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APPARATUS FOR STORAGE AND UTILIZATION OF VOLATILE LIQUIDS

Filed Feb. 10, 1941

2 Sheets-Sheet 1

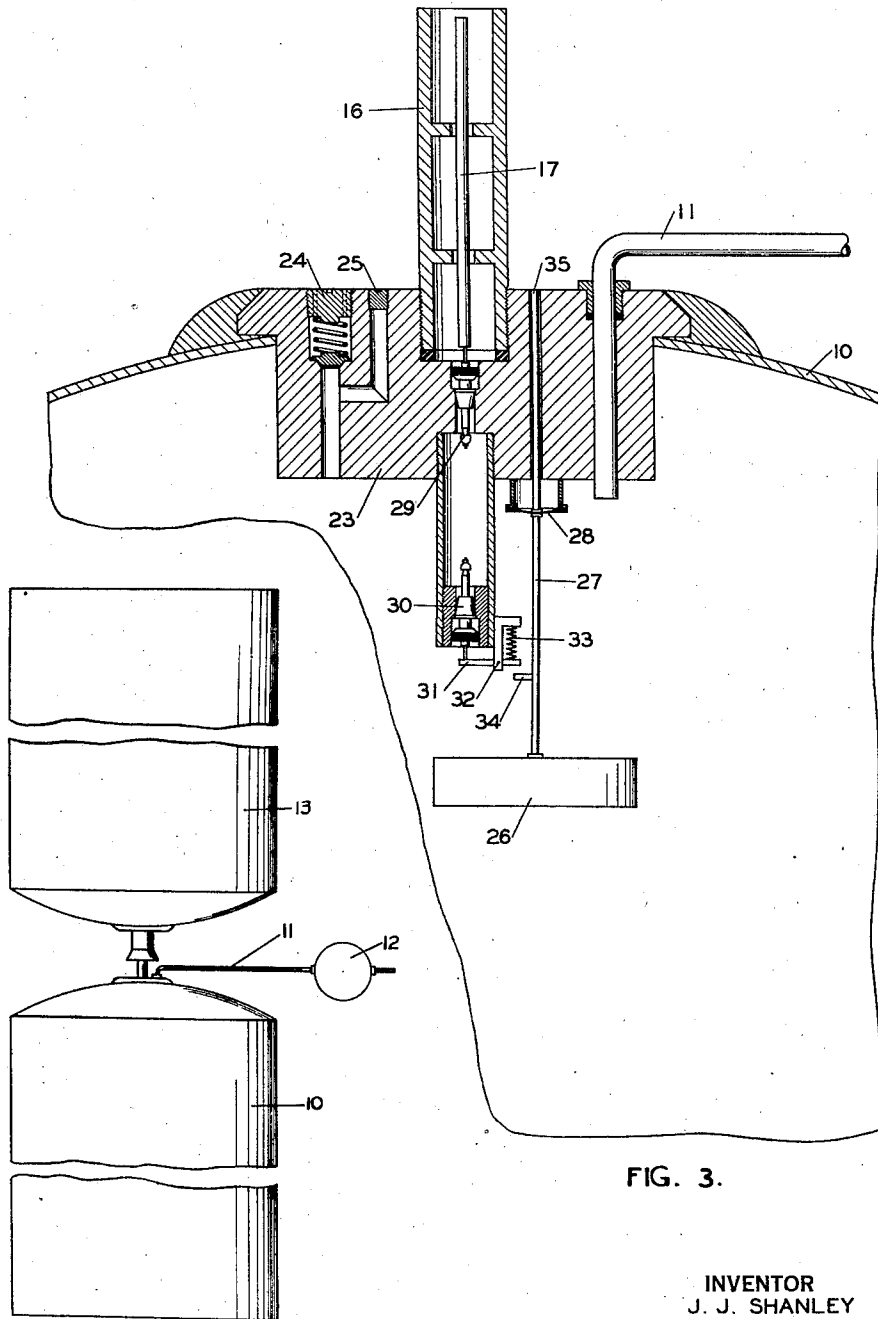


FIG. 3.

FIG. 1.

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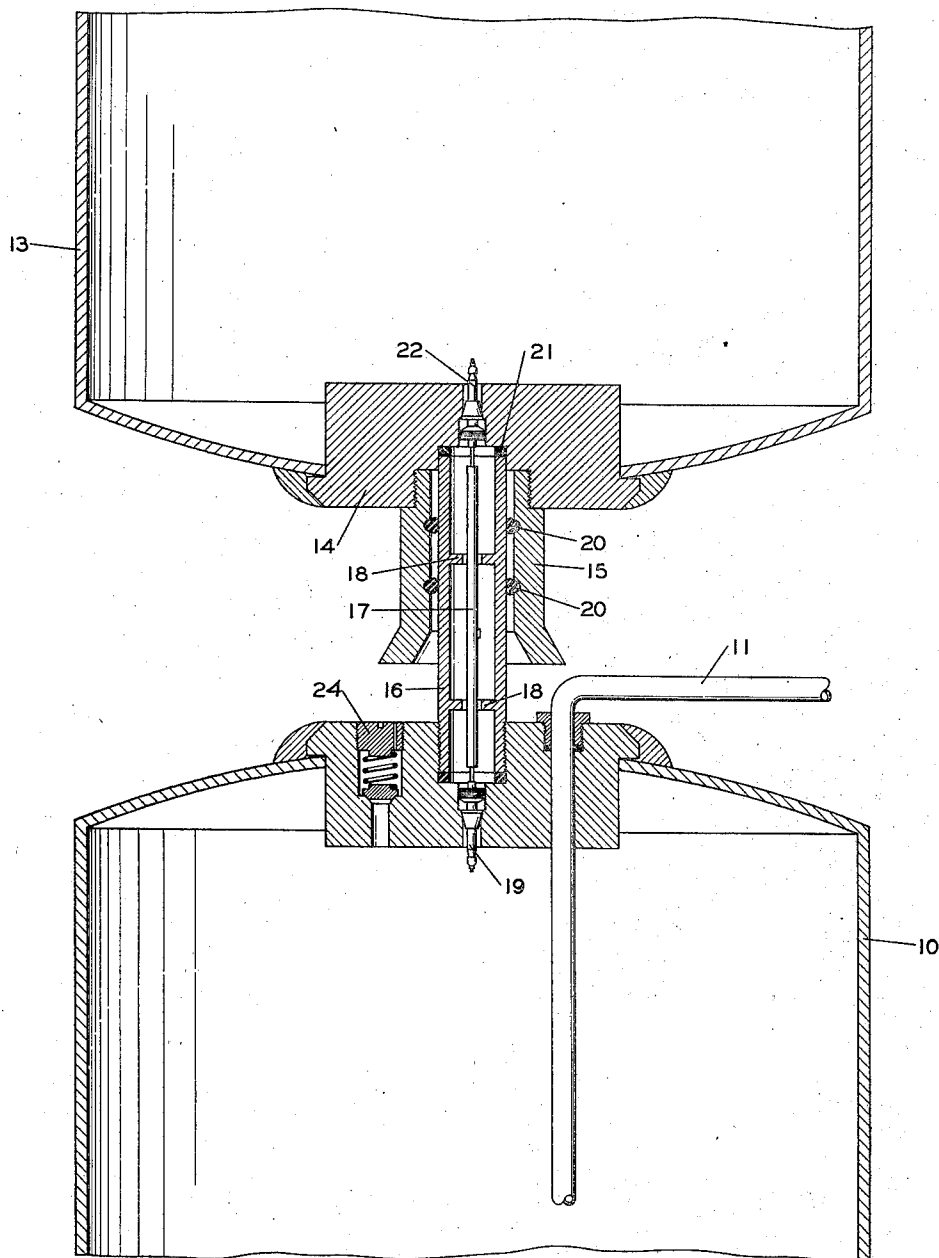


FIG. 2

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APPARATUS FOR STORAGE AND UTILIZATION OF VOLATILE LIQUIDS

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Application February 10, 1941, Serial No. 378,306

6 Claims. (Cl. 62—1)

This invention relates to a system for storing and utilizing volatile liquids and liquefied gases.

Liquefied petroleum gases, especially propane, butane, and mixtures of the two, are extensively marketed for use as fuel in communities where natural gas is not available. In making use of this liquefied gas for operating gas-consuming appliances, it is customary to provide the customer with one or more containers for storage of the liquefied gas and means for establishing connection between the containers and a service line through a suitable arrangement of valves and pressure regulators. Those installations, in which a single container is used, usually comprise a large container which is refilled from a tank truck by a service man. Two types of systems employing a plurality of containers are widely used; one, the "two-drum" system and the other, the "self-service" system. In the two-drum system the customer is provided with two cylinders, each containing a quantity of liquefied gas sufficient to last the customer for a considerable period of time. One of the cylinders is used as an active source of gas supply while the other cylinder is held in reserve until the first cylinder is exhausted. When one cylinder is emptied, a change-over of withdrawal connections is made and the reserve cylinder placed into service. During the time this second cylinder is in service, supplying gas, the empty cylinder is replaced with a filled cylinder. Due to the size and weight of the cylinders, and the necessity of skill and care in installing them properly, they are serviced and handled by service men. The self-service system which has been developed, operates on the same principles as the two-drum system. The customer is provided with two or more containers which he replaces with filled containers when they become emptied. The self-service system, however, employs small containers which the customer can easily handle, and the valves, connections, etc., are so improved and simplified that even the inexperienced may make the connections and adjustments necessary to place the containers in operative position. The customer buys the liquefied gas in a suitable container from his dealer, transports it to the place of service, uses the gas formed by vaporization of the liquefied gas, and returns the empty containers to the dealer.

The disadvantages of the systems employing a single container and of those of the two-drum type are that they require the attention of a service man to deliver the liquefied gas to the place of use and put it in position for use by the customer. They also require the attention of a

skilled service man occasionally for repairs and adjustments, especially of the valves. The self-service system requires very little attention other than that which the customer must give it to insure an unfailing gas supply. The valves which are most subject to wear and deterioration are attached to the self-service container and may be examined and tested by the dealer each time the container is returned to him for refilling. It is evident that the self-service system is economically advantageous and may be successfully used in communities in which the population or number of customers is not sufficient to warrant the investment and operating expense required by the other two systems. However, the self-service system has one disadvantage in common with the two-drum system, i. e., the connection between the container and the customer's service pipe involves the use of a flexible coupling which is subject to deterioration and which may become hazardous if not given sufficient and proper attention.

An object of this invention is to provide an improved system for storage and utilization of volatile liquids and liquefied gases.

Another object of this invention is to provide such a system which is especially applicable to self-service.

A further object of this invention is to provide a system which will require little or no attention other than to replenish the supply of liquefied gas.

Figure 1 is an elevation of the apparatus of this invention.

Figure 2 is a vertical cross section of the system of Figure 1.

Figure 3 is a vertical cross section of a modification of the present invention.

With reference to Figure 1 of the drawings, the reference numeral 10 designates a container for the liquefied gas. This container remains on the customer's premises except when being repaired or tested. The container 10 is connected to the gas-consuming appliances by the customer's service line 11 having a pressure reducing valve or gas pressure regulator 12 interposed therein. The container 10 may be of any suitable size and type, for example, an existing container previously used in a single-container or two-drum installation, may be used. A cylinder 13, preferably a container of the type used in self-service systems, is inverted and connected with cylinder 10. The cylinder 13 may be maintained in connection with cylinder 10 by the force of gravity or may

be held in position by any suitable connector or clamping device.

Figure 2 is a vertical section of the system of Figure 1 in which the contents of the containers are dispensed as a liquid. The liquid feed or flash vaporization method of dispensing liquefied gas is well known in the art. Into the tap plug 14 of the container 13 is screwed an adapter 15. A connector 16 is screw-threaded into the tap plug of the cylinder 10 and normally remains attached thereto. The connector 16 includes a push pin 17 positioned and movably retained therein by guides 18. The push pin 17 rests on the cylinder valve 19 which remains closed except when the cylinder 13 is connected as shown in the drawing. Gaskets 20, positioned on the internal wall of adapter 15, make sealing connection with the exterior walls of connector 16 to give a dash pot effect when making connection between cylinder 13 and cylinder 10. The upper end of connector 16 makes sealing engagement with the conventional cylinder gasket 21 in the tap plug of cylinder 13. When connection is established between the two cylinders in this manner, the push pin 17 opens the valve 19 in cylinder 10 and the valve 22 in cylinder 13. The numeral 24 designates a safety relief valve which prevents damage to the cylinder 13 from excessive pressure developed therein. Other known safety devices may be incorporated in either or both containers and form no part of the present invention.

In operation the liquid from the cylinder 13 flows through the connector 16 into the cylinder 10 as required. When the cylinder 13 is empty the customer lifts the cylinder 13 off connector 16 thereby allowing both cylinder valves to close. The customer then unscrews the adapter, which he retains, returns the depleted cylinder to the dealer and obtains a full one. The adapter 15 is screwed into the tap plug of the full cylinder. The cylinder is then inverted and placed in position on the connector 16 as shown in the drawings. During the interim, while the cylinder 13 is being replaced, liquefied gas is withdrawn from the cylinder 10 through the pipe 11 as needed to supply the customer's gas-consuming appliances. In most instances the quantity of liquefied gas used during that interval will be sufficient to lower the liquid level in the cylinder 10. When the full cylinder is connected, liquefied gas will either run by gravity or, if cylinder 13 is under greater pressure than cylinder 10, be forced into cylinder 10 through connector 16. Cylinder 10 will be maintained full of liquid as long as there is liquid in the cylinder 13. Any liquid remaining in the cylinder 13 around the tap plug 14 will vaporize and, when empty, the cylinder 13 will be filled only with gas under pressure. The customer may determine whether or not the container 13 is empty by tapping it or by disconnecting the cylinder and weighing or shaking it. Alternatively, the liquid level in the cylinder 10 may be determined and when this cylinder is not full, cylinder 13 must be empty.

Figure 3 is a vertical section of a modification of this invention in which the liquefied gas is vaporized in the container and the resulting vapors withdrawn for use in the customer's appliances. In this modification the service pipe 11 terminates above the liquid level in the container 10. The tap plug 23 of the container 10 is provided with customary safety devices, such as the excess pressure relief valve 24 and the fusible plug 25. To prevent the container 10 from over-

filling with liquid and flooding over into the service pipe 11, positive means are provided for limiting the liquid level in the container. The float 26 is attached to a vertical float rod 27, which extends upward through the tap plug 23 to a point adjacent the external surface of the tap plug as shown in Figure 3. The float rod 27 passes through a sealing diaphragm 28 which is sufficiently flexible to allow movement of the float and float rod. In addition to the regular cylinder valve 29 in the filler opening of the tap plug 23, a second similar valve 30 is provided in the same passageway. The valve 30 is actuated into open position by means of the lever arm 31 pivotally mounted on a pin 32 which acts as a fulcrum for the lever. The end of the lever arm opposite the valve 30 is acted upon by the spring 33. When the liquid level in the container 10 is below the predetermined maximum, the float 26 assumes the position shown in Figure 3 and the spring 33, through the medium of the lever arm 31 maintains the valve 30 in an open position allowing liquid from the container 13 to flow into container 10 as described in detail in connection with Figure 2. When sufficient liquid has entered the container 10 to cause the float 26 to rise to the position corresponding to the maximum liquid level in the container 13, the projection 34 on the float rod engages the spring pressed end of lever arm 31, compresses the spring 33, and allows the valve 30 to close. The valve 30 normally remains in closed position unless actuated to open position by some external force. The rise of the float 26 and float rod 27 causes the upper end 35 of the float rod to project above the external surface of the tap plug and come into view.

The operation of the system of Figure 3 is generally the same as that of the system of Figure 2 except that a vapor space is maintained in cylinder 10 by operation of the valve 30 in conjunction with the float 26. This assures withdrawal of vapors free from liquid through the service pipe 11 as needed to supply gas to consuming appliances. It is clearly within the scope of this invention to supply the container of Figure 2 with a float control arrangement similar to that of Figure 3 to prevent over-filling of the container operated under the liquid feed method of dispensing liquefied gas. As long as the indicator 35, the upper end of the float rod, remains in view, the upper cylinder 13 still contains liquid. When the indicator 35 is not in view, indicating that the liquid level in the container 10 is somewhere below the maximum, the cylinder 13 is empty. Upon observing that the indicator 35 has disappeared from view, the customer replaces the empty top cylinder with a filled one following the procedure described in the foregoing description relative to Figure 2.

The present invention provides a simple, safe, and efficient means of converting existing single-container or two-drum-system installations into the more economical self-service system. In addition, the disadvantage of the present self-service systems, i. e., the use of flexible couplings, is eliminated by the novel method by which connection is made between the self-service container and the customer's service pipe. The float control described and illustrated in Figure 3 may be eliminated in those installations in which the size of the permanent container, container 10, is greater than that of the portable or self-service container. This is especially true in those instances in which an existing installation is converted to the system of this invention. Due to

the large size of these containers, the self-service cylinder may be emptied into the stationary container without over-filling the stationary container. The customer may determine by gauging or any suitable means when it is necessary to add the contents of a self-service container to the permanent container to maintain uninterrupted service.

It is to be understood that the form of this invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size, and arrangements of parts, may be resorted to, without departing from the spirit of the invention, or the scope of the subjoined claims.

I claim:

1. A system for storing and utilizing liquefied gas comprising a stationary container for the gas, a service line having one end in communication with the stationary container for delivery of fluid to consuming appliances, a portable container for the liquefied gas, means for establishing communication between the stationary container and the portable container, and means responsive to withdrawal of fluid through the service line for controlling the flow of liquefied gas from the portable container to the stationary container.

2. A system for storing and utilizing liquefied gas comprising a stationary container for the gas, a service line having one end in communication with the stationary container for delivery of fluid to consuming appliances, a portable container for the liquefied gas, means for supporting the portable container and establishing communication between the stationary container and the portable container, and means responsive to the liquid level in the stationary container for controlling the flow of liquefied gas from the portable container to the stationary container.

3. A system for storing and utilizing liquefied gas comprising a stationary container for the gas, a service line having one end in communication

with the stationary container for delivery of fluid to consuming appliances, a valved inlet in the stationary container, a portable container for the liquefied gas, a valved outlet in the portable container and a connector for establishing communication between the inlet of the stationary container and the outlet of the portable container and means responsive to the quantity of liquid in the stationary container for governing the flow of liquefied gas from the portable container to the stationary container.

4. A system for storing and dispensing liquefied gas comprising a first container for the liquefied gas, a service line having one end in communication with the first container for dispensing the gas, a second container for the liquefied gas, a valve controlled conduit in each container having a valve adapted to open by pressure thereon in the direction of its respective container, a connection between the conduits of said containers comprising two relatively movable parts respectively attached to the containers, and a valve operator mounted in one of said parts acting to open said valves and place said containers in communication for transfer of liquefied gas therebetween when said parts move into position to connect said conduits.

5. In the combination of claim 4, said relatively movable parts telescoping when in connecting position and supporting one container on the other, and means for forming a fluid-tight seal between said parts.

6. In the combination of claim 4, a normally open second valve in the conduit of the container in communication with the service line, and means including a float for closing said normally open valve to cut off communication between the two containers when the liquid level in the container in communication with the service line reaches a predetermined height.

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