

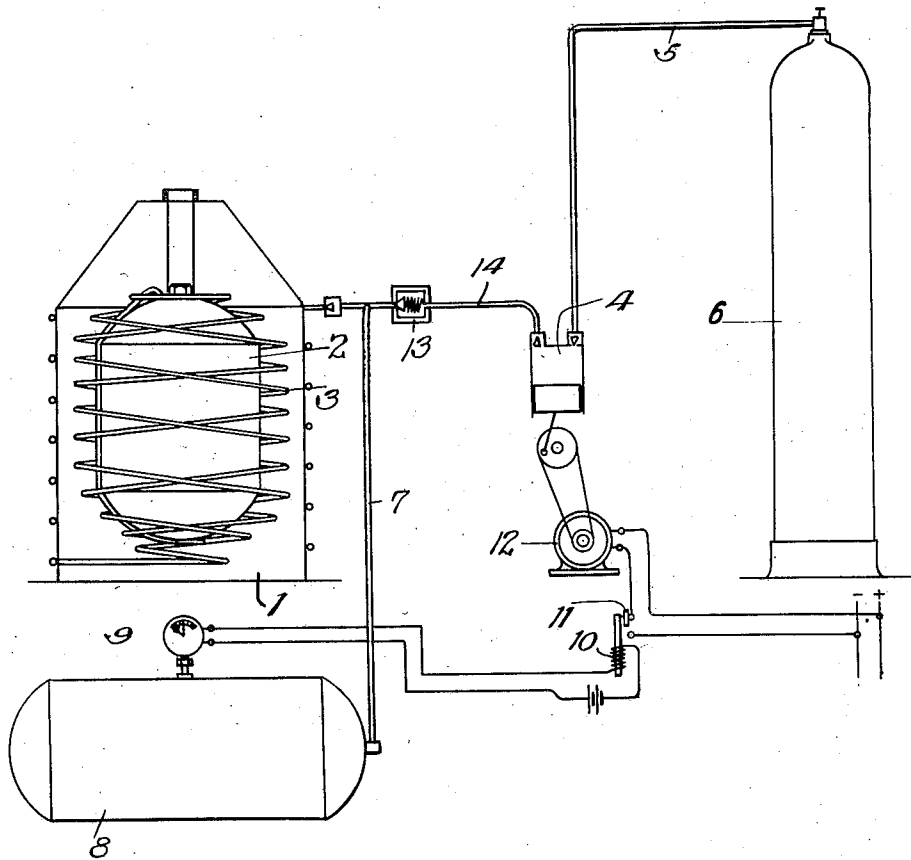
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METHOD AND APPARATUS FOR PRODUCING COMPRESSED GASES FROM LIQUEFIED GASES

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METHOD AND APPARATUS FOR PRODUCING COMPRESSED GASES FROM LIQUEFIED GASES

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This invention relates to a method and apparatus for producing compressed gases from liquefied gases, the object of the invention being to provide a method whereby the gases evaporated from liquid contained in a closed vessel are preliminarily self-compressed and afterwards brought to a higher degree of compression in one or more stages.

Under a method heretofore practised for producing compressed oxygen from liquid oxygen, the liquid oxygen is sucked from an open vessel by means of a compressor associated with an evaporator, in which latter the liquid is evaporated and afterwards compressed in the compressor and finally compressed into steel bottles.

The present method possesses the principal advantage over the above mentioned method in that the evaporated gases, being constrained within a closed vessel, are automatically compressed under the action of heat according to the laws of thermodynamics. This automatic compression may be carried to a very high degree in suitable autoclaves, so that the use of a mechanical compressor for further compressing the gas need be resorted to only for attaining a predetermined high final pressure. For instance, under the method described herein, if the liquefied gas is compressed with an autoclave by its own evaporation to 10 to 30 atmospheres, to attain which it is ordinarily necessary to use a mechanical compressing apparatus, it remains only to compress this preliminarily compressed gas sufficiently to produce the desired final pressure. It is thus evident that important economic advantages are obtained.

According to the formula:

$$L = P_1 V_1 \frac{\ln p_1}{P_2}$$

wherein L indicates the work, P is the pressure, V the volume, $\ln$ is the natural logarithm, p_1 the primary pressure and P_2 the final compression, while $\ln$ (the natural logarithm) is the deciding factor, the work of compression depends on the proportion between the primary and final pressures. The power consumed is, therefore, much less than

would be the case if the mechanical compression should begin at 0 atmosphere.

It may even be conceivable that the compression of the gas up to the final pressure may be brought about entirely by self-compression in autoclaves under heat control, without the use of any mechanical devices such as compressors, blowers or the like. This procedure, however, may be followed only in connection with very small containers, since the compression vessels would have to be constructed with very strong walls and of small diameter.

The preferred method of the present invention combines the advantage of not requiring the exertion of enormous pressure, in view of the use of the pressure vessel containing the liquid, with the further advantage that only comparatively small mechanical force is necessary for the final compression. For instance, if the compression in autoclaves under heat control has reached by self-compression nearly 30 atmospheres, naturally the ensuing mechanical compression by means of a compressor, blower or the like will represent only a fraction of the total amount of the work. The technical progress resulting from the use of the method herein described, therefore, consists in fully utilizing the known vessels capable of withstanding high pressures, as well as vacuum vessels, for accumulating the compressed gases up to the usual pressure of 150 atmospheres without the necessity of exposing the evaporating vessel proper to any exceedingly high pressure.

The accompanying drawing is a diagrammatic view of an apparatus suitable for carrying out the present invention. In this drawing, 1 designates a receptacle within which is disposed a heat-insulated container 2 for the liquid to be evaporated. A coil 3 communicates at one end thereof with said container 2 and at its opposite end with a compressor 4, whereby the gas evaporated from the liquid in the container 2 is sucked therefrom. By virtue of its passage through the coil 3, the gas is preliminarily self-compressed and upon arrival in the compressor 4 is brought to the desired final pressure of about 150 atmospheres, this compression be-

ing accomplished in one or more stages. The compressed gas is then forced from the compressor 4 through a conduit 5 into a strong steel bottle 6.

5 The drawing also illustrates a low-pressure container 8 which communicates with the coil 3 by way of a valved conduit 7, whereby the self-compressed gas in the coil 3 may be admitted to the low-pressure container 8 before reaching the compressor 4, so that after the gas has attained a predetermined high pressure the compressor 4 is automatically brought into action by a suitable pressure-regulating device, whereby the gas is drawn off from the container 8 at the proper time to avoid interference by the pressure in the container 8 with the evaporation of the liquid in container 2. This pressure regulation may be accomplished by providing the vessel 8 with a pressure gauge 9, the pointer of which is adapted to close a circuit through a coil 10, which when energized will actuate a switch 11 into position to close the circuit through the driving motor 12 of the compressor.

25 The compressor then draws the gas through pipe 7 and valve 13 and pipe 14 and forces it through pipe 5 into the steel bottle 6, or into a set of such bottles. The valve 13 is of a well known type so constructed that as soon as the compressor begins to operate the valve is opened and remains opened until the operation of the compressor ceases, which occurs as soon as the pressure in vessel 8 has fallen sufficiently low to cause the pointer of the pressure gauge 9 to open the circuit through the coil 10, and consequently opening the motor circuit.

I claim as my invention:

40 1. The method of producing compressed gases from liquefied gases, which consists in confining a liquefied gas in a closed vessel under heat control thereby to cause vaporization of the liquid, inducing a self-compression in the gas arising from said liquefied gas, and subjecting the self-compressed gas to a final mechanical compression.

45 2. The method of producing compressed gases, which consists in confining a liquefied gas in a closed vessel under heat control, thereby to cause vaporization of the liquid, subjecting said gas to a self-compression, to a predetermined degree, and thereafter subjecting it to a final mechanical compression.

50 3. An apparatus for producing compressed gas, comprising a closed receptacle having a liquid container disposed therein, an evaporating coil in communication with said container, said coil being adapted to subject gases vaporized in the container to a self-compression, and a mechanical compressor in communication with said coil and adapted to withdraw the self-compressed gas therefrom and subject the same to a final compression.

4. An apparatus for producing compressed gas, comprising a closed receptacle having a liquid container disposed therein, means in communication with said container for subjecting the gas vaporized in the container to self-compression, a low-pressure receiver in communication with said means, a mechanical compressor normally out of communication with said receiver, and means automatically effective when the gas in said low-pressure receiver has reached a predetermined degree of self-compression to establish communication with the compressor for withdrawing said gas and imparting thereto a final compression.

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

CHRISTIAN WILHELM PAUL HEYLANDT.