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BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

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D E C I S I O N
of 11 October 1995

Case Number: T 0778/92 - 3.3.2

Application Number: 83108338.1

Publication Number: 0106076

IPC: C01B 3/02

Language of the proceedings: EN

Title of invention:
Preparation of ammonia synthesis gas

Patentee:
The M. W. Kellogg Company

Opponent:
Imperial Chemical Industries PLC

Headword:
Synthesis gas/KELLOGG

Relevant legal provisions:
EPC Art. 56, 104(1)

Keyword:
"Inventive step - yes"
"Apportionment of costs - no"

Decisions cited:
-

Catchword:
-

Case Number: T 0778/92 - 3.3.2

D E C I S I O N
of the Technical Board of Appeal 3.3.2
of 11 October 1995

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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office dated 19 May 1992, with written decision posted 30 June 1992 concerning maintenance of European patent No. 0 106 076 in amended form.**

Composition of the Board:

Chairman: P. A. M. Lançon
Members: G. J. Wassenaar
R. E. Teschemacher

Summary of Facts and Submissions

I. European patent No. 0 106 076 was granted in response to European patent application No. 83 108 338.1.

II. A notice of opposition was filed by the Appellant. Revocation of the patent in its entirety was requested on the grounds of lack of inventive step (Articles 52, 56 and 100(a) EPC).

Twelve documents were cited of which the following remain relevant for this decision:

(1) US-A-4 296 085
(2) US-A-3 442 613
(3) GB-A-1 578 270
(4) JP-A-53-82691 (English translation)
(12) US-A-3 584 998

III. The Opposition Division maintained the patent in amended form on the basis of claims 1 to 6 filed with the letter of 13 April 1992.

Amended claim 1 reads as follows:

"1. A process for producing ammonia synthesis gas which comprises introducing normally gaseous hydrocarbon fresh feed and steam to an endothermic, catalytic conversion zone operated under steam reforming conditions including a steam to C_1 ratio between 2.5 and 4.5 to produce primary reformed gas containing hydrogen, carbon oxides, methane and steam; introducing the primary reformed gas, supplemental steam and heated air compressed by centrifugal means

driven by a gas turbine to an adiabatic, catalytic conversion zone operated under autothermal reforming conditions to produce raw, hot, ammonia synthesis gas; passing raw, hot, ammonia synthesis gas to the endothermic catalytic conversion zone in indirect heat exchange with the normally gaseous hydrocarbon and steam therein; and recovering raw ammonia synthesis gas from the endothermic catalytic conversion zone, characterized in that in order to provide the entire endothermic heat of conversion employed to produce the primary reformed gas from heat in the raw, hot, ammonia synthesis gas, the compressed air is heated to a temperature in the range from 700°C to 900°C by indirect heat exchange with exhaust gas from the gas turbine, which exhaust gas is additionally heated by combustion of supplementary fuel added thereto prior to indirect heat exchange with the compressed air, and normally gaseous hydrocarbon fresh feed is also introduced to the adiabatic, catalytic conversion zone in admixture with the primary reformed gas and supplemental steam at an overall steam to C_1 ratio between 2 and 3."

According to the Opposition Division claim 1 comprised the following nine process features:

"(i) providing the entire endothermic heat of conversion employed to produce the primary reformed gas from heat in the raw, hot, ammonia synthesis gas;

(ii) operating the primary reformer at a steam to C_1 ratio between 2.5 and 4.5;

(iii) using centrifugal means to compress the air to be introduced to the secondary reformer;

(iv) employing a gas turbine to drive the centrifugal means to compress the process air;

(v) additionally heating exhaust gas from the gas turbine by combustion of supplemental fuel added thereto prior to indirect heat exchange with the compressed air;

(vi) heating the compressed air to a temperature in the range from 700°C to 900°C by indirect heat exchange with the exhaust gas from the gas turbine;

(vii) introducing part of the normally gaseous hydrocarbon fresh feed, together with the primary reformed gas, supplemental steam and the heated compressed air, also to the adiabatic, catalytic conversion zone operated under autothermal reforming conditions to produce raw, hot, ammonia synthesis gas;

(viii) operating the secondary reformer at an overall steam to C_1 ratio between 2 and 3;

(ix) passing raw, hot ammonia synthesis gas to the primary reformer in indirect heat exchange with the hydrocarbon fresh feed and steam therein."

They considered that (1) disclosed features (iii) and (vii), that (4) disclosed features (i) and (ix) and that (2) disclosed a heat exchanger type primary reformer, but that the combination of documents (1), (2) and (4) failed to disclose at least the

features (v), (vi) and (viii). They further considered that (12) disclosed the use of only a secondary reformer instead of a primary and secondary reformer but that the overall steam to C_1 ratio would be more than 3 so that feature (viii) was not disclosed in (12) either.

They concluded that the combination of process features described in claim 1 was new and involved an inventive step.

IV. The Appellant lodged an appeal against this decision.

In his statement of the grounds of appeal, the Appellant argued that features (v) and (vi) were disclosed by a combination of (1) and (2) and that (12) did disclose a steam to C_1 ratio within the range of 2 to 3, i.e. feature (viii).

The Appellant submitted that the Opposition Division was fallacious in rejecting his argument that the invention was a logical development from (1). Even when taking (2) as a starting point it was argued that the process of claim 1 lacked an inventive step in view of (1) and taking into consideration the general knowledge of the skilled person. It was submitted that the process of claim 1 was simply the result of applying the teaching of (1) to the process as taught by (2).

To illustrate the general knowledge of the skilled person the following new documents were cited:

(13) "Nitrogen" 100 (1976), p. 71-75
(14) "Ammonia", Slack et al Part III (1977), p. 361-363

(15) "Ammonia Plant Safety" 21 (1979), p. 130-137.

Oral proceedings were requested should the appeal be dismissed.

V. The Respondent disagreed with Appellant's submissions, merely referring to the arguments already presented in the first instance, and requested oral proceedings should the appeal not be dismissed.

VI. After the summons for oral proceedings, with telefax dated 29 September 1995 the Respondent notified that he would not attend the oral proceedings and withdrew his request for oral proceedings. He requested that a decision be made on the basis of the record as it stands.

With telefax dated 6 October 1995 the Appellant notified that he had discovered that the patent in suit had lapsed in at least the designated states BE, DE, FR, GB and NL. He argued that as a result of the Proprietor's failure to advise that the patent had lapsed he had spend two days for preparing oral proceedings. He notified that he likewise would not intend to appear for oral proceedings and withdrew his request thereof.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety. He also requested the reimbursement of the costs for the preparation of the oral proceedings.

The Respondent requested that the appeal be dismissed.

VIII. Oral proceedings took place on 11 October 1995 in the absence of the parties. After deliberation it was decided that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

2. *Allowability of amendments under Article 123 EPC*

Present claim 1 is identical to claim 3 as granted and is based on a combination of claims 2 and 4 as originally filed. Thus present claim 1 clearly satisfies the requirements of Article 123(2) and (3) EPC.

3. *Novelty*

Since none of the prior art documents on file discloses a process for producing ammonia synthesis gas having all the features of claim 1, the subject matter is novel. Novelty was in fact not disputed in the contested decision.

4. *Inventive step*

4.1 Of the cited documents (1), (2) and (4) are the most relevant but none of these three documents comes clearly closer to the subject matter of claim 1 than the others. The Board sees no reason not to follow appellant's line of argument in the appeal proceedings and to take (2) as a starting point for an inventive step discussion.

Document (2) discloses a process for reforming hydrocarbons to obtain a synthesis gas from which ammonia may be formed, using a primary and secondary reformer, whereby the amount of process air employed in the secondary reformer is such that substantially more nitrogen is introduced into the process gas stream than is required to achieve a stoichiometric hydrogen to nitrogen ratio in the ammonia synthesis gas. It further discloses the use of a gas turbine to compress the process air.

The amount of excess air may be such that the heat of combustion generated in the secondary reformer is sufficient to provide the necessary heat for the endothermic primary reformer (column 3, lines 63 to 69). The latter option is not realised in the detailed Example as illustrated by Figures 1 to 3. According to said Example, the primary reformer is heated by the combustion of fuel gas with the exhaust gas of the gas turbine, whereby the excess heat of said fuel gas burning is used for the preheating of the compressed air. The use of the excess heat from the secondary reformer for the endothermic reaction in the primary reformer is described in detail in column 9, line 75 to column 10, line 53 with respect to the auto-thermal reformer illustrated by Figure 4, wherein primary and secondary reformer are combined in one apparatus so that the secondary reformer is completely enclosed within the primary reformer. Since the process of present claim 1 requires as essential feature (i) that the entire endothermic heat of conversion employed to produce the primary reformed gas from heat in the hot ammonia synthesis gas, it is only the above mentioned latter option in (2) which comprises feature (i) of

present claim 1. Document (2) discloses that in the latter option, the need for fuel gas, such as is used in the primary reformer according to Figure 1, is eliminated. Not disclosed is, however, how in that case the compressed air is preheated and the heat of the exhaust gas of the gas turbine is used. Of the technical features mentioned above (2) discloses in combination only (i), (iii), (iv) and (ix).

4.2 Developments in the technical field of ammonia synthesis gas generally try to reduce the amount of energy or as it is called in the patent in suit, minimizing feed and fuel requirements.

Starting from (2), the technical problem underlying the invention can be seen in providing a process for preparing ammonia syntheses gas with a reduced amount of feed and fuel.

According to claim 1, this problem is solved by a combination of new technical features (ii), (v), (vi), (vii) and (viii) with the other technical features already known from (2).

There are no direct comparable figures to check whether the said problem is actually solved. From (1), which also relates to the production of ammonia synthesis gas, it is however known that the essential part of feature (vii), according to which a part of the feed by-passes the primary reformer, reduces the fuel and steam requirements, thereby achieving an overall energy saving (column 2, line 67 to column 3, line 2).

In the Board's view it is, therefore, credible that the process of claim 1 actually solves the said problem.

4.3 It remains therefore to be decided if the present solution was obvious in view of the available prior art.

In agreement with the position of the Appellant, the Board considers feature (vii) to be the main difference with respect to (2). Apart from the supplemental addition of steam, this feature is known from (1) and the skilled person, trying to reduce the feed and fuel requirements of (2) would be aware of the potential energy savings of reducing the duty of the primary reformer by bypassing the primary reformer with a portion of the feed. The bypass of a portion of the feed requires, however, that the secondary reformer has a separate entrance for the feed. In the combined primary and secondary reformer according to Figure 4 of (2) no such separate entrance is available and it is not obvious to the skilled person how such an entrance in the secondary reformer, which is completely enclosed by the primary reformer, can be made.

The Board agrees with the Appellant that feature (i) is also disclosed in other documents relating to the production of ammonia synthesis gas, e.g. (3) and(4). Replacing the auto-thermal reactor of Figure 4 of (2) with the connected primary and secondary reformers 3 and 4 of Figure 1 of (4) would solve the problem of connecting the feed bypass to the secondary reformer. This would, however, imply a combination of selected teachings from three unconnected documents which, without hindsight, cannot be regarded as being obvious.

But even if the combination of the teachings of (1) and (4) with (2) were regarded obvious to solve the problem underlying the invention, at least feature (vi) would still be lacking.

The Board cannot follow Appellant's contention that if the gas turbine exhaust in the process of (2) is not needed for heating the primary reformer, as is the case if the auto-thermal reactor of Figure 4 is used, it would be self evident to use it together with additional fuel for heating the compressed air. According to (2), column 10, lines 43-46, the auto-thermal operation with the reactor of Figure 4 eliminates the need for fuel gas. Present feature (vi), requiring the use of additional fuel, would be contrary to the teaching of (2).

Document (12) discloses a process for the syntheses of ammonia without using a primary reformer and is thus rather remote from the processes discussed above. Whether or not it discloses a steam to C_1 ratio between 2 and 3 is irrelevant for the inventive step reasoning.

Documents (13) to (15) illustrate the undisputed fact that the Braun process according to Figures 1 to 3 of (2) is put into practice. They do not reveal processes wherein the heat for the primary reformer is completely provided by the hot synthesis gas from the secondary reformer. They have thus no bearing upon the inventive step reasoning.

The other citations are even more remote from the subject matter of claim 1 and cannot provide the

skilled person with any incentive for the claimed solution of the above mentioned technical problem.

For these reasons, the subject matter of claim 1 involves an inventive step in the meaning of Article 56 EPC.

4.4 The outcome of the inventive step analysis would not be different if (1) or (4) were taken as a starting point. The technical problem would be the same and to arrive at the solution of present claim 1, at least selected teachings of (2) and (4) with (1) or (1) and (2) with (4) had to be combined, which is deemed non-obvious without hindsight.

5. *Apportionment of costs*

As a rule, Article 104 (1) EPC provides that each party to the proceedings shall bear its own costs. An order deviating from this principle for reasons of equity requires special circumstances such as improper behaviour which make it equitable to award costs against one of the parties (T 170/83, OJ EPO 1984, 605).

In the present case the Appellant has not shown such circumstances. It has not been alleged that the patent has lapsed in all designated states since no indication in respect of Italy has been made. Therefore, the Board was not in a position to assume that the requirements under Rule 60 (1) EPC were fulfilled. Even if the patent has lapsed also in Italy, this would not make an immediate end to the opposition proceedings. Rather these might be continued at the request of the

opponent. The Appellant has not submitted that he would have abstained from such a request or withdrawn his appeal if he had known that the patent had lapsed and that this was apparent to the Respondent. The oral proceedings did not become superfluous by the facts submitted by the Appellant and his decision not to take part in them was made deliberately and was not the mere consequence of the procedural behaviour of the Respondent. Therefore, it cannot be said that the Appellant's preparation for the oral proceedings was caused by an improper conduct of the Respondent.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

P. Martorana P. A. M. Lançon