

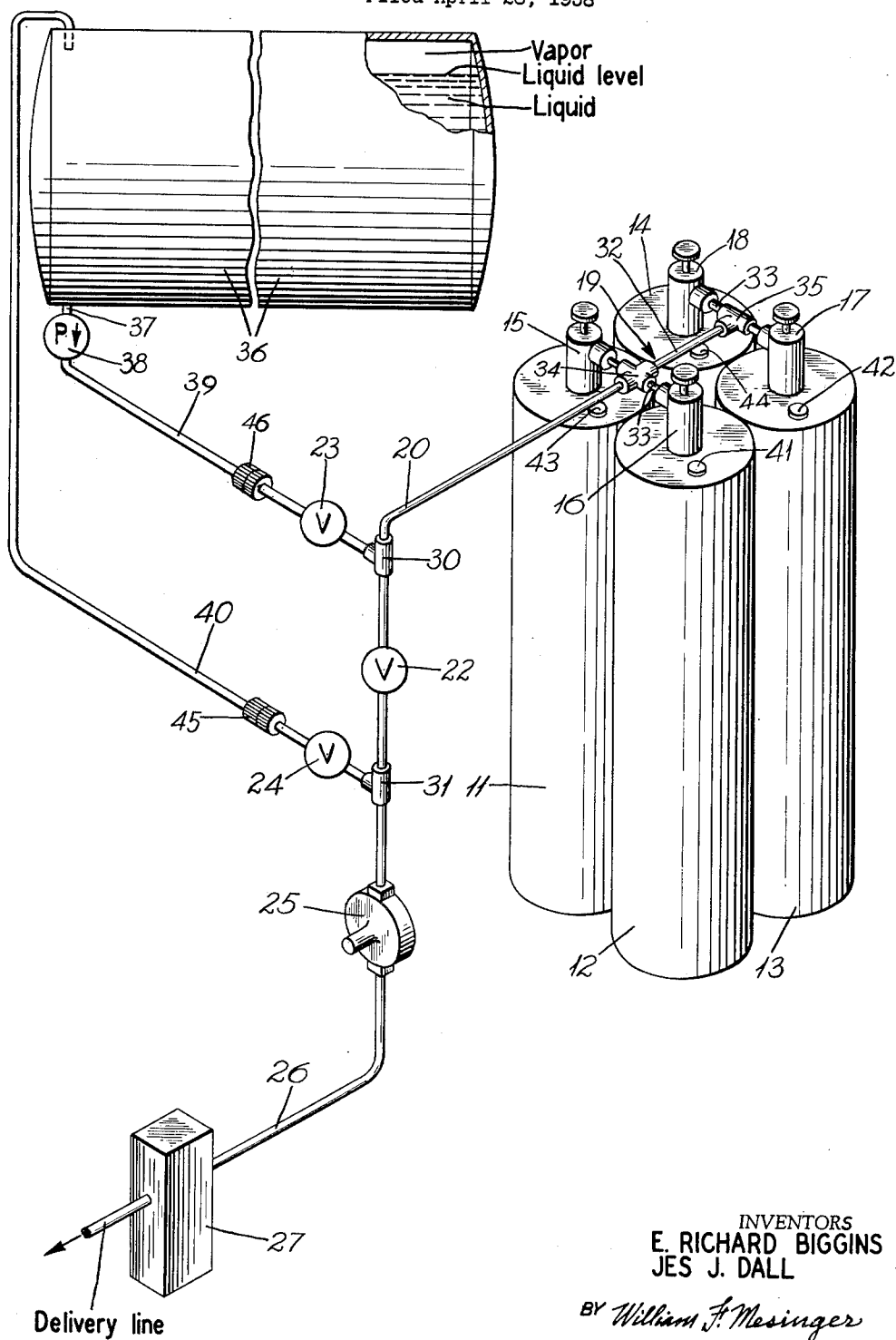
Dec. 4, 1962

E. R. BIGGINS ETAL

3,066,495

APPARATUS AND METHOD FOR FILLING MANIFOLDED GAS CONTAINER

Filed April 28, 1958



INVENTORS
E. RICHARD BIGGINS
JES J. DALL

BY *William F. Mesinger*
ATTORNEY

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3,066,495

APPARATUS AND METHOD FOR FILLING MANI- FOLDED GAS CONTAINER

Edward Richard Biggins, Manhasset, and Jes J. Dall, New York, N.Y., assignors to Union Carbide Corporation, a corporation of New York

Filed Apr. 28, 1958, Ser. No. 731,370

4 Claims. (Cl. 62—50)

This invention relates to a method and apparatus for replenishing gas dispensing systems having a liquefied gas reserve. It is more particularly directed to a method for refilling manifolded stationary pressure containers with a liquefied low pressure petroleum gas such as methane, butane or propane.

In a system for supplying gas to a consumer delivery line wherein the source of supply resides in containers of the liquefied gas, such supply means may be maintained by either of two methods. One method consists of replacing the exhausted supply cylinders or containers with similar full ones. The other method entails refilling the exhausted cylinders from a tank truck or other transportable reservoir designed for that purpose.

The latter method is advantageous, but its utilization presents many technical problems. For example, in any system where the gas is supplied in liquid form, the gas handling apparatus such as regulators and measuring devices are generally susceptible to severe damage or malfunction if permitted to contact the liquefied gas. To avoid such possible contact, a widely used practice is to disconnect or valve off the supply containers from the feed line during the refilling operation. This precaution is necessary in that the typical liquefied gas cylinder is usually provided with a single valve which serves the dual function for both intake and gas discharge.

Consequently, when a cylinder or bank of cylinders requires refilling, that cylinder or bank is generally segregated from the delivery line either physically or by valving means, thereby temporarily interrupting the flow of gas to the consumer delivery line. In this practice there of course resides many disadvantages, not the least of which is the inconvenience and probable economic loss to the gas user.

It is therefore an object of the present invention to provide a simple method and apparatus for replenishing the supply of liquefied gas to a dispensing system having a stationary cylinder or bank of cylinders as a reservoir. A further object is to provide an apparatus suitable to permit such replenishing of a liquefied gas supply while maintaining a continuous flow of gas to the user's line.

According to the present invention, there is provided a distribution system for gas from liquefied gas held in a plurality of liquefied gas containers, a manifold mutually communicating the control valves of said containers, a valve means connected to said manifold through which vapor phase gas may controllably flow to a delivery line from said gas containers, and a transportable tank of gas adaptable to simultaneously supply both the liquid and vapor phase gas to the distribution system.

The process of the invention will be illustrated by a description of its use in the replenishing of a bank of propane cylinders. Reference will be made to the drawing to facilitate the explanation of the process.

The drawing is a diagrammatic view of an exemplary

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apparatus according to the invention and utilized in carrying out the process.

The apparatus represented in the drawing includes a plurality of cylinders, four cylinders being shown as 11, 12, 13 and 14 for containing propane or a similar liquefiable gas in liquid form at a pressure determined by its vapor pressure corresponding to its temperature. Each cylinder is provided in its head section with a control valve respectively designated 15, 16, 17 and 18 and a liquid level gauging device designated 41, 42, 43 and 44. A supply of liquefied propane is maintained within the cylinders which are permitted to discharge vaporized propane either individually or in combination into the manifold 19 which mutually interconnects the various cylinder valves.

A conduit 20 extending from the manifold conducts the gas to a shut-off valve 22. Disposed in the line to either side of this valve 22 are T fittings 30 and 31, the side branches of which include a pair of stop valves 23 and 24. Downstream of fitting 31 is interposed a gas pressure regulator 25 for controllably limiting the pressure of gas admitted to a feed line 26. A gas flow meter 27 may be provided to indicate the volume of gas flowing to the gas consuming equipment in the delivery line.

In normal operation, with valves 23 and 24 closed and valve 22 open, the pressure of gas to the delivery line from the supply containers is controllably regulated by proper adjustment of the pressure regulator 25.

The most convenient means by which liquefied gas may be transferred to an empty cylinder or bank of cylinders is to employ a bulk volume container such as a tank truck 36 having extendable hoses 39 and 40 attached thereto and capable of being connected through appropriate fittings 45 and 46 to the apparatus.

These fittings for securing the respective hoses to the apparatus comprise generally mating half sections with a contacting seat therebetween and means for threadably joining said half sections to provide a gas tight seal at the contacting seat.

In accordance with the present invention, one hose 39 is in communication with the bottom or liquid space of the tank 36, the other hose 40 communicated with the top or vapor space thereof. The lower hose, thus, will conduct liquefied gas which may be pumped from the tank, whereas the upper hose will conduct only gas in vapor form which is drawn from the section of tank above the liquefied gas surface.

Referring to the drawing, the manifold 19 is made up of a central tubular body 32 having a plurality of tubular branch arms 33 outwardly extending therefrom and being communicably joined therewith. The manifold form and construction are contingent upon the number of cylinders to be accommodated and their relative positions, each manifold branch threadably fastens to a cylinder valve by a suitable connecting means to provide a gas passage from the cylinders to the central manifold body 32.

A preferred material for the manifold is metal tubing having a degree of flexibility. A more rigid manifold might be employed using a composite of threadably joined tubes and tube fittings. The extremity of each arm section is provided with a suitable coupling means for securing to the respective cylinder valve outlets in a gas tight connection.

A fitting 34 on one extremity of the manifold body is adaptable to engage the extended conduit 20. The other

extremity of the body may be plugged with a gas tight sealing device or provided with extension means for accommodating additional cylinders. For such purpose, fitting 35 may be similar to fitting 34 and used to accommodate additional cylinders if the system is to be expanded.

In accordance with the invention, there is provided a continuous gas passage between the manifold 19 and the inlet side of the pressure regulator 25. A shut-off valve 22 incorporated in this passage between fittings 30 and 31 furnishes a means for regulating the gas flow therethrough. The valve 22, when in the open position, permits a gas flow to the regulator 25 located downstream thereof, but closing of the valve will block further passage of gas to the regulator 25 or delivery line.

The T fitting 30 disposed upstream of the shut-off valve 22 accommodates the liquid valve 23 providing a means for injecting liquefied gas into the manifold system. A similar T fitting 31, downstream of the shut-off valve 22 accommodates the vapor valve 24 whereby vaporized gas may enter the system and flow through regulator 25 and the delivery line 26.

Assuming the distribution system is in operation with valve 22 open, and valves 23 and 24 closed, to effect a replenishing of the exhausted gas in cylinders 11, 12, 13 and 14, according to the invention process, the following steps may be taken:

First a transportable container of liquid propane, such as a tank truck 36 or similar bulk gas container, is positioned proximately close to the cylinder installation.

Hose 39 from the liquid gas pump 38 is coupled to valve 23 by means of fitting 46.

Hose 40 from the top portion of the tank 36 is similarly coupled to valve 24 by means of fitting 45.

Valve 24 is now opened to provide a flow of vaporized gas to the system, which flow passes to the regulator 25 and delivery line 32.

Valve 22 is now closed, thereby effectively segregating the distribution system into liquid and vapor phase portions.

Valve 23 may next be opened and the pump operated to allow a flow of liquid gas from the pump 38 to enter the manifold 32 and the various containers.

The simultaneously segregated liquid and gas flow to the distribution system is maintained until the containers become filled, as indicated by an effusion of vapor and liquid from the liquid level indicators 41, 42, 43 and 44. At such indication, the particular container valve is closed.

Subsequent to the last container being filled, the filling process is discontinued as follows:

Valve 23 is closed to cut off the flow of liquid to the system.

Container valves 15, 16, 17 and 18 are opened.

Valve 22 is opened allowing gas to flow from the containers 11, 12, 13 and 14 to the regulator 25.

Valve 24 is closed to shut off the gas flow from the tank 36.

The hoses 39 and 40 are now disconnected from the system at the respective couplings 45 and 46.

By proper manipulation of the various valves in the prescribed sequence, it is seen that an uninterrupted flow of vaporized gas is maintained to the delivery line at all times. A notable advantage attained by the present method is the ability to replenish a customer's liquid gas cylinder installation regardless of the demand for gas at the delivery line. It is also noted that, while a simple transportable tank is described as the supplying means, no such limitation is intended, for instance more than one tank or container could be utilized. In this event, a separate cylinder of liquefied gas carried on the transportable tank truck may be connected to valve 24 to provide the flow of vapor to the system through a hose substituted for hose 40.

What is claimed is:

1. Apparatus for delivering a continuous flow of gas to a delivery line while providing a flow of liquefied gas to containers adapted to normally supply said delivery

line, which apparatus comprises a plurality of liquefied gas containers, a valve in each of said containers for controlling the flow therefrom, a manifold having a discharge port mutually communicating each of said valves, a piping system communicating said manifold discharge port to conduct a flow of gas from said containers to said delivery line; said piping system including a main gas conduit connected at one end thereof to said manifold outlet port, a flow control valve having inlet and outlet, interposed in said main conduit for adjustably controlling fluid flow therethrough, a flow regulator connected to said flow control valve outlet for determining the flow to said delivery line, a branch conduit communicably joined to said main conduit at a point intermediate the control valve outlet and the manifold discharge port for introducing a flow of fluid into said main conduit, said branch provided with a flow control means and coupling means, a second branch conduit communicably joined to said main conduit at a point intermediate of the control valve outlet and said regulator for introducing gas to said main conduit, said second branch conduit also provided with flow control means and coupling means, a gas supply source having liquid and vapor portions, a hose coupled to and communicating the vapor phase of said supply source to the second branch conduit, another hose coupled to and communicating the liquid phase portion of said supply source with said branch conduit, whereby simultaneous flows of liquid and vapor gas may be introduced to the piping means and separately maintained for continuously providing gas flow to the delivery line while providing a liquid gas flow to the containers.

2. Apparatus for furnishing a continuous flow of vapor phase gas to a delivery line while simultaneously replenishing the liquid phase of a supply of gas held in gas and liquid phase, the gas phase of which is normally intended for flow to said delivery line, said apparatus comprising: a container holding such supply of the gas material in liquid and vapor phase, conduit means communicating the upper portion of said container with the delivery line to normally conduct the vaporous flow thereto, normally open fluid regulating means interposed in said conduit operable to define separable upstream and downstream portions thereof, a second reservoir holding a supply of the gas in both liquid and vapor phase, means communicating said upstream portion with said liquid phase in said second reservoir for supplying the gas material in liquid phase at sufficient pressure for replenishing the liquid phase in said container, and means external to the container communicating said downstream portion with said vapor phase in said second reservoir to maintain a flow of vaporous gas to the delivery line during the replenishing of the liquid phase in said container.

3. System for supplying a continuous supply of vaporous gas to a customer's delivery line which comprises a supply reservoir of the gas material normally maintained therein in the liquid and gas phases, a conduit communicating the upper portion of said supply reservoir with the delivery line, a valve in said conduit for controlling the flow of gas passing therethrough, said valve being operable to define the conduit into upstream and downstream portions respectively, a second reservoir holding a supply of the gas in both liquid and vapor phase, means communicating the liquid phase portion of said second reservoir with the conduit at a point upstream of the valve, and means communicating the vapor phase portion of said second reservoir at a point downstream of the valve, whereby a flow of liquid gas may be introduced upstream of said valve for replenishing the liquid in said supply reservoir, simultaneously with a flow of the gas in vapor phase being introduced from said second reservoir downstream of the valve for maintaining a continuous flow of said gas to the delivery line.

4. Method of replenishing a gas distribution system consisting of a first container holding a supply of gas material in liquid and gas phases, a delivery line for receiving a

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flow of the gas in vapor phase and means communicating said container and delivery line, which method comprises: providing a second container holding a supply of the gas in both liquid and vapor phase, interrupting the flow of vapor phase gas passing material from the said first container to the delivery line, introducing a flow of liquid phase gas material from the second container liquid portion, to the said first container until the liquid phase therein is replenished, and simultaneously introducing a flow of vaporous gas from the second container vapor portion, to said delivery line, and when the liquid phase of the first

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container is replenished stopping the flows from said second container and restoring the flow of vapor phase gas from the first container to the delivery line.

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