[Second Edition.]

PATENT SPECIFICATION

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3416

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), of 13, rue des Saussaies, Paris, in the Republic of France, a French company, 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 described in our prior specification in question for carrying out under pressure and at a high temperature exothermic catalytic chemical reactions, such as the synthesis of ammonia from its elements, of the type in which a part or practically the whole of the heat disengaged by the reaction is caused to be absorbed by the gases which are to react immediately before the combination of the said gases 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. Further there is also described in our prior specification above referred to a method of carrying out this process in which the gases which are to react are utilised for circulation between the outer pressure-resisting receptacle or tube and the inner device, the said gases after being thus circulated being cooled if necessary and thereafter combined.

According to the present invention it has been found that under certain conditions, and in especial when the absorption of the heat of reaction by the gases which are to react is not sufficient, it is desirable when the aforesaid gases which are to react are utilised for circulation between the outer pressure-resisting receptacle or tube and the inner device not to cool the aforesaid gases but on the contrary to heat them after they have served as a protective screen for the walls of the pressure-resisting receptacle or tube and before passing them into the interior of the chamber containing the catalysing material in indirect contact therewith where the gases absorb a further quantity of heat before their admission on to the catalysing material. The aforementioned heating of the gases may be effected by means of interchange of heat with the gases that have reacted or by any other suitable means.

As an example of one method of carrying into effect the present invention reference may be made to the apparatus illustrated in Figure 1 of our aforementioned prior specification No. 268,721. With such an apparatus the fresh gaseous mixture is admitted through the conduit D, serves as a protective screen during its circulation through the space between the outer wall of the chamber A and the inner wall of the pressure-resisting tube C, and leaves through the conduit E, whereafter it passes through a coil F immersed in a bath which raises its temperature to the required amount and then returns by the tube G to the catalysing apparatus in the interior of which it follows the course indicated by the arrows.

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 chemical reactions claimed in our prior patent specification No. 268,721, which consists in heating the gases which are to react after the said gases have served as a protective screen for the walls

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of the pressure-resisting receptacle or tube but before circulating them in indirect contact with the catalysing material and finally effecting the combination of the gases by direct contact with the catalysing material.

2. A process as claimed in claim 1, in which the gases which have served as the protective screen are heated, prior to their being circulated in indirect contact with the catalysing material, by means of interchange of heat with the gases that have reacted.

3. A process for carrying out exothermic catalytic chemical reactions substantially as hereinbefore described.

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

5. An apparatus for carrying out the process as claimed in Claim 1, constructed and adapted to operate substantially as hereinbefore described with reference to Figure 1 of the drawings of our prior patent specification No. 268,721.

Dated this 23rd day of January, 1929.

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