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CONTAINER FOR LIQUEFIED GASES

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Fig. 1.

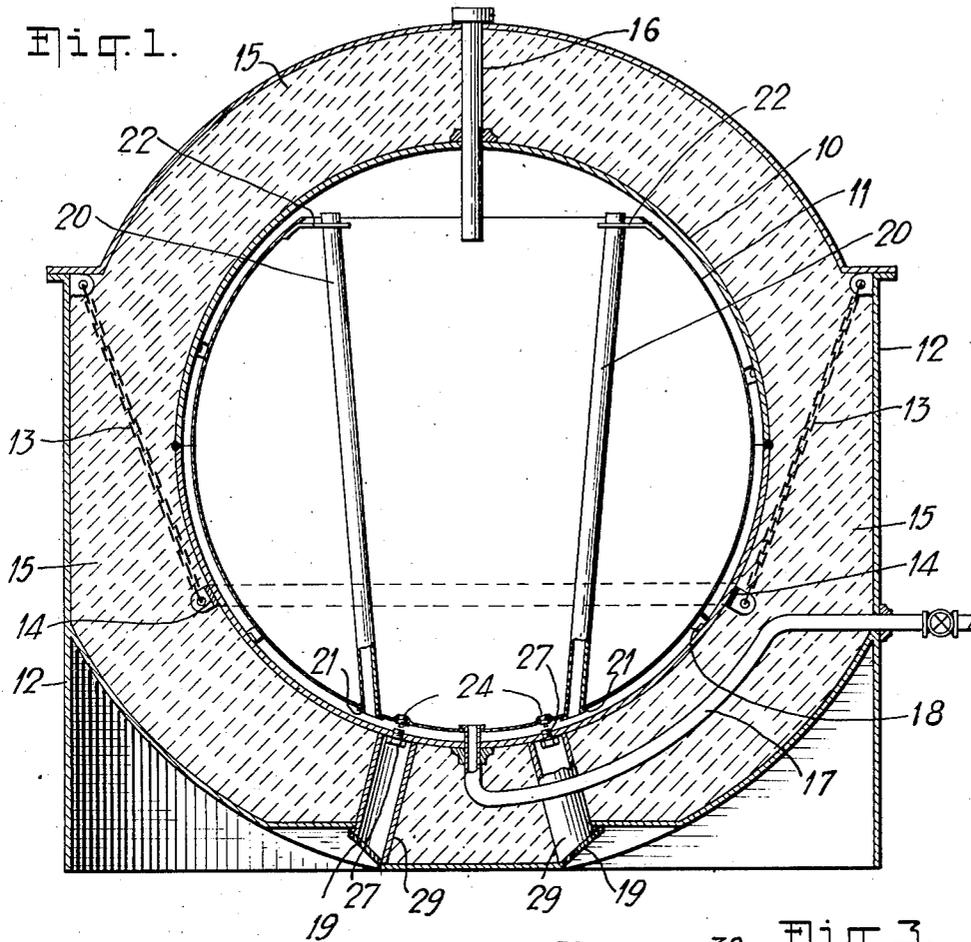


Fig. 2.

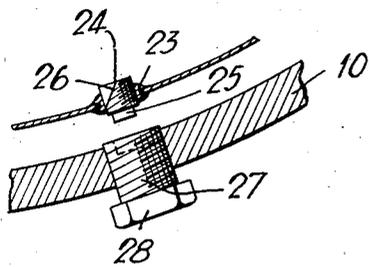
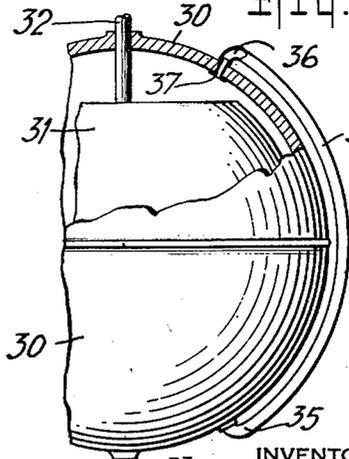


Fig. 3.



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CONTAINER FOR LIQUEFIED GASES

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15 Claims. (Cl. 62—1)

This invention relates to containers for liquefied gases, and particularly to containers of the insulated type for gases which exist in the liquid phase only at temperatures below 273° K.

5 The invention has for its object generally an improved construction and arrangement of parts in containers of the character indicated, which is efficient, economical and readily manufactured.

More specifically, it is an object to provide a container for liquefied gases with a pressure vessel constructed in a manner adapted to be converted from an efficient stationary container to an efficient transport container, and vice versa.

10 It is also an object to provide pressure vessels for containers of the character indicated with an improved spaced lining or basket construction whereby the pressures in the upper and lower zones of the space intervening between the basket and the wall in the pressure vessel are equalized.

15 Still another object is to provide a construction in pressure vessels having a spaced inner lining or basket with means whereby there is a restricted feed of liquid from the inner lining or basket into the space about the basket to generate gas therein at will.

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

The invention accordingly comprises the features of construction, combination of elements, 25 and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

30 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:

35 Fig. 1 is a view mainly in vertical section showing a container for liquefied gases constructed in accordance with the invention;

40 Fig. 2 is an enlarged fragmentary sectional view showing the means for providing the restricted flow from the lower portion of the basket to the space between the basket and the inner wall of the pressure vessel in accordance with the invention; and

45 Fig. 3 is an enlarged fragmentary view partly in section and partly in elevation showing a modified form of the invention.

50 Referring now to the drawing and particularly to Fig. 1, 10 denotes a pressure vessel having a spaced inner lining or basket 11 for holding a body of liquefied gas, for example, a body of liquid oxygen. The pressure vessel is preferably dis-

posed within an envelope or outer casing 12, here shown as having a cylindrical lower portion and a dome-like upper portion, in order to provide a rigid support for the vessel and economy in the use of space enclosed about the vessel.

60 The pressure vessel 10 is secured in the casing in any convenient manner, for example, by means of cables or chains 13 that are anchored at one end to the interior cylindrical wall portion of the casing 12 and at the other end to lugs on a supporting ring 14 which holds the pressure vessel 10. The intervening space between the casing and the pressure vessel 10 is preferably substantially filled with suitable insulating material 15, which may be of any suitable character, 65 for example, porous magnesium carbonate. A filling connection 16 is shown as passing through the dome of the casing 12 and extending below the brim of the basket 11 in the pressure vessel 10. A withdrawal connection 17 for gas material in the liquid phase is shown as leading from the bottom of the basket through the wall of the pressure vessel and the wall of the casing 12 to the exterior. Withdrawal connections for gas material in the gas phase may, of course, be provided, but the showing thereof has been omitted 70 in the interests of clearness.

75 In pressure vessels of the character shown, the inner lining or basket 11 is everywhere spaced from the inner wall of the vessel 10 by supporting means, which may be annular in form as shown at 18, so that a shell-like space intervenes between the basket and the inner wall of the pressure vessel. This shell-like space preferably has a substantially uniform thickness, and since the basket is generally of very thin material, the uniform spacing of the basket is not always maintained, and the pressures in different portions of this shell-like space and those obtaining on the interior and exterior of the basket are not 80 always quickly equalized.

85 In the present invention, pressure equalizing means are associated with the pressure vessel which insure equalization of the pressures at all times in the upper and lower zones of the shell-like space about the basket and of the pressures within and without the basket in the pressure vessel. The equalizing means here proposed 90 comprise one or more conduits of relatively large cross-sectional area arranged to afford free communication between the regions where unequal pressures are likely to occur within the pressure vessel. In the preferred form of the invention, these means comprise tubular members 20 which 95 extend from a point adjacent the brim of the inner

lining or basket 11 and pass through the bottom of the same, as indicated at 21, to communicate with the shell-like space on the exterior of the lining. These tubular members may with advantage be secured to the brim of the inner lining or basket, as indicated by the securing plate 22 extending from the wall of the basket to engage with the tubes 20. The tubes 20 thus inserted serve not only as means for establishing communication between the upper and lower zones of the shell-like space about the basket, but also serve as columns for mechanically bracing the basket against collapse.

In order that the container may be convertible according to the present invention, the basket 11 is provided with means affording restricted communication between the lower portion of the basket and the shell-like space about the basket. To this end, the wall of the basket is perforated at one or more points near its bottom, the opening preferably having means to control the passage of liquid in the manner desired. Details of an advantageous arrangement for this purpose are shown in Fig. 2.

Here the restricted flow of liquid from the basket into the shell-like space is arranged to be regulated, though it is by no means essential, each opening in the bottom of the basket being shown as provided with adjustable flow-controlling means. The opening is shown in Fig. 2 as bushed at 23, the bushing being threaded and having its upper and lower edges rolled over against the inner and outer basket walls. Engaging with the bushing is a threaded plug 24, the outer end of which is provided with a squared portion 25, or other suitable means, adapted to be engaged by a manipulating tool. A diagonal kerf 26 is also preferably cut in the side and end of the plug so that there is a graduated opening when the plug is sufficiently turned in the bushing affording communication between the interior of the basket and the shell-like space about the same. By cutting this kerf diagonally, it is seen that the further the plug is unscrewed, the greater is the cross-sectional area of the passage that affords this communication. Directly beneath the plug 24 in the wall of the pressure vessel 10 is a larger plug 27 that makes threaded engagement with the wall of the vessel 10. The outer end of this plug is also provided with an actuating head 28 for engagement by a suitable manipulating tool.

In order that the plugs 27 in the bottom of the vessel 10 may be manipulated when the pressure vessel is in place in the casing 12, passage members 29 are provided in the lower part of the casing extending up close to or in contact with the outer wall of the pressure vessel, but making light engagement therewith. The function of these members is to keep the insulating material 15 away from the plugs 28 and to provide a path of ready access from the outside of casing 12, whereby the plugs 28 may be inserted and removed, and when removed afford access for manipulating or removing the plugs 24. The lower ends of the passage members 29 are closed by means of closures 19, in order to shut out the outer atmosphere that would otherwise impair the insulating qualities of the casing at these points by exposing the wall of the pressure vessel 10. Before the closures 19 are put in place, insulating material may be inserted, if desired.

In operation, it is seen that the pressure vessel is filled with liquefied gas through the connection at 16 and gas material withdrawn through the

withdrawal connections when desired. When the container is to be used for storage purposes, the closures in the bottom of the basket 11 are kept closed while pressure is slowly built in the pressure vessel.

When the container, which has a pressure vessel provided with a basket, is to be used in transport service, or when it is desired to move the container soon after filling to some location when the liquefied gas is to be used, then relatively large loss of gas may ensue if the wall of the pressure vessel be relatively warm. This condition will result if the pressure vessel has stood empty for some time. The transmission of heat from the pressure vessel walls to the basket is slow, but not slow enough to prevent the vaporization of considerable quantities of liquid from within the basket. For stationary use, this condition is desirable in that the pressure is best built up by the evaporation of liquid from which the evaporated gas is placed above the liquid surface.

Thus, when it is desired quickly to cool the mass of metal in the pressure vessel, the liquefied gas is brought into direct contact with the interior wall of the pressure vessel 10. This is accomplished by allowing a quantity of liquid to pass through an opening 23 from the basket into the shell-like space about the basket. Accordingly, the plug 24 is turned in the opening 23 sufficiently to open the same either wholly or partially. To accomplish this, the closures 19 are first removed, plugs 27 taken out and the plugs 24 turned to afford the desired passage of liquid. The plugs 24 may also be removed when it is desired completely to drain the basket.

In transportation service, it is desirable to have the pressure vessel wall cooled down at all times to a value which is close, or equal, to the temperature of the liquefied gas so that the evaporation which will ensue is due merely to that which can leak in from the insulation, which heat is a relatively small quantity in the few hours required to transport the container from the filling plant to the place of consumption. In such service, the removable plugs 24 are arranged to pass the liquefied gas into the space between the basket and the pressure vessel wall in such quantity as to cool the wall very quickly. The evaporated gas resulting from cooling the wall is collected and saved at the point of filling rather than being permitted to escape enroute. The amount of evaporation occurring enroute under these circumstances, it will be seen, is relatively small.

While the tubes 20 shown in Fig. 1 provide a simple and direct way of applying means for equalizing the pressure in the upper and lower zones of the shell-like space about the basket, it is not essential that such means be of a columnar nature, nor within the pressure vessel 10. The means employed to equalize the pressure in the upper and lower zones of the shell-like space may be conduit-like passages disposed on the outside of the vessel 10 and arranged to pass through the wall of the vessel 10. Also, it may be of advantage to have the top of the basket completely closed in and not open directly to the shell-like space within the vessel 10, as indicated in Fig. 1. This is advantageous when the container is to be employed in transport service where there is a liability for the liquid in the basket to splash over into the shell-like space. A modified construction of a pressure

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vessel which embodies these features is shown in Fig. 3.

In Fig. 3, 30 denotes the wall of a pressure vessel having a basket 31 and a filling connection 32 extending down into the same. A withdrawal connection 33 is shown at the lower end which is similar in nature to that shown at 17 in Fig. 1. The pressure equalizing means here employed comprises one or more tubular passages 34 disposed about and on the outside of the pressure vessel, but having the ends bent inwardly and entering the wall of the pressure vessel. The lower end 35 and the upper end 36 pass through the vessel wall and communicate respectively with lower and upper zones of the shell-like space about the basket 31. These ends are secured in place in the wall of the pressure vessel in any convenient manner, for example, by brazing the inturned ends to nipples 37 which have their inner ends rolled over against the wall of the pressure vessel, as shown.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, 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. In a container for liquefied gas, the combination comprising a pressure vessel having an insulating envelope and provided with a spaced inner basket for holding the liquefied gas, said basket being provided with a restricted opening communicating with the space between said basket and said vessel, said opening being adjacent the bottom of said basket, and means in said envelope associated with said opening whereby the flow therethrough may be regulated.

2. In a container for liquefied gas, the combination comprising a pressure vessel having an insulating envelope and provided with a spaced inner basket for holding the liquefied gas, said basket being provided with a restricted opening communicating with the space between said basket and said vessel, said opening being adjacent the bottom of said basket, threaded means engaging with said opening arranged to be adjusted by turning, and means in said envelope affording access to turn said threaded means.

3. In a container for liquefied gas, the combination comprising a pressure vessel, an insulating envelope about said vessel, a supporting casing for said vessel and envelope, an inner basket for holding liquefied gas disposed in said vessel in spaced relation to the inner wall thereof, said basket being provided with a restricted opening adjacent the bottom thereof, removable means in said opening for regulating flow therethrough, and means in the wall of said pressure vessel adjacent said opening affording access to said removable means.

4. In a container for liquefied gas, the combination comprising a pressure vessel having an insulating envelope and provided with a spaced inner basket for holding the liquefied gas, the lower portion of said basket extending adjacent the wall of said vessel and provided with an opening, and regulating means housed in said envelope for permitting a flow of liquid into the space about said basket at will.

5. In a container for liquefied gas, the combination comprising a pressure vessel having an in-

insulating envelope and provided with a spaced inner basket for holding the liquefied gas, said basket being provided with an opening adjacent the bottom thereof, regulating means in said opening adapted to be turned to a position affording a desired flow, and passage means disposed in said envelope having a removable closure affording access to said regulating means.

6. In a container for liquid oxygen, the combination comprising a relatively thick walled metal vessel of substantial mass adapted to support the weight and withstand the pressure of a contained body of oxygen, an envelope of heat insulation about said vessel, a relatively thin walled basket disposed within said vessel made of metal and of small mass adapted to hold the body of oxygen, said basket being supported in spaced relation to the wall of said vessel, means passing through said insulation for introducing liquid oxygen into said basket, means for introducing liquid oxygen to the space between said basket and the wall of said vessel whereby the latter may be cooled to a desired degree, chambered means having a closure disposed in said envelope affording access to operate said means for introducing liquid oxygen to the space about said basket.

7. In a container for liquid oxygen, the combination comprising a relatively thick walled metal vessel of substantial mass adapted to support the weight and withstand the pressure of a contained body of oxygen, an envelope of heat insulation about said vessel, a relatively thin walled basket disposed within said vessel made of metal and of small mass adapted to hold the body of oxygen, said basket being supported in spaced relation to the wall of said vessel, means passing through said insulation for introducing liquid oxygen into said basket, valved means in the wall of said basket for causing a restricted flow of liquid oxygen into the space between said basket and the wall of said vessel, means in the wall of said vessel whereby said valved means may be manipulated, and passage means in said envelope affording operating access to said manipulating means.

8. In a container for liquefied gas, the combination comprising a pressure vessel provided with a spaced inner basket for holding the liquefied gas, the intervening shell-like space serving to insulate thermally the basket from said vessel, and means disposed within said vessel for equalizing the pressure within and without said basket and in the upper and lower zones of said shell-like space.

9. In a container for liquefied gas, the combination comprising a pressure vessel provided with a spaced inner basket for holding the liquefied gas, the intervening shell-like space serving to insulate thermally the basket from said vessel, and tubular passages in the wall of said basket for establishing communication in said vessel with the upper and lower zones of said shell-like space.

10. In a container for liquefied gas, the combination comprising a pressure vessel provided with a spaced inner basket for holding the liquefied gas, the intervening shell-like space serving to insulate thermally the basket from said vessel, and columnar means having a through passage of relatively large cross-sectional area in said vessel passing through a wall of said basket and establishing communication between the upper and lower zones of said shell-like space.

11. In a container for liquefied gas, the combination comprising a pressure vessel provided with a spaced inner basket for holding the liquefied

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gas, the intervening shell-like space serving to insulate thermally the basket from said vessel, said basket having a brim in the upper portion of said vessel, and a tubular member in said vessel extending from a point adjacent said brim to a point in said shell-like space adjacent the lower portion of said basket.

12. In a container for liquefied gas, the combination comprising a pressure vessel provided with a spaced inner basket for holding the liquefied gas, the intervening shell-like space serving to insulate thermally the basket from said vessel, said basket having a brim in the upper portion of said vessel, and a plurality of tubes in said vessel secured to said brim and extending downwardly and passing through the bottom wall of said basket in a fluid-tight manner.

13. In a container for liquefied gas, the combination comprising a pressure vessel, an insulating envelope about said vessel, a supporting casing for said vessel and envelope, an inner basket for holding liquefied gas and provided with exterior means for supporting the same in said vessel in spaced relation to the inner wall thereof, means associated with said vessel for equalizing the pressure within and without said basket, said basket being provided with a restricted opening adjacent the bottom thereof, removable means making screw threaded engagement with said opening, means in the wall of said pressure vessel adjacent said opening affording access to said removable means, and a passage member disposed

in said casing penetrating said insulating envelope and extending to a point adjacent said access affording means in the wall of said pressure vessel.

14. In a container for liquefied gas, the combination comprising a relatively thick walled pressure vessel, an insulating envelope about said vessel, a supporting casing for said vessel and envelope, a relatively thin walled inner basket for holding liquefied gas and provided with exterior means for supporting the same in said vessel in spaced relation to said vessel and forming a shell-like space about said basket, and means associated with said vessel within said envelope for equalizing the pressure in the upper and lower zones of said shell-like space.

15. In a container for liquefied gas, the combination comprising a relatively thick walled pressure vessel, an insulating envelope about said vessel, a supporting casing for said vessel and envelope, a relatively thin walled inner basket for holding liquefied gas and provided with exterior means for supporting the same in said vessel and forming a shell-like space about the same, said basket being provided with an opening admitting liquid to the lower zone of the space about said basket, regulating means in said opening for controlling the flow of liquid there-through, and means associated with said vessel within said envelope for equalizing the pressure in the upper and lower zones of the space about said basket.

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