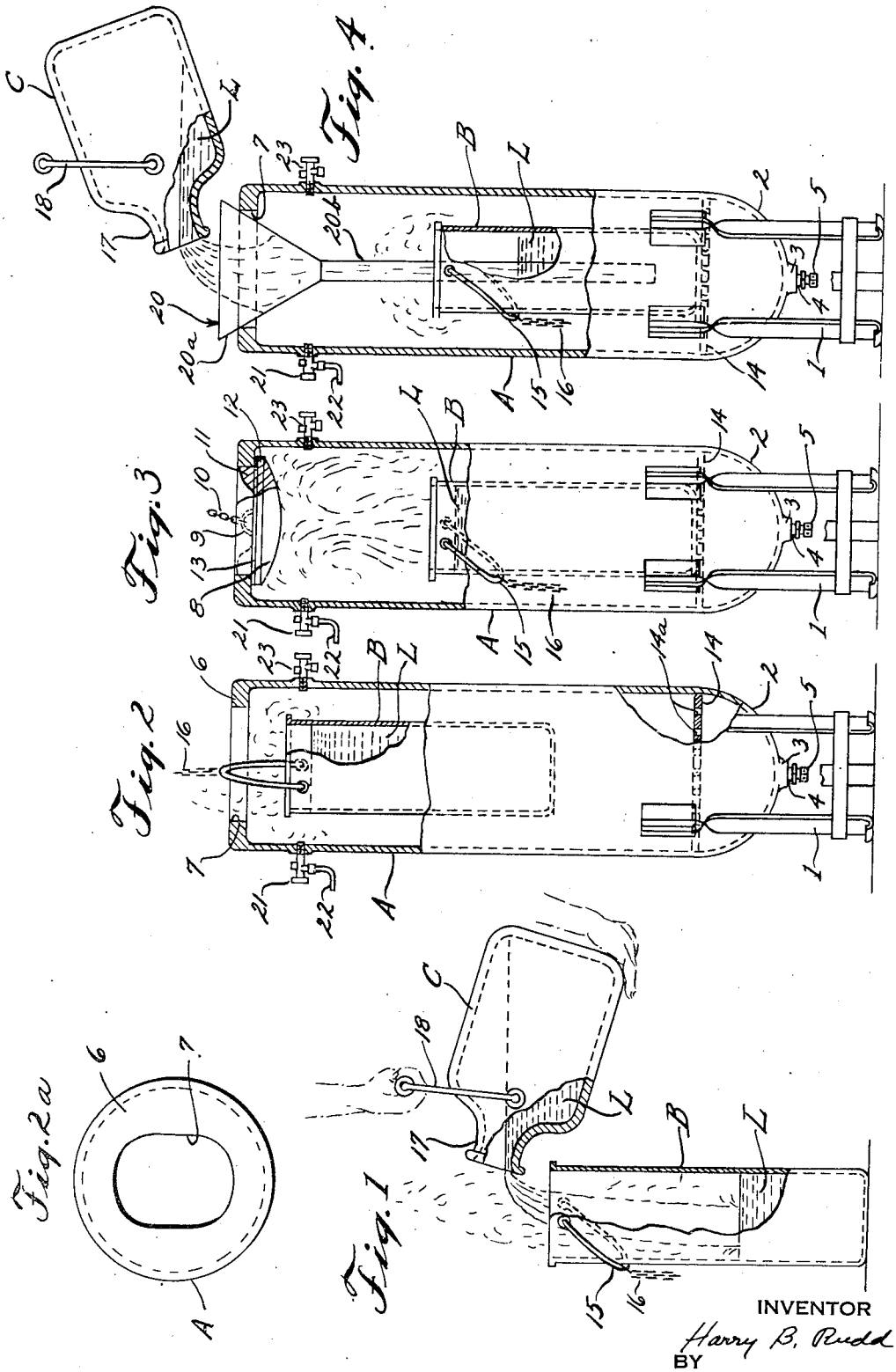
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ART OF CHARGING CONVERTERS WITH LIQUEFIED GAS

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ART OF CHARGING CONVERTERS WITH LIQUEFIED GAS

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2 Claims. (Cl. 62—1)

My invention relates to the liquefied gas art and comprehends a method of and apparatus for disposing in a container a quantity of liquefied gas which changes in phase to thereby produce a supply of gas at high pressure.

My invention has particular reference to a method of filling a container in such manner that the liquefied gas as such is placed in the container without developing a gaseous back pressure sufficient to seriously interfere with the filling operation.

Various other objects, features and advantages of my invention will become apparent from the following detailed description.

My invention resides in the method of filling a container with liquefied gas, apparatus for accomplishing that purpose as well as features of the liquefied gas art of the character hereinafter described and claimed.

For an understanding of my invention and for an illustration of some of the forms thereof, reference is to be had to the accompanying drawing, in which:

Figure 1 is an elevational view, partly in section, illustrating the disposal of a liquefied gas in a measuring container;

Fig. 2 is an elevational view, partly in section, illustrating the disposal of the measuring container in a converting container;

Fig. 2*a* is an enlarged plan view of the converting container;

Fig. 3 is an elevational view, partly in section, showing the converting container after it has been sealed; and

Fig. 4 is an elevational view, partly in section, illustrating a modification of the invention.

Referring to the form of the invention illustrated in Figs. 1, 2, 2*a* and 3, I have shown a container or casing A, herein designated as a "converting container" or "converter," which may be one of the various forms of containers known in the art as liquefiers for solid carbon dioxide.

As herein shown, the converter A is of seamless, tubular configuration and is supported in vertical upright relation by suitable standards 1 which rest upon a floor or other surface and, at their upper ends, are suitably attached to said converter A. As clearly shown in Figs. 2 and 3, the converter A comprises a curved lower section 2 which, if desired, may terminate in a depending neck 3 having a passage threaded interiorly for the reception of a suitable closure device such, for example, as a nozzle 4, the upper threaded end of which is received in said internally threaded passage and the lower threaded end of which carries a cap 5 which may be removed when it becomes desirable to vent the converter A at the bottom thereof.

The converter A comprises a top wall 6 formed integrally therewith, this top wall 6, preferably, having greater thickness than the lower tubular wall and, in the example shown, said top wall 6 comprises a filling opening 7 of generally elliptical configuration. The opening 7 is adapted to be closed by a closure plate or member 8, Fig. 3, the upper surface of which preferably carries a handle 9 and an attached chain 10. The closure plate 8 comprises an upstanding flange 11 and a laterally extending section 12 both of elliptical configuration in correspondence with the configuration of the filling opening 7. The corner formed by the flange 11 and the laterally extending section 12 of the plate 8 is adapted to receive a gasket 13 which, when the converter A is used as hereinafter described, should be of suitable non-inflammable material such, for example, as wet asbestos. In Fig. 3, the closure plate 8 is shown in closing position, the gasket 13 being compressed between the closure plate section 12 and the adjacent lower surface of the top wall 6, these surfaces with which the gasket 13 coacts having previously been machined so as to render them smooth and even to thereby positively prevent leakage at the sealed joint.

Preferably, in accordance with the present invention, a thin plate or member 14 formed preferably from metal having a thickness of $\frac{1}{16}$ of an inch, more or less, is positioned horizontally in the lower converter section and welded thereto so as to be suitably maintained in fixed position. The plate 14 should be provided with a plurality of holes or passages 14*a*.

Referring to Fig. 1, I have shown an auxiliary measuring container B which may be formed from suitable sheet metal such, for example, as aluminum, brass or the like having a thickness of 0.15 of an inch more or less. The measuring container B preferably comprises a bale 15 and an attached chain 16.

In accordance with the invention, the measuring container B is filled to a desired extent and in suitable manner with a quantity of a liquefied gas, this expression being herein used in a generic sense as descriptive of liquid oxygen, liquid air or liquid nitrogen. This operation may be performed in any suitable manner and, as illustrative of a convenient way of so doing, I have shown a container C having a pouring spout 17 and equipped with a bale 18, the container C being of

suitable character such, for example, as one comprising a vacuum space serving for heat-insulating purposes.

After a desired quantity of the liquefied gas L has been transferred from the pouring container C to the container B, for example, in the manner illustrated in Fig. 1 and with the closure plate 8 removed from its seat on the converter A, the filled container B may be manually elevated and then passed downwardly through the filling opening 7 of the converter A whereby said container B comes to rest upon the member 14 in such manner that it is spaced more or less equidistantly from the adjacent curved wall of said converter A. Thereupon, the closure plate 8 may be passed endwise through the filling opening 7, turned horizontally into proper closing position with respect to said filling opening 7 and then suitably held for an interval until a sufficient quantity of the liquefied gas has changed in phase to increase the gas pressure interiorly of the converter A to such extent that gas pressure alone holds the closure plate 8 in sealing position with respect to the filling opening 7 as shown in Fig. 3. Thereafter, as change in phase of the liquefied gas proceeds, the gas pressure interiorly of the converter A progressively increases until, eventually, the liquefied gas in said converter A is replaced by a body of gas having high pressure.

From the foregoing, it will be understood by those skilled in the art that, by my method, a desired quantity of liquefied gas may be charged or placed in the converter A in an efficient, practical manner.

The container C should be filled with liquefied gas obtained from an insulated chamber and, because heat-insulating, there is little loss at the mouth thereof. The measuring container B is formed from thin sheet material, the mass of which is small compared with the mass of the liquefied gas which is introduced thereinto. Hence, only slight boiling of the liquefied gas occurs as a result of the introduction thereof into said container B. As soon as the container B is filled, it is placed in the converter A where it comes to rest upon the member 14. It follows, therefore, that there is no contact of the liquefied gas with the metal mass of the converter A. Further, heat may be transferred from said converter A to the liquefied gas in the container B only by way of the plate 14 and through the gas space between said converter A and container B. Obviously, during the short period of time which elapses while disposing the container B in the converter and effecting the sealing of the latter, only a negligible amount of heat may be transmitted to the liquefied gas in the manner described, and as a result, only slight boiling of the liquefied gas occurs prior to the time that the converter A is sealed.

It follows, therefore, that, by my invention, a converter may be charged with a desired quantity of a liquefied gas and, before the converter is sealed, only a small quantity of the liquefied gas boils away. Such gas as does boil away is sufficient, approximately to displace the atmospheric air from within said converter. By my invention, the pressure in the converter A, prior to the sealing thereof, remains substantially at atmospheric value inasmuch as the described slight boiling of the liquefied gas causes escape of gas, i. e., most if not all of the atmospheric air in the converter, to the atmosphere or equivalent pressure zone by way of the filling opening 7. This maintenance of atmospheric pressure is of distinct importance in connection with the charging of a converter with a liquefied gas.

It will be understood by those skilled in the art that the measuring container B, or equivalent, may be filled to a desired extent otherwise than as illustrated in Fig. 1 and, from this, it follows that my invention is not to be limited to the use of a container C for filling said measuring container B.

For an understanding of a modified form of the invention, reference is to be had to Fig. 4 wherein there is illustrated a converter A of the same character hereinbefore described and which is adapted to be sealed by a closure plate 8 likewise in the same manner as previously described in a detailed manner.

With the form of the invention illustrated in Fig. 4, a measuring container, which may be of the same character as the measuring container B and is so shown, is adapted to remain permanently within the converter A and to be spaced from the adjacent wall structure thereof in the manner hereinbefore described. When this measuring container B of Fig. 4 is to be charged with a quantity of liquefied gas, a funnel 20 may be positioned as shown with the conical section 20*a* of the funnel resting upon the adjacent upper surface of the top wall 6 of the converter A and the spout 20*b* of the funnel extending downwardly into the measuring container B. The funnel 20 should be constructed from thin sheet material, such, for example, as sheet aluminum, sheet copper or the like, somewhat the same as the container B.

With the measuring container B and the funnel 20 positioned as shown in Fig. 4, liquefied gas from a suitable supply thereof may be poured into the funnel 20 so as to pass downwardly into the measuring container B. As one arrangement for doing this, there may be used an insulated container C of the character hereinbefore described. It shall be understood, however, that my invention is not to be limited to the use of a container C for pouring the liquefied gas into the container B.

By reason of the fact that the mass of the funnel 20 is small compared with the mass of the liquefied gas passing therethrough and, further, by reason of the fact that the funnel 20 has only line contact with parts of the elliptical filling opening of the converter A so that heat transfer from the converter A to the funnel 20 is negligible, it results that only slight boiling of the liquefied gas occurs as it passes into the measuring container B, Fig. 4. In order to keep this boiling to a minimum, it is desirable that the spout 20*b* of the funnel terminate close to the bottom of the container B so as to decrease the period of time during which the descending column of liquefied gas is in contact with the air. As stated in connection with the form of the invention first described, there is only slight transfer of heat from the converter A to the measuring container B and, hence, the manner of supporting the container B is a negligible factor as regards boiling away of the liquefied gas prior to the time that the converter is sealed.

As the filling operation proceeds and until the converter A of Fig. 4 is sealed, the pressure interiorly of said converter A remains substantially at atmospheric pressure, this occurring because that small portion of gas which does boil away causes atmospheric air to pass freely to the atmosphere or equivalent pressure zone along a path defined by the outer surface of the conical

funnel section 20a and the adjacent surface of the converter top wall 6, this path being separate from the path through the funnel 20 which is taken by the liquefied gas as it enters the container B. With both forms of my invention as herein disclosed, the pressure interiorly of the converter A remains substantially at the atmospheric value until said converter is sealed. Further, the air displaced by the gas which does boil away escapes to the atmosphere along an open path. Hence, the gaseous material escaping from the converter does not impede passage into the converter of the incoming liquefied gas, the feature last noted being particularly characteristic of the form of the invention shown in Fig. 4. These features are of decided importance in connection with the successful operation of my invention.

After the measuring container B of Fig. 4 has been filled to a desired extent, the funnel 20 is removed and the converter A is sealed by use of a closure plate 8 in the same manner as hereinbefore described.

It shall be understood that my invention is not to be limited to the utilization of converters A of the character herein described in detail. As well, there may be utilized converters of other equivalent types and, further, the converter sealing arrangement need not be constituted by an elliptical closure plate for a corresponding filling opening since, as well understood in the art of liquefying solid carbon dioxide, there are other equivalent sealing arrangements and these may be used if desired in practicing my invention.

A converter A of the character herein disclosed is intended to serve as a source of supply of gas resulting from the change in phase of the liquefied gas. Accordingly, a suitable dispensing arrangement should be associated with each converter A and, to this end, there may be utilized, for example, a high pressure valve 21 as known in the art for controlling the flow of gaseous oxygen, said valve 21 being threaded through the converter side wall so as to communicate with the interior of the converter, this valve 21 controlling the passage of the high pressure gas to a suitable conduit 22 which leads to any suitable dispensing station, not shown. Further, it is desirable for each converter to have a similar normally closed second valve 23 threaded through the wall thereof so as to communicate with the interior thereof. This valve 23, when provided, may be utilized for venting the converter A to the atmosphere should that become necessary or desirable. For example, the gas pressure interiorly of the converter A may remain somewhat above the atmospheric value after all the gas has been drawn therefrom that is commercially practical. In order to release this pressure to atmospheric value, the valve 23 may be opened to the atmosphere whereupon the closure plate 8 may be released from its seat.

After the converters A have been filled with liquefied gas and sealed as hereinbefore described, change in phase of the liquefied gas occurs in response to transfer of heat through the walls of the converters A from the ambient air. If desired, such change in phase may be expedited by exchanging heat in any suitable manner with the liquefied gas.

High pressure converters A of the character herein described are rather massive and the temperature thereof, such temperature ordinarily being room temperature, is decidedly higher than the temperature of the liquefied gas L. By my invention, as stated, there is only slight transfer of heat from the massive converter to the liquefied gas. The mass of the funnel 20 and/or the measuring container B is so small that, even though these devices are at room temperature when the filling operation is initiated, the resultant boiling of the liquefied gas is slight. Therefore, allowing for all factors which act to cause boiling away of the liquefied gas, the total amount which actually boils away during the short time required for a filling and sealing operation is slight.

In one form of the invention, the gas pressure interiorly of a converter A, when the phase-changing operation has been completed, may be of the order of 3,000 pounds per square inch and the drums, which are to be charged with gas from the converter may reach a pressure of the order of 2,000 pounds per square inch. However, in no manner at all is my invention to be limited to converter pressures or drum pressures of the values just stated.

In applications filed of even date herewith, Serial No. 289,388, filed August 10, 1939 and Serial No. 289,389, filed August 10, 1939, I have disclosed methods of charging drums with gas obtained from converters A of the character herein disclosed. It will be understood that the invention of this application may be used in association with the inventions of either of the applications above noted and, if so, the resulting system comprehends a converter as herein disclosed for receiving liquefied gas which changes in phase to produce gas at high pressure, this high pressure gas being charged into drums in the manner disclosed in either of said applications last noted, for example.

Although the use of a container C is desirable when practicing my invention, it shall be understood that the invention is not to be so limited since the containers B may be filled otherwise in suitable manner. Further, it will be understood that my invention is not to be limited to the use of a funnel 20. Obviously, the container B of Fig. 4 could be filled otherwise than by the use of a funnel 20. Thus, for example, said container B of Fig. 4 could be held in elevated position while disposed within the converter A, filled with liquefied gas while so held, and then lowered into the position shown.

While the invention has been described with respect to certain particular preferred examples which give satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In the art of producing a supply of gas in a converter having a charging opening, the method which comprises lowering into the converter through the charging opening thereof a container of small heat capacity and having therein a quantity of liquefied gas, supporting the container within said converter in poor heat-conducting relation with respect thereto, said charging opening being open to the atmosphere while said container is thus lowered into and supported within said converter whereby gas is permitted to escape to the atmosphere, placing a closure plate in sealing position with respect to said charging opening to maintain said converter

sealed while change in phase of the liquefied gas proceeds, the gas as thus changed in phase holding said closure plate in sealing position.

2. In the art of producing a supply of gas in a converter having a charging opening and having a container of small heat capacity supported in said converter in poor heat-conducting relation with respect thereto, the method which comprises passing liquefied gas through said charging opening and into said container while substantially preventing exchange of heat between the liquefied gas and the metal surfaces defining the converter charging opening and converter walls and while permitting escape of gas, upon increase in pressure interiorly of the converter, to the atmosphere by way of said charging opening, placing a closure plate in sealing position with respect to said charging opening to maintain said converter sealed while change in phase of the liquefied gas proceeds, the gas as thus changed in phase holding said closure plate in sealing position.

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