[Second Edition.]

PATENT SPECIFICATION

Convention Date (France): Dec. 24, 1926. 282,658

Application Date (in United Kingdom): Dec. 13, 1927. No. 33,743/27.

(Patent of Addition to No. 268,721: dated March 31, 1926.)

Complete Accepted: May 24, 1928.

3418

COMPLETE SPECIFICATION.

Improvements in or relating to Processes for Carrying Out Exothermic Chemical Reactions Under Pressure and at a High Temperature.

We, L'AIR LIQUIDE SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE, a French company, of 48, rue St. Lazare, Paris (Seine), in the Republic of France, Assignees of SOCIETE CHIMIQUE DE LA GRANDE PAROISSE (AZOTE & PRODUITS CHIMIQUES), a French company, of 19, 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:—

This invention relates to an improvement in or modification of the invention described and claimed in our prior Patent Specification No. 268,721.

The process for carrying out exothermic catalytic gaseous reactions under pressure and at a high temperature such as the synthesis of ammonia from its elements described in our prior specification in question consists in circulating between the outer pressure-resisting receptacle or tube and the inner device comprising the receptacle or tube containing the catalysing material a suitable gas under conditions so regulated that the said gas forms a protective screen for the walls, that is so that the part of the heat of reaction which reaches the said gas heats it at the utmost to the highest degree permissible for the resistance of the outer receptacle or tube, and then discharging to the outside of the pressure resisting receptacle or tube the gas which has been thus circulated. In carrying out this process however it may happen that it is not practically possible to ensure under good conditions the removal of the part of the heat evolved by the reaction which has to be carried away by the gases circulating between the outer pressure resisting receptacle and the inner device comprising the receptacle or tube containing the catalysing material. Such for example may be the case when on account of the chemical reaction evolving a very large amount of heat, there would be an inducement to permit the circulation of a practically too large quantity of gas between the outer tube and the inner device.

The present invention has for its object to overcome difficulties of the nature referred to above, and for this purpose according to the present invention there is circulated in the inner device comprising the receptacle or tube containing the catalysing material and in indirect contact with the said material an amount of the gases larger than that which reacts in contact with the catalysing material, the excess of these gases being discharged to the outside of the catalysing apparatus after their partial or total heating to the temperature of reaction at their admission on to the catalyst. In this way it is possible to discharge supplementary amounts of heat from the apparatus.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be described more fully with reference to the accompanying drawing which illustrates diagrammatically one arrangement for carrying out the modified process according to the present invention.

The apparatus illustrated is similar to that shown in Figure 1 of our prior Specification No. 268,721 hereinbefore referred to, save that the receptacle A containing the catalysing material is provided at its end opposite that at which the gases are admitted with an exit pipe Z which may for instance be placed inside the pipe E through which the gases are discharged after having circulated round the receptacle A; this pipe Z may be made of a metal specially resistant to pressure and temperature, such as alloys with a high nickel content, and it may, if necessary, be covered with heat insulating material. The circulation of the gases round the receptacle A takes place as described in our prior specification in connection with

[Price 1/-]

the apparatus illustrated in Figure 1 of the drawings thereof, these gases circulating between the said receptacle and the wall C of the pressure resisting tube which may be protected if necessary by an internal sleeve made of a substance which is not attacked by the gases and which may be metallic or heat insulating or both.

The gases which are to react pass through the tube G and circulate inside the tubes H where they become heated by absorbing part of the heat evolved by the reaction; then after arriving in a heated condition at the end of the tube Y, a part of the hot gases is discharged to the exterior by the pipe Z, whilst the remaining part returns in the reverse direction and circulates in direct contact with the catalysing material where it reacts.

The pipe Z may be prolonged (as indicated in dotted lines) inside the tube Y and one of the group of tubes H in order to take off the discharged gases at such a temperature as is desired.

The gases which pass out through the pipe Z may be cooled or not and may, for instance, as shewn in the drawing, be mixed with the gases that leave through the pipe K after these latter have been cooled or without cooling them. A cock R permits of regulating the output of the gases passing out through the pipe Z and consequently of varying the amount of heat thus discharged to the exterior.

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. An improvement in or modification of the process for carrying out exothermic catalytic gaseous reactions claimed in our prior Patent Specification No. 268,721, which consists in circulating in the inner device comprising the receptacle or tube containing the catalysing material and in indirect contact with the said material a quantity of gases larger than the amount of gases which reacts in contact with the catalysing material, and in discharging the excess of these gases to the outside of the catalysing apparatus after their partial or total heating to the temperature of reaction at their admission on to the catalyst.

2. A process as claimed in Claim 1, in which the excess of gases is discharged to the outside of the catalysing apparatus through a pipe communicating with the receptacle containing the catalysing material at the end opposite to that at which the gases are admitted.

3. A process as claimed in Claim 2, in which the pipe through which the excess of gases is discharged to the outside of the catalysing apparatus is made of metal resistant to pressure and temperature and covered if necessary with heat insulating material.

4. A process as claimed in Claim 2 or 3, in which the pipe through which the excess of gases is discharged is prolonged inside one of the group of tubes in the receptacle containing the catalysing material through which tubes the gases which are to react flow, for the purpose specified.

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

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

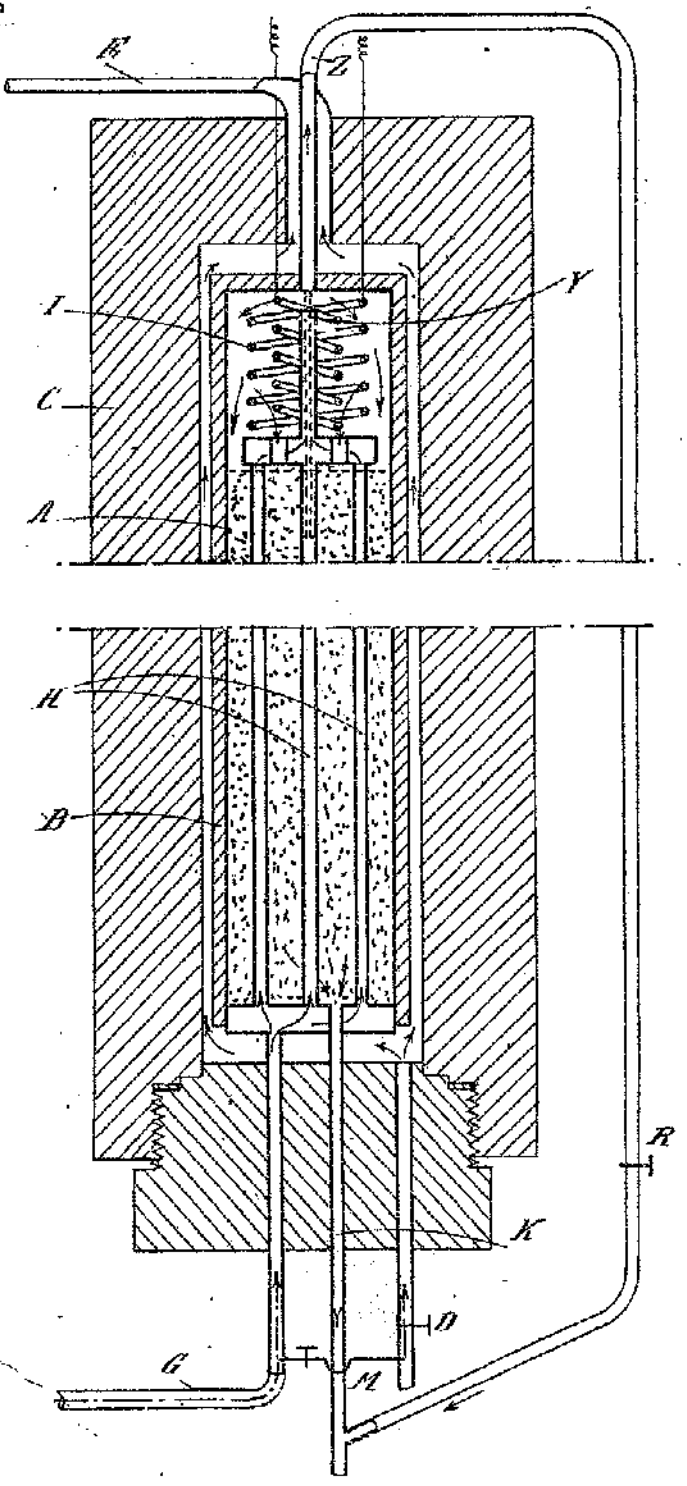
7. An apparatus for carrying out exothermic catalytic gaseous reactions having its parts constructed, arranged and adapted to operate substantially as described with reference to the accompanying drawing.

Dated this 13th day of December, 1927.

HASELTINE, LAKE & Co.,
28, Southampton Buildings, London,
England, and
19—25, West 44th Street, New York,
U.S.A.,
Agents for the Applicants.

Abingdon : Printed for His Majesty's Stationery Office, by Burgess & Son.
[Wt. 56A.—125/1/1929.[

2nd Edition



[This Drawing is a reproduction of the Original on a reduced scale.]

Charles & Read Ltd. Photo Litho.