Feb. 14, 1933. P. S. ENDACOTT ET AL 1,897,165

METHOD AND APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Filed Nov. 9, 1929 2 Sheets-Sheet 1

FIG. 1.

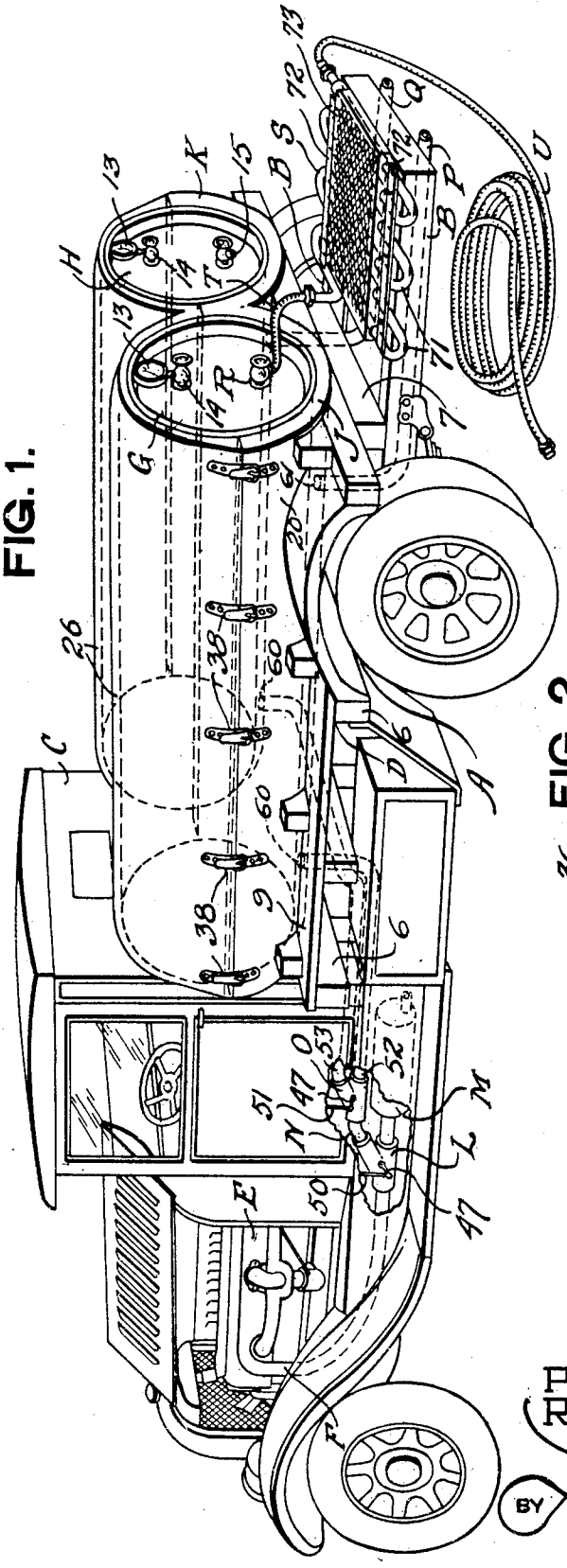
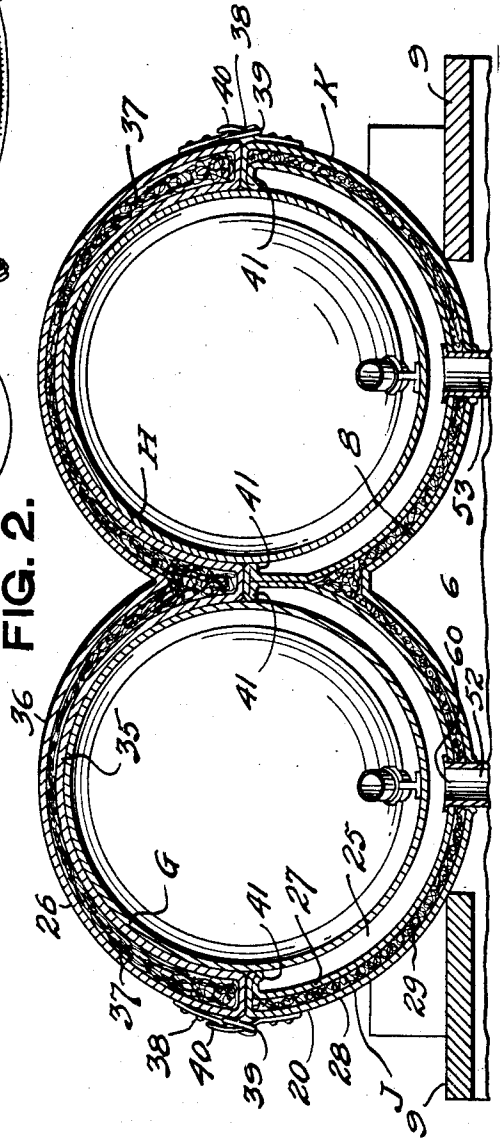


FIG. 2.



INVENTORS.
Paul S. Endacott
Rosswell W. Thomas
BY Lancaster and Allwine
ATTORNEYS.

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FIG. 4.

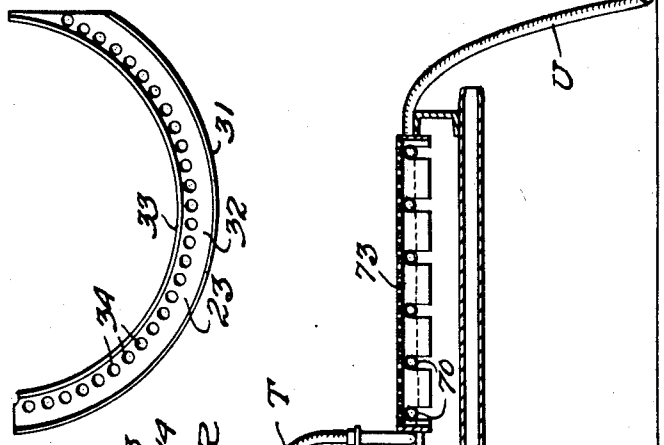
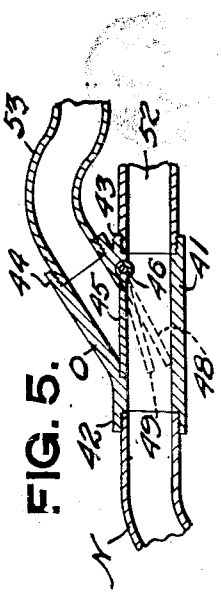


FIG. 3.

FIG. 5.



INVENTORS.
Paul S. Endacott
Roswell W. Thomas
BY Lancaster and Allwine
ATTORNEYS.

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UNITED STATES PATENT OFFICE

PAUL S. ENDACOTT AND ROSSWELL W. THOMAS, OF BARTLESVILLE, OKLAHOMA, ASSIGNORS TO PHILLIPS PETROLEUM COMPANY, OF BARTLESVILLE, OKLAHOMA, A CORPORATION

METHOD AND APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Application filed November 9, 1929. Serial No. 406,149.

The present invention relates to a method and apparatus for servicing of liquefied gas to customers by the distributor, and more particularly to a method capable of being carried out by use of motor truck carried apparatus, and to the truck including a container or containers for the liquefied gas under superatmospheric pressure with suitable equipment whereby the liquefied gas may be quickly, economically and safely expressed from the container or containers and conditioned for delivery to the customer's service tanks.

The primary objects of the present invention are to utilize heat for the purpose of increasing the temperature and hence the pressure of the already compressed liquefied gas in the container that it may be expressed from the servicing container into the customer's service tanks where there may be a quantity of liquefied gas already at superatmospheric pressure,—at a pressure above, or substantially equal to the pressure of the liquefied gas in the servicing container when the latter is under normal atmospheric temperature condition; and to condition the thus heated liquefied gas so that it will be introduced into the distributing line or hose, and hence into the customer's service tank at a reduced temperature approximating or equal to normal atmospheric temperature.

Another object of the present invention is to provide apparatus which may use the heat of the exhaust gases of the heat engine, (used for propelling the truck) as a temperature raising and pressure increasing medium thus making for economy and convenience.

Other objects and advantages of the invention will appear in the following detailed description of one embodiment of the present invention, taken in connection with the accompanying drawings, forming a part of this specification, and in which drawings:

Figure 1 is a perspective view of a liquefied gas distributor's servicing truck constructed according to the present invention, portions being broken away to disclose some of the units and an example of suitable apparatus which may be used in carrying out the method.

Figure 2 is an enlarged vertical transverse view thru a portion of the truck, servicing containers and suitable jackets associated therewith.

Figure 3 is a vertical longitudinal sectional view thru a portion of the truck including one of the containers and a radiator.

Figure 4 is a detail view in elevation of a saddle which may be used for support of the container for liquefied gas.

Figure 5 is an enlarged vertical sectional view thru a valve used in selectively directing hot gases used as a medium for raising the temperature and increasing the pressure of the liquefied gas in the container.

In the drawings, wherein like characters designate similar parts thruout the views, A designates a truck chassis including longitudinal frame members B upon which are mounted a cab C and body D, and which frame members B also support a heat engine E, such as an internal combustion engine having an exhaust conduit F. The heat engine may be used for propelling the truck and may be broadly termed a heat generator.

In the example shown, the body D supports two containers G and H for liquefied gas, but this is to be understood as merely by way of example since the invention is applicable to trucks having one or a plurality of such containers. In co-opending application for patent filed by the present applicant, Paul S. Endacott, on July 27, 1929, serial number 381,502, entitled Liquefied gas distributor's servicing trucks is disclosed and claimed suitable body constructions which may be used in the support of the containers G and H, so that such frame forms no part of the present invention, being merely shown by way of example.

Means J and K, for containers G and H, respectively, are provided to conduct the exhaust gases from conduit F into such proximity to the liquefied gas therein as to raise the temperature and increase the pressure thereof to express the liquid gas, when desired. A valve L is provided to direct the exhaust gases from conduit F to the atmosphere thru an ordinary muffler M if desired, or to direct such gases into the means J—K if

desired thru conduit means designated generally by N and including a valve O. Suitable exhaust pipes P and Q are provided for means J and K, respectively. The containers G and H are provided with outlet valves R, either of which may be placed in communication with a radiator S thru flexible conduit T and the radiator S may deliver to a flexible conduit U adapted for connection to the customer's service tank, not shown in the drawings.

The body D may comprise a plurality of transverse major supports 6 which rest upon companion minor transverse supports 7, the former being recessed as at 8 for a purpose to be subsequently set forth. The minor transverse supports 7 may be secured upon the longitudinal frame members B and the major transverse supports 6 may receive at their end portions platforms or walkways 9.

The containers G and H, in which the distributor carries the liquefied gas under pressure, to the customer's equipment, are capable of withstanding high internal pressure and comprise elongated body 10 having inwardly bulged front and rear walls 11 and 12, respectively, the rear wall having the valve outlet R, a suitable pressure gauge 13 controlled by valve 14, and such other accessories as are deemed necessary or desirable. The valve R is provided with a suitable nipple 15 for detachable connection with the conduit T.

The means J and K, in the example shown are for use with the two containers G and H and will be so described, but it is to be understood that this equipment is applicable to a truck having but one large distributor container for liquefied gas, and its associated means to condut the exhaust gases from conduit F into such proximity to the liquefied gas in the container, as to raise the temperature and increase the pressure thereof to express the liquefied gas, when released, without departing from the spirit of the invention as claimed.

Each of the means J and K in the example shown comprises a trough-like shell 20 into which the companion container is disposed so that its lower half is in the shell, but spaced therefrom except at ends 21 and 22 of the shell and at suitable saddles 23 shown in detail in Figure 4, providing a cavity 25; and a removable heat insulating covering 26 adapted to embrace and engage in intimate contact the upper half of the container. The shell 20 may comprise inner and outer walls 27 and 28, between which is disposed heat insulation, such as felt 29, the ends 21 and 22 having solid members 30 between these walls, disposed above the supports 6 adjacent the ends of the container, so that the latter is effectively supported even tho nested in the shell 20. The saddles 23 are provided, by way of example, to support the intermediate portion of the container above other of the supports 6. The saddle may comprise a base portion 31, a web 32 and a crown portion 33, the web portion 32 provided with a plurality of transverse perforations 34, to permit circulation of the heated gases in cavity 25.

The covering 26 may comprise inner and outer walls 35 and 36, respectively and a filling of heat insulating material 37, such as felt. The walls 35 and 36 are preferably flexible so that the covering may be readily removed to facilitate the placing or removal of the container. This covering may be held in place by suitable fastening devices 38 in spaced apart relation longitudinally of the joint between shell 20 and covering 26. These fastening devices, by way of example, may comprise buckles 39 and straps 40. It is preferred to provide the shell 20 with inwardly extending longitudinal flanges 41 which engage the container, as shown in Figure 2 so that the covering 26 need not serve to confine the heated gases in the cavity 25 adjacent the covering.

Since the valves L and O may be of like construction, as shown in Figure 5, each may be of a construction to comprise a main body portion 41 including an entrance sleeve portion 42 and branch sleeve portions 43 and 44; a blade-like valve 45; a pivot pin 46 rigid with the valve; and a crank arm 47 on pivot 46. In Figure 5 the valve 45 is shown in a position to direct gases thru the sleeve portions 42 and 43, but the valve may be moved to the dotted position 48 and direct the gases from sleeve portion 42 to 44, or the valve may be disposed in an intermediate position as indicated by dotted lines 49 and thereby direct gases from sleeve portion 42 into both sleeve portions 43 and 44. The valve L is provided with an operating arm 50 which may extend into the cab C where it may be conveniently operated by the driver. This valve is intended to direct the exhaust gases of the engine or heat generator E from the exhaust conduit F to the muffler M, when in one position, or direct such gases upwardly into conduit means N when in another position. The valve O, operated by arm 51, also conveniently extended into cab C, may direct the gases into either or both of the branches 52 and 53 of the conduit means N, the former having communication with the cavity 25 associated with container G and the latter communicating with the cavity 25 associated with container H. Referring to Figure 5, with the blade valve 45 in the position shown in full lines, the hot gases are directed into branch conduit 52 for the purpose of raising the temperature and increasing the pressure in container G; if said valve is in the dotted position shown at 48, the hot gases will be directed into branch conduit 43 for a similar purpose in connection with container H; and if the valve assumes the position indicated

in dotted lines at 49, the exhaust gases will be directed into both branch conduits 52 and 53 for the purpose of raising the temperature and increasing the pressure in both containers G and H. The inlet ends of branch conduits 52 and 53 to their respective cavities are preferably adjacent the forward ends of the containers, as indicated at 60, and the exhaust conduits P and Q have their intake ends 61 open to their respective cavities 25 adjacent the rear end portion of the containers. Because of the size of the cavities 25 it is not necessary to first pass the exhaust gases of the engine thru the muffler M before introduction of such gases into the cavities in order to prevent objectionable noise when the exhaust gases issue from the rear ends of conduits P and Q.

Any suitable radiator may be provided, but in the example shown the preferred type comprises a tortuous pipe including a plurality of parallel runs 70, with suitable bends 71 at ends, the radiator resting upon frame members B and held thereto by bars 72. A suitable grid-like platform 73 may be mounted upon radiator S in order that an attendant may rest thereon when manipulating valves 14, changing the position of conduit T from the nipple portion 15 of one valve R to the other like valve, and otherwise directing his attention to the equipment.

The operation of the method and apparatus is as follows:

Bearing in mind that the liquid gas is under superatmospheric pressure in the containers G and H, and that so long as any liquid gas is in the customer's service tank, the same is also under superatmospheric pressure, and if the temperatures of both the distributor's and the customer's tanks are about the same, the superatmospheric pressure therein will be about equal, it will be seen that some difference in pressure is necessary in order to force the liquefied gas into the customer's tank. Under certain conditions it may be found convenient to do this by gravity flow. According to the present invention, the liquefied gas may be expressed from the distributor's containers by raising the temperature of the liquefied gas and hence increasing the pressure. It is desirable, however, that the temperature be restored to approximately normal atmospheric temperature before the liquefied gas reaches the customer's tank, and preferably before entering the flexible conduit U. The method is therefore one of expressing and conditioning the liquefied gas from the motor truck carried containers and the economy and convenience in practicing the method resides in utilizing heat of the motor or engine of the truck to increase the temperature and pressure, and subsequently cool or reduce the temperature of the liquefied gas before it leaves the truck carried apparatus.

The manner in which the valves L and O are operated to accomplish the object in view is no doubt obvious from the foregoing but it is pointed out that the equipment may be simplified to quite some extent where the truck is equipped with but one large distributor's container.

In reduction to practice, it has been found that the form of invention illustrated in the drawings and referred to in the above description as the preferred embodiment, is efficient and practicable where it is desired to transport large quantities of liquefied gas and to draw first from one container and then from the other, but realizing that conditions concurrent with the adoption of this equipment will necessarily vary, it is desired to emphasize the fact that various minor changes in details of construction, proportion and arrangement of parts may be resorted to, when required, without sacrificing any of the advantages of the invention, as defined in the appended claims:

We claim:

1. In apparatus for distribution of liquefied gas, the combination of a truck including a heat engine for operation of the truck, provided with a conduit for the exhaust thereof, a container for liquefied gas under superatmospheric pressure, carried by the truck, means in communication with said conduit to conduct exhaust gases of said heat engine into such proximity to the liquefied gas in said container as to raise the temperature and increase the pressure thereof, a valve in said conduit for directing the exhaust gases to said means or to the atmosphere without passing thru said means, and a radiator carried by the truck, in communication with the outlet of said container for reducing the temperature of the outgoing liquefied gas.

2. In apparatus for distribution of liquefied gas, the combination of a truck including a heat engine for operation of the truck, provided with a conduit for the exhaust thereof, a pair of containers for liquefied gas under superatmospheric pressure carried by the truck to each side of the longitudinal axis thereof, means for each container in communication with said conduit to conduct exhaust gases of said heat engine into such proximity to the liquefied gas therein as to raise the temperature and increase the pressure thereof, and a valve in said conduit for directing the exhaust gases to the means of either or both of said containers.

3. In apparatus for distributing liquefied gas, the combination of a truck; a container for liquefied gas under superatmospheric pressure, including a controlled outlet, a heat generator and a radiator on said truck; means for conducting heat of said generator to a position relative to the liquefied gas to increase the temperature and pressure thereof, and a connection between said outlet and

radiator whereby the liquefied gas expressed from the container is reduced in temperature before leaving the truck.

4. In apparatus for distribution of liquefied gas, the combination of a horizontally disposed elongated high pressure resistant container for liquefied gas under superatmospheric pressure, a trough-like shell for removably receiving said container and into which the lower portion of said container is disposed to confine gases in said shell to passage in close proximity to said container, said shell provided with an inlet, a heat generator, and means for introducing heat of said generator into said inlet to increase the temperature and pressure of the liquefied gas in said container.

5. In apparatus for distribution of liquefied gas, the combination of a horizontally disposed elongated high pressure resistant container for liquefied gas under pressure, a trough-like shell for removably receiving said container and into which the lower portion of said container is disposed to confine gases in said shell to passage in close proximity to said container, said shell provided with an inlet, a heat generator, means for introducing heat of said generator into said inlet to increase the temperature and pressure of the liquefied gas in said container, and heat insulation removably disposed on the upper portion of said container.

6. A method of transferring a liquid which changes into a gas at normal atmospheric pressure and temperature from a tank on a motor truck to a service tank, which consists in heating said liquid while in the first mentioned tank by exhaust gases from the motor of the truck and thereby increasing the pressure of said liquid, causing said liquid to flow from said first mentioned tank by said increased pressure, cooling said liquid after it leaves said first mentioned tank, and then discharging same into the service tank which is under the pressure of its saturated vapor.

7. A method of transferring a liquid which changes into a gas at normal atmospheric pressure and temperature from a tank on a motor truck to a service tank, which consists in heating said liquid while in the first mentioned tank by exhaust gases from the motor of the truck and thereby increasing the pressure on said liquid, causing said liquid to flow from said first mentioned tank by said increased pressure, and then discharging same into the service tank which is under the pressure of its saturated vapor.

PAUL S. ENDACOTT.
ROSSWELL W. THOMAS.