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METHOD OF AND APPARATUS FOR STORING AND DISPENSING LIQUEFIED GASES

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2 Sheets-Sheet 1

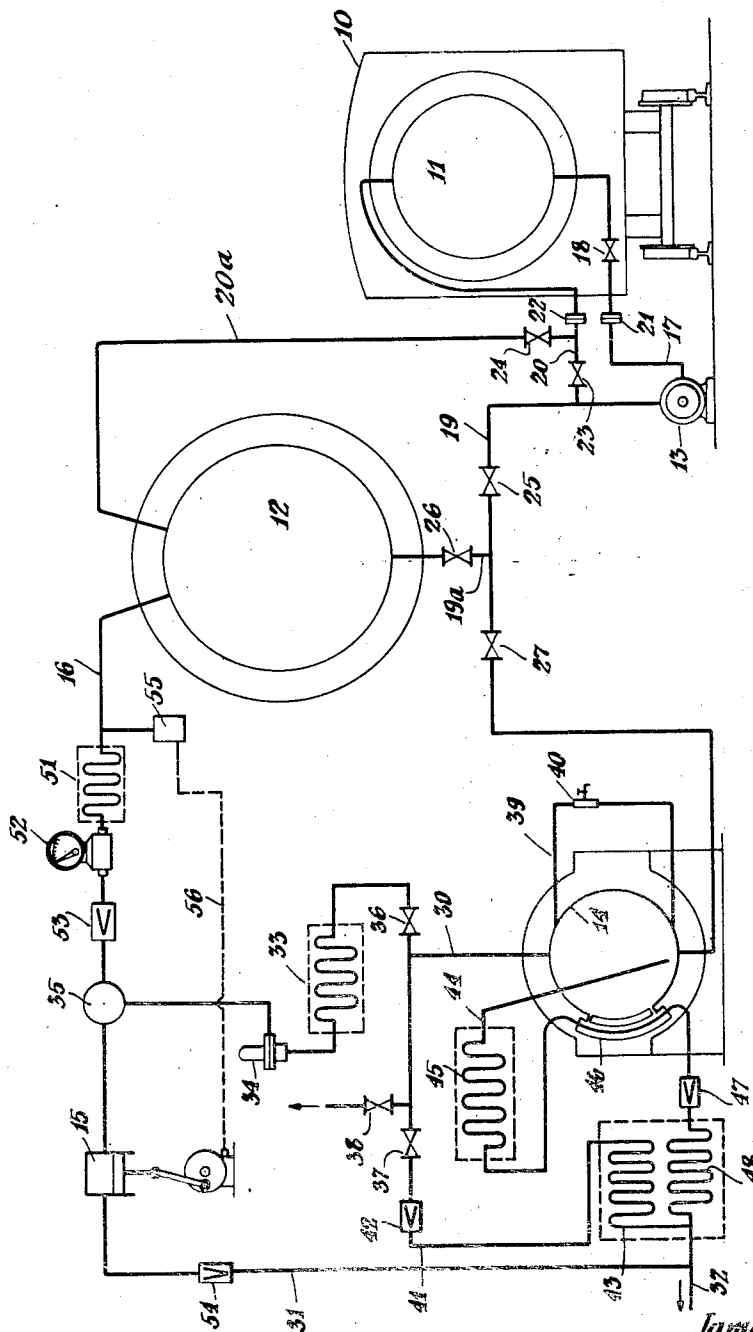


Fig. 1

INVENTORS
James G. Van Vleet
George W. Patch, Jr.
BY

Watson, Bristol, Johnson & Leavenworth
ATTORNEYS

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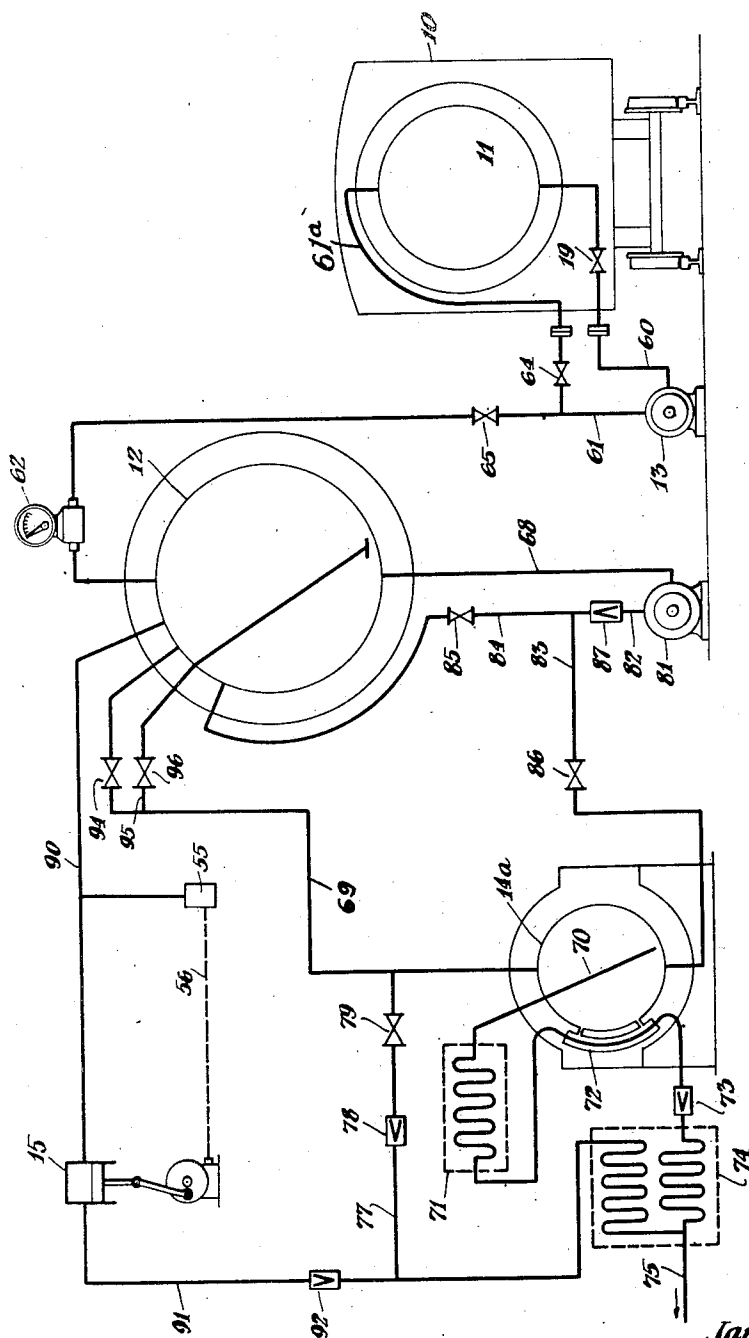


Fig. 2

INVENTORS
James G. Van Vleet
George W. Patch, Jr.

BY

Watson, Bristol, Johnson & Leavenworth
ATTORNEYS

UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR STORING
AND DISPENSING LIQUEFIED GASES

James G. Van Vleet, Larchmont, and George W. Patch, Jr., Kenmore, N. Y., assignors to The Linde Air Products Company, New York, N. Y., a corporation of Ohio

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16 Claims. (Cl. 62-1)

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The invention is concerned with the transportation, storage and dispensation of liquefied gases including the vaporization thereof for industrial use, and is particularly directed to effecting economies in conserving or eliminating losses of the material in transferring it from one container to another and in vaporizing it for use. Liquids of the character to which the invention is applicable are highly volatile having a boiling point at atmospheric pressure below 273° K. The invention is particularly useful in the handling and dispensing of liquid oxygen, the boiling point of which at atmospheric pressure is in the range below 233° K.

Because of the extreme volatility of such liquids the system is necessarily subject to the generation and accumulation of gases at various points therein and which may be at different pressures at the different points. The liquids may flash into gas as a result of coming in contact with warm surfaces, or a sudden decrease in pressure. Liquid pumps are subject to gas binding and if the alternative method is employed of using differential static pressure for transferring the material from one vessel to another, problems are introduced of blowing down particular containers to reduce the pressure and to maintain them for periods of time at a relatively lower pressure without substantial loss of the material. These factors are further complicated in the normal installation by the fact that the gas must be delivered eventually to the consuming apparatus at a relatively high pressure, and the further fact that the quantities delivered must be measured and accounted for on the basis of some common standard of measurement.

The invention is directed to principles of operation and a system adapted to meet and reconcile these various factors in an effective but relatively simple, economical manner.

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 which invention will be indicated in the claims.

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 drawing, in which:

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Fig. 1 is a view largely diagrammatic showing the various elements and their relation in a system illustrative of the invention; and

Fig. 2 is a view of another system similar to Fig. 1 but varying therefrom in certain features.

Referring first to Fig. 1, which depicts one system illustrative of the principles of the invention and the method of carrying it into effect, there is shown a transport container 10 adapted to convey the liquefied gas from a source of supply to the consumer's installation. The transport which may be of various types appropriate to the circumstances, such as an auto truck, tank car or barge is shown in the present instance as a tank car. It embodies an insulated inner tank 11 designed to carry the material therein at low pressure, which may be substantially atmospheric.

As shown in Fig. 1, the installation at the consumers includes in general an insulated main storage container 12 maintained at low pressure, a pump 13 for transferring the liquid from the transport to the container 12, and an auxiliary container 14 of the type commonly referred to as a "cold converter." This auxiliary container is likewise insulated in a suitable manner and the liquid and gas in the inner container 14 are intended to be maintained at a relatively high pressure during delivery of gas material therefrom to the consumption apparatus. As noted, the container 12 is preferably maintained at a low pressure such as 15 lbs. per square inch gauge. Accordingly the pump 13 may conveniently and economically be of the single stage rotary type having a comparatively high capacity at low pressures.

A gas pump 15 is connected by way of the pipeline 16 to the gas space of the main storage container 12, this line including auxiliary elements and features which will be described shortly.

Additional elements of the system may conveniently be pointed out in connection with a description of the operation of the system shown in Fig. 1. The pump 13 is provided with a suction line 17 connected to the bottom of the transport tank 11 and having therein adjacent the tank 11 a shut-off valve 18. The pump is also provided with delivery lines 19 and 20, the line 20 having a branch 20a communicating with the upper portion of the storage container 12. The lines 17 and 20 will embody suitable couplings 21 and 22 respectively. Preliminary to transfer of the liquid from tank 11 to the storage container 12, it will normally be necessary to prime the pump 13, and this operation is accomplished

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by opening valves 18 and 23 and closing valves 24 and 25. As soon as priming has been accomplished the valves will be adjusted to cause the pump to deliver to the container 12. This will usually be through the line 19 connected to the container 12 at the bottom by means of the branch 19a, but, if preferred, under certain circumstances the delivery to the container 12 may be through the line 20a with suitable provision of valves and adjustment thereof. During delivery to the container 12 through line 19 the valves 23, 24 and 27 will be closed and valves 25 and 26 in the open position. If desired under certain operating conditions the pump 13 may be caused to deliver directly to the converter 14 by closing valve 26 and opening valve 27.

Referring now to the apparatus for removing charges of liquid from the storage container 12 to the cold converter 14 and the delivery from the latter of the gas for consumption, there is shown a line 30 leading from the upper part of container 14 for bleeding off or withdrawing of gas and discharging it into the line 16 from which it is pumped by the compressor 15 into the line 31 which leads to the consuming apparatus, and for this purpose if desired may be joined into the main supply line 32 leading directly from the auxiliary container 14. The apparatus as a whole is designed to deliver gas through the line 32 at a pressure suitable for consumption apparatus normally employed in an industrial plant, which, in the case of oxygen, may be for example in the neighborhood of 150 lbs. per square inch.

The line 30 serves also as a means of blowing down the pressure in the container 14 preliminary to a recharging of the container 14. It embodies preferably a heater for the gases shown diagrammatically at 33. After leaving the heater the gas passes through a pressure reducing valve 34 and is discharged into the line 16. The line 16 preferably embodies a ballast tank 35 into which the line from heater 33 leads. Assuming the container 14 has been blown down in the manner described, reducing the pressure to some value such as 15 lbs. per square inch, valves 36 and 37 will be closed and valve 38 opened, venting the line 30 to the atmosphere. Thereupon a measured charge of liquid is drawn into the container 14 by opening the valves 26 and 27. The transfer of liquid may be aided by gravity, or effected entirely by gravity, and container 12 maintained at substantially atmospheric pressure if preferred. The entering liquid will cool container 14 and any evolved gas will slowly escape to the atmosphere through the valve 38. The container 14 is provided with a liquid level indicating line 39 having therein suitable try-cocks or indicators shown generally at 40. By this means an accurate measurement of the net liquid charge delivered to the container 14 is made and accounted for.

The container 14 is provided with the usual means for withdrawing gas material therefrom and delivering it at suitable pressure to the consuming apparatus. As illustrated, this includes a gas phase withdrawal line 41 having therein the control valve 37, check valve 42 and heater 43, the line communicating eventually with main supply line 32. There is shown also a liquid phase withdrawal line 44 leading from the bottom of container 14, through a vaporizer shown generally at 45, then down the heat exchanger 46 for imparting heat to the contents of the container 14, causing some vaporization and maintaining the desired pressure therein, the gas

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material from exchanger 46 passing out through the check valve 47, superheater 48, and to the main line 32 for use.

The system embodies a gas withdrawal and compressing means, heretofore referred to in general, which cooperates with the remaining elements described in effecting economies and contributing to the practical operation of the system as a whole. This gas in line 16 leading from the storage container 12 passes through a heater 51, then through a gas meter 52 with the gas maintained preferably at substantially atmospheric temperature, then through the check valve 53 into ballast tank 35 from which it is drawn by the compressor 15 and discharged through the line 31, which preferably embodies a check valve 54 to the main supply line 32 leading to the consumption apparatus.

The gas pump is preferably automatically controlled, and for this purpose there is shown a pressure responsive device 55 connected into the line 16, the device 55 controlling the operation of the pump 15 through any suitable means such as by opening and closing the electric connections through 56 which in turn control an electric motor for driving the pump 15. As heretofore mentioned, the container 12 may be maintained at a relatively low pressure as, for example, 15 pounds or even lower if desired, and accordingly the control device 55 is designed to control the pump 15 in a manner to withdraw gases and maintain the pressure in the line 16 and container 12 at a value not higher than such predetermined value. It will be observed that by blowing down the gases from the container 14 into the suction side of the gas pump 15 preliminary to a recharging operation of the container 14, such gases are conserved and delivered to the consuming apparatus. The gas withdrawn from the container 12 through the line 16 is metered at 52 and a record kept thereof and added to the record of material recorded in the recharging of the converter 14.

The system functions to conserve further the material by reason of the fact that gases in the tank car 11 may be conducted to the storage container 12 and from there pass through the meter 52 and be recorded and delivered by pump 15 to the consumption apparatus. Pipeline 20a serves this purpose and by opening valve 24 therein pressures between the two containers 11 and 12 may be equalized, initially to transfer of the liquid from the tank, and at the completion of the transfer the remaining gaseous material in the tank 11 blown down to a very low value equal substantially to the low pressure maintained in the storage container 12. If the pressure in the container 12 is permitted normally to rise under the automatic control to 15 lbs., for example, the container 11 at the completion of delivery of a charge may nevertheless be exhausted to substantially atmospheric pressure, and a corresponding conservation of gas material effected, by manually or automatically controlling temporarily the operation of pump 15.

The system as a whole will, of course, embody various auxiliary equipment such as pressure relief valves and gauges which it is deemed unnecessary to describe for the purposes of the present invention. Likewise the line to the consuming apparatus will include elements appropriate to the particular installation, such as regulator valves and gas receivers, to compensate for fluctuations in the demand and supply.

Fig. 2 depicts another system embodying many

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of the elements and principles of the system of Fig. 1 but differing as to others. Similarly to Fig. 1 there is shown a transport 10, a main storage container 12, a pump 13 for transferring the liquid from the transport to the storage container, a cold converter 14a and a gas pump 15. The various connections and conditions of operation will be described more specifically.

The pump 13 is provided with a suction line 60 and a delivery line 61, which latter has a pump priming branch 61a each provided with a suitable coupling as in Fig. 1. In accordance with a preferred method the pressure in container 11 will be maintained at a relatively low value such as 15 to 20 lbs. per square inch gauge. Located in the delivery line 61 immediately over the container 12 is a liquid meter 62 which enables the amount of liquid delivered to the consumer to be readily and accurately determined without resorting to weighing operations, the entire measurement of liquid supplied the consumer being made at the meter. When a delivery is to be made, the valves 19 and 64 are opened and valve 65 closed until the pump has been primed after which valve 65 is opened and valve 64 closed and delivery to the storage container ensues. As noted with respect to the system of Fig. 1 the gas pump removes gas delivered to, or generated from heat leakages into the container 12, and maintains the latter at a low pressure. Consequently transfer of liquid to container 12 may be effected readily by the single stage pump 13 without resorting to any initial blowdown of container 12. Also, during delivery, the liquid coming into the top of container 12 tends to cool and condense the gas present in the upper part. For charging the cold converter 14a a line 68 leads from the bottom of container 12, and a gas line 69 connects the gas spaces at the top of the two containers respectively for equalizing the pressures preliminary to and during transfer of a charge. Liquid is drawn from the container 14a and vaporized and heated for use in any suitable manner such as by the pipe 70, leading through vaporizer 71, heat exchanger 72, check valve 73, superheater 74 and to the main supply line 75. Any accumulation of gas in container 14a may be taken directly to the main supply line 75 by way of the line 77 leading through superheater 74, the line embodying a check valve 78 and shut-off valve 79. Converter 14a is designed to supply gas at a relatively high pressure, such as 150 lbs. per square inch.

The recharging of auxiliary container 14a may be effected by gravity but is preferably effected by mechanical means through the incorporation in the system of the transfer pump 81 having the suction line 68 leading from the bottom of container 12 and a delivery line 82 communicating with pipe 83 leading to the container 14a. The delivery line 82 also has a branch 84 leading back to the container 12 for priming purposes. During such operation valve 85 is of course open and valve 86 closed. The delivery line 84 will include preferably a check valve 87 as shown. Since pump 81 operates against a low head, it may be of a high capacity single stage rotary type similar to pump 13.

The gas pump 15 is connected to the upper part of the main storage container 12 by line 90. The arrangement preferably includes an automatic control for the pump similar to that in Fig. 1. The pump is designed to remove gas accumulating in the main container through generation from heat leakages or blowdowns into container

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12 from the converter 14a, and to maintain the pressure in the container below a predetermined maximum which may be in the neighborhood of 15 or 20 lbs., and to elevate the pressure to that required for consumption apparatus. The pump is shown as discharging into line 91, which includes a check valve 92, through the superheater 74, and then into the main supply line 75.

In accordance with the present arrangement blowdown losses from the high pressure auxiliary supply container 14a may be completely avoided under normal conditions of operation. Preliminary to a recharging of container 14a the valve 79 is closed and valve 84 opened permitting gas to blow down from container 14a to the main container 12. If circumstances render it preferable the gas may be blown through a branch pipeline 95 controlled by valve 96, the line 95 leading to below the normal level of liquid in the storage container 12. The lower end of pipe 95 may be provided with a suitable diffuser. This method causes the gases to bubble up through the liquid in container 12 condensing some at least of the gas and avoiding what might in some cases be too great a pressure increase in container 12, or too great a load on the gas compressor 15, or both.

After the pressures in the main and auxiliary containers have been equalized, the pump 81 is primed through the connections and in the manner heretofore described; and then with valves 85 and 79 closed and valves 86 and 94 or 96 open a desired charge of liquid is delivered through pipeline 83 to the container 14a.

If the conditions are such as to make it particularly desirable to avoid reducing the pressure in container 14a and interrupting the service during recharging of container 12 a pump 81 may be provided of a character to deliver at the full service pressure. Such a pump could comprise a multi-stage rotary type pump.

Since certain changes in carrying out the above method 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 drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. A method of storing a liquefied gas and delivering the material from a main storage container closed to the atmosphere and provided with means for transferring charges to an auxiliary container which comprises maintaining the pressure in said auxiliary container at an elevated pressure substantially in excess of that in the main storage container suitable for supplying consuming apparatus, withdrawing gas material from said auxiliary container and supplying it in gaseous form and at suitable temperature to consuming apparatus, and maintaining the pressure in said storage container at or below a predetermined value by withdrawing gas from the accumulation thereof in said storage container and elevating the pressure thereof and delivering it direct to the consuming apparatus.

2. A method of storing a liquefied gas and

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delivering the material from a main storage container closed to the atmosphere and provided with means for transferring charges therefrom to an auxiliary container which comprises, releasing gas from said auxiliary container preliminary to a recharging operation into a portion of the supply system maintained at relatively low pressure, transferring such a charge to said auxiliary container, sealing off said auxiliary container from low pressure points of the supply system, and elevating the pressure in said auxiliary container to a point considerably above that in said main storage container suitable for use in consuming apparatus and so delivering gas material therefrom, and concurrently withdrawing gas from the accumulation thereof in the main storage container and elevating the pressure thereof for use in the consuming apparatus.

3. A method of storing and dispensing liquefied gas material which comprises storing the liquid in a closed main container at relatively low pressure, intermittently transferring charges of liquid therefrom to an auxiliary container and producing therein a relatively higher pressure suitable for consuming apparatus and so supplying gas material, withdrawing gas from said auxiliary container preliminary to recharging to reduce the pressure therein and passing said gas through a compressor and supplying it thereby at a suitable pressure for consumption equal to that supplied by said auxiliary container, and withdrawing gas accumulating in said storage container and constantly maintaining the pressure in the latter below a predetermined maximum and compressing and delivering the withdrawn gas at a suitable pressure for consumption.

4. A method of storing and dispensing a liquefied gas material from a main container closed to the atmosphere and an auxiliary container adapted to receive charges therefrom, said method comprising withdrawing gas from said auxiliary container preliminary to recharging thereof into a part of the system at lower pressure, sealing off the withdrawal and venting the auxiliary container to the atmosphere while being recharged from the main storage container, withdrawing accumulating gas from said storage container and maintaining the pressure therein below a predetermined maximum of relatively low value, compressing the said withdrawn gases and thereby conserving and supplying same at a suitable pressure for consumption, concurrently supplying gas from said auxiliary container directly to the consumption apparatus, and supplementing the gas to the consumption apparatus as required for use by withdrawing liquid from said auxiliary container and passing it through a vaporizer.

5. In a system for storing and dispensing in gas form a liquefied gas, an insulated main storage container, an auxiliary smaller container, fluid connections and controls therein for transferring charges of liquid as required for consumption from said storage container to said auxiliary container, means for withdrawing liquid therefrom for conversion into gas for consumption, a gas withdrawal line leading from said auxiliary container, a gas withdrawal line leading from said storage container, a gas meter in said latter line, and a gas pump connected to supply for consumption the gas from said withdrawal lines.

6. A method of storing and dispensing gas material having a boiling point at atmospheric pressure below 233° K., and measuring the amount

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thereof comprising, storing a supply thereof in the liquid state in a closed insulated main container at low pressure, transferring measured charges of the liquid to an auxiliary smaller container as required, supplying gas material therefrom at relatively higher pressures suitable for consumption, withdrawing the gas accumulations in the main container through a gas meter and compressing the gas and delivering it to the consumption apparatus at said higher pressure suitable for consumption.

7. In a system for storing and dispensing liquefied gas and measuring the material thus dispensed, a main storage container, a supply conduit for delivering liquid thereto, a liquid meter in said supply conduit for measuring the liquid thus supplied, an auxiliary container, conduit means and a line pump for transferring charges of liquid from said storage container to said auxiliary container, fluid connections between said containers for equalizing the pressures, valve means for closing said conduit means and for said fluid connections to enable said auxiliary container to build up and maintain a higher pressure than said storage container for delivering gas material for consumption while a charge is not being transferred, and a gas pump for withdrawing gas from said storage container and adapted to deliver it at a high pressure suitable for consumption.

8. A method of storing and dispensing gas material having a boiling point at atmospheric pressure below 233° K. and measuring the amount dispensed comprising, delivering the gas in liquid form through a liquid meter to a main storage container closed to the atmosphere, intermittently transferring charges of liquid to an auxiliary container as required for use, supplying gas material therefrom at an increased pressure suitable for use, blowing the gas down from said auxiliary container to said main storage container preliminary to each recharging operation, and withdrawing gas from said main container as required to maintain the pressure in said main container at or below a predetermined low value and compressing said gas and delivering it at an elevated pressure suitable for consumption.

9. In a system for storing and dispensing a liquefied gas and converting it into a gas for industrial use, a main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container at a relatively high pressure suitable for industrial use of the gas, gas withdrawal conduit means leading from the gas phase of said auxiliary container to gas servicing connections, a gas withdrawal conduit means leading directly from said main storage container to said servicing connections, a pump means therein adapted to maintain the pressure in said main container below a predetermined low value and to elevate the pressure of the delivered gas to a pressure suitable for industrial use comparable to that supplied by said auxiliary container, both of said gas withdrawal conduits being adapted to supply gas concurrently, and a liquid withdrawal conduit means including vaporizer means leading from the liquid phase of said auxiliary container to said servicing connections adapted to supplement concurrently the gas supplied by

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said gas withdrawal conduits as required at said servicing connections.

10. In a system for storing and dispensing a liquefied gas and converting it into gas for industrial use, a main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container being adapted to operate at a relatively high pressure suitable for industrial use of the gas, gas servicing connections, gas withdrawal conduit means leading to said servicing connections from the gas phase of said auxiliary container and liquid withdrawal conduit means including vaporizer means therein leading to said servicing connections from the liquid phase of said auxiliary container for supplementing the gas phase withdrawal as service demands require, both said withdrawal conduit means being maintained open contemporaneously to meet service requirements, a gas conduit means leading directly from said main storage container to said servicing connections, and a pump means therein adapted to withdraw gas as it accumulates in said main container and deliver it to said servicing connections at a pressure suitable for industrial use comparable to that supplied normally by said auxiliary container.

11. In a system for storing and dispensing a liquefied gas and converting it into gas for industrial use, a main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container being adapted to operate at a relatively high pressure suitable for industrial use of the gas, gas servicing connections, gas withdrawal conduit means leading to said servicing connections from the gas phase of said auxiliary container and liquid withdrawal conduit means including vaporizer means therein leading to said servicing connections from the liquid phase of said auxiliary container for supplementing the gas phase withdrawal as service demands require, both said withdrawal conduit means being maintained open contemporaneously to meet service requirements, a gas conduit means leading directly from said main storage container to said servicing connection, a pump means therein adapted to deliver gas at a pressure equal to the maximum required at said servicing connections, and means responsive to pressure in said main container for controlling said pump means to cause it automatically to withdraw gas accumulating in said main container and maintain the pressure therein at or below a predetermined low value.

12. In a system for storing and dispensing a liquefied gas and converting it into gas for industrial use, a main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container being adapted to operate at a relatively high pressure suitable for industrial use of the gas, gas servicing connection

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means, conduits embodying heater means said conduits being connected and arranged to deliver to said servicing connection means gas from the gas space of said auxiliary container augmented by material drawn from the liquid phase thereof and converted to gas by said heater means as required to meet the service demands, gas conduit means leading directly from said main storage container to said servicing connection means, a reciprocating pump therein adapted to deliver gas at a pressure equal to the maximum required at said servicing connection means, and means responsive to pressure in said main container for controlling said pump to cause it automatically to withdraw gas accumulating in said main container and maintain the pressure therein at or below a predetermined low value.

13. In a system for storing and dispensing a liquefied gas and converting it into gas for industrial use, a permanently installed main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including permanently connected fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container being adapted to operate at a relatively high pressure suitable for industrial use of the gas, gas servicing connection means, conduit means connecting said auxiliary container to said servicing connection and having associated therewith heater means, said conduit means being selectively operable to deliver to said servicing connection means gas from the gas phase of said auxiliary container augmented by material from the liquid phase thereof as required to meet the service demands, gas conduit means leading directly from said main storage container to said servicing connection means, a reciprocating pump therein adapted to deliver gas at a pressure equal to that supplied by said auxiliary container, and means responsive to pressure in said main container for controlling said pump to cause it automatically to withdraw gas accumulating in said main container and maintain the pressure therein at or below a predetermined low value.

14. In a system for storing and dispensing a liquefied gas and converting it into a gas for industrial use, a main storage container, an auxiliary smaller container having space for the material in both the liquid and gas phases, means including fluid conduits for delivering charges of liquid from said main storage container to said auxiliary container, said main container being adapted to operate at a low pressure and said auxiliary container at a relatively high pressure suitable for industrial use of the gas, means for equalizing the pressures between said containers preliminary to a charging operation, gas withdrawal conduit means leading from the gas phase of said auxiliary container to gas servicing connections, a gas withdrawal conduit means leading directly from said main storage container to said servicing connections, a pump means therein adapted to maintain the pressure in said main container at or below a predetermined low value and to elevate the pressure of the delivered gas to a pressure suitable for industrial use comparable to that supplied by said auxiliary container, and a liquid withdrawal conduit means embodying vaporizer means leading from the liquid phase of said auxiliary container to said servicing connections adapted to supplement concurrently the

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gas supplied by said gas withdrawal conduits as required at said servicing connections.

15. A method of storing and dispensing from a closed main container and a closed smaller auxiliary container a liquefied gas having a boiling point temperature at atmospheric pressure materially below 273° K. which comprises, equalizing the gas pressures in the two containers, transferring a charge of liquid from the main container to the auxiliary container and elevating the gas pressure in the latter and maintaining it at a value suitable for industrial consumption, withdrawing gas generated in said auxiliary container and delivering it to the consumption apparatus, concurrently withdrawing gas from the main container to maintain the pressure in the latter at or below a predetermined low pressure and delivering the gas to the consuming apparatus at an elevated pressure suitable for such industrial consumption, and concurrently supplementing as required by the consumption apparatus the withdrawal of gas from the main and auxiliary containers by withdrawing liquid from the auxiliary container and vaporizing it and delivering the gas to the consumption apparatus.

16. A method of storing a liquefied gas having a boiling point temperature at atmospheric pressure materially below 273° K. and converting it into a gas and dispensing it to consuming apparatus as required, which comprises storing the

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liquid in a closed main container, transferring charges of the liquid therefrom as required to an auxiliary closed container having liquid and gas spaces and maintaining the material therein at a relatively high pressure suitable for use at consuming apparatus, withdrawing gas generated in said auxiliary container and delivering it to the consuming apparatus, concurrently withdrawing gas from the main container to maintain the pressure in the latter at or below a predetermined low pressure and delivering the gas to the consuming apparatus at an elevated pressure suitable for industrial use, and concurrently supplementing as required by the consuming apparatus the withdrawal of gas from the main and auxiliary containers by withdrawing liquid from the auxiliary container and vaporizing it and delivering the gas to the consuming apparatus.

JAMES G. VAN VLEET.

GEORGE W. PATCH, Jr.

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