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Bezeichnung der Erfindung:

Title of invention:

Hydrocarbon conversion process and Industries

Titre de l'invention :

**ENTSCHEIDUNG / DECISION**

vom / of / du 18 September 1983

Anmelder / Applicant / Demandeur : Imperial Chemical Industries

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art.52(1),56

"inventive step"

Leitsatz / Headnote / Sommaire

Europäisches  
Patentamt  
Beschwerdekammern

European Patent  
Office  
Boards of Appeal

Office européen  
des brevets  
Chambres de recours



Case Number : T33/83

**DECISION**  
**of the Technical Board of Appeal 3.3.1**  
**of 18 September 1983**

**Appellant:** IMPERIAL CHEMICAL INDUSTRIES LIMITED  
London

**Representative:** Martin, David Lincoln  
Imperial Chemical Industries PLC  
Legal Department: Patents  
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Millbank, London SW1P 4QG  
England

**Decision under appeal:** Decision of the Examining Division 029 of 14 September  
1982 to reject European Patent Application No. 79 301 374.9,  
in accordance with Article 97(1) EPC

**Composition of the Board:**

Chairman: D. Cadman  
Member: K. Jahn  
Member: O. Bossung

SUMMARY OF FACTS AND SUBMISSIONS

- I. European Patent Application No.79 301 374.9 filed on 12 July 1979 and published on 20 February 1980 under publication no. 0 008 166, claiming the priority of the British prior application of 7 August 1978, was refused by decision of the European Patent Office dated 14 September 1982 on the basis of claim 1 with the following wording:

"A process for hydrocarbon conversion characterised in that a hydrocarbon feedstock is converted in a heated furnace to produce hydrocarbon process gas, wherein the furnace is heated by burning a mixture of fuel and preheated air, the preheated air having been obtained by passing air through successive compression, heating and gas turbine expansion zones, the work thereby obtained from the gas turbine expansion zone being used, at least in part, to compress hydrocarbon process gas produced in the furnace and wherein during passage through said heating zone the thus-compressed air is partially heated by heat exchange with off-gases produced in the hydrocarbon conversion process."

- II. The stated ground for the refusal was that the subject-matter of that claim did not involve an inventive step. A process for recuperating energy from hot gas streams in hydrocarbon conversion plants is known from FR-A-1 572 008 wherein the furnace is heated by burning a mixture of fuel and preheated air, the preheated air having been obtained by compression, heating and subsequent gas turbine expansion. Supplementary energy obtained from the gas turbine expansion zone can be used

.../...

to compress process gas produced in the unit. During passage through the heating zone the compressed air is partially heated by heat exchange with gas produced in the conversion process (figure 2, /64/ /65/). The only difference from the subject-matter of claim 1 lies in the fact that off-gas is not mentioned as a source for recuperating heat.

In days of high energy costs it forms one of the routine tasks of a skilled plant designer to reduce energy consumption of a plant to a minimum by judiciously exploiting any available heat by heat exchange and recycling. The partial heating of the compressed air with off-gas from the hydrocarbon conversion process of the present application is considered to be an obvious example of such exploitation.

It is true that the documents cited in the search report contain no reference to the use of off-gas for recuperating heat. However, the problem of regaining low-grade heat would not necessarily have arisen so long as energy was cheap. With present high rising energy prices it becomes economically more and more worthwhile to exploit low grade energy from any potential source.

It is generally known that waste gas leaving a combustion process must obviously contain inherent heat and it is considered standard procedure to apply this recovered heat wherever a fluid stream entering the plant needs preheating, for instance air for a combustion process.

III: On 10 November 1982 the appellant lodged an appeal against this decision by telex which was confirmed on 15 November 1982, the fee for appeal also being paid on

the former date. The Statement of Grounds was submitted on 10 January 1983, the substance of which was as follows:

The Applicants do not dispute that plant designers must attempt to make use of any available waste heat. However, a source of waste heat has to be identified first and then use has to be found for it. Matching sources of waste heat with their potential outlets is a very skilled and, at times, a very difficult exercise.

Most crackers in use today are based on designs dating from before the time, say 1973-74, when energy saving became crucial following the considerable increase in oil prices. It is well known nevertheless that such crackers were already highly efficient in energy usage and energy saving. Whatever the design of the cracker, the process is bound to produce some off-gases and yet, so far as the Applicants are aware, none of the extensive prior art relating to hydrocarbon conversion processes has even touched upon the possibility of using the relatively low-grade waste heat available from such off-gases to pre-heat partially the incoming furnace air.

It is surely surprising that in the very extensive prior art on hydrocarbon conversion processes there is apparently no reference whatsoever to such a proposal. The Applicants therefore submit that the presently claimed process cannot be obvious.

- IV. The Board of Appeal then, in a communication to the appellant, set out objections to the application in respect of lack of inventive step, in view of two new

documents i.e. US-A-3 426 733 and Oil and Gas Journal, 2 September 1974, pages 59 to 68, particularly pages 61 and 62, right hand column.

The appellant contested that these references would render the present application obvious. According to the appellant, U.S. Patent No. 3 426 733 describes a method of pre-heating combustion air but it differs significantly from that proposed by the Applicants. Claim 1 of the present application relates to a hydrocarbon conversion process in which the air used in the furnace is preheated by passage through successive compression, heating and gas turbine expansion zones and in which at least some of the work from the gas turbine expansion zone is used to compress hydrocarbon process gas. There is no suggestion in the U. S. Patent of this method of preheating the incoming air. The whole thrust of the U.S. patent is to use a portion of the incoming hydrocarbon process stream to heat the incoming combustion air. The patentee notes (column 3 lines 5 and 6) that most process streams are delivered to furnaces at temperature well above ambient (see for example, Figure VI, where the incoming process stream in line 12 is at 500°F). The patentee, therefore, splits the hydrocarbon stream into a process stream (for immediate reaction) and an auxiliary stream, the latter being used to heat the incoming air. In contrast, in the specific example in the present application the hydrocarbon feedstock enters along line 12 and passes through heat exchanger 5 but it is not used to pre-heat the incoming air.

Similar comments apply to the other reference, from the Oil & Gas Journal. Once again there is no reference to preheating using successive compression, heating and

gas turbine expansion zones. The authors of the paper again suggest the use of heat exchange with furnace flue gases but there is no suggestion of using the relatively low-grade waste heat from the off-gases of a hydrocarbon conversion process.

The Appellants submit, therefore, that neither of these references will take the skilled reader of French specification No. 1 572 008 much further forward in solving his problem of reducing energy consumption. If he is helped at all, the solution arrived at will not be the Applicants' invention.

The Appellants therefore submit that the process claimed in the present application is not obvious and that it does involve an inventive step. They request that the decision be reversed and that the claim be allowed.

#### REASONS FOR THE DECISION

1. The appeal is in accordance with Articles 106-108 and Rule 64 EPC; it is therefore admissible.
2. The present application is concerned with a process for hydrocarbon conversion which is essentially characterised by the following features:
  - a) a hydrocarbon feedstock is converted in a heated furnace to produce hydrocarbon process gas
  - b) the furnace is heated by burning a mixture of fuel and preheated air

- c) the preheated air has been obtained by passing air through successive compression, heating and gas turbine expansion zones
- d) the work obtained in the expansion zone is, at least partially, used to compress hydrocarbon process gas
- e) the compressed air is partially heated by heat exchange with off-gases produced in step b) (cf. page 3 lines 20 to 29 in combination with the figure, particularly reference nos. 1, 2, 15, 16 and 3).

According to the state of the art, such a process which comprises features a) to d) is already known from FR-A-1 572 008 (referring to a): cf. page 3 lines 10 to 13, referring to b): cf. résumé (2) and (6), the description to fig. 1 in combination with page 10 line 16 and page 11 paragraph 2; referring to c): cf. résumé 1; referring to d): cf. résumé 4).

3. In this known process the off-gases of the burner can be discharged through a stack (cf. page 4 lines 35 to 37), pointing at the fact that the heat energy of these off-gases has been allowed to go to waste. It can be presumed that the applicant in starting from this - although incomplete - prior art stated in his description that there is still a need to reduce energy consumption further (cf. page 2 lines 26 to 32).

However, the above FR-A additionally suggests that the heat energy of the off-gases can be utilised in a heat recovery zone to preheat the components of the starting material due to produce a gas mixture rich in hydrogen (cf. figure 2 particularly reference numbers 39, 58, 38, 43).

In the absence of evidence of further advantages stemming from the applicant's alternative form of the old process, the problem underlying the present application can be seen as no more than a further proposal to utilise the heat energy of the off-gases effluent of the burner which provides the heat needed in the furnace. This problem is solved by heat transfer from the off-gases to the compressed air.

4. According to the finding of the Examining Division, which is not disputed by the Board, such a technical teaching is novel. It is therefore to be examined whether the subject matter of claim 1 is obvious in relation to the prior art. To that end, besides the above FR-A, particularly the article in Oil & Gas Journal, 2 September 1974 pages 59 to 68 has to be taken into consideration where fuel savings in refinery process furnaces are announced by installation of heat recovery equipment which transfers heat from the flue gas to the combustion air for the burners (cf. pages 61 and 62 right-hand column).

An expert who addressed himself to the problem of modifying the distribution of energy consumption in the process of the above FR-A, could easily arrive at the solution as claimed by applying the idea of preheating combustion air with aid of flue gases as set out in the cited article, instead of using heat of the product stream (above FR-A). Since the said idea prevailed in the whole field of refinery processes including, for example, the catalytic stream cracking of hydrocarbons taught in the above FR-A (page 3, lines 10-13) and covered by claim 1 on file (cf. page 1 lines 4 to 7), it is of no importance that this article is silent on a compression-heating-gas-expansion sequence of the refinery process.

In this connection, mention should be made that the term off-gases, as used in claim 1 on file, must be a synonym of flue gases which term was originally and exclusively used in the application as filed (cf. page 3, line 25, page 4, line 31, page 6 line 38, page 7, line 1, claims 5, 6 and 9). For this reason the appellant's submission, according to which the authors of the said article did not suggest the use of the relatively low grade waste heat from the off-gases, is irrelevant. Moreover, in order to dispose of a point made by the appellant, it is pointed out that the range of potential flue gas temperatures due to be reduced to about 300 to 350°F, corresponding 150 to 175°C (page 62 right-hand column lines 23/24 from the bottom), is specified in the article as being 500 to 1000°F, corresponding to 260 to 540°C (figure 2), whilst the application on file does not present any information about the temperature of the off-gases.

In view of the arguments as set out above, the fact that the compressed air is only partially heated by heat exchange with flue gases, instead of the complete acceptance of the known concept, carries no weight, since the term underlined, makes no effective distinction from the state of the art and in any case lies within the realm of routine variation.

5. The process outlined in claim 1 does not involve an inventive step. Claim 1, therefore, cannot be allowed under Article 52(1) EPC. There are no other claims before the Board, since the original claims 2 to 12 were deleted with the applicant's letter dated 7 May 1981 and have not been restored during appeal procedure (cf. letter dated 7 January 1983 paragraph 1 lines 4 to 6 and paragraph 12 lines 1 to 5).

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ORDER

It is decided

that the appeal against the decision of the Examining Division of the European Patent Office dated 14 September 1982, is dismissed.

The Registrar

*J. Rbe*

The Chairman

*J. Cadman*

*MA 9/9.83*

*Be 12.9.*