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Kasahara

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[54] **METHOD OF COMPRESSING CHLORINE GAS**

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[52] **U.S. Cl.** **184/6.23**, 418/99

[51] **Int. Cl.** **F16n 7/32**

[58] **Field of Search** 418/97, 98, 99; 184/6.22, 6.23; 423/500

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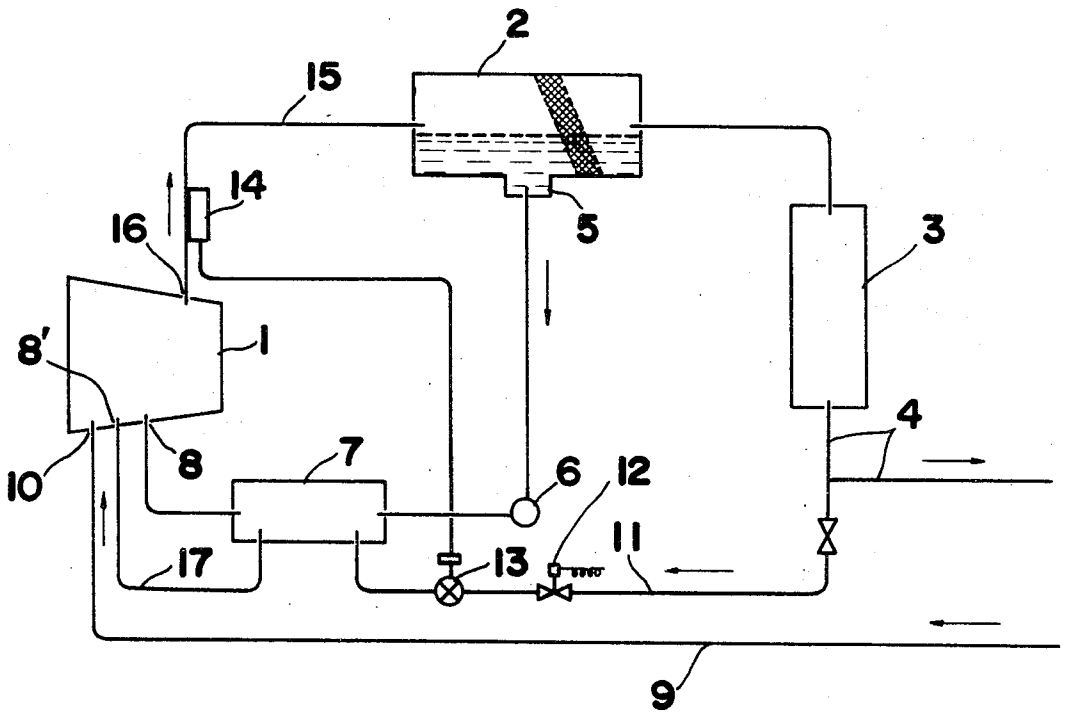
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[57] **ABSTRACT**

A method of compressing chlorine gas characterized by comprising the step of blowing cooled fluon oil or concentrated sulfuric acid into a screw compressor for lubricating and seal said compressor when chlorine gas is compressed by the screw compressor.

3 Claims, 5 Drawing Figures



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FIG. 1

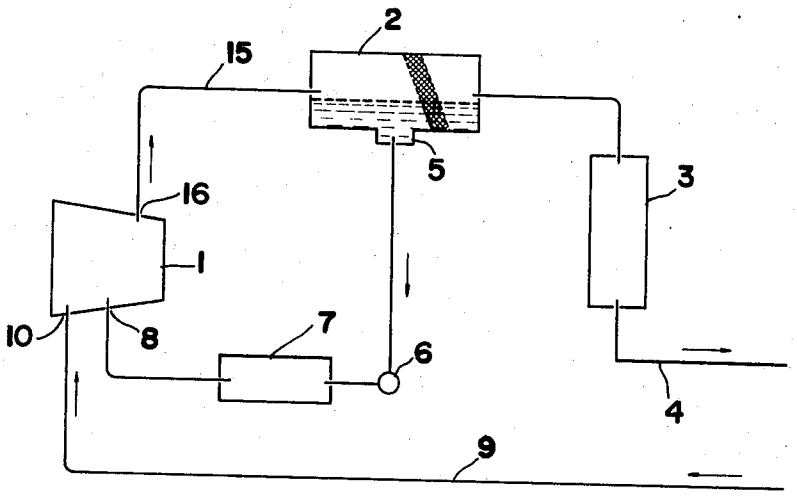


FIG. 3

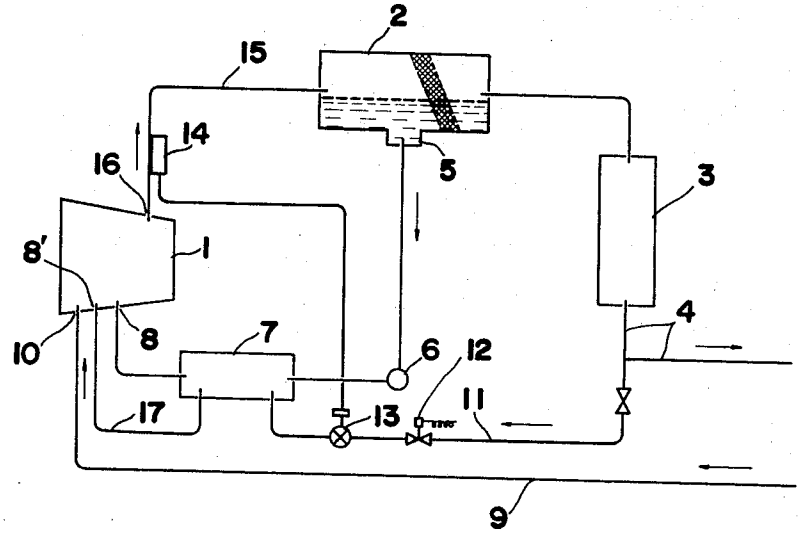


FIG. 2

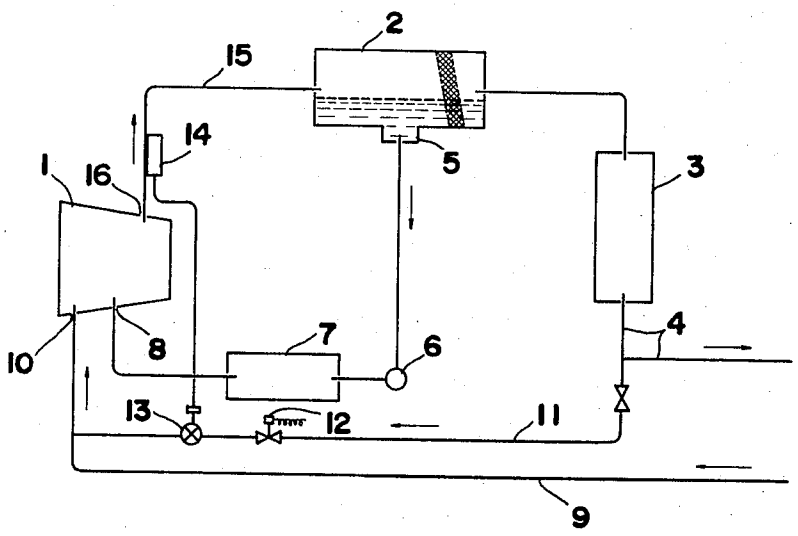


FIG. 4

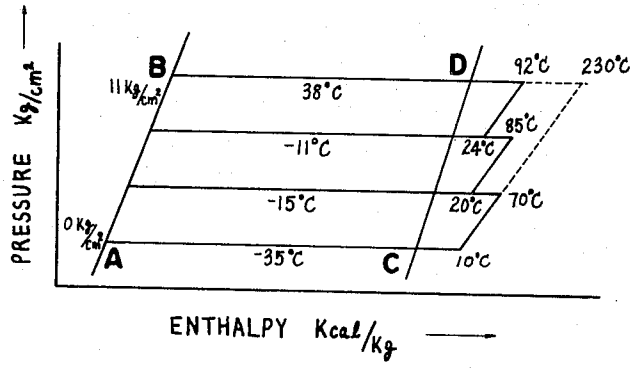
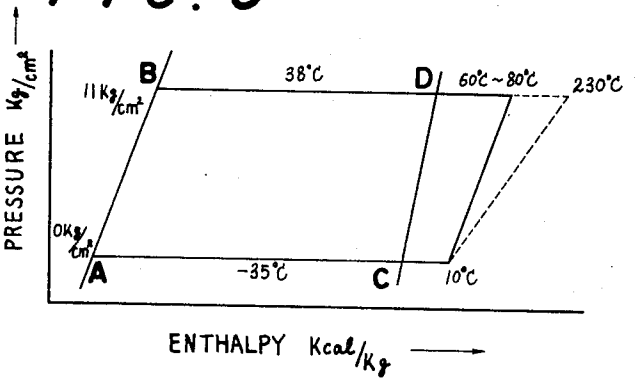


FIG. 5



METHOD OF COMPRESSING CHLORINE GAS

This invention relates to a method of compressing chlorine gas for liquefying chlorine gas at high efficiency by using a screw compressor.

In one method of liquefying chlorine gas known in the art as a medium pressure or low pressure liquefying method, chlorine is cooled to −80°to−60° C by means of a refrigerator for converting the same into liquid. In recent years, however, a high pressure method whereby a gas whose normal pressure is 0 kg/cm² G is compressed by means of a compressor and liquefied by means of a condenser has been developed. The practice of using the high pressure method has been popularized because of the fact that this method is economical as compared with the low pressure method.

However, some disadvantages are associated with the high pressure method. In the high pressure method, an oilless reciprocating compressor is operated to carry out compression in three stages as shown in FIG. 4 so as to preclude a rise in adiabatic compression temperature. Because of this, a compressor of three-stage compression requires an increased space for installation. This naturally entails an increase in production cost. Besides, it is necessary to provide an intermediate cooler in each compression stage and the piping for the compressor becomes complex, further increasing the area for installation. Such compressor often has failures in operation.

An object of this invention is to provide a method of compressing chlorine gas of high efficiency which can be performed by means of a screw compressor of small type, wherein cooled fluon oil or concentrated sulfuric acid which does not act on chlorine is blown into the compressor as a lubricant and seal liquid to reduce the temperature of chlorine, and part of chlorine in liquid form obtained by condensation is introduced into the compressor through a gas suction port to prevent a rise in the temperature of chlorine.

Additional objects as well as features and advantages of this invention will become evident from the description set forth hereinafter when considered in conjunction with the accompanying drawings, wherein:

FIG. 1 to FIG. 3 are flow diagrams of different embodiments of the method according to this invention;

FIG. 4 is a Mollier diagram obtained by the use of a compressor of the reciprocation type; and

FIG. 5 is a Mollier diagram obtained by the method according to this invention in which a compressor of the screw type.

In FIG.1,1 is a screw compressor, 2 a lubricant separator, 3 a condenser, 4 a liquid outlet line, 5 a sump for fluon oil or concentrated sulfuric acid formed at a bottom of lubricant separator 2 to communicate therewith, 6 a liquid delivery pump, 7 a lubricant cooler, 8 a fluon oil or concentrated sulfuric acid ejection port provided in compressor 1, 9 a chlorine gas inlet line connected to a chlorine gas source, and 10 a chlorine gas suction port provided in compressor 1. 15 is a gas outlet line, and 16 is a gas outlet port formed in compressor 1 and communicating with outlet line 15.

In FIG. 2, 11 is a liquid chlorine branch line, 12 an electromagnetic valve, 13 an automatic expansion valve of the temperature response type, and 14 a feeler cylinder.

According to this invention, the chlorine gas introduced through inlet line 9 passes through chlorine gas

suction port 10 into screw compressor 1 where it is compressed. The compressed chlorine gas is led through outlet line 15 into lubricant separator 2 where the mist of fluon oil or concentrated sulfuric acid is completely separated from the chlorine gas. The chlorine gas if further introduced into condenser 3 where it is liquefied. The chlorine in liquid form is discharged through liquid outlet line 4. The fluon oil or concentrated sulfuric acid of a temperature near 80°C which has been separated at lubricant separator 2 and collected in sump 5 is delivered under pressure by liquid delivery pump 6 to lubricant cooler 7 where it is cooled with water to 30° to 35° C. The cooled fluon oil or concentrated sulfuric acid is ejected into compressor 1 through the ejection port 8 formed in compressor 1 in a position posterior to a position in which the gas drawn by suction through the suction port 10 of screw compressor 1 is sealed in by a screw rotor of the compressor.

In the embodiment shown in FIG. 2, the chlorine liquid branch line 11 branching off halfway from liquid outlet line 4 is maintained in communication with gas suction port 10, and electromagnetic valve 12 and automatic expansion valve of the temperature response type 13 are mounted midway in chlorine liquid branch line 11. The automatic expansion valve of the temperature response type 13 which is connected to the feeler cylinder 14 intimately adhered to gas outlet line 15 in a position near gas outlet port 16 opens as the gas in feeler cylinder 14 is expanded by a rise in the temperature of discharged gas above a predetermined level, with a result that part of the chlorine in liquid form is introduced into compressor 1 through suction port 10. At this time, part of the chlorine in liquid form undergoes adiabatic expansion and lowers the internal temperature of compressor 1. Electromagnetic valve 12 is electrically connected to compressor 1 so as to automatically closing chlorine liquid branch line 11 when compressor 1 is shut off.

In the embodiment as shown in FIG. 3, chlorine liquid branch line 11 is connected to lubricant cooler 7, and electromagnetic valve 12 and automatic expansion valve of the temperature response type 13 are mounted in line 11. The chlorine liquid passing through branch line 11 which is employed in place of the cooling water for lubricant cooler 7 undergoes adiabatic expansion in cooler 7 to cool cooler 7. The feeler cylinder 14 for automatic expansion valve of the temperature system 13 is intimately adhered to outlet line 15 in a position near gas outlet port 16, so that automatic expansion valve of the temperature system 13 opens as the gas in feeler cylinder 14 is expanded by a rise in the temperature of discharged gas over a predetermined level. This automatically further lowers the temperature of fluon oil or concentrated sulfuric acid in lubricant cooler 7 to thereby lower the internal temperature in compressor 1.

A chlorine gas outlet line 17 from lubricant cooler 7 is connected to an ejection port 8' formed in compressor 1 in a position which is posterior to a position in which gas is sealed in by the screw rotor of screw compressor 1, so that chlorine gas in lubricant cooler 7 is drawn into compressor 1 at a pressure slightly higher than suction pressure of compressor 1.

From the foregoing description, it will be appreciated that this invention uses screw compressor 1 for compressing chlorine gas, and fluon oil or concentrated sul-

furic acid, which is readily separated from chlorine gas and not damaged by chlorine gas, is used as lubricant and seal liquid for screw compressor 1. Because of this, fluon oil or concentrated sulfuric acid can act as lubricant and seal liquid without affecting chlorine gas. More specifically, the lubricant and seal liquid is cooled in lubricant cooler 7 and ejected in screw compressor 1 through ejection port 8, so that the gas in compressor 1 is completely sealed against leak and the temperature of chlorine gas in compressor 1 is maintained below about 90° C. Thus, the adiabatic compression temperature is made close to an isothermal compression temperature below the critical temperature and a rise in the temperature of compressed gas is precluded. This is effective to prevent decomposition of lubricant by the chlorine gas heated over 100° C or other adverse effect of overheating of chlorine gas.

The provision of feeler cylinder 14 intimately adhered to outlet line 15 near outlet port 16 to which the outlet line 15 is connected is effective to actuate automatic expansion valve of the temperature system 13 so as to cause chlorine in liquid form to undergo adiabatic expansion in the compressor through suction port 10 when the temperature of discharged gas rises, so that suctioned gas or lubricant cooler 7 is automatically overcooled for preventing a rise in the temperature of compressed gas.

FIG. 4 is a Mollier diagram obtained when a compressor of the reciprocation type is used to compress chlorine gas in three stages, and FIG. 5 is a Mollier diagram obtained with the method according to this invention. In these diagrams, A – B is a liquid line and C – D is a saturated steam line. Generally, the adiabatic compression of chlorine takes place as indicated by broken lines in FIG. 4 and FIG. 5 when compression is carried out in one stage. In this case, compression temperature rises and ordinary oil is decomposed and chlorine is brought to a dangerous state. Since fluon oil or concentrated sulfuric acid is cooled and ejected into the screw rotor in considerably large quantity in the screw compressor as shown in FIG. 5, adiabatic compression temperature shows no rise and obtaining of the same discharge temperature in single stage compression as in three stage compression of FIG. 4 is made possible as indicated by solid lines which are approximate to isothermal lines.

What is claimed is:

1. In a method of compressing chlorine gas wherein said gas is delivered to and compressed by a screw compressor, the improvement comprising blowing cooled concentrated sulfuric acid into the compressor as the chlorine is being compressed, the said acid being a mist in the chlorine and thereby lubricating and sealing the compressor.

2. A method as defined in claim 1 further comprising the step of introducing part of chlorine in liquid form into the compressor through a gas suction port provided in the compressor through an automatic expansion valve of the temperature response type adapted to be actuated in response to the temperature of discharged gas from the compressor so that said part of chlorine in liquid form undergoes adiabatic expansion.

3. A method as defined in claim 1 further comprising the step of introducing part of chlorine in liquid form into a lubricant cooler for use as a cooling medium through an automatic expansion valve of the temperature response type adapted to be actuated in response to the temperature of discharged gas from the compressor so that said part of chlorine in liquid form undergoes adiabatic expansion in said lubricant cooler.

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