Aug. 19, 1930. C. W. P. HEYLANDT 1,773,140

METHOD OF PREPARING COMPRESSED GASES

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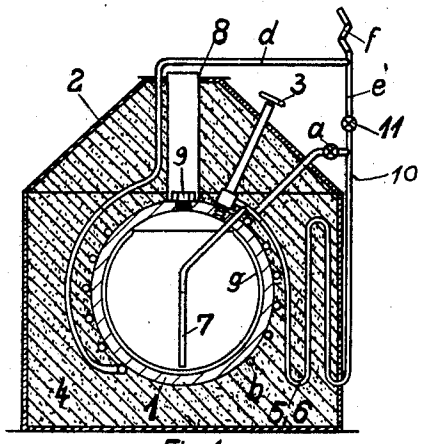

Fig. 1

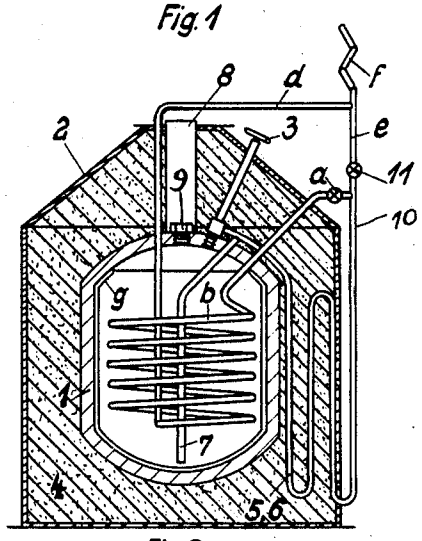

Fig. 2

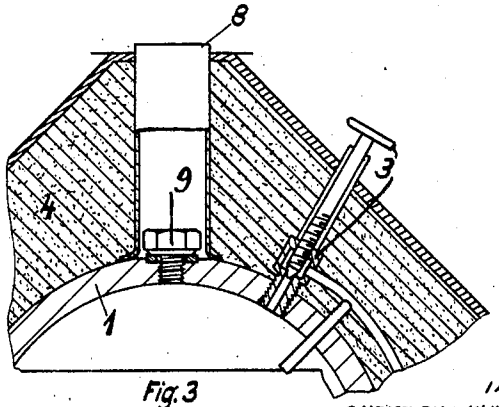

Fig. 3

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METHOD OF PREPARING COMPRESSED GASES

REISSUED

Application filed August 24, 1928, Serial No. 301,886, and in Germany September 20, 1927.

This invention relates to a method of preparing compressed gas of high pressure from a body of liquid enclosed in an insulated pressure vessel, the principal object of the invention being to provide a method by means of which uniform and adequate generation of gas at a pressure higher than the critical pressure of the gas is obtained.

A further object of the invention is to provide a method whereby the gases given off by a body of liquid within an insulated pressure container may be heated and then brought into heat-interchanging relation to said body of liquid thereby to raise the pressure in the container and accelerate evaporation of the liquid.

The pressure vessel usually employed in preparing compressed gases operates satisfactorily up to the critical pressure of the particular liquefied gas which is to be evaporated and converted into compressed gas, so that any desired quantity of compressed gas can be withdrawn at constant pressure either continuously or intermittently. Such pressure vessels, however, are built and used to withstand a working pressure which lies below the critical pressure of the particular liquefied gas to be evaporated. The reason for this is, that below the critical pressure there is in the inner container, during the whole period of evaporation, liquid such as is required for preparing the compressed gas.

The conditions change, however, immediately it is decided to produce highly compressed gas at about 150 to 200 atmospheres; since it then becomes necessary to exceed the limit of critical pressure (52 atmospheres for oxygen) having regard to the dimensions of the vessel for the compressed gas necessitated by the pressure. In this case a constant working pressure cannot be maintained, as the pressure chamber is not filled with liquid, and only very cold vapours having a high saturation point pass into the evaporating coil. In such case no more liquid is evaporated in the heating coil, but only cold gas will still continue to be superheated. If, therefore, the pressure is not to fall, notwithstanding the consumption, provision must be made for the supply of additional heat, as the superheating of the saturated cold gas in the pressure vessel would otherwise not proceed rapidly enough.

The object of the present invention is to overcome the disadvantages above pointed out and to provide a method by means of which the generation of the gas at the desired pressure can be maintained uniform and adequate.

In the drawing accompanying this specification,

Fig. 1 is a central vertical section through an apparatus suitable for carrying out the improved method;

Fig. 2 is a similar view of a modified form of apparatus; and

Fig. 3 is a fragmentary sectional view illustrating on an enlarged scale the controlling valve.

Referring to the drawing, 1 designates the pressure vessel, which is provided with a thin-walled inner receptacle *g* for the reception of the liquefied gas. This receptacle, owing to its thin wall is cooled off comparatively quickly by the liquefied gas so that the evaporation during the filling is small. The pressure vessel 1 is disposed within and spaced from an outer container 2, the space between the container and pressure vessel being filled with a suitable insulating material 4. The pressure vessel is provided at one point with a filling opening normally closed by a suitable screw plug 9, said opening being enclosed by a neck or pipe 8 extending from the pressure vessel and communicating with the atmosphere outside of the container 2, whereby the insulating material is prevented from covering the closing plug. When the vessel is to be filled, the plug 9 may be removed by means of a socket wrench or other suitable tool inserted through the neck 8. Within the inner receptacle *g* is disposed a vertical pipe 7, the lower end of said pipe being in close proximity to the bottom of the receptacle while its upper end passes through the walls of said receptacle and the pressure vessel 1 and communicates with a pipe which is bent to form coils 5, 6, disposed within the insulation material, a portion of

said pipe extending through the wall of the container 2 to the outside thereof, while the inner end of the pipe is in communication by way of a needle valve 3 with the upper portion of the receptacle *g*. The outer exposed portion 10 of this coiled pipe communicates with a conduit *e* adapted to communicate with a gas receiver (not shown), a valve 11 being disposed between said conduit and the pipe 10.

In Fig. 1 a heating coil *b* is shown disposed within the insulating material in encircling relation to the pressure vessel 1, said coil at one end communicating with a pipe *d* which in turn communicates with the conduit *e* at one side of the valve 11, the opposite end of the coil communicating with the exposed portion pipe 10 at the opposite side of said valve, the latter communication being controlled by a valve *a*. It will thus be seen that the coil *b* communicates with the conduit *e* at both sides of valve 11.

In Fig. 2, the coil *b* is disposed within the thin walled receptacle *g* instead of encircling the outer pressure vessel 1. Otherwise the construction and connections are the same as described in connection with Fig. 1. In both forms the conduit *e* may be provided with a reheating coil, as indicated diagrammatically at *f*.

In operation, with the valve 11 closed and the valves *a* and 3 open, the gas above the level of the liquid in the receptacle *g* will flow into the coil pipe 5, 6 and, after being heated by passing through the exposed portion 10 of said pipe, passes through valve *a* into the coil *b* thereby heating the pressure vessel 1, or the contents of the receptacle *g* directly, depending on whether the coil *b* is disposed as shown in Fig. 1 or Fig. 2. The gas, after thus giving up its heat, passes from the coil *b* through pipe *d* to the conduit *e*, whence it may be passed directly to its desired destination, after reheating by passage through the coil *f*. On the other hand, with the valves 11 and 3 closed and the valve *a* open, vaporization will occur within the receptacle owing to the leaking of heat through the insulation. The vapor thus produced will create pressure within the receptacle, whereby the liquid will be forced out through pipe 7, coils 5, 6 where it is converted into vapor, which passes into exposed pipe 10, where it is superheated by the heat of the atmosphere, and passes through valve *a*, coil *b*, pipe *d* and conduit *e* as above set forth.

Should it become necessary to discontinue the operation of the apparatus, it is necessary only to close the valve *a* and open valves 3 and 11, whereupon only a very small normal evaporation of the liquefied gas will occur.

The method herein described is particularly well adapted for the handling of oxygen. This statement, however, is not to be understood as a limitation, as I am well aware that the method can be applied to all liquefiable gases.

I claim:

1. The method of preparing compressed gases of high pressure from a body of liquid enclosed in an insulated pressure container which consists in heating gases given off by said liquid, then bringing said heated gases into heat interchanging relation to said body of liquid, whereby the pressure in the container is raised and the evaporation of the liquid is accelerated, and then further heating said gases and conducting them under the high pressure to the point of use.

2. The method of preparing compressed gases of high pressure from a body of liquid enclosed in an insulated pressure container which consists in subjecting gases given off by said liquid to the temperature of the surrounding atmosphere thereby to heat the gases, then conducting said heated gases into heat interchanging relation to said body of liquid thereby to raise the pressure in the container and accelerate evaporation of the liquid, and then further heating said gases and conducting them under the high pressure to the point of use.

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

DR. PAUL HEYLANDT.