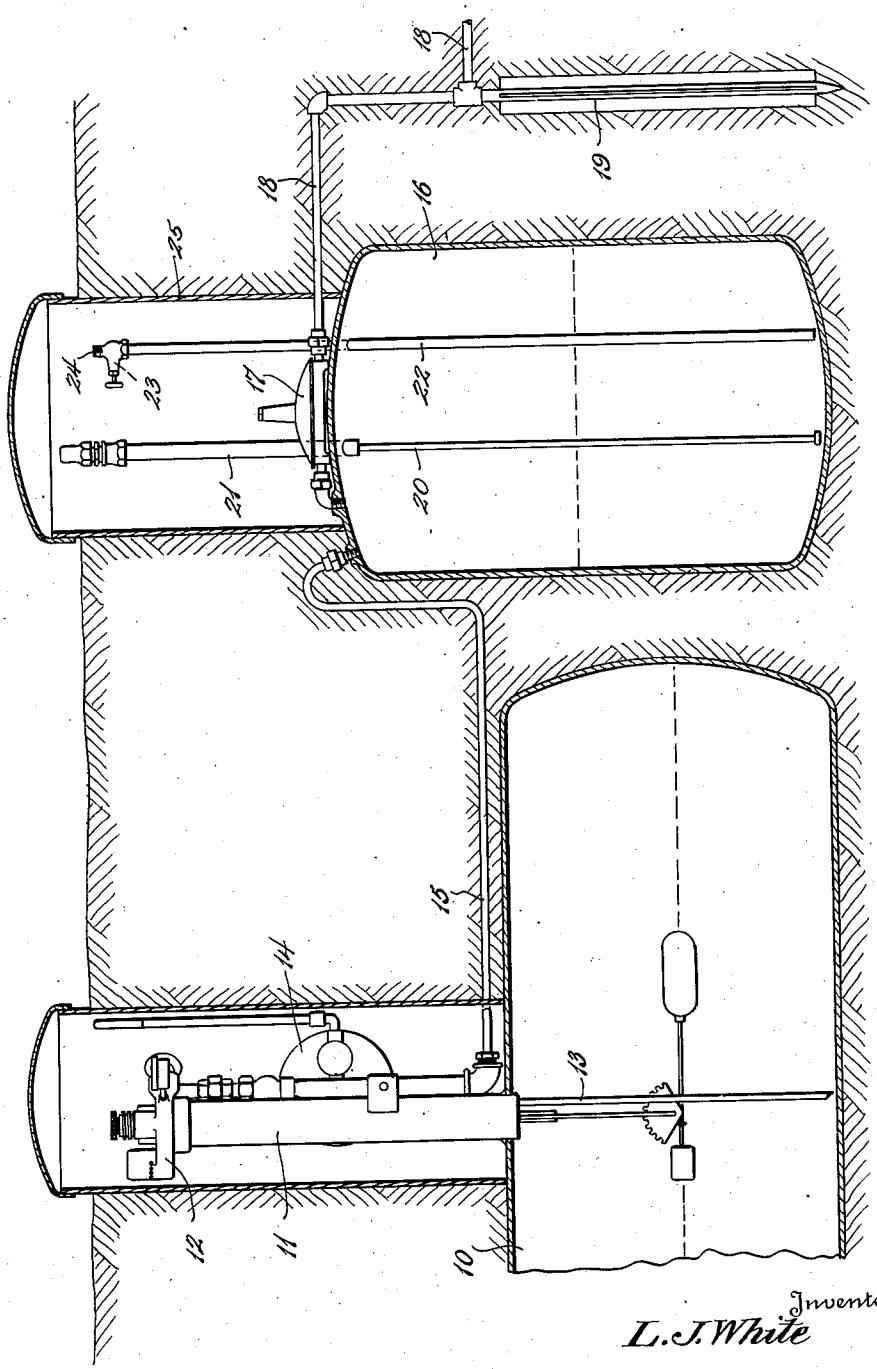
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CONVERSION APPARATUS FOR LIQUEFIED GAS SYSTEMS

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CONVERSION APPARATUS FOR LIQUEFIED GAS SYSTEMS

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This invention relates to apparatus for converting ordinary liquefied gas systems designed to dispense low pressure gas, such as butane, into a system for dispensing a mixture of more highly volatile liquefied gas with normally liquid petroleom distillates or blends thereof, such as gasoline, and this application is a companion to my copending application Ser. No. 420,566, filed November 26, 1941.

One of the main objects of the invention is to provide a combination vaporizing and separating chamber and other appurtenances for use in conjunction with an existing low pressure system designed and installed to dispense butane, either in the vapor phase or in the liquid phase, from a main storage tank. The principal aim is to enable the low pressure equipment already installed to be used safely for dispensing propane which, alone, has a much higher vapor pressure than butane at the same temperature.

As stated in the aforesaid copending application, it is contemplated that butane, which has heretofore been used quite extensively in underground liquefied gas dispensing systems, will be used more extensively in the manufacture of high octane aviation fuel and that practically the whole supply in this country will be required for that purpose.

The design working pressure of the ordinary underground tanks or containers and equipment for storing and dispensing butane is not sufficient to safely withstand the vapor pressures of propane, alone. In accordance with the aforesaid application, propane is blended with a normally liquid petroleum distillate, such as benzine or commercial gasoline, which are liquid at ordinary temperatures, to produce a mixture having a vapor pressure lower than that of propane, alone, and thereby enable it to be used in relatively low pressure systems of the weight and construction now and heretofore employed for storing and dispensing butane. This invention provides a combination or dual purpose vaporizer and separating tank or chamber, together with appurtenances for converting a single stage vapor eduction butane system into a propane gas dispensing system, wherein propane is mixed with gasoline or the like and the gasoline is separated in and evacuated from the vapor generating and separating chamber, as explained in the aforesaid application. The idea is to avoid the expense of replacing pressure storage tanks and other equipment designed for such butane systems. Also, the invention avoids the necessity for consuming large quantities of steel now so essential in connection with the national defense program.

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

The figure is a sectional view of a converted system embodying the invention.

Referring particularly to the illustrated system, the conversion equipment is shown as being combined with a system similar to that shown in U. S. Patent 2,176,829, wherein butane or a blended butane fuel is dispensed in the liquid phase from a storage tank through two pressure reducing regulators, one to reduce the pressure of the liquid and partially vaporize it, and the other to further reduce the pressure of the vapor to be delivered to service appliances. As shown in said patent, a tank 10 is buried in the ground and has a standpipe 11 through which it is filled and liquid is dispensed. The standpipe has a combination valve fitting 12, which is identical with that shown in said patent, and the liquid is delivered through a liquid eduction tube 13 in the tank connected to the fitting, thence through a first stage pressure reducing regulator 14 and an underground pipe 15 exactly as shown and described in the aforesaid patent. In this instance, the tank is charged with a mixture of propane and gasoline, as explained in the aforesaid copending application, to reduce the vapor pressure to the designed working limits of the system.

As stated in said application, it is necessary to remove the gasoline component of the mixture before delivering the propane vapor to the appliances. Therefore, instead of delivering the mixture through a second stage regulator, as shown in the aforesaid patent, it is delivered to a combination vaporizing and separating chamber, herein shown as being in the form of a tank 16, also buried in the ground and preferably adjacent to the main storage tank. The capacity of this tank is preferably such as to hold all of the gasoline used in the mixture which fills the main storage tank. In the case of a 50-50 mixture, the vaporizing tank should be at least half the size of the main tank.

The pressure of the mixture is reduced by the first stage regulator to, say, six to eight pounds, permitting some of the propane component to be vaporized before it reaches the chamber 16. The mixture then further absorbs earth's heat to vaporize all of the propane component and a small quantity of the gasoline which enriches the propane vapor.

From the tank 16, the propane vapor is delivered through a second stage pressure reducing regulator 17 and a service pipe 18 to the consuming appliances. In this instance, the service pipe 18 has a low point to which a suitable underground revaporizer 19, similar to that shown in Patent 2,105,383, is concerned. It is designed to revaporize any condensate which drains into it from the service pipe.

As explained in the aforesaid copending application, it is desirable to ascertain the level of the separated gasoline in the tank 16. For that purpose, there is shown an ordinary slip tube gauge 20 similar to that shown in Patent 2,121,673 and extending through a single upstanding pipe 21 on the tank. However, it is contemplated that any suitable type of liquid level gauge may be employed. Also, it is essential that the separated gasoline in the tank 16 shall be removed periodically or as it accumulates, if desired. In this example, a separate liquid eduction tube 22 is welded in and passes through the top of the tank and is shown as having a valved fitting 23 at its upper end presenting a hose connection 24, so that the valve may be opened and the liquid evacuated from the tank into any suitable container. Such reclaimed gasoline may be used for ordinary purposes, such as in automobiles, tractors and the like.

The tank 16 is shown as having a protecting casing 25 surrounding the appurtenances and providing access thereto from above the ground. However, it is contemplated that the conversion equipment may also be applied to above-ground systems installed in climates suitable for that purpose and where such systems are permitted to be placed above-ground. It is advantageous, however, to use the system underground in climates where the temperature varies quite considerably between winter and summer.

When the conversion equipment is to be applied to a single stage vapor eduction system of the type shown in Patent 2,121,675, it will, of course, be understood that the liquid eduction tube 13 in the pressure storage tank 10 must be provided. The combination valved unit 12 in the present application is substantially identical with that shown in said Patent 2,121,675 and it is only necessary to remove the fitting to apply a tube 13 to the vapor outlet conduit, reference being made to Fig. 4 of said patent. When the fitting is not provided with screw threads in the vapor outlet duct for receiving such a tube, as shown in Fig. 3 of Patent 2,176,829, it will be understood that screw threads may either be tapped into it or the upper end of the pipe may be brazed or welded to it. Then, the single-stage regulator can easily be readjusted to act as a first-stage regulator. Otherwise, the conversion equipment is identical and it becomes a simple matter to switch over from butane to propane at very little added cost.

From the foregoing description, it will be understood that the conversion equipment is very simple in its design and can be manufactured at a relatively small cost. The apparatus can be assembled as a unit at the factory and the protecting casing will prevent damage to the appurtanences in transit. It can be installed in conjunction with existing underground butane systems by unskilled mechanics at a relatively low cost and it is very efficient in operation. In fact, such converted systems will operate as well as the one disclosed in the aforesaid copending application. Moreover, the conversion equipment requires much less steel and dispensing apurtenances than would be required to replace an old system designed for dispensing butane and its mixtures.

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 combination with a liquefied gas dispensing system designed to dispense a low pressure gas, such as butane, including a pressure storage tank adapted to contain a mixture of propane and gasoline and having means for dispensing the mixture from the tank at a reduced pressure; a conversion unit comprising a separate underground vaporizing tank connected to receive said mixture and adapted to absorb vaporizing heat from the surrounding earth; a vapor outlet conduit connected to said vaporizing tank and extending to a point of use; a pressure reducing regulator in said conduit; a revaporizer in said conduit; liquid eduction means also connected to said vaporizing tank for removing separated gasoline collected therein; and a protecting casing on the vaporizing tank surrounding the regulator and liquid eduction means and extending above the ground level.

2. Apparatus for converting an ordinary butane gas dispensing system designed to operate at low pressure into a system for dispensing propane and the like wherein the usual storage tank is charged with a mixture of propane and a readily miscible, normally liquid hydrocarbon fuel to reduce its vapor pressure; comprising an independent unit including a vaporizing tank adapted to be buried in the ground in heat exchanging relation with the surrounding earth and to be connected to the storage tank to receive the mixture at a low pressure to vaporize the propane and separate the normally liquid fuel therefrom; means to dispense the propane vapor at service pressure; means on the tank to determine the liquid level of the separated fuel; and means connected to remove the separated fuel from the vaporizing tank by virtue of the pressure in the tank.

3. Apparatus for converting an ordinary butane gas dispensing system designed to operate at low pressure into a system for dispensing propane and the like wherein the usual storage tank is charged with a mixture of propane and a readily miscible, normally liquid hydrocarbon fuel to reduce its vapor pressure; comprising an independent unit including a vaporizing tank adapted to be buried in the ground in heat exchanging relation with the surrounding earth and to be connected to the storage tank to receive the mixture at a low pressure to vaporize the propane and separate the normally liquid fuel therefrom; means to dispense the propane vapor at service pressure; means on the tank to determine the liquid level of the separated fuel; means connected to remove the separated fuel from the vaporizing tank by virtue of the pressure in the tank; and a protecting casing on top of the vaporizing tank extending to a point above the ground.

4. Apparatus for converting an ordinary butane gas dispensing system designed to operate at low pressure into a system for dispensing propane and the like wherein the usual storage tank is charged with a mixture of propane and a read-

ily miscible, normally liquid hydrocarbon fuel to reduce its vapor pressure; comprising an independent unit including a vaporizing tank adapted to be buried in the ground in heat exchanging relation with the surrounding earth and to be connected to the storage tank to receive the mixture at a low pressure to vaporize the propane and separate the normally liquid fuel therefrom; means to dispense the propane vapor at service pressure; means on the tank to determine the liquid level of the separated fuel; means connected to remove the separated fuel from the vaporizing tank by virtue of the pressure in the tank; a service pipe connected to the dispensing means and extending underground to the point of use; and a depending revaporizer connected to the lowest point of the service pipe.

5. In combination with a liquefied gas dispensing system designed to operate at the relatively low pressure range required for butane and having a pressure storage tank provided with filling and dispensing appurtenances and charged with a mixture of propane and a readily miscible, normally liquid hydrocarbon fuel so that the mixture has a vapor pressure within the safe designed pressure of the system, and also having a conduit provided with a pressure reducing regulator to deliver the mixture from the tank at a relatively low pressure; a conversion unit, including a separate vaporizing tank connected to receive the mixture from said conduit; means to dispense vapor at a low pressure from said vaporizing tank; and a valved liquid eduction conduit communicating with the bottom portion of said vaporizing tank to evacuate the normally liquid fuel component of the mixture which accumulates therein.

6. In combination with a liquefied gas dispensing system designed to operate at the relatively low pressure range required for butane and having a pressure storage tank provided with filling and dispensing appurtenances and charged with a mixture of propane and gasoline so that the mixture has a vapor pressure within the safe designed pressure of the system and also having a conduit provided with a pressure reducing regulator to deliver the mixture from the tank at a relatively low pressure; a conversion unit, including an independent vaporizing and separating tank buried in the ground in heat exchanging relation with the surrounding earth and connected to receive the mixture from said conduit; means to dispense vapor at a low pressure from said vaporizing and separating tank; a valved liquid eduction conduit extending to the bottom of said vaporizing and separating tank to evacuate the residual gasoline which accumulates therein; and means to determine the level of the accumulated gasoline.

7. In combination with a liquefied gas dispensing system designed to operate at the relatively low pressure range required for butane and having a pressure storage tank provided with filling and dispensing appurtenances and charged with a mixture of propane and a readily miscible normally liquid hydrocarbon fuel so that the mixture has a vapor pressure within the safe working pressure of the system and also provided with a conduit having a pressure reducing regulator to deliver the mixture from the tank at a relatively low pressure; a conversion unit, including a separate vaporizing and separating tank adapted to be buried in the ground in heat exchanging relation with the surrounding earth and connected to the conduit to receive the mixture from said pressure storage tank; means to dispense vapor at a low pressure from said vaporizing and separating tank; a liquid eduction conduit extending from the bottom portion of the vaporizing and separating tank to a point near the surface of the ground; a liquid level gauge also connected to said tank to determine the level of the separated liquid also accessible from above the ground; and a protecting casing on top of said vaporizing and separating tank surrounding said gauge and the upstanding portion of said liquid eduction pipe.

8. Conversion apparatus of the character described to be combined with an installed butane dispensing system wherein the usual storage tank is charged with a mixture of propane and a readily miscible normally liquid hydrocarbon fuel which has a vapor pressure within the designed pressure of the system and wherein the tank also has means connected to deliver the mixture at a low pressure therefrom, comprising a single unit associated with the system connected to receive the mixture and arranged to vaporize the propane component and separate it from the normally liquid component; means to dispense the propane vapor at service pressure; and means to evacuate the separated normally liquid fuel component.

9. Apparatus for converting an installed butane gas dispensing system into a propane system, wherein the usual butane pressure storage tank is charged with a mixture composed of propane and gasoline so that the vapor pressure of the mixture comes within the safe working pressure of the tank and wherein a liquid eduction conduit carrying a pressure reducing valve leads from the bottom portion of the tank to deliver the mixture under its own vapor pressure therefrom, comprising a low pressure vaporizing and separating chamber connected to receive the mixture from said conduit and arranged to absorb vaporizing heat for the propane component; a service conduit connected to deliver propane vapor from said chamber to a point of use; a pressure reducing regulator in said service conduit; and a valved liquid eduction pipe communicating with the bottom portion of said chamber to evacuate residual gasoline therefrom after it is separated from the fuel mixture.

10. Apparatus for converting an installed butane gas dispensing system into a propane system, wherein the usual butane pressure storage tank is charged with a mixture composed of propane and a readily miscible, normally liquid hydrocarbon fuel so that the vapor pressure of the mixture comes within the safe working pressure of the tank and wherein a liquid eduction tube having a pressure reducing valve leads from the bottom portion of the tank to deliver the mixture under its own vapor pressure therefrom, comprising a vaporizing and separating chamber connected to receive the mixture from said conduit and buried in the ground to absorb vaporizing heat for the propane component from the surrounding earth; a service pipe connected to deliver propane vapor from said chamber to a point of use; a pressure reducing regulator in said service pipe; and a valved liquid eduction pipe extending through the upper portion of said chamber and communicating with the bottom portion thereof to evacuate residual normally liquid fuel separated from the fuel mixture.

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