Feb. 14, 1933. R. W. THOMAS 1,897,167

APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Filed Jan. 31, 1930 4 Sheets-Sheet 1

FIG. 1.

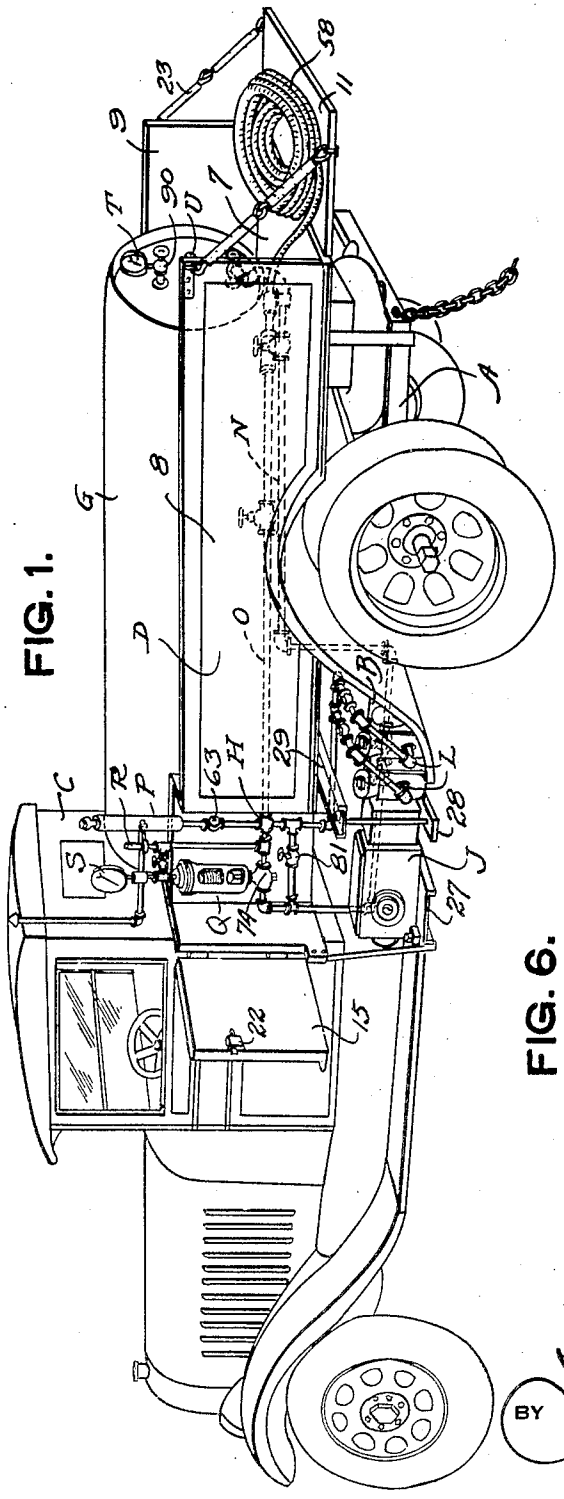


FIG. 5.

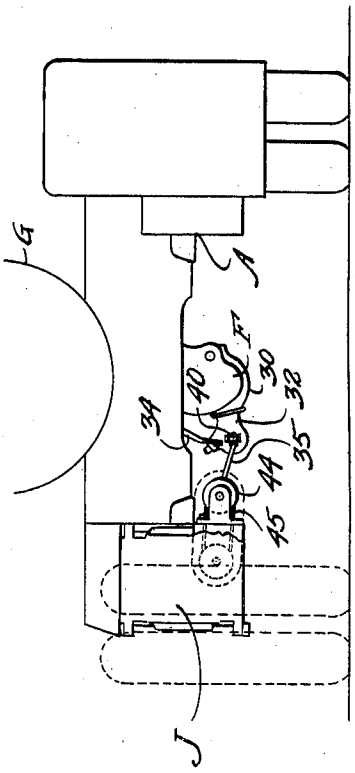
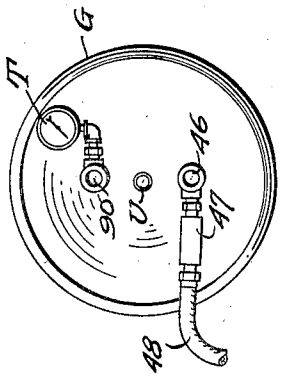


FIG. 6.



INVENTOR.
Rosswell W. Thomas

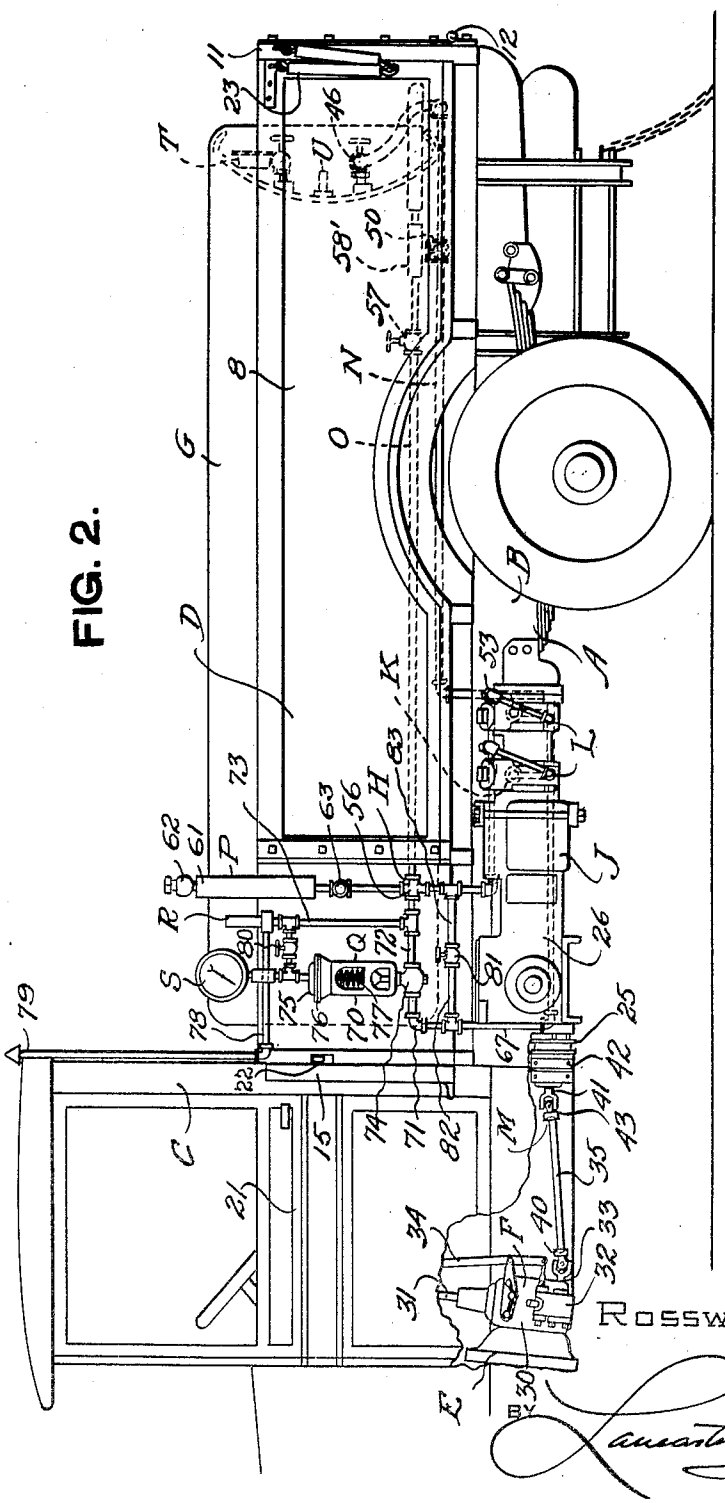
BY Lancaster and Allwine
ATTORNEYS.

Feb. 14, 1933. R. W. THOMAS 1,897,167

APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Filed Jan. 31, 1930 4 Sheets-Sheet 2

FIG. 2.



INVENTOR.
Rosswell W. Thomas

Lancaster and Allwine
ATTORNEYS.

Feb. 14, 1933. R. W. THOMAS 1,897,167

APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Filed Jan. 31, 1930 4 Sheets-Sheet 3

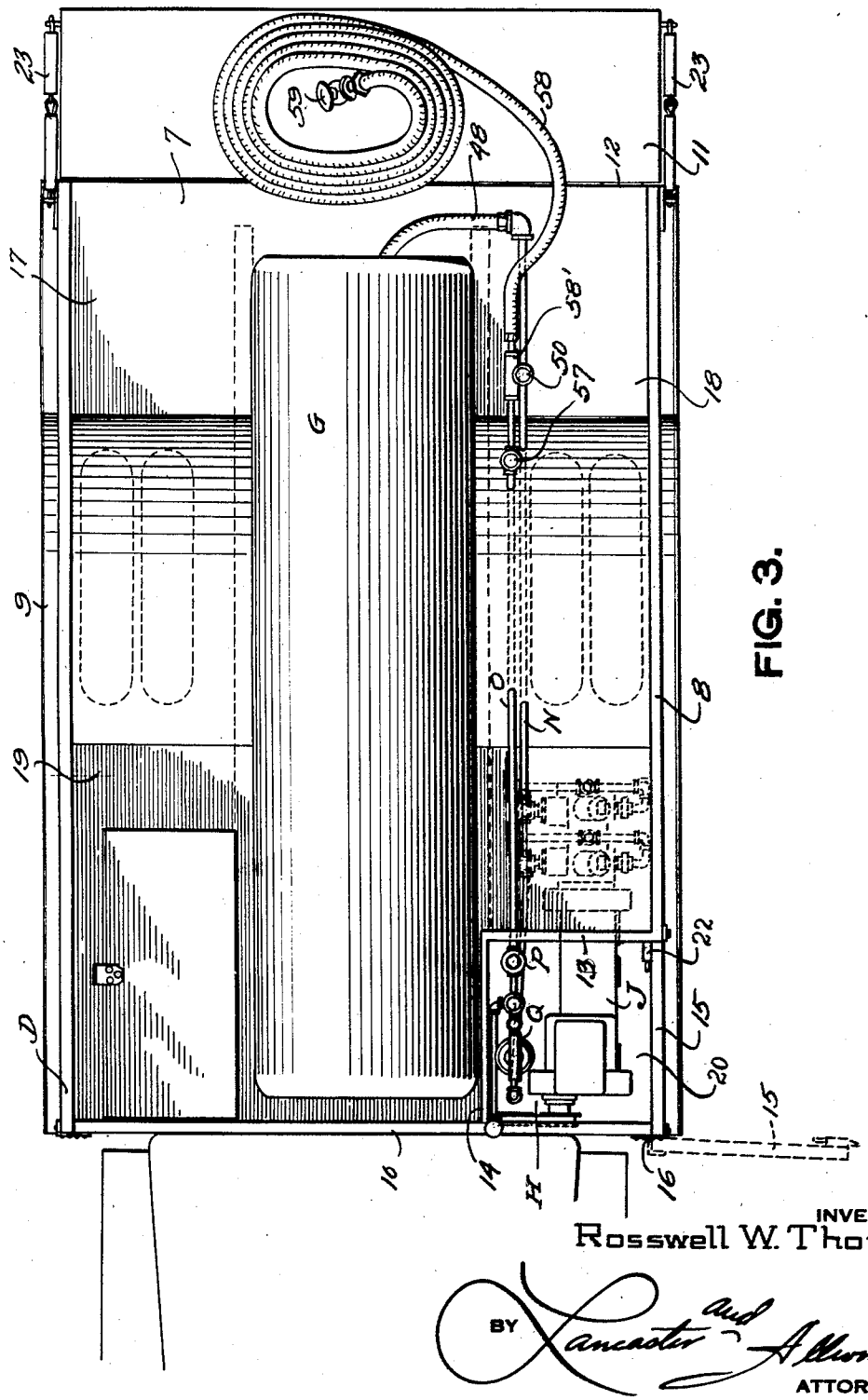


FIG. 3.

INVENTOR.
Rosswell W. Thomas

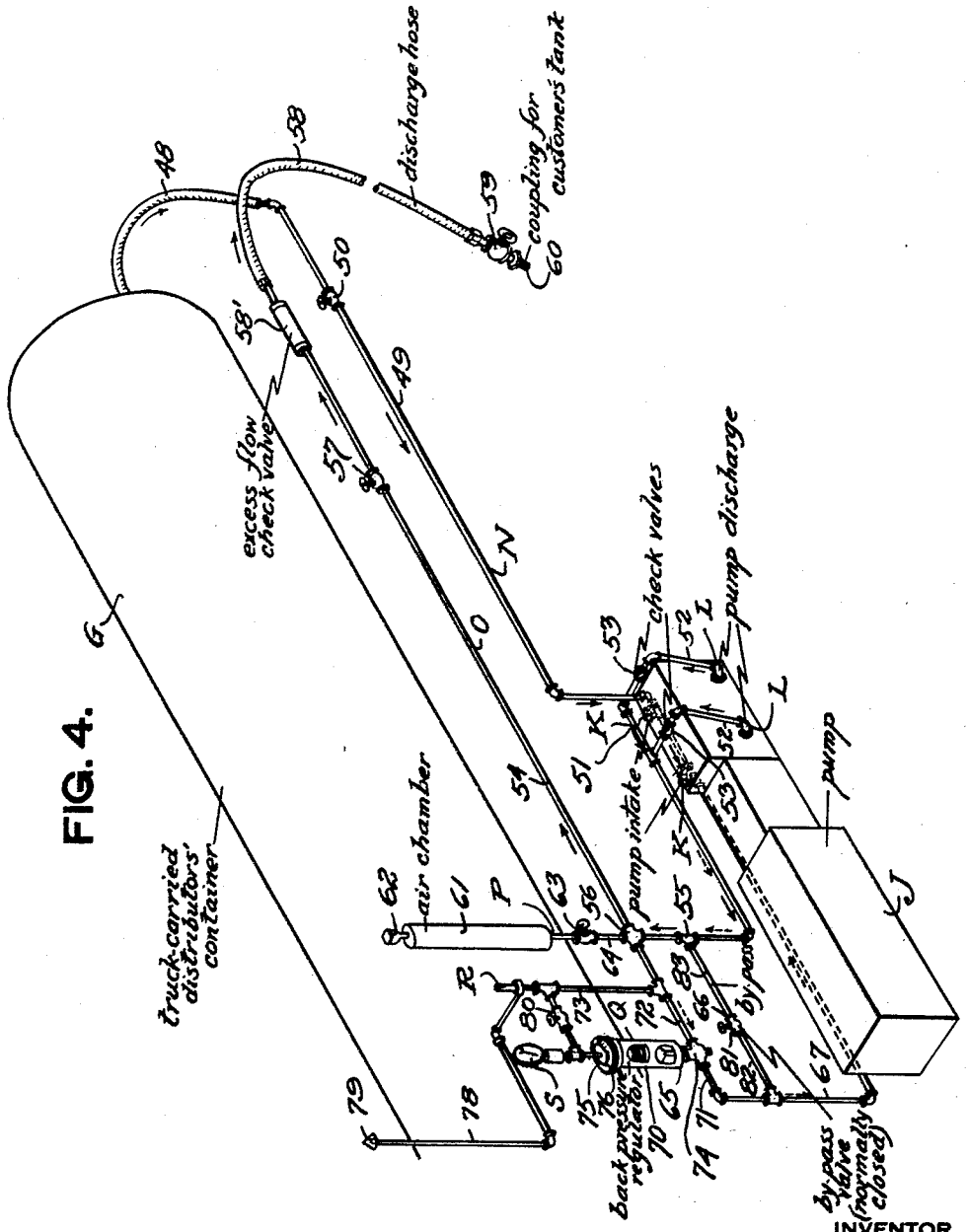
BY Lancaster and Allwine
ATTORNEYS.

Feb. 14, 1933. R. W. THOMAS 1,897,167

APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Filed Jan. 31, 1930 4 Sheets-Sheet 4

FIG. 4.



INVENTOR.
Rosswell W. Thomas

BY Lancaster & Allwine

ATTORNEYS.

Patented Feb. 14, 1933 1,897,167

UNITED STATES PATENT OFFICE

ROSSWELL W. THOMAS, OF DETROIT, MICHIGAN, ASSIGNOR TO PHILLIPS PETROLEUM COMPANY, OF BARTLESVILLE, OKLAHOMA, A CORPORATION

APPARATUS FOR TRANSPORTATION AND DISTRIBUTION OF LIQUEFIED GAS

Application filed January 31, 1930. Serial No. 425,023.

The present invention relates to apparatus for servicing of liquefied gas to customers by the distributor, and more particularly to a truck including a container for liquefied gas, such as popane, under superatmospheric pressure with suitable equipment whereby the liquefied gas may be quickly, economically and safely transferred from the truck carried container to the customer's tank. The customer's tank may be, and very often is remote from the available driveway for the truck, being frequently situated at the rear or side of a dwelling and the available driveway as much as eighty feet or more therefrom.

In co-pending application, Serial Number 281,502 filed July 27, 1929, by Paul S. Endacott is shown a liquefied gas distributor's servicing truck which discloses by way of example, a hand operated pump for withdrawing the liquefied gas from the distributor's container on the truck and forcing same into the customers' tanks. This makes necessary or highly desirable two attendants for each truck,—one to operate the hand pump and the other to observe the weight of the liquefied gas at the customer's tank so as to signal to the operator of the pump to cease operation thereof when the desired quantity of liquefied gas has been introduced into the customer's tank and otherwise complete the servicing operation at said tank.

One of the objects of the present invention is therefor to provide servicing trucks which make possible the expeditious servicing with but one attendant for each truck, by the provision of a power driven pump on the truck and equipment whereby the pump may operate even tho the normal discharge of the pump thru the flexible hose by which the liquefied gas is conducted to the customer's tank is shut off. As an example, with the hand operated type of pump, the attendant if he services alone, must first walk the distance between the truck and customer's tank to carry the hose and make proper connection with the tank, then return to the truck and operate the pump. If he can not observe from the truck when the desired quantity of liquefied gas has been introduced into the tank, other trips to and from the tank may be made to operate the scale or other device by which the quantity of liquid in the tank may be determined. After the desired amount of liquid is in the tank another trip thereto must be made to uncouple the hose and otherwise condition the equipment so that it may not be tampered with. According to the present invention an attendant may if he so desires accomplish this in one trip,—starting the motor driven pump before making connection with the customer's tank, stay at the tank during the filling operation, and shut off and disconnect the hose before returning to the truck and while the pump continues to operate.

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 and showing normally closed wall portions of the truck body swung to positions whereby access may be gained to parts of the equipment.

Figure 2 is an enlarged fragmentary side elevation of the truck, parts being broken away to disclose details and with the rear wall or tail gate in a closed position.

Figure 3 is a plan view of that portion of the truck shown in Figure 2, but with the rear wall or tail gate open and a wall or door portion for the protection of certain of the equipment in a closed position.

Figure 4 is a diagrammatic view of the liquid transfer equipment of the truck.

Figure 5 is a view partly in elevation and partly diagrammatic of suitable equipment whereby the pump may be operated from the engine of the truck.

Figure 6 is a rear elevation of the distributor's container.

In the drawings, like characters are used to designate similar parts throughout the views. A designates the truck chassis including longitudinal frame members B upon which are mounted a cab C and body D. The frame members B also support an engine E and

transmission F which may be of any usual or approved design and construction.

The body D detachably receives a container G for liquid gas and this may be accomplished in a manner similar to that which is disclosed in the aforesaid application, Serial number 281,502, the specific mounting and means for retaining the container against longitudinal and transverse movement with respect to the body, forming no part of the present invention.

Means H to transfer the liquefied gas from container G to the customers' tanks, not shown in the drawings, comprises in addition to a suitable motor, such as the truck engine E, a pump J having one or more intakes K and one or more discharges L; suitable motion transmitting means M between the motor E and pump J which means may include a part of transmission F; intake conduit means N; discharge conduit means O; means P for absorbing the shocks or pulsations incident to operation of the pump J; means Q for by-passing some of the liquefied gas from the discharge L to the intake K of the pump J when the latter is operating and all of the liquefied gas from the discharge to the inlet of the pump J when the discharge conduit means O is closed; and such other accessories as may be deemed necessary or desirable, as safety valve R and pressure gauge S associated with means Q and pressure gauge T to show the pressure in container G, and safety valve U also associated with said container.

The body D is preferably elongated and rectangular in shape and includes a floor 7, longitudinally extending side walls 8 and 9, front end wall 10, rear end wall 11, which may be hinged as at 12 to act as a tail gate and partition walls 13 and 14. A portion 15 of the side wall 8 may act as a door, hingedly connected as at 16 to the front end wall portion 10. The walls 8, 9, 10 and 11 define a major floored section 17 and the elongated cylindrical distributor's container G is preferably supported with its major axis longitudinally of the elongated rectangular body, spaced from the side walls 8 and 9 to provide walkways 18 and 19 and suitable space for the storage of supplies, tools, etc. The partition walls 13 and 14 in connection with the hinged section 15 of wall 8 and a portion of front end wall 10 define a minor well section 20, preferably situated at the front left corner of the body, adjacent the door 21 of cab C, used by the driver of the truck. The door section 15 may be provided with a suitable latch 22, preferably at the inside of wall 20 to hold the door section closed, and the rear wall 11 may be provided with flexible supports 23 to hold this wall in a substantially horizontal position when lowered, as shown in Figures 1 and 3.

The pump J is, by way of example, of the single cylinder double acting type including a pulley 25, operating suitable speed reducing gearing, (not shown in the drawing) in housing 26. The pump may be supported from the longitudinal frame members B as by transverse frame members 27, 28 and 29 and is preferably situated at the left side of the truck beneath the major and minor portions of body D.

The motion transmitting means M, in the example shown comprises the usual gear set 30 including lever 31, whereby different speed ratios may be obtained or the gear set placed in neutral; a unit 32 including a driven shaft 33 receiving its power from gear set 30 and controlled by a lever 34 in any suitable manner, so that shaft 33 may be rotated by engine E, when lever 31 is set at neutral; a rearwardly extending shaft 35 connected to shaft 33 by universal joint 40; a shaft 41 supported by the frame members B, as by bracket 42 having connection with shaft 35 as by universal joint 43; a pulley 44 on shaft 41; and a belt or chain 45 trained about pulleys 25 and 44 as shown in Figures 2 and 5. It is to be understood that the pump may therefor be operated when the truck is not in motion, by the engine E, upon the manipulation of levers 31 and 34. The specific motion transmitting means M in the example shown forms no part of the present invention and is merely shown as suitable means whereby the truck engine may be used to operate the pump as well as propel the truck.

The intake conduit means N preferably comprises an eduction valve 46 on the rear end of container G; an excess flow check valve 47 adjacent valve 46, the function of which will be subsequently set forth; a flexible length of tubing 48 having connection with valve 47; and a major run 49 of pipe and fittings connecting the flexible tube 48 at the rear portion of body D with the intake ports K of pump J, there being interposed in the run 49, a suitable control valve 50, preferably located adjacent the rear of body D.

The discharge conduit means O preferably comprises a manifold 51 adjacent pump J, having branches 52, connected to the discharge ports of the pump, there being provided check valves 53 in the branches 52; a major run 54 of pipe and fittings, in the example shown including a T fitting 55 and a cross fitting 56, control valve 57, and an excess flow check or automatic pressure operated valve 58′, the latter two being adjacent the rear portion of body D; a discharge hose 58 having communication with the rear end of run 54; a control valve 59 at the egress end of discharge hose 58; and a suitable coupling 60 whereby the discharge hose may be connected to the customer's tank, not shown in drawings. The excess flow check or automatic pressure operated valve 58′ may be of any suitable type, such as is shown in patent

to Stevens, 1,060,142, April 29, 1913, which operates to cut off flow to the discharge hose 28 and associated fittings should any one of them become broken or leaky.

The means P comprises a chamber 61 for gas, such as air, preferably in the form of a cylindrical body having at its upper portion a charging valve 62 and adjacent its lower portion a manually operable valve 63 which, thru a pipe length 64 places the air chamber 61 in communication with the discharge conduit means O, when the valve 63 is open, the pipe length 64 having connection to the cross fitting 56 above referred to. The charging valve 62 is of any suitable type whereby gas under pressure may be introduced and retained in chamber 61.

The shock or pulsation absorbing medium introduced in chamber 61 may be of any suitable gas, such as air and the term "air" will be used hereinafter to designate such gas, but it is to be distinctly understood that this is merely by way of example since it may be desirable to introduce into the chamber 61 some other elastic or shock absorbing medium such as compressed nitrogen or carbon dioxide, as well as many other gases which are relatively insoluble in the propane liquid.

Means Q for by-passing the liquefied gas from the discharge L to the intake K of pump J may comprise an automatic section 65 and a manually operable section 66, the former having communication with the discharge conduit means O by a connection with the cross fitting 56, and the manually operable section 66 having communication with said discharge conduit means O as thru the T fitting 55; these sections 65 and 66 having communication with the intake conduit means N as by piping 67.

The automatic section 65 of means Q comprises a back pressure regulator 70 of any suitable type capable of affording communication between the discharge and intake of the pump when the latter is in normal operation; and suitable fittings 71, 72 and 73 of which 71 affords communication with the piping 67, 72 communication with the discharge conduit means O, and 73 for impressing the pressure of the discharge line on the back pressure regulator 70. In the example shown, the back pressure regulator 70 includes a valve 74 disposed between the fittings 71 and 72; a diaphragm chamber 75 including a diaphragm 76 and suitable motion transmitting means 77 for operation of the valve 74 when liquid under pressure acts upon the diaphragm. The fitting 73 may have connection with safety valve R, which preferably includes a vent pipe 78, the egress end 79 of which is adjacent the roof of cab C. The fittings 73 is also provided with a valve 80 by which communication between the discharge conduit means O and the diaphragm chamber 75 may be shut off when desired.

The manually operable section 66 of means Q comprises a manually operable valve 81; a fitting 82 at one side of said valve and the piping 67; and a fitting 83 at the other side of valve 81 and having communication with the discharge conduit means O.

Natural gas may be compressed and liquefied at locations convenient to the producing well and transported in any suitable manner to points of distribution where it may be pumped into large containers such as G. Bearing in mind that the liquefied gas is under superatmospheric pressure in the container G, and that, so long as any liquefied gas is in the customer's tank, the same is also under superatmospheric pressure, and if the temperatures of both the distributors' and the customers' tanks are about the same, the superatmospheric pressure therein will be about equal, it will be seen that some means is necessary to force the liquefied gas into the customer's tank altho if found convenient it may be placed therein by gravity flow, as by opening the valves 46, 50, 81, 57 and 59 and closing valve 80. However, the present invention has more to do with a method and apparatus whereby the liquefied gas may be pumped or transferred from the container G to the customer's tank in such a manner that a single attendant may, with a minimum number of trips to and from the customer's tanks accomplish the object in view. Therefore, in order to condition the apparatus for pumping, the air chamber 61 is filled, as before leaving the distributing station, to substantially the same pressure as that of the truck carried distributor's container G. This is done thru the air chamber charging valve 62. The manually operable valve 63 is then opened, allowing the air pressure to act against the pressure in the discharge conduit means O. The vapor pressure in the container G is recorded on the gauge T at the rear of the container G, the pressure being admitted to the gauge thru a manually operable valve 90 to which it is attached. In case the vapor pressure in the cylinder shoulder exceed a pressure of say three hundred and seventy pounds per square inch, the safety valve U, also at the rear end of the cylinder will operate to release vapor and thus reduce the pressure.

When servicing, the pump J may be set into operation if desired, before the coupling 60 is connected to the customer's tank. This is best accomplished by initially opening manually operable by-pass valve 81 before starting the pump and immediately closing said valve when the pump is operating. This procedure not only makes possible easy starting of the pump but insures the pump, transmission, etc., against damage in the event the pump should be violently thrown

into motion transmitting relation with the engine, as for example if the operator's foot should slip off the clutch pedal. After the coupling 60 has been properly connected to the customer's tank the manually operable valve 59 is opened allowing the liquefied gas to be pumped into the customer's tank, the line of flow being from the container G to the pump thru the flexible hose or tubing 48 and the run 49 of pipe and fittings, to the intake of the pump, and thence from the discharge of the pump, thru the check valves 53, manifold 51, fittings 55 and 56, run 54 of pipe and fittings, valve 57, excess flow check valve 58′, discharge hose 58, valve 59 and coupling 60, as indicated by full line arrows in Figure 4. The pulsating due to the reciprocating action of a single cylinder double acting pump is taken up by the cushioning effect of the air in the air chamber 61, and excess liquid pumped but which cannot be delivered to the customer's tank is by-passed from discharge to intake of the pump J thru the automatic section 65 of by-pass means Q.

If a break should occur in the delivery hose 58, any further flow of liquid thru the discharge line would be stopped by the excess flow check valve 58′ in that line, which would close upon any increased velocity of the liquid thru the line due to a break. Escape of gas from the safety valve R is delivered at the outlet of vent pipe 78 adjacent the roof of the cab. Should a break occur in the suction line, the excess flow check valve 47 would operate to stop the flow of vapor from the container G, as a result of any increased velocity of the liquid thru the line due to a break.

When sufficient liquefied gas has been pumped into the customer's tank, the flow is stopped by closing the valve 59. Since the normal discharge line of the pump is now closed and the suction line is still open and the pump running, the pressure in the normal discharge line will immediately build up, and the automatic section 65 of by-pass means, which, while the customer's tank was being filled, took care of only the excess pressure in the discharge line, now by-passes all of the liquid pumped as indicated by broken arrows, Figure 4, rather than the pump drawing from the container G. This by-passing of the liquid from discharge to the intake of the pump will continue until operation of the pump is discontinued, as by the manipulation of lever 34. Any possible back flow to the pump due to the building up of pressure is prevented by the check valves 53.

Should the regulator 70 fail to function for some reason, the pressure would continue to build up until it exceeds the pressure for which the safety valve R is set and this valve operating would allow the gas to escape thru the safety outlet 79. If dependence were placed on this safety valve for any great length of time there would be a needless waste of gas, so that the manually operable section 66 of means Q may be also used as follows: The back pressure regulator 70 being inoperative, the valve 74 is of course closed. Upon opening the valve 81 the transfer of liquefied gas from the discharge of the pump to the intake may be had thru the fittings 82 and 83, and open valve 81 as is obvious from an inspection of Figure 4.

It is preferred to dispose the air chamber 61, back pressure regulator 70 and the valves 63, 74, 80 and 81, as well as associated fittings mainly in the well 20 where they are in a more or less protected position when the door 15 is closed. This arrangement also locates these parts which are manipulated by the attendant, and which require inspection, convenient to the driver's compartment and also groups these parts so that the major portion of the body may be utilized for the storage of supplies, tools and other equipment incident to the servicing of customers.

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 practical where it is desired to transport a large quantity of liquefied gas and to expeditiously and economically transfer quantities of the liquefied gas into customers' tanks, but realizing that conditions concurrent with the extensive use of this equipment will necessarily vary, it is to be understood 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:

I claim:

1. In apparatus for transporting and distributing liquefied gas, the combination of a pump, means for operating same, a container for liquefied gas, intake conduit means affording communication between the said container and the intake of the pump, a relatively long discharge conduit means in communication with the discharge of said pump and provided with a valve at its end portion remote from said pump, adapted to control exit of said discharge conduit means, means in communication with said discharge conduit means for cushioning the pulsations of the pump when operating, by-pass means operating automatically upon the building up of a predetermined pressure in said cushioning means for by-passing the liquefied gas from the discharge directly to the intake of said pump when the latter is operating and said valve is closed, and manually operable by-pass means to by-pass the liquefied gas from the discharge directly to the inlet of said pump.

2. A servicing truck for liquefied gas comprising a chassis, a body on said chassis including a floor and upright walls defining a major floored section and a minor well section, a container for liquefied gas carried by said body between said walls, and means secured to said chassis for transferring liquefied gas from said container, at least part of said means being disposed in said well and protected by said body walls.

3. A servicing truck for liquefied gas comprising a chassis including longitudinal frame members, a body carried by said frame members, including a floor and upright walls defining a major floored section and a minor well section adjacent one of said longitudinal frame members, a container for liquefied gas carried by said body between said walls, and means secured to said last mentioned frame member and extending into said well and protected by the walls thereof, for transferring liquefied gas from said container.

4. A servicing truck for liquefied gas comprising, a chassis, a body on said chassis including a floor and upright walls defining a major floor section and a minor well section, one of said walls serving as a door to permit access to the well, a container for liquefied gas carried by said body between said walls, and means secured to said chassis for transferring liquefied gas from said container at least in part disposed in said well and protected in said body walls.

5. A servicing truck for liquefied gas comprising, a chassis, an elongated rectangular body on said chassis including a floor and upright walls defining a major floored section and a minor well section situated at one corner of the rectangular body, an elongated container for liquefied gas carried by and disposed with its major axis longitudinally of the body and spaced from the walls thereof to provide walkways and storage space to each side of the container, between the container and walls, and means secured to said chassis for transferring liquefied gas from said container at least in part located in said well and protected by said body walls.

6. A servicing truck for liquefied gas comprising, a chassis, an elongated rectangular body on said chassis including a floor and upright walls defining a major floored section and a minor well section, situated at one corner of the rectangular body, one of said walls serving as a door to permit lateral access to the well, an elongated container for liquefied gas carried by and disposed with its major axis longitudinally of the body and spaced from the walls thereof to provide walkways and storage space to each side of the container, between the container and walls, and means secured to said chassis for transferring liquefied gas from said container at least in part located in said well and protected by said body walls.

7. In apparatus for transporting and distributing liquefied gas, the combination of a pump, means for operating same, a container for liquefied gas under super-atmospheric pressure, intake conduit means affording communication between the said container and the intake of the pump, a relatively long discharge conduit means in communication with the discharge of said pump and provided with a valve at its end portion remote from said pump, adapted to control exit of said discharge conduit means, and means in communication with said intake conduit means and discharge conduit means for by-passing at least some of the liquefied gas from the discharge to the intake of said pump at all times when the latter is operating.

8. In apparatus for transporting and distributing liquefied gas, the combination of a pump, means for operating the same, a container for liquefied gas under super-atmospheric pressure, intake conduit means affording communication between said container and the intake of the pump, a relatively long discharge conduit means in communication with the discharge of said pump and provided with a valve at its end portion remote from said pump adapted to control exit of said discharge conduit means, an excess flow check valve in advance of said first mentioned valve, and means for by-passing liquefied gas from the discharge to the intake of the pump when either of said valves is closed.

9. In apparatus for transporting and distributing liquefied gas, the combination of a pump, means for operating same, a container for liquefied gas under superatmospheric pressure, intake conduit means affording communication between the said container and the intake of the pump, a relatively long discharge conduit means in communication with the discharge of said pump and provided with a valve at its end portion remote from said pump, adapted to control exit of said discharge conduit means, a chamber, and means for charging said chamber with gas normally at a pressure substantially equal to the pressure in said container, said chamber being in communication with said discharge conduit means for absorbing shocks incident to pulsations of the pump when operating.

ROSSWELL W. THOMAS.