[Second Edition.]

PATENT SPECIFICATION

307,039

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Complete Accepted: Sept. 6, 1929.

3417

COMPLETE SPECIFICATION.

Improvements in or relating to the Purification of Gases.

We, "L'AIR LIQUIDE" SOCIETE ANONYME POUR L'ETUDE & L'EXPLOITATION DES PROCEDES GEORGES CLAUDE, a French Société Anonyme, of 48, Rue St. Lazare, Paris, France, Assignees of STE. CHIMIQUE DE LA GRANDE PAROISSE, AZOTE & PRODUITS CHIMIQUES, of 40, rue du Colisée, Paris, France, a French Société Anonyme, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

For the purification of gases intended for synthesis reactions, it is known to use reactions, (catalytic or not) which transform gaseous impurities into condensable or into neutral products. Said purification is generally obtained by causing the gaseous mixture to pass over catalysing or non-catalysing matter held in a special container, frequently known as a protube or a purifier tube fitted with the usual heating devices and with devices for exchanging heat between inflowing and outflowing gases whereby the material is maintained at a temperature sufficient for the purifying reaction to be practically complete.

But it is an obvious fact that, unless very elaborate heating and heat exchanging devices are used, the temperature cannot be maintained at a selected value if the purifying reaction evolves but little or no heat or if (which is equivalent) the reaction being exothermic the proportion of impurities is low.

According to this invention, it has been found that if, instead of effecting the purifying reaction in a special tube, it is caused to take place in a container surrounded with the catalysing material which serves to operate the main reaction so that there may be indirect contact and, consequently, exchange of heat between the main reaction (which generally evolves a considerable amount of heat) and the purifying reaction, there is thus obtained, besides a considerable simplification of the plant, a far more uniform and reliable progress of the purifying reaction.

To carry out the invention, the fresh gases containing impurities are circulated first over the material used for purification and then (either immediately or after having eliminated through cooling or otherwise the products formed) over the catalyzer used for the main reaction.

The volume of gas treated by the two successive reactions may, of course, be different, either on account of there being added to the purified gas any amount of pure gas (constituted for instance, by the gases that have not combined while passing a first time over the catalyzer) or owing to the taking off of a certain portion of the purified gas previous to its being passed over the main reaction catalyst.

A process taken as an example may be that of purifying the gaseous mixture intended for producing synthetic ammonia, which process consists in hydrogenating oxygen into water and carbon monoxide into methane or other organic compounds and water. Referring to the two Figures in the drawing appended hereto, several methods of performing the invention in the said particular case will now be described.

In diagram 1: A is a container adapted to withstand high pressure; the nitrogen and hydrogen mixture containing a little oxygen and carbon monoxide enters through 1, rises in the space 2 while becoming heated, descends through 3 and reaches B, which contains the purifying reaction catalyst; the gas flowing out of 4 contains no carbon monoxide and comes in contact in space C with the ammonia reaction catalyzer and reacts within said space C, thereby evolving heat which is used to maintain space B at such a temperature as will render the purifying reaction practically complete. The mixture of non-combined gases, ammonia and water flows out of 5.

If necessary, the outer wall A may be kept at a relatively low temperature by means of known devices.

Diagram 2 illustrates a method for causing the gases to come out of the tube after the purifying reaction is completed in order to eliminate (by condensation) water and the organic compounds formed if any.

The fresh gas enters through 1, circulates round the casing D, reaches 2 on the purifying reaction catalysts B, flows out again through tube 3 (which is heat insulated at D) is cooled at H so that the water and the other condensed products are collected at J and drawn off through a valve 7. The gas then comes back through 4 to enter at 5 on the ammonia reaction catalyst C; the mixture of non-combined gases and of ammonia leaves through 6. An electric heating device E supply the balance amount of heat required.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process for the purification of gases intended for exothermic synthesis reactions characterised by the fact that the purifying reaction takes place with an exchange of heat through indirect contact with the main reaction.

2. An application of the process claimed in Claim 1 to the elimination of oxygen and to the destruction of carbon monoxide contained in gases intended for making synthetic ammonia, especially by hydrogenating said impurities in the presence of a suitable catalyst.

3. A method of carrying out the process claimed in Claims 1 and 2 consisting in causing the impure gaseous mixture to pass successively over the material (catalysing or not), which produces purification and over the material which brings about the main reaction, said two materials being arranged in two distinct and contiguous compartments of one and the same enclosure.

4. Apparatus for carrying out the process claimed in Claim 3 consisting of a container for holding the material used for purification, the said container being located within another container for holding the main reaction catalysing material, and means to circulate the impure gaseous mixture firstly round the last mentioned container, and then through the inner container and finally through the main reaction catalyst.

5. The process for the purification of gases substantially as described.

6. The apparatus for the purification of gases substantially as described or substantially as illustrated in Figure 1 and Figure 2 of the accompanying drawings.

Dated this 5th day of June, 1928.

"L'AIR LIQUIDE" SOCIETE ANONYME pour L'ETUDE & L'EXPLOITATION des PROCEDES GEORGES CLAUDE,
Per Boult, Wade & Tennant,
111/112, Hatton Garden, London, E.C. 1,
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Fig.1.

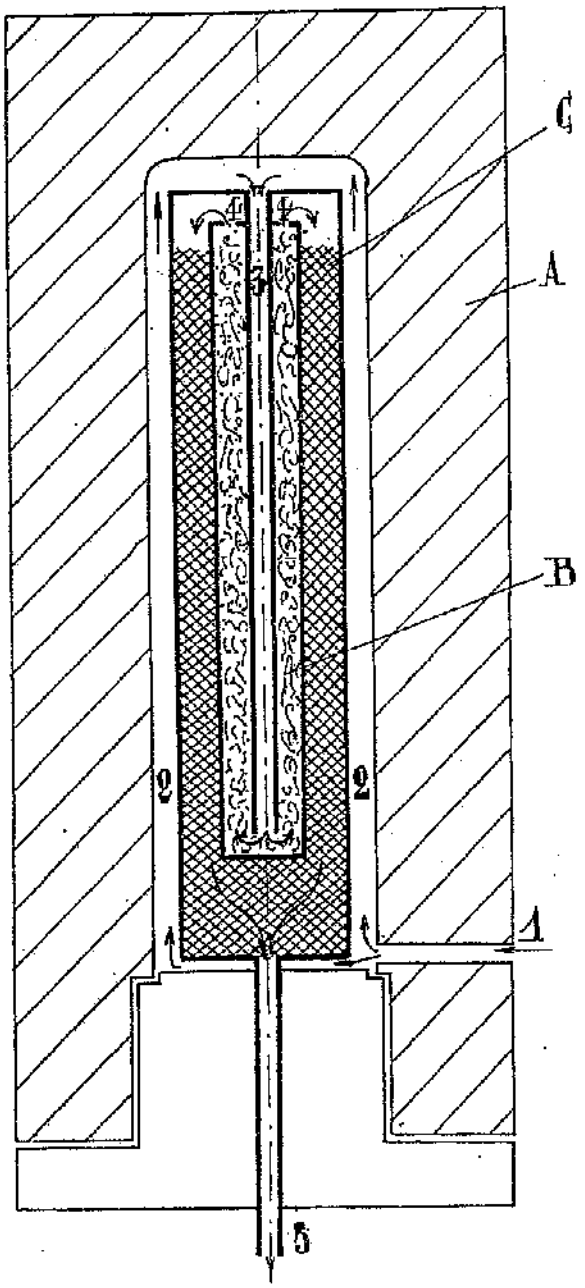

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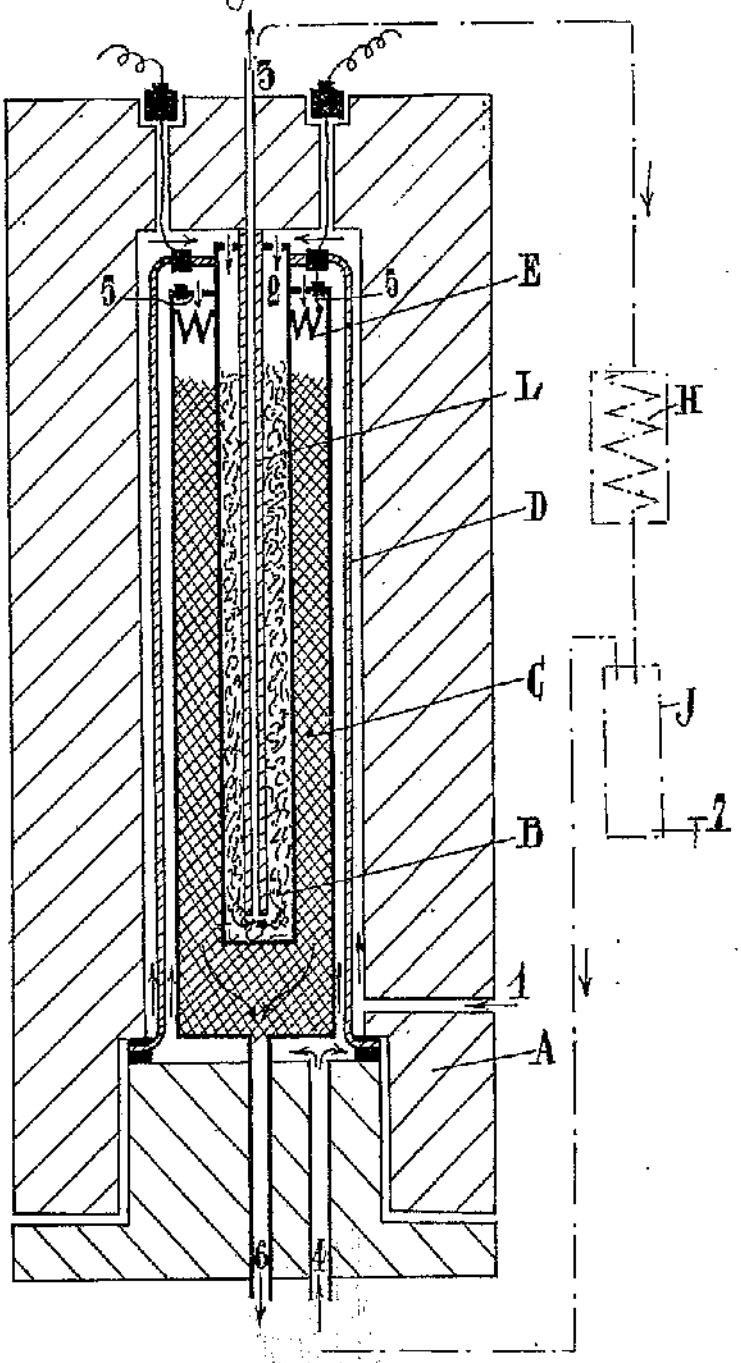
Fig. 2.



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807,039 COMPLETE SPECIFICATION

2 SHEETS
SHEET 2

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SHEET 1

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Fig.1.

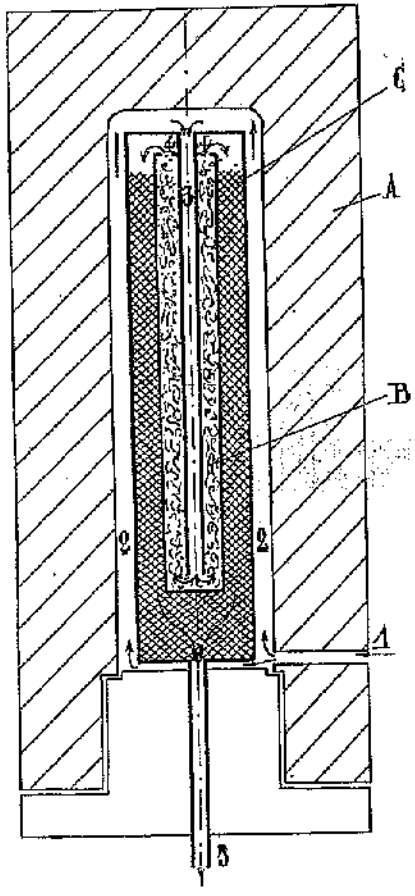
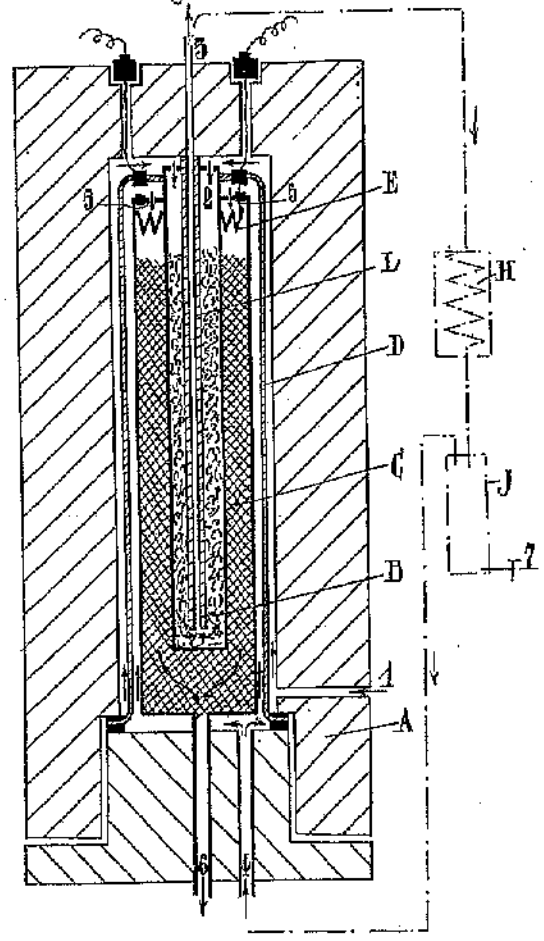


Fig.2.



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