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METHOD AND APPARATUS FOR DISPENSING GAS MATERIAL

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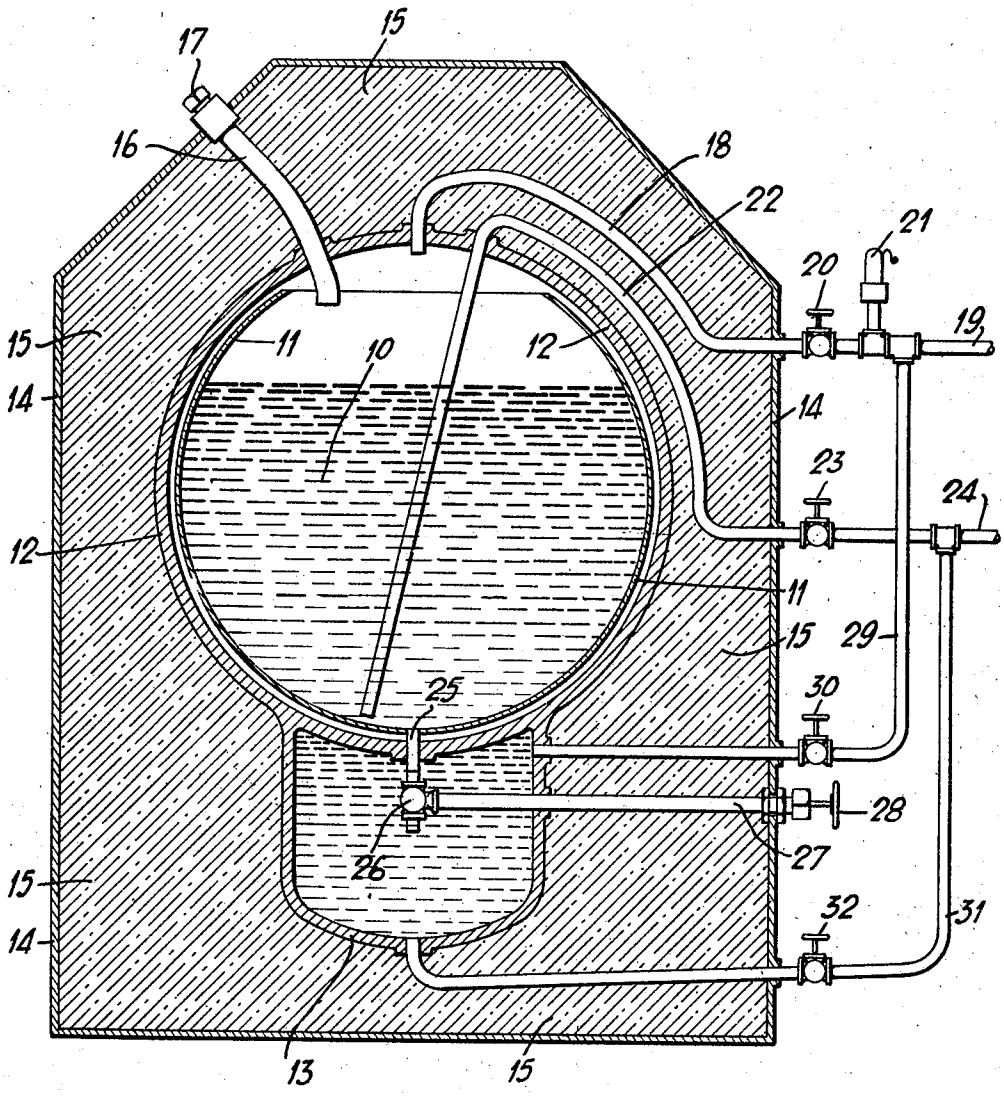

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METHOD AND APPARATUS FOR DISPENSING GAS MATERIAL

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This invention relates to a method and apparatus for dispensing gas material, particularly gas material which is stored in the liquid phase at temperatures below 273° Kelvin, and has for its principal object to avoid the present practice of providing two main containers at the place of discharge and yet maintain a continuous supply of gas material to the consuming apparatus.

More specifically, it is an object to provide an auxiliary container for use at the place of discharge arranged to cooperate with the main container of liquefied gas.

A further object is to provide a method and means for continuing the supply of gas material during the process of charging the main container.

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.

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:

The figure is a view mainly in vertical section showing a preferred construction of a container for liquefied gases for use in accordance with the invention.

Referring now to the drawing, 10 denotes liquefied gas, which is shown as held by an inner receptacle or "basket" 11 disposed within a relatively thick-walled pressure vessel or container 12 in such a manner that a comparatively narrow space exists between the walls of these vessels. The inner vessel or basket 11 is provided with means affording communication for gas pressure from its interior to the space between the walls of the two vessels, for example, an opening at the top of the basket.

In accordance with the present invention, a container or pressure vessel of the character indicated has associated with it an auxiliary container or vessel, preferably of smaller capacity than the main container. Such auxiliary container may have any desired relation to the main container but is preferably so disposed that gravity will cause a flow of liquid from the main container into the auxiliary container. To this end an auxiliary container is shown at 13 disposed below the main container 12; both containers in this instance being enclosed in a common envelope 14 that is preferably substantially filled with solid heat insulating material, as indicated at 15, whereby the heat leakage from an external source is reduced to a relatively small amount. While the vessel 13 may be structurally independent of the vessel 12, it is advantageous in manufacture to have a portion of their walls in common, for example arranged in the manner illustrated where a portion of the lower spherical wall of the vessel 12 forms the top wall of vessel 13.

The main pressure vessel 12 is provided with suitable openings and connections for filling and for withdrawal of gas material that are here shown as comprising a filling conduit 16 and withdrawal conduits 18 and 22. The conduit 16 passes through the wall of vessel 12, insulation 15 and envelope 14, and preferably has its inner end depending below the rim of basket 11; the external end being fitted with a suitable closure as a plug 17. One end of conduit 18 is disposed in the top of main vessel 12 to withdraw gas therefrom, while the other end joins with gas supply conduit 19 which conducts the gas material to a consuming apparatus. After passing to the outside of the envelope 14, the conduit 18 is provided with a stop valve 20 and is in communication with a safety pressure relief valve 21. The liquid withdrawal conduit 22 leads from a point near the lowest portion of the inner vessel 11, out through the wall of the main vessel 12 and to the outside of the envelope 14, where it is provided with valve 23 and joints conduit 24. Conduit 24 conducts liquefied gas to the consuming apparatus.

From the bottom of inner vessel 11, a connection 25 conducts liquefied gas through the common wall into the auxiliary pressure vessel 13. The flow of liquefied gas into the auxiliary pressure vessel is controlled by a stop valve 26 at the end of connection 25. The stop valve 26 is provided with an extended stem and bonnet 27, which passes out of the auxiliary pressure vessel and through the insulation and outer envelope 14, so that its hand wheel 28 may be readily manipulated from outside the casing. From an upper portion of the auxiliary vessel 13, a conduit 29 conducts gas material, when desired, into conduit 19. Conduit 29 is provided at a point external to the envelope 14 with a stop valve 30. A liquid withdrawal conduit 31 is connected at

its one end to the bottom of the auxiliary pressure vessel 13, and at the other end to conduit 24. It is also provided with a stop valve 32 at a point just outside of casing 14.

In order to insure an uninterrupted supply of gas material to consuming apparatus, it has been the usual practice to install at the place of delivery to consuming apparatus two main "cold converters" or containing devices having pressure vessels for holding liquefied gas insulated against the influx of heat. When the contents of one cold converter becomes exhausted, withdrawal is continued from the other cold converter and the exhausted cold converter refilled. Heretofore it was customary, when refilling cold converters, to close the withdrawal valves and release the pressure to the atmosphere, whereby the liquefied gas being placed in the exhausted converter may flow in readily. To add liquefied gas to a partially filled cold converter would generally result in a relatively great loss of gas material, as liquefied gas under pressure is usually at a higher temperature than its boiling point at atmospheric pressure. The release of such pressure gas, in consequence, would cause evaporation and boiling of the liquefied gas until its temperature was lowered to the boiling point at the lower pressure. These losses are avoided by the practice of the present invention.

The method of using the cold converter with liquid reserve in accordance with the invention above described is as follows: By operating hand wheel 28, the stop valve 26 is closed. Valves 20, 23, 30 and 32 are also closed and pressure released, for example, by loosening the closure 17. When the pressure has been released, the desired quantity of liquefied gas is introduced through the filling conduit 16. The basket 11, being of relatively small mass, will cause the evaporation of only an inappreciable amount of liquefied gas during the filling operation. After the closure 17 is replaced, the valves 20, 23 and 30 are opened, and finally valve 26 is opened by manipulation of hand wheel 28 to permit the flow of liquefied gas from the main container 11 into the auxiliary container 13. The metal walls of the auxiliary container being warm, cause evaporation of liquefied gas to occur by the exchange of sensible heat of the mass of metal to latent heat of evaporation of the liquefied gas until the metal has been cooled to the temperature of the liquefied gas. Heat is transferred by conduction to the connected walls of the auxiliary container from the walls of the main pressure container 12. The gas that is evaporated in the auxiliary container passes by means of conduits 29 and 18 to the gas spaces of the main pressure vessel and to the consuming apparatus through connected conduit 19.

The consuming apparatus is so controlled that withdrawal through conduit 19 occurs only when the pressure of gas therein exceeds a certain desired maximum. Withdrawal through conduit 24 is likewise controlled by the consuming apparatus so that the desired quantity of gas material is withdrawn through conduit 24 when the pressure is equal to or lower than the desired pressure. The valve 23 being open, liquefied gas is withdrawn from the inner vessel 11 of the main container until the supply therein is exhausted.

At this time valve 32 is opened and valves 23, 26 and 20 are closed so that the main container is completely sealed and withdrawal of gas material continues from the auxiliary container 13 through conduits 29 and 31. The pressure in the main container may now be released by the removal of closure 17, and the main container refilled without interrupting the continuity of supply. After refilling the main container, the opening of valve 20 causes a return flow of gas through conduit 18 to effect a desired increase in pressure in the main container. Liquefied gas withdrawal is then resumed from the main container by opening valve 23 and closing valve 32, after which the valve 26 may be opened to refill the auxiliary container.

It will thus be seen that the exemplary apparatus illustrated and used in accordance with the method of the invention, as described, provides a means for maintaining a continuous supply of gas material to consuming apparatus and avoids having available at the place of delivery to the consuming apparatus two separate main containers of liquefied gas or cold converters. By this invention, the methods of dispensing liquefied gas material are simplified and the cost of apparatus required therefor is reduced.

It will also be seen that the construction of the apparatus of the present invention provides means under the control of the operator for accelerating the evaporation of a portion of the liquefied gas to develop an increase of pressure when such increase of pressure is most likely to be desired, as after the first charge of liquefied gas has been placed in the main container and after the apparatus has been shut down for a period of time after the discharge of all of the liquefied gas.

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 drawing 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. A method of dispensing gas material which comprises charging liquefied gas into a thermally insulated container having an associated auxiliary container arranged to have its insulation in common with the main container, charging the auxiliary container directly from the main container, and thereafter discharging gas material in liquid and gas phases as desired from said containers.

2. A method of dispensing gas material which comprises charging liquefied gas into a thermally insulated container having an associated auxiliary container arranged to have its insulation in common with the main container, charging the auxiliary container from the main container, and thereafter discharging gas material independently from said containers in either liquid or gas phases.

3. A method for dispensing gas material which comprises charging liquefied gas into a thermally insulated main container for liquefied gases, to which is directly connected within a common envelope an auxiliary container for liquefied gases, transferring a portion of the liquefied gas charge into said auxiliary container, discharging desired gas material from both containers, and recharging the main container while continuing the discharge of gas material from the auxiliary container.

4. An apparatus for dispensing gas material comprising a main container for liquefied gas, an auxiliary container connected directly below said main container, common heat insulation for

said containers, means for transferring a portion of the charge from the main container to the auxiliary container, and means associated with both containers for independently discharging gas material therefrom.

5. An apparatus for dispensing gas material comprising a main container for liquefied gas, an auxiliary container connected with said main container, heat insulating material surrounding both containers, an envelope surrounding both containers and said insulating material, means for transferring a portion of the charge of the main container to the auxiliary container, and means for discharging gas material independently from both containers.

6. An apparatus for dispensing gas material comprising a main container for liquefied gas, an auxiliary container connected with said main container, heat insulating material surrounding both containers, an envelope surrounding both containers and said insulating material, means for filling said main container from without said envelope, means within said envelope for filling said auxiliary container by gravity from said main container, and means for discharging gas material from both containers.

7. An apparatus for dispensing gas material comprising a main container for liquefied gas, an auxiliary container connected with said main container, heat insulating material surrounding both containers, an envelope surrounding both containers and said insulating material, means for filling said main container from without said envelope, means within said envelope for filling said auxiliary container from said main container, a gas phase withdrawal conduit having branches connected to the upper portions of each of said containers, and a liquid phase withdrawal conduit having branches connected to the lower portion of each of said containers.

8. An apparatus for dispensing gas material comprising a main container for liquefied gas, an auxiliary container attached to said main container arranged to have a portion of its wall in common with said main container, heat insulating material surrounding said containers an envelope surrounding both containers and said insulating material, gravity means for transferring a charge of liquid from said main container to said auxiliary container, and means affording the discharge of gas material from both of said containers.

9. An apparatus for dispensing gas material comprising a main container of liquefied gas, a depending auxiliary container attached to said main container and having a portion of its bounding wall in common with said main container, heat insulating material surrounding both said containers an envelope surrounding both containers and said insulating material, communicating means in said common wall portion affording the transfer of a liquid charge from said main container into said auxiliary container and withdrawal conduits connected to withdraw gas material at will from both said containers.

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