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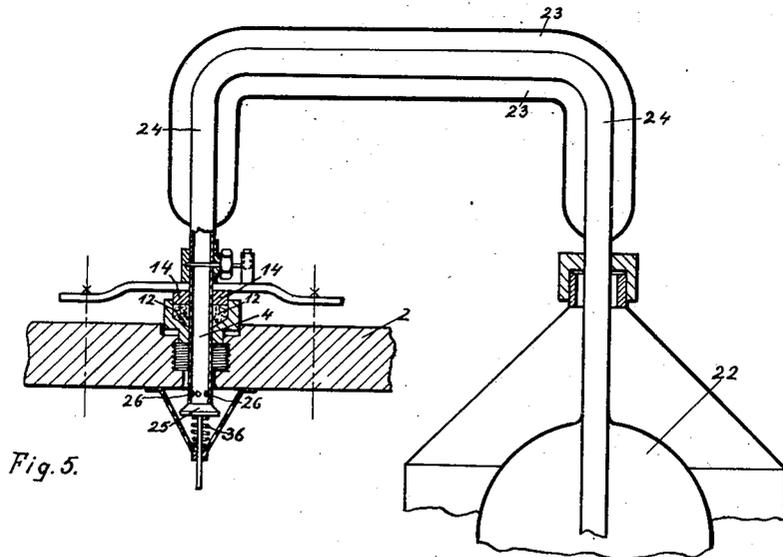
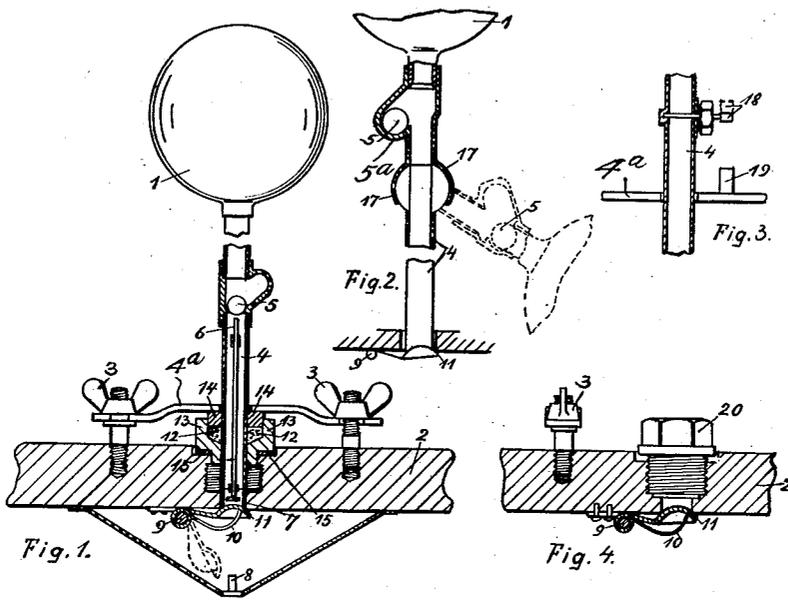
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APPARATUS FOR TRANSFERRING AND STORING LIQUEFIED GASES

Filed Nov. 12, 1927

2 Sheets-Sheet 1



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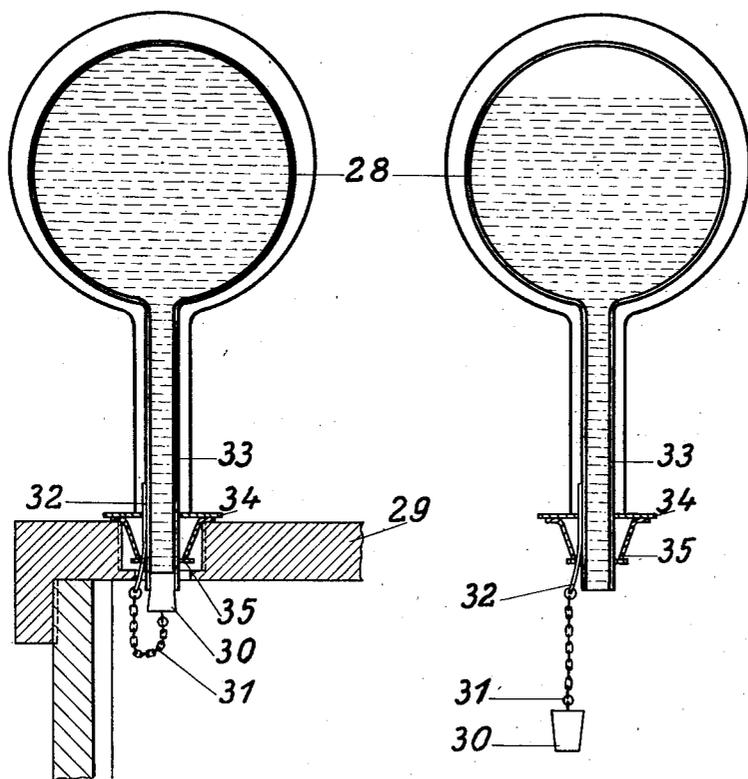


Fig. 6.

Fig. 7.

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# UNITED STATES PATENT OFFICE

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## APPARATUS FOR TRANSFERRING AND STORING LIQUEFIED GASES

Application filed November 12, 1927, Serial No. 232,924, and in Germany November 13, 1926.

This invention relates to a method and apparatus for transferring and storing liquefied gases and has for its object generally the provision of suitable steps together with apparatus for carrying out the same whereby containers for liquefied gases may be readily and economically charged so as to avoid the waste of gas due to natural evaporation heretofore incident to a charging operation.

10 As is well known, whenever it is desired to transfer liquefied gases, such for instance as liquefied air, oxygen, nitrogen and the like, from one vessel into another, under the methods heretofore in use there is always considerable loss of gas by reason of the fact that  
15 the liquid must necessarily come into contact with a considerable area of the surface of the new vessel and is thereby heated and becomes vaporized, the vapors arising from the liquid  
20 being lost unless they are collected in a gasometer as these gases have little or no pressure, and before they can be utilized for useful work they must first be compressed in a suitable compressor, blowing machine or injector.  
25 This operation renders the utilization of the gases so expensive that they are usually permitted to escape into the atmosphere. The present invention, therefore, is designed to overcome the difficulties heretofore encountered  
30 in the handling of such gases in such manner that they can be stored, transported and transferred from one vessel to another practically without loss and to provide for the utilization of the waste gases produced by natural evaporation without the necessity of subjecting them to the action of a compressor.

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:

Fig. 1 is a fragmentary view partly in section and partly in elevation illustrating the operation of filling a container for liquefied gases in accordance with the invention;

Figs. 2 and 3 are fragmentary detail views illustrating modified forms of automatically acting valves or closures for the filling means;

Fig. 4 is a fragmentary sectional view

showing the container closed after being filled;

Fig. 5 is a view similar to Fig. 1, but showing the manner of filling the container from a liquid containing vessel of greater capacity  
55 than that of Fig. 1;

Fig. 6 is a vertical sectional view showing a measuring vessel provided with a modified form of closure; and

Fig. 7 is a view similar to Fig. 6, showing  
60 the closure removed from the vessel.

Referring to the drawings, and particularly to Fig. 1, a filling means, for example a double-walled vessel or measuring bottle 1 is shown mounted on the upper end of a thin-walled tube 4 which is separate from the filling means and is arranged for sliding movement in the wall 2 of a suitable container for liquefied gas, for example a vessel adapted to hold gas in a state of compression; only a  
70 portion of its top-wall being shown. The tube 4 is maintained in vertical position by means of a plate 4<sup>a</sup> through which the tube passes, said plate being secured to the wall 2 in spaced relation thereto by suitable means,  
75 for example screws having wing nuts 3. A gravity controlled valve 5 in the form of a ball is provided for the measuring bottle, and means is provided for opening said valve as soon as the bottle is placed in inverted position  
80 with its symmetrical axis parallel to the direction in which gravity acts. The said valve-opening means comprises a rod 6 having a foot 7 supported within the tube 4 and arranged for longitudinal movement therein.  
85

The opening in the wall 2, which receives the tube 4, has a cooperating valve 11 which automatically closes the same. This is here accomplished by providing the valve in the form of a flap-valve hinged to the under side  
90 of the wall 2 at 9, a spring 10 being coiled about the pintle of the hinge in order to bias the valve in closed position. By this arrangement it is seen that when the tube 4 is pushed through the opening in wall 2 under  
95 the influence of the filling means, the valve 11 is pushed back into the position indicated in dotted lines in Fig. 1.

A stop for limiting the descent of the tube 4 is also provided within the container below  
100

the opening in wall 2, which may be in the form of a frame that carries an upwardly projecting pin 8, arranged for cooperating with the foot 7 on rod 6. When the tube 4 had descended sufficiently low, the pin 8 engages the foot 7 of the rod 6 and upon further descent of the tube the rod moves upward and thus pushes the ball 5 from its seat thus permitting free passage of liquid from the vessel 1 to the container.

For preventing leakage of gas or liquid at the point where the tube 4 enters the container, a stuffing box is provided which comprises a flanged box 13 packed with a suitable packing material 12, which is compressed by a metal ring or follower 14. The box 13 is seated in an opening in the wall 2, a packing ring 15 of elastic material being interposed between the box and its seat. The packing material 12 should preferably be renewed before each filling operation, in order to guard against the hardening of the material due to freezing. For closing the opening in the wall 2 after removal of the stuffing box therefrom, the wall of the opening is threaded for the reception of a threaded plug 20, as shown in Fig. 4.

In Fig. 2 the gravity valve is shown connected with the tube 4 by means of a ball joint 17 of well known construction. In this form of the device, when a measuring bottle is raised from the position shown in dotted lines to the vertical filling position, the ball 5 will fall into the tubular portion below the pocket 5<sup>a</sup> until it rests on the upper end of the rod 6, which is omitted from this figure for the sake of clearness. When the tube 4 moves downward into the compression tank 2, however, the valve 11 is first opened against the tension of its spring 10, but as soon as the lower end of the rod 6 contacts with the pin 8 further descent of the rod is prevented while the tube 4 continues its downward movement until the ball rolls off the upper end of rod 6 and falls into the pocket 5<sup>a</sup> and thus leaves a free passageway for the passage of liquid from the measuring bottle 1 to the container.

In Fig. 3, an automatically operative butterfly valve is shown in the tube 4 which may take the place of either of the valves shown in Figs. 1 and 2. In this form the valve is provided with a crank lever 18 which, when the tube 4 moves downward, strikes the end of a lug 19, thereby tilting the valve into open position.

In Fig. 5 there is shown a form of the device, adapted for transferring fluid from a liquid container, of greater capacity than that shown in Figs. 1 and 2. In this apparatus the vessel 22 communicates with the tube 4 by way of a siphon pipe 24, the exposed portion of which is provided with an insulating jacket 23. The tube 4 in this case is mounted in the same manner as described in connection with Fig. 1 and is provided with a valve similar

to that shown in Fig. 3. In place of the valve 11 and the springs shown in Fig. 1, a valve member 25 of the poppet variety is provided and arranged to seat on the under side of the opening in the container wall 2. A spring 36 is disposed to bear against this valve member in order to bias it in closed position. The tube 4 bears downwardly on this valve member when it slides into the opening in container wall compressing the spring 36; the tube being provided with one or more openings 26 in its side, which are uncovered when the tube has reached its downward limit of motion. The butterfly valve in this tube is also so positioned that when the tube has reached this lowermost position, the trip mechanism throws the butterfly valve also into the open position, so that a free passageway for liquid from the vessel 22 is established.

In Figs. 6 and 7 there is shown a further modification which is adapted to accomplish a filling operation in a quick and simple manner. In this form of device a measuring bottle 28 is indicated inverted and provided with a neck 33 extending into a filling opening in a top-wall 29 of a container of the pressure variety. The neck 33 is normally closed by a stopper 30 secured to one end of a chain 31, the opposite end of which is secured to the free end of a spring 32 which is soldered or otherwise secured to the neck of the measuring bottle. A funnel 35 is seated in the opening in the wall 29 and serves to guide the spring 32 when the neck 33 is placed therein. By means of said funnel, the spring 32 is compressed so that it can spring out radially from the neck only to a predetermined extent. Applicant has observed during numerous tests that rubber when exposed to low temperatures, such for instance as that of liquid oxygen, contracts considerably. For this reason, the stopper 30 is made of rubber, and applicant has proven beyond question that the freezing action of the liquid above the inverted stopper will cause the same to contract, whereupon the downward pressure of the liquid will expel the stopper, as shown in Fig. 7, such expulsion being probably assisted by the contact of the liquid with the warm stopper. The action of the spring 32 is such as to carry the stopper to one side and out of the path of the descending liquid so as to avoid spraying said liquid.

In all these forms of device, it will be seen that the arrangement, by which the filling tube or neck of the charge containing vessel is guided and introduced into the filling orifice, is such as not only to reduce the escape of compressed gas from the orifice when a filling operation is about to take place, but also to insure against the conduction of substantial amounts of heat to the charge of liquefied gas; since the operative engagement between the wall of the container and the

neck is reduced to a very small area or permitted only at a very few points. This is particularly true of the forms shown in Figs. 1 and 5, where the tube 4 engages with a packing 12 that is of insulating material and then traverses a hollow chamber in the wall 2 before further engagement, which displaces the biased valve guarding the orifice of the container.

These arrangements, however, are merely illustrative of suitable means for carrying out an important step of the method of the present invention. By such means, the step of insuring against losses, which may be due in part to the escape of compressed gas from the orifice at the commencement of or during the filling operation and in part due to heat conduction from the wall of the container to the charge of liquefied gas being discharged into the container, is accomplished. Thus after the neck of the charge containing vessel has been introduced, the practice of this step enables one thereafter to effect the release of the charge from its vessel into the container in a manner which is substantially without loss of gas material.

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 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. In apparatus for transferring and storing liquefied gas, the combination with a container for liquefied gas of the pressure type having a wall provided with a filling orifice and means for maintaining the same normally closed, of a filling vessel for holding a charge of liquefied gas provided with a neck adapted to extend through said filling orifice, means in said orifice for guiding said neck to operative position arranged to have thermal contact with the same over a relatively small area, and means in said neck for releasing said charge from said filling vessel when moved to operative position.

2. In apparatus for transferring and storing liquefied gas, the combination with a container for liquefied gas of the pressure type having a wall provided with a filling orifice and means for maintaining the same normally closed, of a filling vessel for holding a charge of liquefied gas provided with a neck adapted to extend through said filling orifice, means for limiting the entrance of said neck into said orifice, additional means in said orifice for guiding said neck to operative position arranged to make thermal contact therewith over a relatively small area, means in said neck for releasing said charge from

said filling vessel, and means associated with said neck for automatically operating said releasing means when said neck has moved to the limiting position.

3. In apparatus for transferring and storing liquefied gas, the combination with a container for liquefied gas of the pressure type having a wall provided with a filling orifice and means for maintaining the same normally closed, of a filling vessel for holding a charge of liquefied gas provided with a neck adapted to extend through said filling orifice, means in said orifice for making gas-tight engagement with said neck, valved means associated with said neck controlling the release of fluid from said vessel and means associated with the closure of said orifice whereby when said neck is introduced to operative position said valved means is opened.

4. In apparatus for transferring and storing liquefied gases, the combination with a container for liquefied gases having a wall provided with a filling opening and a valve associated therewith and biased to maintain normally a closed position, of a filling means having an orifice and valve controlling the same whereby a quantity of liquefied gas may be supplied to said container, a tubular connection cooperating with said filling means and adapted to slide into said filling opening and move said biased valve to valve-open position, valve opening means arranged to operate the valve controlling said filling means, and slide-limiting means associated with said filling opening for arresting said connection in a predetermined position when said biased valve is open; said slide-limiting means having an associated part for actuating said valve opening means when said connection has attained the limiting position.

5. In apparatus for transferring and storing liquefied gases, the combination with a container for liquefied gases having a wall provided with a filling opening and a valve associated therewith and biased to maintain normally a closed position, of a filling means having an orifice and valve controlling the same whereby a quantity of liquefied gas may be supplied to said container, a removable packing disposed in said filling opening, a tubular connection adapted to slide through said packing into said opening and move said biased valve to valve-open position, an actuating member associated with said connection for operating the valve controlling said filling means, slide-limiting means associated with said filling opening for arresting said connection in a position where said biased valve is opened and where communication between said container and said filling means may be established, and a tripping member associated with said filling opening for operating said valve actuating member when said tubular connection has attained the limiting

position, whereby the valve controlling said filling means is also opened and communication established.

5 In apparatus for transferring and storing liquefied gases, the combination with a container for liquefied gases having a wall provided with a filling opening and a valve associated therewith and biased to maintain normally a closed position, of a filling means  
10 having a ball valve normally biased by gravity to shut off communication with the outside, a tubular connection cooperating with said filling means and adapted to slide into said filling opening and move the biased  
15 valve in said filling opening to valve-open position, a rod disposed in said tubular connection arranged to slide longitudinally thereof and to engage with said ball valve and move the same to an open position, and  
20 slide limiting means associated with said filling opening and provided with a pin adapted to be engaged by said rod and move the same to dislodge said ball valve when said tubular connection has been arrested in its sliding  
25 movement.

In testimony whereof I have signed my name to this specification.

**CHRISTIAN WILHELM PAUL HEYLANDT.**

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