Feb. 21, 1950 O. R. ANDERSON 2,497,969

LIQUEFIED GAS DISPENSING APPARATUS

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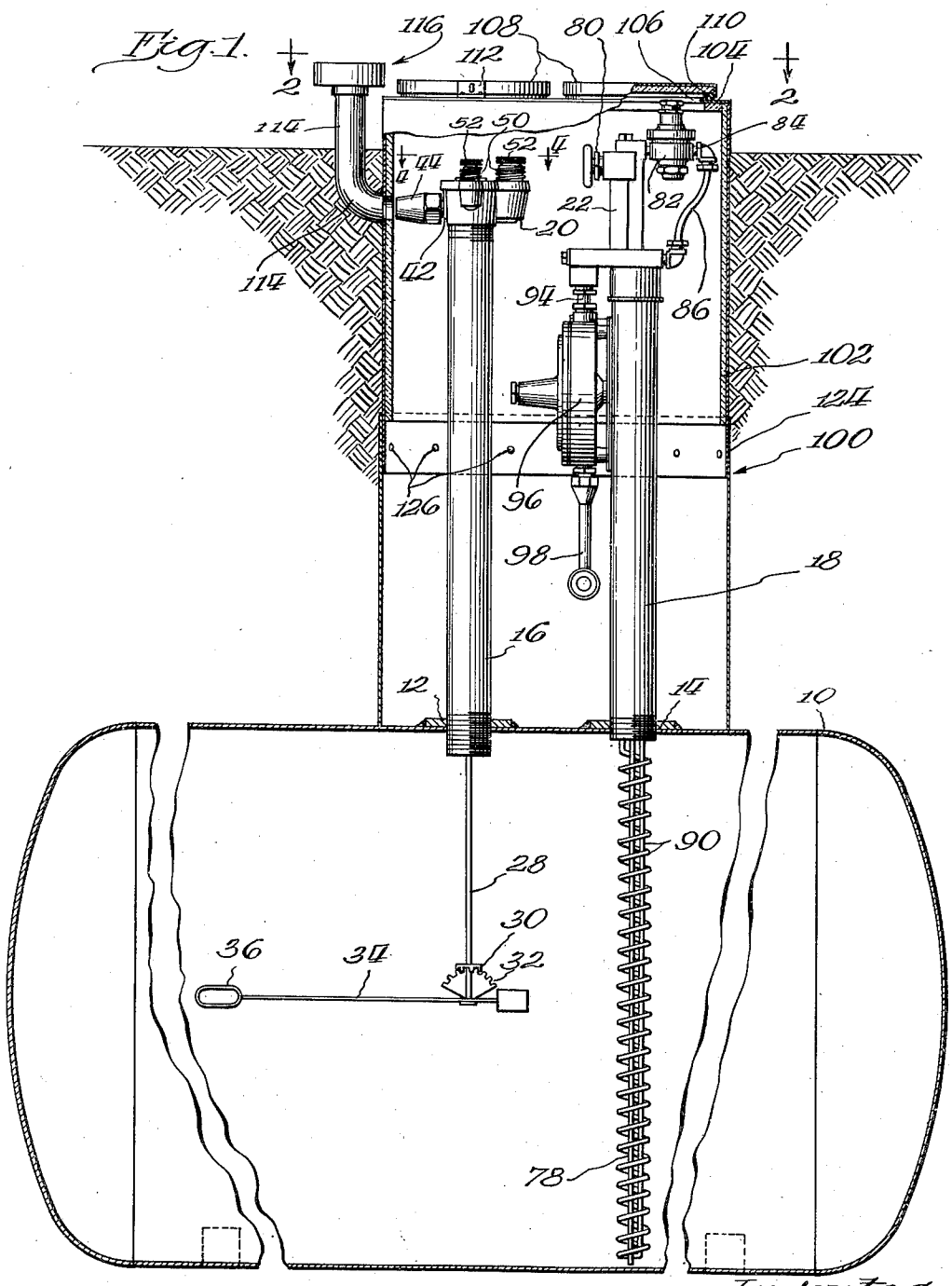
Fig. 1.



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LIQUEFIED GAS DISPENSING APPARATUS

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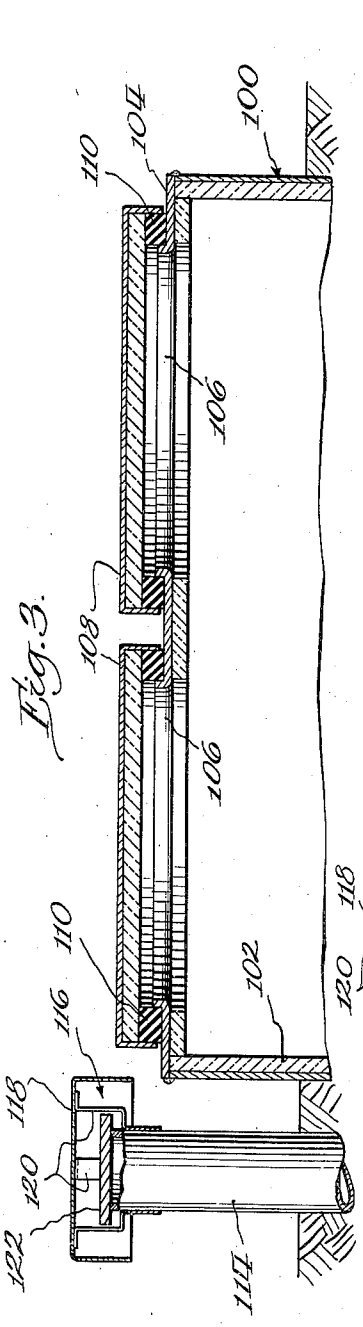

Fig. 3.

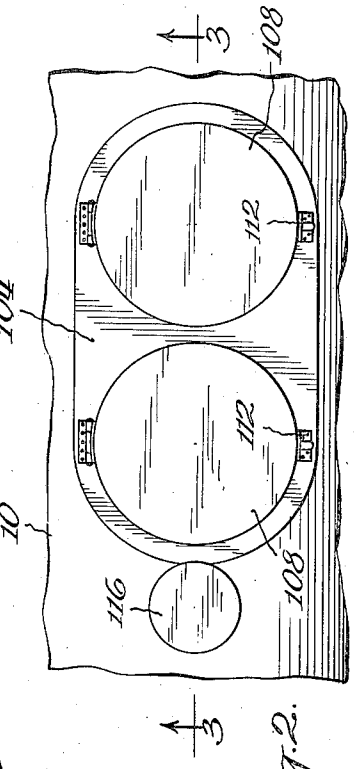

Fig. 2.

Fig. 6.

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Fig. 4.

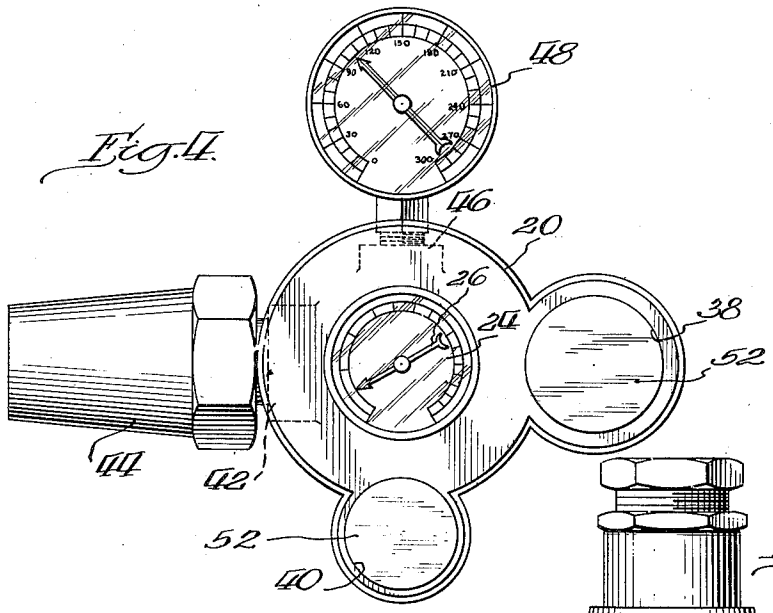
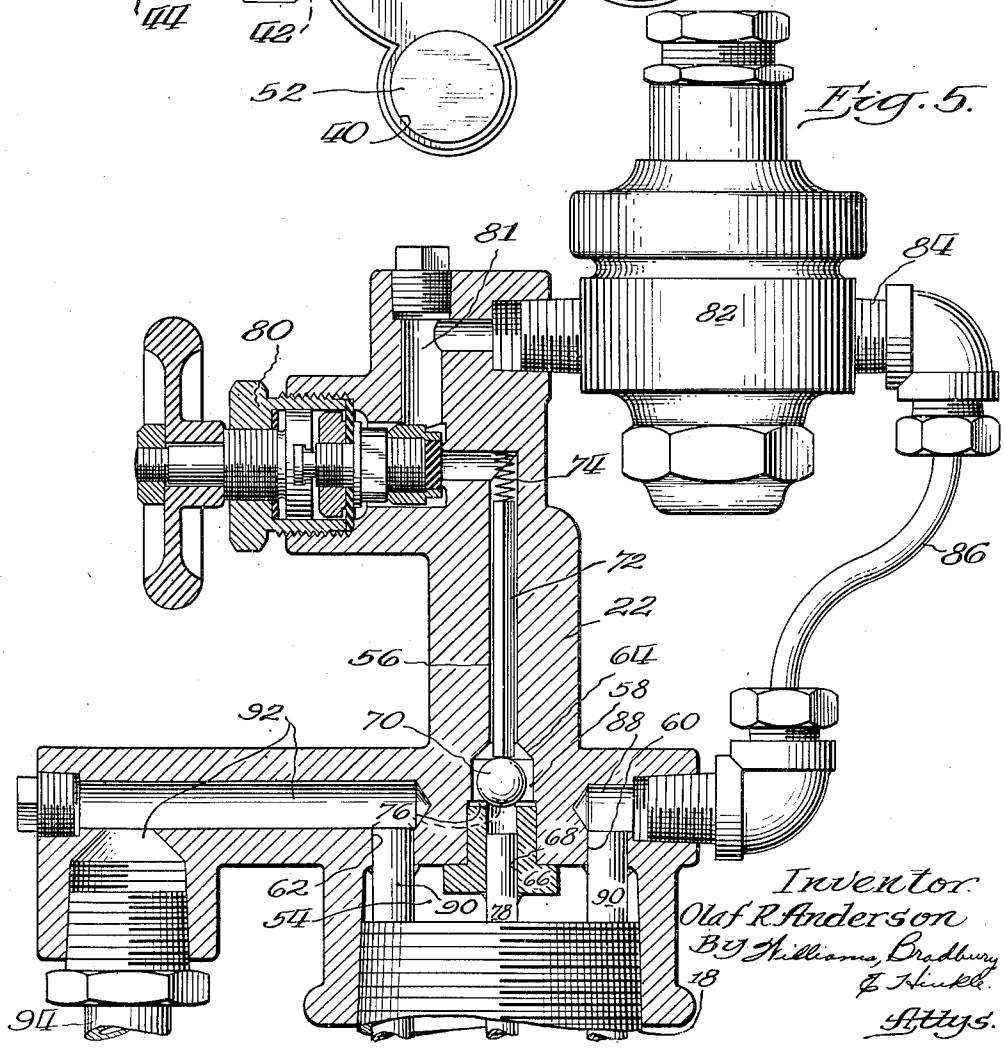


Fig. 5.



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Patented Feb. 21, 1950 2,497,969

UNITED STATES PATENT OFFICE

2,497,969

LIQUEFIED GAS DISPENSING APPARATUS

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Application June 7, 1940, Serial No. 339,218

6 Claims. (Cl. 62—1)

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This invention contemplates and provides an improved liquefied gas dispensing apparatus of the general type commonly known as consumer bulk systems.

These systems usually comprise a liquid storage tank buried in heat exchange relation with the surrounding earth and are usually designed to operate with mixtures of propane and butane gases, inasmuch as these gases and mixtures thereof vaporize at comparatively low temperatures.

Two methods of vaporizing the liquid in the tank are in general use. One method, commonly known as batch vaporization, consists merely in conducting the gas collected above the liquid level in the tank through a pressure reducing regulator and thence to the gas consuming appliance. The other method, known as flash vaporization, consists in withdrawing unvaporized liquid from the tank and passing this liquid through a heat exchanger placed at some remote point, usually within the house served by the system. In the heat exchanger the liquid is ordinarily converted to a gas and the gas piped to the gas consuming appliances through a pressure reducing regulator.

Each of the above systems has disadvantages which it is an object of the present invention to overcome.

One objection to consumer bulk systems of the batch vaporization type, using mixed gases, is that propane has a higher vapor pressure than butane and, consequently, the proportion of the two gases in the mixture supplied by such a system is constantly changing. The effect of this is that the adjustment of burners designed to burn the gas must at best be a compromise, and therefore, the burners cannot use the gas as efficiently as would be possible if a gas of a uniform mixture could be supplied from the generating apparatus.

The flash vaporization system, although it supplies a gas of substantially constant character, is objectionable because of an inherent lack of safety. This is brought about by the fact that when considerable gas is being used, the capacity of the heat exchanger may be exceeded, inasmuch as each gallon of liquid vaporized absorbs approximately 750 B. t. u. of heat. Since the heat exchanger and the tank do not depend on the same source for heat, it frequently happens that the tank is warm enough to force liquid to the heat exchanger, while the heat exchanger is so cold that vaporization therein is not accomplished. The result of this is that liquid may

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squirt from the gas burners, and since a small quantity of liquid creates a large body of gas, a serious explosion or fire is likely to result.

Another objection to flash vaporization systems as usually provided is that the installation expense is relatively high because of the necessity for installing and connecting the several separate units.

It is, therefore, the principal object of my invention to provide a novel consumer bulk system which combines the advantages of the above systems without incorporating their serious disadvantages.

An additional object of my invention is to provide a novel and safer gas dispensing apparatus of the above general type, which dispenses a uniform gas even though the liquid in the tank may be a mixture.

Still another object of my invention is to provide a novel flash vaporization consumer bulk system which may be installed as a unit in the manner usually employed in the installation of batch vaporization systems.

Another object is to provide an improved gas dispensing system which will operate to dispense a uniform gas from such varied mixtures of high vapor pressure petroleum fractions as casing head gas without the danger of liquid being forced to the gas consuming appliances.

An additional object of my invention is to provide a novel protective casing for a gas dispensing apparatus which is collapsible for shipping, and which enables the user to obtain access to the dispensing accessories while allowing access to the filling accessories only to one authorized to service the system.

Still another object is to provide novel means for venting the protective casing to the atmosphere.

An additional object is to provide a novel fitting having all accessories for servicing a consumer bulk system.

Other objects and advantages will become apparent from the following description of a preferred embodiment of my invention.

In the drawings:

Fig. 1 is a longitudinal sectional view of a gas storage and dispensing apparatus embodying the present invention;

Fig. 2 is a plan view of a portion of the apparatus showing the manhole covers, casing vent and general shape of the casing;

Fig. 3 is a transverse sectional view taken in the direction of the arrows substantially along the line 3—3 of Fig. 2, illustrating the portion

of the apparatus which projects above the ground;

Fig. 4 is a plan view of the apparatus secured to the filling pipe;

Fig. 5 is a vertical sectional view through the upper portion of the apparatus for dispensing gas from the tank; and

Fig. 6 is a view similar to Fig. 3 showing an alternative arrangement of the low pressure vent valve.

Referring to Figs. 1 to 5, the liquefied gas storage and dispensing apparatus illustrated comprises a tank 10 provided with two longitudinally spaced flanged openings 12 and 14. Of these, the opening 12 has a vertical pipe 16 either threaded or welded therein. The opening 14 is similarly provided with a second pipe 18 secured parallel to the pipe 16.

The top end of the pipe 16 is provided with a cast, or preferably forged, fitting 20 threaded or welded thereto, while the pipe 18 is similarly provided with a fitting 22. As a matter of convenience, the pipe 16 and fitting 20 will be referred to, respectively, as the filling pipe and filling fitting, while the pipe 18 and fitting 22 will be referred to as the dispensing pipe and dispensing fitting.

The filling fitting 20 is provided in the center of its upper surface with a glass covered opening 24 beneath which is positioned an indicator and card 26 of a liquid level gauge. To prevent leakage, this gauge is preferably of the magnetic type, the construction of which is well known. The gauge is controlled by a depending shaft 28 rotated by a gear 30 and sector 32, the latter of which is attached to a pivoted rod 34 having a float 36 at its outward end—all in a manner well known in the art.

The filling fitting 20 is hollow and has a filling opening 38, a vapor return outlet opening 40, a threaded opening 42 to accommodate a safety valve 44, and a threaded opening 46 provided for a pressure gauge 48.

It should be noted that the two horizontal openings 42 and 46 are directly opposite the filling and vapor return openings, respectively. This arrangement makes it possible, when drilling the opening 42, to continue with the drill into the opposite side of the forging to form the horizontal passage of the filling opening. In a similar manner, the horizontal passage to the vapor return opening can be drilled in the operation that forms the opening 46. Thus, the horizontal passages leading from the central portion of the forging to the vapor return and filling openings can be provided without the necessity for blind passages which require plugs to close one end.

The filling and vapor return openings are externally threaded at 50 to provide means for connecting hose couplers thereto for filling the tank 10 from a service truck. Within each of these openings automatic cutoff valves, not shown, are provided in a well-known manner. These valves are normally closed to prevent the pressure within the tank from causing gas to escape when caps 52 are removed in preparation for connecting the filling and vapor return hoses to their respective openings, but are adapted to be opened by apparatus in the hose couplers when the connection is made.

In filling the tank, the caps 52 are removed, the filling and vapor return hoses from the service truck are connected to their respective openings and the service truck valves opened to allow liquefied gas to flow from the service truck into the tank 10 through the pipe 16. After the tank has been filled to the proper level, the flow of liquefied gas from the service truck is shut off, the hose couplers disconnected and the caps 52 replaced.

The dispensing fitting 22 has a cup-shaped recess 54 in its lower portion into which the pipe 18 is either threaded or welded. Extending vertically within the fitting and communicating with the recess 54 are a central bore 56 and counterbore 58 and two side bores 60 and 62. A conical valve seat 64 is formed at the junction of the bore 56 and counterbore 58, while a bushing 66, having a bore 68 therethrough, is secured in the lower portion of counterbore 58. A ball valve 70 freely movable within the counterbore 58 is retained therein by the bushing 66. This ball 70 acts as an excess flow check valve and is normally held in its open position against the upper end of the bushing 66 by means of a preferably square or triangular rod 72 located within the bore 56 and urged downwardly by a spring 74. The top or inward end of the bushing 66 is slotted as at 76 to enable liquid to flow around the valve when the ball is against the bushing. A tube 78 fits within the bore 68 and is welded, or otherwise suitably secured, to the bushing 66. This tube 78 extends downwardly through the pipe 18 nearly to the bottom of the tank 10.

The bore 56 communicates at its top through a cutoff valve 80 of any suitable construction and intersecting bores 81 with a liquid pressure regulator 82. The outlet connection 84 of the liquid pressure regulator is in turn connected by means of standard tubes and pipe fittings 86 to a horizontal bore 88 intersecting the vertical bore 60.

A tube 90, having one end welded within the opening 60, extends downwardly through the pipe 18 to the bottom of the tank and is then coiled back upwardly to form a heat exchanger and has its opposite end welded within the vertical bore 62. This bore 62 in turn communicates, by means of intersecting bores 92 within the fitting 22 and a tube 94, with a vapor pressure regulator 96 mounted upon the pipe 18. The outlet connection of this vapor pressure regulator is connected to the gas using appliances by a service pipe 98.

In operation, liquid from the tank 10 is forced upwardly through the tube 78, around the excess flow check valve, through the bore 56 to the cutoff valve 80, and thence to the liquid pressure regulator 82 through the bores 81. This regulator 82 is adjusted to pass liquid therethrough whenever the pressure on its outlet side drops below approximately ten pounds per square inch. From the regulator 82 the liquid flows into the coiled tube 90 by means of the tubes and fittings 86 and bores 88 and 60. Within this coiled tube 90, which is in heat exchange relation to the liquid within the tank 10, the liquid is quickly vaporized at the decreased pressure maintained therein—approximately ten pounds per square inch. The vapor passes upwardly from the coiled tube 90 and into the vapor pressure regulator 96 by way of the bores 62 and 92 and tube 94. The regulator 96 is adjusted to pass vapor therethrough whenever the pressure in the service pipe 98 drops below the necessary service pressure. This pressure is, as a rule, a matter of only a few ounces per square inch.

The liquid and vapor pressure regulators 82 and 96, respectively, have not been described in detail, since these elements are of well-known

construction and are standard articles of commerce.

A metal hood or casing 100 encloses the pipes 16 and 18 and their fittings and extends from slightly above ground level downwardly and has its lower edge welded to the tank 10. The interior of the casing 100 is lined with heat insulating material 102 from the top thereof downwardly to a point somewhat below the frost line. This casing is covered by a top plate 104 welded to the side walls and provided with two manholes 106, one directly above each of the pipes 16 and 18. Each of these manholes is closed by a hinged cover 108, which is sealed against the top 104 by a suitable gasket 110 positioned between the top and the cover. The covers 108 are provided with hasps 112 or other suitable devices by means of which the covers can be padlocked when in closed position.

With this arrangement, the user of the gas dispensing device can be given a key, by means of which he may unlock the manhole cover over the dispensing pipe 18 so that he may open or close the shutoff valve 80 or adjust the pressure regulators. The service man may carry a key to unlock the other cover to enable him to check the liquid level and tank pressure and to replenish the supply of liquefied gas.

Preferably, the two manhole covers 108 and the top 104, as well as the side walls, are lined with heat insulating material.

As shown in Figs. 1 to 5, the side wall of the casing 100 directly opposite the exhaust end of the safety valve 44, is provided with an aperture therethrough leading to a pipe 114 welded to the casing. This pipe 114 extends upwardly above the surface of the ground and at its upward end carries a low pressure relief valve 116. This valve consists of a hood 118, supported from the pipe 114 on arms 120 to prevent dirt and other foreign substances from obstructing the operation of the valve, and a circular disc 122 to cover the end of the pipe 114.

The above arrangement prevents rain water or dirt or troublesome insects from getting inside the casing 100 and is particularly valuable in sand storm areas. It also prevents the outside air from circulating through the casing, thereby making it more nearly possible to maintain a uniform temperature within the casing. On the other hand, any leakage from the fittings, pressure regulators or any exhaust from the safety valve easily escapes from the casing 100 through the pipe 114 and low pressure relief valve 116.

A similar arrangement is illustrated in Fig. 6, excepting that in this embodiment the low pressure relief valve 116 is mounted directly upon one of the manhole covers and communicates therethrough with the interior of the casing. In this embodiment the pipe 114 and the aperture in the side of the casing leading thereto are not necessary.

If the apparatus is to be shipped a considerable distance, it is preferable to provide the pipes 16 and 18 and the flanged openings 12 and 14 with screw threads, so that the two pipes 16 and 18 and their attachments and fittings can be removed from the tank and shipped in separate packages. It should be noted in this connection that the heat exchanger 90 is of such a diameter that it may be removed through the opening 14. With the above units removable, the casing may to advantage be made to telescope, for instance at the point 124, by making the top portion of the casing 100 of slightly smaller diameter than the lower portion. Thus, the tank can be shipped with the top portion of the casing pushed downwardly inside the lower portion. To erect the casing, the upper portion is pulled outwardly and bolts 126 inserted through aligned apertures in the two portions of the casing.

From the above it will be seen that while a consumer bulk system built as described will supply a gas of constant character, it is not inherently dangerous as is the usual flash vaporization system. This is because the heat exchanger absorbs its heat from the liquid in the tank and, consequently, the heat exchanger cannot become substantially colder than the liquefied gas in the tank. Thus, if the heat exchanger should become too cold to vaporize the liquid therein, this is because the whole body of liquid is cold, and, therefore, the vapor pressure in the tank would not be sufficient to force liquid into the heat exchanger. Thus, the system merely stops operating instead of forcing liquid to the gas using appliances in the event that the heat exchanger becomes too cold to vaporize the liquid.

It will be appreciated that the present invention contemplates modifications of the preferred embodiment described and illustrated herein and that the invention is to be measured by the scope of the appended claims.

I claim:

1. In a device of the class described, a tank adapted to be buried beneath the surface of the ground, a casing extending from the tank to a point above the surface of the ground, said casing having a top with two manholes therein, manhole covers to close each of said manholes, a low pressure relief valve communicating with the inside of said casing and exhausting to the atmosphere, said low pressure relief valve adapted to open when the pressure inside of said casing substantially exceeds atmospheric pressure, dispensing fittings secured to said tank and located beneath one of said covers and filling fittings secured to said tank and located beneath the other of said covers.

2. In a device of the class described, a tank adapted to be buried beneath the surface of the ground, a metal sleeve secured to said tank and extending upwardly, a second metal sleeve telescoping the first sleeve, said second sleeve having a top with a manhole therein, a manhole cover to close said manhole and a low pressure relief valve communicating with the space inside of said sleeves and exhausting to the atmosphere, said low pressure relief valve adapted to open when the pressure inside of said sleeves substantially exceeds atmospheric pressure.

3. An apparatus for supplying a fuel of substantially uniform composition and at a low pressure from a mixture of liquid hydrocarbons, said apparatus comprising an underground tank having an opening therein, conduit means extending from said tank to a place where the fuel is consumed, and means for regulating the flow of fuel through said conduit; said conduit including a section extending through said opening having a portion arranged to be normally covered by the body of liquid fuel in the tank and having its inlet adjacent the bottom of said tank, a second section extending through said opening connected to said first section and having a substantial portion thereof in close proximity to and coiled about that portion of the first section disposed within the tank, said last mentioned portion being bodily movable through the opening in said tank, and a third section communicating

with the second section and terminating near the place of fuel consumption; said control means including a pressure reducer arranged between the first and second sections of said conduit and a second pressure reducer arranged in the third mentioned section to control the flow of fuel through the latter.

4. Apparatus for supplying fuel at a low pressure from a mixture of liquid hydrocarbons, said apparatus comprising a pressure storage tank buried in the ground to absorb heat from the surrounding earth and having an opening remote from the bottom thereof, conduit means extending from the tank to a place where the fuel is consumed, and means controlling the flow of fuel through said conduit means; said conduit means including a portion having its inlet adjacent the bottom of said tank and extending through said opening, a second portion connected to said first portion including a vaporizing section extending in part parallel to and in close proximity to said first portion and in part coiled about the same, said vaporizing section being bodily movable through said opening, and a third portion communicating with the coiled part of said vaporizing section to deliver fuel therefrom at a point of use; said control means including an automatic valve in said second portion of the conduit controlling the flow of fuel from the tank to the parallel part of said vaporizing section as the vapor is consumed, and a pressure reducing valve in said third portion to control the flow of fuel through the latter.

5. In a gas dispensing apparatus, a tank adapted to contain liquefied gas under pressure and be buried in heat exchange relation to the earth, said tank having an opening therein, an eduction tube extending through said opening into said tank and having an opening below the liquid level therein, a liquid pressure regulator connected to said tube, a vapor pressure regulator, a tube extending through the tank opening having a portion positioned in heat exchange relation to the liquefied gas in said tank, said portion being bodily movable through the tank opening and extending in part parallel with and in part coiled about said eduction tube and connected between the liquid pressure regulator and the vapor pressure regulator, said pressure regulators being arranged above the tank.

6. In a gas dispensing apparatus, a tank adapted to contain liquefied gas under pressure and be buried in heat exchange relation to the earth, a standpipe connected thereto, a unitary fitting for the outer end of said standpipe having an opening for connection therewith, an eduction tube communicating with the interior of said fitting extending through the standpipe into said tank and having an opening below the liquid level therein, a liquid pressure regulator communicating with said tube through said fitting, a vapor pressure regulator, a tube passing through the standpipe having a portion positioned in heat exchange relation to the liquefied gas in said tank and extending in part parallel with and in part coiled about said eduction tube and communicating through the interior of said fitting with the liquid pressure regulator and the vapor pressure regulator.

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