. The heater is shown as being protected by a conical hood 36 removably secured to its upper end. The arrangement is such that any water or steam which may be discharged through the fusible plug opening will be deflected by the hood and some of it will fall through the flue 27 on the burner 31 and extinguish the flame.

In cold climates or during extremely cold weather, some of the gas in the service main 23 will condense and cause considerable trouble if it is not revaporized. In this example, any condensate formed in the service main is revaporized by the heated water in the tank 18. Referring to Figs. 2 and 3, the branch 29 is connected to the lowest part of the service main and extends into the bottom portion of the tank 18, having a closed end 37 within the tank. Any condensate in the main will drain back into the closed pipe and be revaporized by heat absorbed from the water.

From the foregoing description, it will be seen that the improved system is entirely automatic and reliable in operation. The indirect or external heater maintains the temperature of the water in the tank or gas generator substantially uniform and the gas at a substantially constant pressure. The gas is cleansed of tarry products by the water and is humidified to improve its combustion quality. Moreover, the indirect heater which may be arranged inside a cellar or house avoids any danger of an explosion which might be caused by a direct heater. The generator also revaporizes all condensate in the gas main and thereby prevents any stoppage of gas flow due to trapped condensate. The indirect heater and generator may be assembled at the factory and installed as a unit. Furthermore, the whole system can be sold at a very reasonable cost and is especially adapted for household and commercial uses, even in the coldest climates.

What is claimed is:

1. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit including a container partially filled with water to which the dispensing pipe is connected below the water level; and a heater having indirect heating means connected to heat the water in said container.

2. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit including a container partially filled with water to which the dispensing pipe is conected below the water level; a heater having indirect heating means connected to heat the water in said container; and thermally controlled means connected to maintain the temperature of the water substantially constant.

3. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit including a container partially filled with water to which the dispensing pipe is connected below the water level; a heater for said container; and a thermostat responsive to the temperature in the container connected to control the heater and thereby maintain the temperature of the water substantially constant.

4. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit including a container partially filled with water to which the dispensing pipe is connected below the water level; a gas conduit connected to said container above the water level; a pressure regulator connected to said conduit; and an indirect heater for said container supplied with gas from said conduit.

5. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit including a container partially filled with water to which the dispensing pipe is connected below the water level; a gas conduit connected to said container above the water level; a pressure regulator connected to said conduit; a separate water heater connected to heat the water in said container; a burner for said heater supplied with gas from said conduit; and a thermostatic valve controlling said burner responsive to the temperature of the water in said container to maintain the temperature of the water substantially constant.

6. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generator comprising an upright tank partially filled with water to which said dispensing pipe is connected near the bottom so that the liquefied gas delivered thereto passes through the water; a check valve in said dispensing pipe to prevent water from flowing into said storage tank; a gas delivery conduit connected to the upper portion of said water tank and having a pressure reducing valve therein; and an indirect heater for the water in said tank having a gas burner connected to be supplied with gas delivered therefrom.

7. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generator comprising an upright tank extending above the ground level and partially filled with water to which said dispensing pipe is connected below the water level; a check valve in said dispensing pipe to prevent water from flowing into the storage tank; a gas delivery conduit connected to the upper end of said gas generating tank; a pressure regulating valve in said conduit; a gas main having its lowest portion adjacent to the lower end of said gas generating tank; a heater for the water in said gas generating tank supplied with gas from said conduit; a thermostatically controlled valve for the heater connected to maintain the temperature of the water in said gas generating tank substantially constant; and a pipe connected to said gas main at its lowest point extending into the lower portion of said gas generating tank to absorb heat from the water therein and revaporize any condensate formed in said gas main.

8. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit comprising a container partially filled with water to which said dispensing pipe is connected below the water level; heating means connected to said container; a gas delivery conduit connected to said container and having its lowest point near the bottom of said container; and a pipe connected to said gas de-

livery conduit extending into said container in heat exchanging relation with the water therein to revaporize any condensate formed in said container.

9. In a liquefied gas storage and dispensing system having an underground pressure storage tank and a dispensing pipe for the liquefied gas, a gas generating unit comprising an upright tank partially filled with water to which said dispensing pipe is connected below the water level; a gas delivery conduit connected to the upper end of said tank; an indirect heater for the water in said tank including a water container and a gas burner connected to be supplied with gas generated in said tank; and a fusible plug in said heater to prevent overheating of the water therein.

10. In a liquefied gas dispensing system having a pressure storage tank and filling appurtenances connected thereto whereby it may be partially filled while the pressure is maintained therein; a separate gas generating tank partially filled with liquid; a liquid eduction pipe connected to deliver gas in the liquid phase from the storage tank to the generating tank below the liquid level therein; valve means in said eduction pipe; a gas service pipe connected to the vapor space in said generating tank; and a pressure reducing regulator connected to said service pipe, one of said tanks being buried in the ground to absorb heat from the surrounding earth.

11. In a liquefied gas dispensing system having a pressure storage tank and filling appurtenances connected thereto whereby it may be partially filled while the pressure is maintained therein, a separate gas generating tank partially filled with liquid; a liquid eduction pipe connected to deliver gas in the liquid phase from the storage tank to the generating tank below the liquid level therein; and an underground gas service pipe having a condensate trap portion at its lowest point arranged in heat exchanging relation with the generating tank.

DAVID J. LITTLE.