

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

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Improvements in or relating to Processes for Carrying Out Exothermic Chemical Reactions.

We, L'AIR LIQUIDE SOCIÉTÉ ANONYME POUR L'ÉTUDE ET L'EXPLOITATION DES PROCÉDÉS GEORGES CLAUDE, a French company, of 48, rue St. Lazare, Paris (Seine), in the Republic of France, Assignees of SOCIÉTÉ CHIMIQUE DE LA GRANDE PAROISSE (AZOTE & PRODUITS CHIMIQUES), a French company, of 13, rue des Saussaies, Paris, in the Republic of France, 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:—

The present invention relates to improvements in processes for carrying out catalytic exothermic gaseous reactions, for example for effecting the synthesis of ammonia, and has for its object to improve the conditions of carrying out such reactions and in especial to render the temperature more uniform throughout the whole of the catalysing material. The invention has particular reference to processes in which the gases which are to react circulate before reaction through a space or spaces in which they are in indirect contact with the catalysing material and where they become heated by absorption of heat from the said catalysing material.

According to the present invention it has now been found to be advantageous to fill the space or spaces in question partially or wholly with catalysing material. In this way if for any reason during the operation of the process the temperature of the gases circulating in such space or spaces reaches the temperature of reaction before they arrive in contact with the main portion of the catalysing material, these gases will have an opportunity of reacting immediately by reason of the presence of this additional portion of catalysing material.

Such an arrangement also tends to render uniform the temperature in the catalysing material placed in the space or spaces above mentioned, that is to say in the heat exchange device, on account of the greater velocity of the gases

traversing this device, thus diminishing for this very reason the violence of the reaction; this greater velocity arises from the fact that generally the transverse section of the heat exchange device is smaller than that of the space occupied by the catalysing material in the apparatus heretofore used.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawing, which illustrates diagrammatically, by way of example, one construction of apparatus embodying the improved arrangement according to the present invention.

In this apparatus the heat exchange device inside the catalysing material is constituted by the tubes G, G' arranged concentrically and provided at one of their ends with a part K in which some catalysing material is placed. The gases which are to react are admitted to the apparatus through the tube A and become heated during their passage therethrough by indirect contact with the catalysing material. The gases then pass through the interior of the tubes C and on to the catalysing material contained in the space K where they partly react and which they leave before they reach a too high temperature. They then pass through the external tubes C' where they are cooled both by the gases circulating through the tubes C and by the main body of catalysing material which is at a lower temperature on account of being cooled by the gases entering through the tube A which latter may be replaced if necessary by a plurality of tubes. After having arrived at the end of the tubes C' the gases come into contact with this main body of catalysing material and start reacting again. The gases pass through the main body of the catalysing material and finally leave the apparatus through the annular conduit D. It must be noted that the arrangement of the first body of catalytic material K in the neighbourhood of the outlet conduit D has the advantage of

avoiding too great a cooling of the gases during their circulation through the region towards the end of the main body of the catalysing material, thereby further conducting to rendering the temperature uniform.

Instead of two tubes C, C¹ one inside the other there may be used U tubes, the tube C¹ being then a continuation of the tube C and the bent part of their junction being filled with catalysing material.

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 carrying out catalytic exothermic gaseous reactions which consists in letting the gases first react in direct contact with a portion of the catalysing material and in indirect contact with the main body of this catalysing material with which they afterwards come into direct contact.

2. A process as claimed in Claim 1, in which the reacting gases after their circulation in direct contact with the aforementioned portion of the catalysing material circulate through a space containing no catalysing material in indirect contact with the main body of the catalysing material.

3. A process as claimed in Claim 2, in which the aforementioned portion of the catalysing material with which the gases first come into contact is placed in a space located in the colder zones of the main body of the catalysing material.

4. A process as claimed in Claim 2, in which there is provided a heat exchange device constituted by an inner tube and an outer tube surrounding said inner tube, the lower portion of said outer tube containing some catalysing material, the gases which are to react being first passed through the interior of the inner tube, thereupon passing on to the catalysing material contained in the outer tube where they partly react and then continuing their passage through the outer tube, and finally entering the main body of the catalysing material contained in the reaction chamber.

5. A process for carrying out catalytic exothermic gaseous reactions substantially as hereinbefore described.

6. A process as claimed in any of the preceding claims adapted to the synthetic production of ammonia from its elements.

7. An apparatus for carrying out catalytic exothermic gaseous reactions having its parts constructed, arranged and adapted to operate substantially as described with reference to the construction illustrated in the accompanying drawing.

Dated this 2nd day of May, 1928.

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Agents for the Applicants.

2nd Edition

[This Drawing is a full-size reproduction of the Original]

