

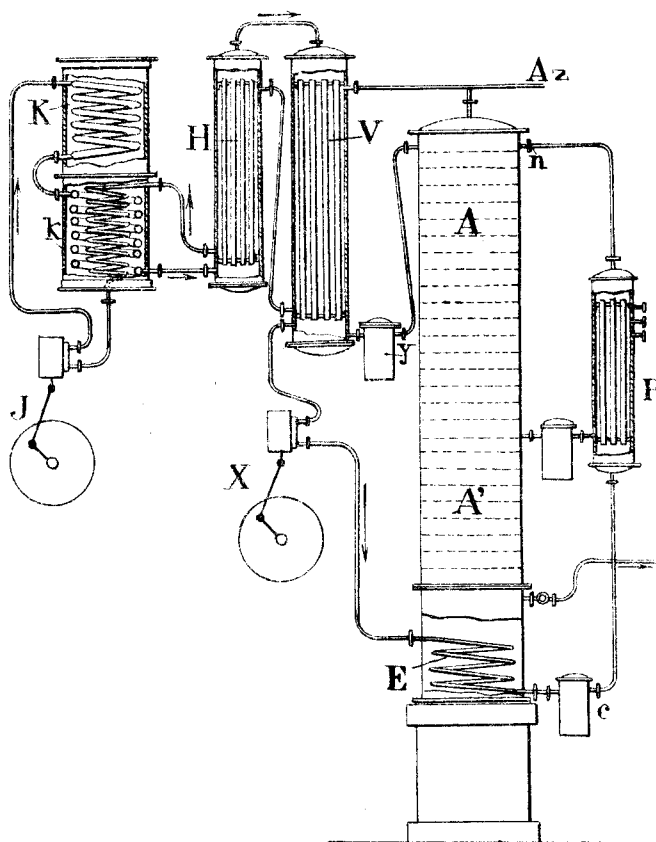
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PROCESS FOR CONTINUOUS RECTIFICATION OF LIQUID AIR OR OTHER LIQUEFIED GASES

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PROCESS FOR CONTINUOUS RECTIFICATION OF LIQUID AIR OR OTHER LIQUEFIED GASES.

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To all whom it may concern:

Be it known that I, EMILE AUGUSTIN BARBET, a citizen of the French Republic, and residing at 5 Rue de l'Echelle, Paris, France, have invented certain new and useful Improvements in the Process for Continuous Rectification of Liquid Air or Other Liquefied Gases, of which the following is a specification.

10 This invention relates to improvements in the process of rectification of liquid air and its object is to obviate the loss of cold which takes place in the existing processes and thus to simplify the means for carrying the process into effect by enabling the elaborate and delicate auxiliary apparatus previously required to make good the loss of cold to be dispensed with.

15 The process which will be described hereinafter effects a very great simplification of the usual process and therefore of the apparatus for carrying it into effect owing to the fact that only a nitrogen compressor and its series of regenerators are necessary, the complications due to the necessity of supplying additional cold in the form of liquid air or nitrogen being avoided. The condition for successful working of the improved process is that the compressor shall work at a higher pressure than that hitherto employed.

20 The accompanying drawing illustrates in elevation the apparatus used in carrying out the improved process with the exception of the usual accessories.

25 AA' is a rectification column into which liquid air is introduced at about its mid height and in which the rectification of the nitrogen is effected in the upper part A of the column while the rectification of oxygen is effected in the base A' of the column.

30 J is a nitrogen compressor exhausting the gaseous rectified nitrogen at the upper part of the column A through the pipes Az, liquefying column V, heat exchanger H. J compresses the nitrogen and sends it into the heating coil of the base E of the column AA' where it is liquefied by the cold of the pure oxygen in the base, and at the same time causes some vaporization of the oxygen. The liquefied nitrogen is raised through the separator c, the heat exchanger R and to the inlet n at the top of the column AA' owing to the pressure due to the compressor J. A certain part of the liquid

nitrogen entering at n is vaporized and enters the pipe Az and follows the path just described. The liquid nitrogen entering at n serves as a reflux of nitrogen to the nitrogen rectifying plates in part A of the column.

60 The compressor J drives the gaseous nitrogen under pressure through the cooler K in which the heat due to its compression is withdrawn, and then to the heat exchanger H where it is cooled by the gaseous nitrogen coming from A. The nitrogen vapour is then passed through the liquefying column V in which a certain proportion of the gaseous nitrogen is liquefied.

70 The liquid nitrogen produced in V passes through the separator g and enters directly at the top of A as a reflux additional to the reflux entering at n.

75 The remaining portion of the compressed but gaseous nitrogen passes from V to the engine x which effects an adiabatic expansion of the gas producing a fall in temperature of the gaseous nitrogen sufficient to cause a liquefaction of 15% to 20% of its volume. It is this additional cold produced by the expansion by the machine X of the unliquefied fraction of the compressed nitrogen which makes good the unavoidable loss of cold which takes place in the process.

85 The expansion of the nitrogen in x is carried to a point such that the pressure reached is that necessary to the normal working of the rectification apparatus.

90 The liquid nitrogen produced by the expansion of the gaseous nitrogen by the engine x passes together with the gaseous nitrogen to the coil E, in which the balance of the gaseous nitrogen will be liquefied.

95 The adiabatic engine X may be replaced by a turbo-engine or by any other kind of engine suitable for the same purpose.

100 It is possible to do entirely away with an adiabatic engine, and to effect the expansion without energy if the pressure in J is raised to a sufficiently high value, for instance, 20 kilogrammes. The cold produced by this expansion without energy could also be utilized for more satisfactorily cooling the gaseous nitrogen under pressure which is passed into V whereby a somewhat higher rate of liquefaction would be produced therein.

105 The above description of the carrying out of my process is by way of illustration only, 110

as my improved process and the means for carrying it into effect are capable of various modifications and I do not limit myself to those described but claim all such as come within the scope of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The process for the continuous rectification of liquid air which comprises producing an excess of liquid nitrogen by means of a nitrogen compressor working at a pressure in excess of that necessary for the operation of the rectification apparatus, the excess of liquid nitrogen produced forming a reserve of cold units to make good loss of cold by the apparatus.

2. The process for the continuous rectification of liquid air as claimed in claim 1, which comprises submitting the portion of the compressed nitrogen remaining unliquefied to adiabatic expansion, thereby effecting a fall in temperature of the said portion of

the nitrogen which fall in temperature provides the excess reserve of cold units.

3. The process for the continuous rectification of liquid air as claimed in claim 1, in which the adiabatic expansion of the said portion of the nitrogen is carried to a point such that the pressure reached is that necessary to the normal working of the rectification apparatus.

4. The process for the continuous rectification of liquid air which comprises producing an excess of liquid nitrogen by means of a nitrogen compressor working at a pressure in excess of that necessary for the operation of the rectification apparatus, and submitting the portion of the compressed nitrogen which remains unliquefied to adiabatic expansion with work, thereby effecting a fall in temperature of the said portion of the nitrogen which fall in temperature provides the excess reserve of cold units.

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

EMILE AUGUSTIN BARRET.