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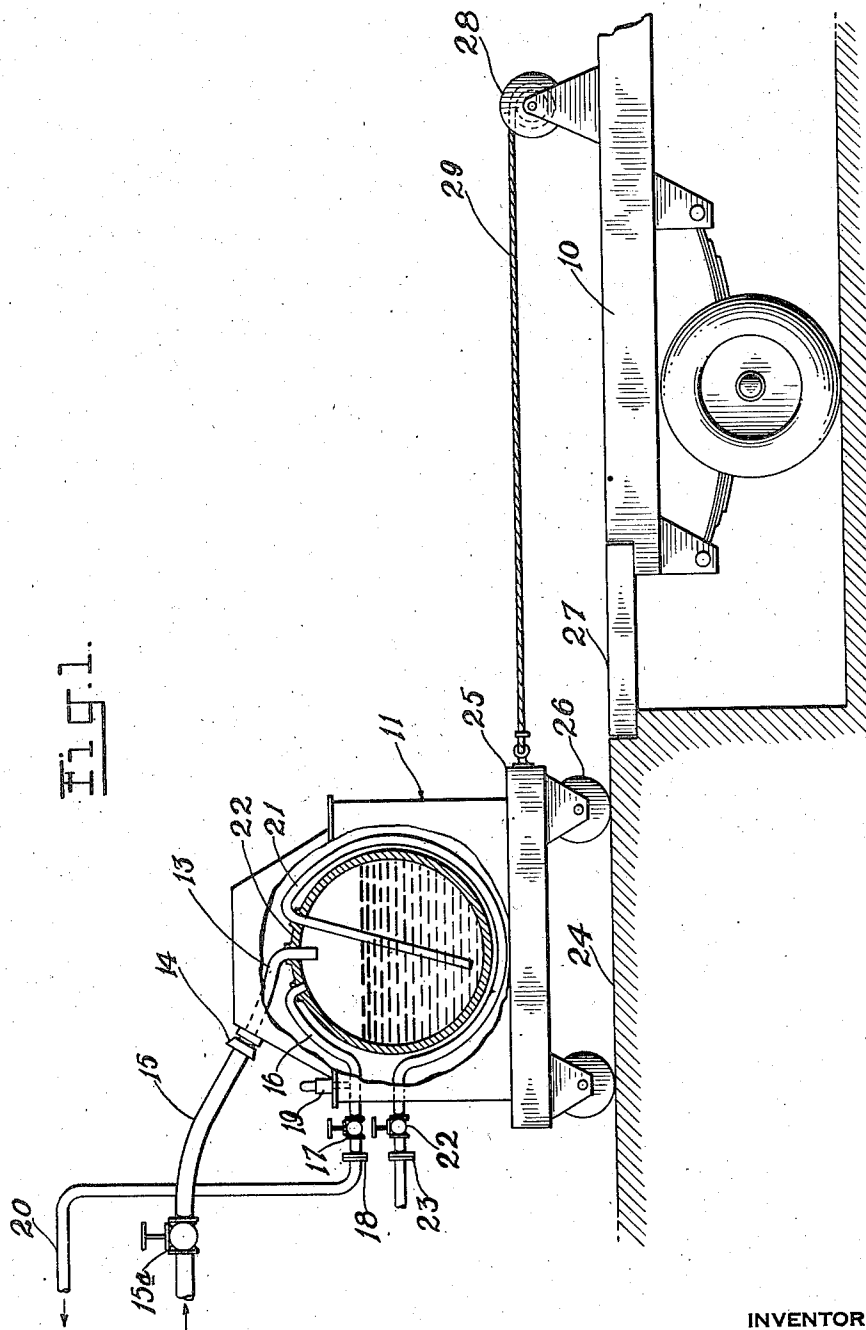
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2,044,673

METHOD AND APPARATUS FOR DISTRIBUTING LIQUEFIED GASES

Filed June 30, 1932

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

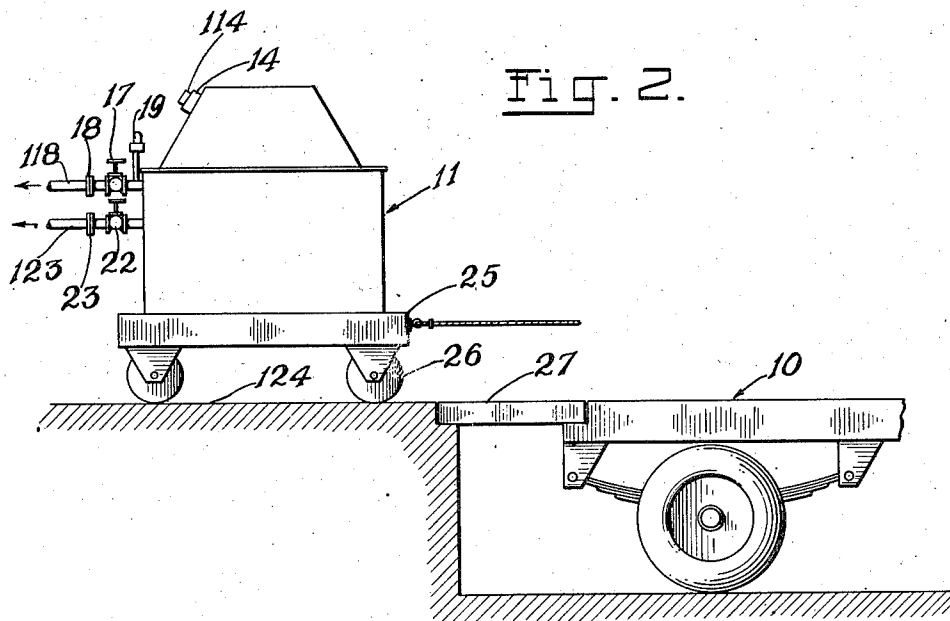


Fig. 2.

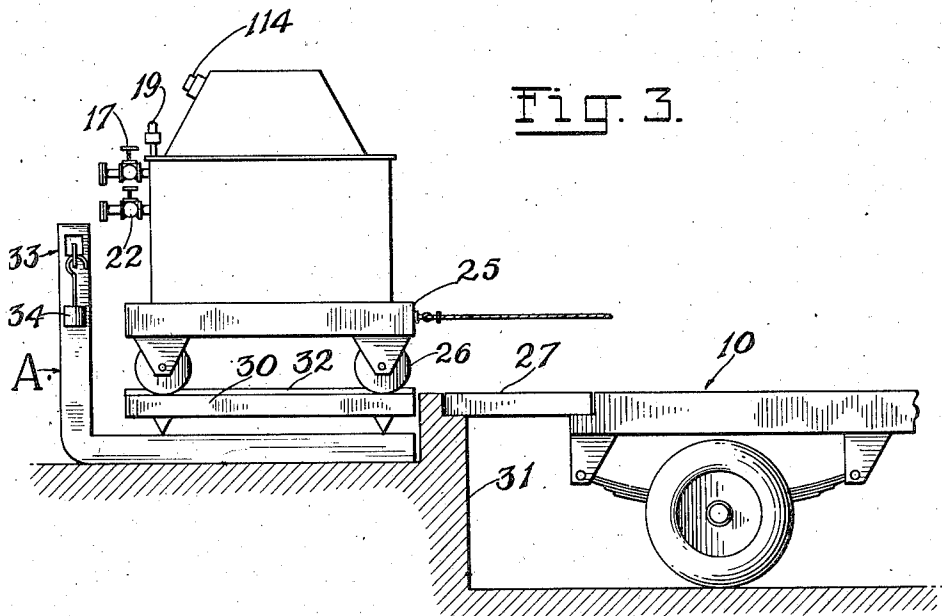


Fig. 3.

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Fig. 4.

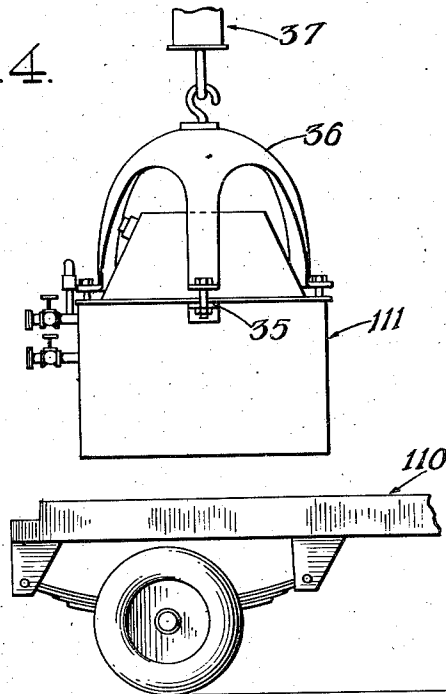
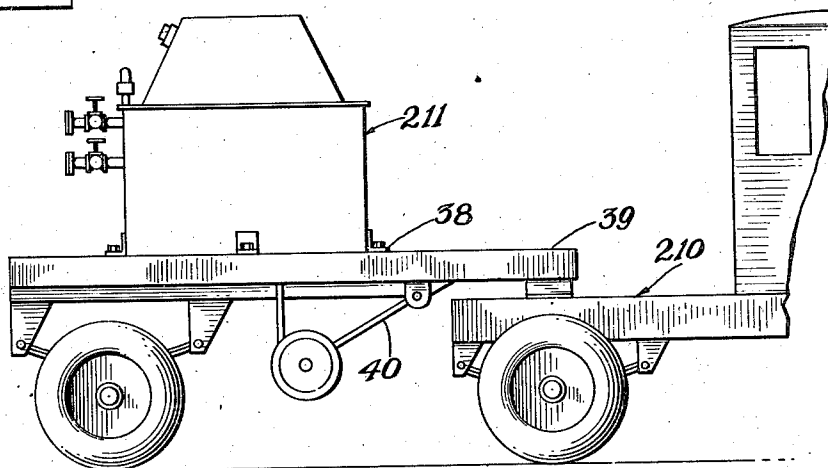


Fig. 5.



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METHOD AND APPARATUS FOR DISTRIBUTING LIQUEFIED GASES

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Application June 30, 1932, Serial No. 620,275

5 Claims. (Cl. 62—1)

This invention relates to a method and apparatus for distributing liquefied gases, particularly liquefied gases having a boiling point below 273° Kelvin for relatively large consumers.

5 The invention has for its object generally the provision of a suitable procedure and a container for liquefied gas which combine the functions of storing, transporting, and supplying for use at the place of consumption the liquefied gas in a manner adapted to be converted into gas at a desired pressure.

10 More specifically, it is an object to provide suitable steps and containers adapted both for converting the liquefied gas into a gas material at a pressure desired for use in consuming apparatus and for conveying liquefied gas from producing plant to place of consumption and vice versa.

15 Another object is to avoid appreciable evaporation losses to the atmosphere by reducing the number of transferrals of the liquefied gas from one container to another.

20 Another object is to provide means for quickly and readily dismounting and remounting containers from vehicles or other transport means.

25 Still another object is to provide means for determining readily the amount of liquefied gas delivered to or consumed at a consumer's place of use.

30 Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

40 For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

45 Fig. 1 shows partly in section and partly in elevation a portable container for liquefied gas, which is being filled at the liquefied gas producing plant together with a suitable conveyance, constructed in accordance with the invention;

50 Fig. 2 shows in elevation the portable container, shown in Fig. 1, when it has arrived at the consumer's place of use, in position to deposit the gas material, together with a portion of the conveyance;

55 Fig. 3 illustrates generally an arrangement for

determining by weighing the contents of a container to ascertain the amount of gas material consumed or added;

Fig. 4 illustrates a modified form of means for removing the container of liquefied gas from a conveyance in accordance with the invention; and

Fig. 5 is an elevational view on a reduced scale showing in full another form of container and conveyance adapted for carrying out the invention.

Referring now to the drawings and particularly to Fig. 1, 10 denotes generally a portion of a suitable conveyance, for example, a motor truck or trailer, for transporting a portable liquefied gas container 11, whose outer envelope or casing together with the insulation are broken away to show the construction employed. Within the casing is an inner vessel 12 which holds the gas material. Disposed in the top of this vessel is a conduit 13 terminating in a filling coupling 14, to which is coupled a conduit 15 for conveying the liquefied gas from the producing plant into the container. Connected also to the top of the vessel 12, is a conduit 16, which is provided with a stop valve 17 and terminates in a coupling 18. A safety relief valve 19 is also preferably disposed in communication with conduit 16 to relieve excess pressure that might occur therein. A conduit 20 leading to a gas holder or receiver is connected to coupling 18. A conduit 21 is also provided leading from the lower portion, below the liquid level, of the vessel 12 to the outside and terminating in a valve 22 and coupling 23.

The container 11 is provided with suitable means for transferring it from a platform or foundation 24 to the bed of the conveyance 10 and vice versa. Such means may comprise, for example, a frame 25 attached to the casing of the container having rollers 26.

A bridge piece 27 is shown as disposed between the foundation 24 and the conveyance 10 to compensate for variations between the level of the foundation and conveyance. Suitable means for moving the container 11 on and off the conveyance are also provided, for example, a winch 28 and cable 29.

In Fig. 2 the liquefied gas container 11 is shown in position on another foundation 124, which may be that at the consumer's place of use. Here a suitable closure 114 is fitted to the terminus 14 of the filling conduit. The gas phase withdrawal conduit which terminates with valve 17 and coupling 18 and the liquid phase withdrawal conduit which terminates with valve 22 and coupling 23 are connected to conduits 118 and 123, 58

respectively, both of which lead to the gas material consuming apparatus.

In Fig. 3 the container 11 is shown after it has been moved off the conveyance 10 onto the platform 30 of a weighing device indicated generally at A.

When it is desired to determine the amount of gas material added to or discharged from the container 11, the complete conveyance and container are here placed on a suitable balance or scale and weighed before and after the addition or discharge of gas material. This is illustrated by Fig. 3, which shows a weighing device mounted on a foundation 31 that may be located at the place of filling or of discharge or at another convenient location. The container has been moved from the conveyance 10 by means of the rollers 26 cooperating with the bridge piece 27 and guiding means 32 disposed on the platform 30 of a platform scale A. The weight of the container 11 and its contents are determined by adjustment of the scale beam and weights 34 of the platform scale. The container may remain, if desired, on the scale during the filling or discharging processes.

In the modified form of means for dismounting the container from the conveyance 110, illustrated by Fig. 4, the container 111 is fitted with suitable means 35 for attaching a lifting tackle 36, so that the container may be raised and lowered by hoisting apparatus, indicated generally at 37.

In Fig. 5, the gas material container 112 is shown permanently mounted on a conveyance 38, which is here shown as of a type commonly known as a trailer. It is fitted with means 39 for attaching power means 210, for example a motor truck. When it is desired to disengage the motive power means and allow the trailer and container to remain at a destination, the support 40 is moved into and fixed in the proper position to support the end of the trailer that is otherwise supported by the motor truck.

The method of distributing the gas material from the producing plant to the consumer installations, in accordance with the invention, is practiced as follows:

The container 11 is filled, either directly from the liquefied gas producing apparatus, or from a storage device which may be located at the producing plant or elsewhere. The container, while being filled, may be mounted either on the transport conveyance, or on the foundation 24, as illustrated in Fig. 1, or upon the platform of a weighing device.

During the filling operation, the valve 22 on the liquid withdrawal conduit remains closed, but the valve 17 on the gas phase withdrawal conduit is opened to permit the gas being displaced by the liquid entering the container 12 to pass out through conduit 20. Such gas is preferably led to a means for receiving gas, thus avoiding the loss of any gas material.

When the container has received the proper amount of gas material, the valve 15^a on the filling conduit 15 is closed and the conduit disconnected from the terminus 14, which then is sealed by a suitable closure 114, shown in Fig. 2. The valve 17 may then be closed and the conduit 20 uncoupled at 18. The container is now ready to be transported to the place of consumption and, if not already on the conveyance, is placed thereon either by means of the winch and cable, illustrated in Fig. 1, or by hoisting, as

illustrated in Fig. 4. If of the special type illustrated in Fig. 5, then the necessity to transfer to or from a conveyance is avoided.

To avoid loss of gas material during transit, the container may be hermetically closed. This procedure is possible because the container is constructed to withstand a considerable working pressure; the safety valve 19 being adjusted to open after the maximum working pressure is exceeded. The boiling point of the liquefied gas material that is placed in the container is at a temperature corresponding to the boiling point of the gas material when in equilibrium with its vapor at a low pressure, while the boiling point of the gas material corresponding to equilibrium conditions at the maximum working pressure is at a substantially higher temperature. Therefore, it is necessary to add sufficient heat to the body of liquefied gas material to raise its temperature through the range indicated before the maximum working pressure is exceeded and loss of gas material can occur.

Since the body of liquid in the container is insulated sufficiently to insure against the influx of substantial quantities of heat from external sources, the rate of evaporation in the container is comparatively low and it, therefore, requires a considerable period of time, because of the substantial specific heat of the body of liquid and the inner vessel, for the necessary quantity of heat to have entered the liquid. This period of time will usually be long enough to permit conveyance of the container from the producing plant to the place of consumption without substantial loss of gas material to the atmosphere.

When the container arrives at the place of consumption, it is dismounted from the conveyance and placed in proper position so that the withdrawal conduits 118 and 123, leading to the control apparatus and consuming devices may be coupled to the proper outlets of the container, as illustrated in Fig. 2. If the container is permanently mounted on the conveyance, as for example, on the trailer, shown in Fig. 5, the container and trailer are placed in position for attaching the withdrawal conduits and are left in position until the container is exhausted of liquefied gas, or until sufficient gas material has been withdrawn. The valves 22 and 17 are opened as required for liquid and gas phase withdrawal, respectively.

When sufficient gas material has been withdrawn, the valves 22 and 17 are closed and the conduits 123 and 118 disconnected. The container is now placed on the conveyance and transported to the producing plant without loss of any of the gas material from the container. Upon arrival at the producing plant, the gas material in the container may be transferred to the gas holding means usually present in such plants to avoid waste.

When it is desired to measure the amount of gas material consumed at the place of use, the determination is very conveniently made by weighing by virtue of the advantages of the present method of distribution. The filled container is placed on a scale as shown in Fig. 3 and the gross weight recorded. After the consumer has used all the gas material he requires, or after its contents have been exhausted, the container is again weighed and its weight subtracted from the original weight to determine the amount of gas material consumed.

It will thus be seen that the present method of distribution eliminates losses of gas material

which would otherwise occur during distribution by the use of liquefied gas containers previously used and losses that occur during the filling from the transport container of the container formerly used at the place of consumption. Another loss that is eliminated is the loss of the gas which is left in the container at the place of consumption because it is at too low a pressure to flow out into the consuming apparatus. The present method of distribution permits this gas to be returned to the producing plant, whereas formerly it was necessary to release it to the atmosphere before the container could be filled from the transport vessel.

It will be seen also that the container, since it is regularly returned to the producing plant for filling, will be under direct periodic observation of the producing plant personnel and can be maintained and tested as part of a regular routine.

Since certain changes in carrying out the above process and in the constructions set forth, which embody the invention may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. The method of distributing liquefied gas to a consumer's place of use, which comprises charging a portable container of a character transportable separately from transport vehicles, with a body of liquefied gas at relatively low pressure, determining the weight of said charged container before discharging to consumer's apparatus, sealing said container and generating a relatively high pressure therein, discharging liquefied gas from said portable container directly to consumer's apparatus while under said relatively high pressure, redetermining the weight of said container when the desired discharge has ceased, and then unsealing and conserving the gas remaining in said container.

2. The method of distributing liquefied gas to a consumer's place of use, which comprises charging a portable container of a character transportable separately from transport vehicles, directly from the production plant with a body of liquefied gas, determining the weight of the charged container before discharging to the consumer's apparatus, maintaining said container sealed while in transit and while in service, adding heat to liquefied gas obtained from said container for accelerating the rate of discharge from said container, discharging liquefied gas directly to consumer's apparatus in response to the consumer's demand, redetermining the weight of said container when said demand has ceased, and un-

sealing and conserving the gas remaining in said container at the production plant.

3. The method of distributing liquid oxygen to a customer's place of use, which comprises charging a portable container of a character transportable separately from transport vehicles, directly from the production plant with a body of liquid oxygen at a relatively low pressure, determining the weight of the container when charged with liquid oxygen before discharging to the consumer's apparatus, sealing said container and generating a relatively high pressure within the container above the surface of the liquid oxygen, discharging liquid oxygen from said portable container directly to the consumer's apparatus while under said relatively high pressure in response to the consumer's demand, removing said container and again determining its weight when said demand has ceased, and then unsealing said container and conserving the gas returned in said container.

4. Apparatus for dispensing liquefied gas which consists of an insulated container adapted to be transported to and from a consumer's place of use on a transport vehicle, and capable of being transported separately from the transport vehicle, said container comprising a heavy walled pressure vessel for holding the liquefied gas, a casing including a heat insulating envelope surrounding and supporting said pressure vessel, filling and withdrawal means each having controlling valves associated with said pressure vessel and having couplings accessible from the exterior of said envelope for attachment to and detachment from external connections, and means associated with said envelope independent of said couplings for mounting and demounting said container on a transport vehicle.

5. Apparatus for dispensing liquefied gas which consists of an insulated container adapted to be transported to and from a consumer's place of use on a transport vehicle, and capable of being transported separately from the transport vehicle, said container comprising a heavy walled pressure vessel for holding the liquefied gas, a casing including a heat insulating envelope surrounding and supporting said pressure vessel, conduits associated with said pressure vessel for introducing and withdrawing gas material, each having controlling valves and provided with couplings accessible from the exterior of said envelope for attachment to and detachment from external connections, and an auxiliary vehicle having means whereby it may be moved adapted to receive and hold said container whereby the same may be moved to desired positions on and off a transport vehicle.

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