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Bezeichnung der Erfindung: Removal of hydrogen sulphide and carbonyl sulphide from gas stream
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : C01B3/16

ENTSCHEIDUNG / DECISION

vom / of / du 18 March 1986

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent / Titulaire du brevet : Air Products & Chemicals, Inc. (Respondent)

Einsprechender / Opponent / Opposant : Linde A.G. (Appellant)

Stichwort / Headword / Référence : gas purification / Air Products

EPÜ / EPC / CBE Art. 56,114(2), 123(2)(3) EPC

Inventive step -
Admissible explanatory amendment of claims.
New documents in appeal.

Leitsatz / Headnote / Sommaire

1. If a process has been performed successfully on a commercial scale for more than 20 years in spite of economic disadvantages associated with it, and the claimed invention provides a solution to the technical problem of avoiding such economic disadvantages, this supports a finding of inventive step.

2. An amendment to a claim to clarify an inconsistency does not contravene Art. 123(2) or (3) if the amended claim has the same meaning as the unamended claim, on its true construction in the context of the specification.

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3. The introduction of new grounds of opposition and new documents at the appeal stage of opposition proceedings may not be allowable, in the exercise of discretion under Art. 114(2), depending especially upon the degree of relevance and the lateness.

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Case Number: T 271 / 84

DECISION

of the Technical Board of Appeal 3.3.1

of 18 March 1986

Appellant: (Opponent)
Linde Aktiengesellschaft, Wiesbaden
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Representative:

Respondent: (Proprietor of the patent)
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office dated 8 October 1984 rejecting the opposition filed against European patent No. 16631 pursuant to Article 102(2) EPC

Composition of the Board:

Chairman: K. Jahn
Member: G. Szabo
Member: G. Paterson

I. Summary of Facts and Submissions

I. European patent No. 16 631 was granted on 16 February 1983 with 9 claims in response to the European patent application No. 80 300 826.7 filed on 19 March 1980 claiming the priority of the earlier application in the US of 19 March 1979. Claim 1 was worded as follows:

1. A process for removing hydrogen sulphide and carbonyl sulphide from a gas stream obtained by the gasification of coal or heavy hydrocarbon oil and containing inter alia hydrogen, carbon monoxide, carbon dioxide, hydrogen sulphide and carbonyl sulphide, characterised in that said process comprises the steps of washing said gas stream with a physical absorbent comprising an organic solvent containing absorbed CO_2 and H_2S in a first absorbent stage to remove substantially all of the hydrogen sulphide but not more than 65% (by volume) of the carbonyl sulphide in said gas stream; reacting the gas leaving said first absorption stage with water vapour in the presence of a sulphur resistant shift catalyst to convert at least part of the carbon monoxide therein into hydrogen and to hydrolyse the carbonyl sulphide to hydrogen sulphide; washing the remaining gas with said physical absorbent containing absorbed CO_2 in a second absorption stage to remove substantially all of the hydrogen sulphide therein; and washing

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the gas leaving said second absorption stage with said physical absorbent in a third absorption stage to absorb CO_2 therefrom, and wherein at least part of said physical absorbent passed from said third absorption stage through said second absorption stage and through said first absorption stage and is regenerated and returned to said third absorption stage.

II. The Opponents filed notice of opposition against the European patent on 9 November 1983, requesting that it be wholly revoked on the ground of non-patentability because of lack of inventive step. This ground of opposition was based upon the prior publication of a prospectus on the "Rectisol scrubbing process", issued in June 1973 (1), and DE-A-2 548 700(2).

III. The Opposition Division rejected the opposition in a decision of 8 October 1984. The reason for the rejection was that document (1) suggested a process in which virtually all of the carbonyl sulphide (COS) was removed from the gas, whilst document (2) recommended that the gas should first be subjected to a shift conversion and the COS-free product then treated with methanol to separate the components. Neither document described the partial removal of COS from the gas in the first absorbent stage and thereby a substantial reduction of the solvent requirement, and there was thus no justification in combining these documents to create a starting point for attacking the inventive step of the patent-in-suit. In view of the advantages derived from the claimed process, the attack upon the validity of the patent failed.

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During the opposition the Opponents also based an argument of lack of inventive step upon DE-A-1 567 696 (3) which was cited during the examination procedure, but this argument was rejected because document (3) refers only to chemical absorption of sulphur-containing gases and was thus considered to be hardly relevant to the claimed invention which is concerned with a physical absorption process.

IV. The Opponents filed an appeal on 12 November 1984 and paid the appeal fee at the same time, and submitted a Statement of Grounds on 8 February 1985. This Statement of Grounds referred to two new documents in support of the appeal, namely "Ullmanns Encyklopädie der Technischen Chemie", 4th Edition, Vol. 14, pages 426-427 ("Ullmann") (4) and LANDOLT-BÖRNSTEIN, 6th Edition, Vol. IV, Part 4/c, pages 5, 26, 27, 184, 185, 238, 255, 280, 281 and a diagram (5). An oral hearing was held on 18 March 1986.

V. The Appellants (Opponents) argued that it was known that hydrogen sulphide (H_2S) and COS could be converted into carbon dioxide (CO_2) and H_2S after the chemical absorption of H_2S - See document (3). The general applicability of the conversion reaction, irrespective whether this was carried out after physical or chemical separation steps, was confirmed by Ullmann (4). The removal of the remaining H_2S and CO_2 could then be effected by extraction with the suggested solvent according to (2). They also argued that the claim required that "substantially all of the hydrogen sulphide" (i.e. at least 99%) should be removed in the first absorbent stage. The requirement

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that no more than 65% of COS should be absorbed with "substantially all of the H_2S" (in the above sense) was in many instances an impossible condition, in view of calculations based on (5).

VI. The Respondents strongly emphasised that it was nowhere suggested in the cited documents to adjust the initial extraction in the manner claimed. The "Rectisol" method (1) removes essentially all of the sulphurous contaminants, and this requires a lot of solvent in view of the low solubility of COS. It was discovered by the patentees that the COS could be effectively converted provided that most of the H_2S had first been removed, and that it was not necessary to attempt to absorb all of the COS. The amount of solvent could be drastically reduced, and arranged counter-currently, i.e. solvent with some H_2S and CO_2 contents could be utilised. The cited documents together failed to disclose all such claimed features of the process.

At the invitation of the Board the Respondents submitted an amended Claim 1 in which the word "substantially" at column 10, line 1 was deleted and replaced by the words "the major portion but not", with consequential corresponding amendment at column 2, line 23 of the specification.

VII. The Respondents also raised strong objections against the admissibility of documents (4) and (5) filed by the Appellants together with the Statement of Grounds for the appeal. They argued that the purpose of the appeal process should be the reviewing of the decision

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at first instance and that the appeal process should not enable an opponent to present a revised case against the patent. The Opponents had had plenty of time within the nine month opposition period for submitting documents before the first instance, and the introduction of new documents at the appeal stage may cause a severe loss of time and money for the Patentee. The admission of such documents would be contrary to the purpose and spirit of the Convention with regard to opposition proceedings and could open the door for severe abuse; for example, the introduction of new documents at the appeal stage could render the whole of the first instance procedure irrelevant.

VIII. At the end of the hearing the Appellants requested that the decision under appeal be set aside and the patent be revoked. The Respondents requested that the appeal be dismissed and that the patent be maintained amended as submitted during the oral proceedings.

II. Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.

2. The amendment of the main claim raises no objections on formal grounds and is necessary to remove an inconsistency caused by the use of the same phrase "to remove substantially all of the hydrogen sulphide" in relation to both the first and the second absorption stages of the process (cf. column 10, lines 1 and 2, and lines 12 and 13). On its face the same phrase should mean the same thing in both parts of the claim.

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However, it is quite clear from the description of the claimed process that the phrase is not intended to mean the same thing in the first and second absorption stages. In the first stage only a major fraction or proportion is removed in view of equilibra imposed by the limits of COS removal and of the requirement of the catalyst (see column 3, lines 46-58 and column 4, lines 1-9), whereas in the second stage absorption could be adjusted to a virtually total removal. The amendment therefore does not broaden the claim because prior to amendment on its proper construction in the light of the above disclosure, which is in accordance with the Example at column 6, lines 36 and 62 which shows an 88% removal of H_2S in the first stage, the meaning of Claim 1 is as set out in the amended version. The amended Claim 1, therefore, complies with Articles 123(2) and (3) EPC. Moreover, the Appellants expressly agreed during the oral hearing that the proposed amendments were allowable and did not contravene Article 123.

3. As far as the admissibility of documents (4) and (5) is concerned (which were filed with the Statement of Grounds and therefore well outside the nine month period for opposition), these documents did not form the basis for a new attack on the patentability of the claimed process. Document (4) was accepted by the Respondents as being part of the common general knowledge, and discloses prior art techniques forming part of the background against which the claimed process should be assessed. Document (5) was used by the Appellants in support of an argument relating primarily to the scope of the claimed process.

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The arguments of the Respondent against their admissibility (see VII above) raised points of principle which were general in their nature, and it was made clear by the Respondents at the oral hearing that the admission of documents (4) and (5) in this case would not prejudice the Respondents unduly, nor could the Appellants' request for their admission be recognised as a major abuse of procedure.

Whilst the Board recognises that the raising of new grounds of opposition and the introduction of new documents after the expiry of the nine month opposition period might in certain cases be objectionable (depending especially upon the degree of relevance and the lateness), in the present case the Board decided during the oral hearing to admit documents (4) and (5) into the appeal having regard to what is set out above.

4. The argument that the claimed process is irreproducible and the claim unclear in its scope in view of the removal of a bit more than 65% of COS in the first extraction stage, when virtually all H_2S is taken up by various solvents, cannot be accepted. As already mentioned, the Example in the patent shows that the required rate of removal for H_2S could be as low as 88%. If this is permissible, the removal rate for COS stays below the maximum of 65%. In some cases this remains true even if the removal of H_2S is at a high level. The skilled person has scope for adjusting, for instance, the distribution coefficient and the pressure and the temperature, to obtain the results specified in the claim. Any uncertainty in this respect has in any case been clarified by the amendment of the main claim.

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5. The subject-matter of the patent concerns the purification of gas obtained by the gasification of coal and heavy hydrocarbon oil, and is concerned in particular with the removal of sulphurous contaminants. One commercially successful process of this kind is the "Rectisol" process (1), which is the closest state of the art document. This process first removes virtually all the sulphurous contaminants i.e. H_2S and COS, by extraction with adequate quantities of methanol and then treats the gas with steam in the presence of a catalyst to convert carbon monoxide (CO) into CO_2.

6. The technical problem in respect of the closest art was to improve the economy of the process by reducing the material and energy requirements corresponding to the use of large quantities of absorbent. The claimed solution to the problem adjusts the conditions of the first solvent extraction, i.e. volume proportions, temperature, pressure, so that only a major portion of H_2S is removed and no more than 65% of the COS. In addition, the COS in the gas is converted together with CO in the next stage with steam and a sulphur resistant shift catalyst. Furthermore, the resulting small amounts of H_2S and all the CO_2 are then counter-currently extracted with fresh solvent, which is then partly directly recycled to the first stage carrying its CO_2 and H_2S content. The combination of these conditions apparently enables the solvent flow to be considerably reduced and thus the energy requirements for pumping, in comparision with the closest relevant art (see column 1, line 32 to column 2, line 11 of the specification which was not

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challenged by the Appellants). It is clear that the technical problem has thereby been solved. In the absence of any document which discloses all the features of the claimed process, the claimed process is also novel. This was not in dispute.

7. As to the question of inventive step, the processes known in the art have either preferred to remove all sulphurous contaminants at once (cf. closest art (1)), or to treat first all the CO in a shift reaction before the removal of any "acid" impurities, i.e. H_2S and CO_2, with methanol or similar solvent (cf. (2) and also the orignal "Purisol" process described in US-A-3 505 784). The former technique requires excessive amounts of solvent to eliminate virtually all of the COS (i.e. down to less than 1ppm in (1)) before the shift conversion is applied to convert the considerable CO content, of the gas into CO_2. It seems that this process (in fact the Appellants' process) has been successfully applied on a commercial scale for more than 20 years before the priority date of the present application, in spite of its inherent inconvenience.

8. The alternative process described in (2) treats gas from a converter with a solvent in order to remove H_2S and CO_2, and presumably other impurities. The present invention follows neither the "Rectisol" process nor the latter "Purisol" process, but employs a specially adjusted extraction stage and, subsequently, a particular conversion technique, which are both different from those used in the earlier processes.

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The first modification departs from the practice to treat the sulphurous contaminants together, and rather attempts a partial separation which changes the proportion of these components. The second modification then converts CO together with the COS present in the gas in circumstances where the H_2S content is reduced but not completely eliminated. Although such joint conversion was known from Ullmann (4), the advantage of the described circumstances with regard to the H_2S in the gas, were not specifically foreshadowed (cf. column 1, lines 49-55). The partial separation of H_2S and COS before conversion was nowhere disclosed and the complete removal of H_2S with an alkaline, i.e. chemical absorbent (document (3)) could not act as an encouraging model for the much less perfect physical separation systems.

9. If anything, the two basic techniques represented by (1) and (2) were rather incompatible with each other, without any suggestion that a merger would represent any advantage, let alone the solution of the given technical problem. The time which has elapsed since these techniques, together with their apparent inconveniences, formed part of the state of the art confirms the impression that there was no reason to combine (1), (2) and (3). In particular, it appears that the Appellants were in full possession of all relevant state of the art knowledge for some years before the priority date of the European patent, and did not think of advancing from their Rectisol process to the claimed process in the way that they now allege to be obvious. The envisaged advantageous effect of saving costs through the reduction of solvent volumes

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and regeneration expenses was therefore not expected in the circumstances. As in mechanical cases, new chemcial engineering methods are often combinations of known elements, whose function can easily be deduced with ex post facto wisdom. None of the prior art documents showing individual aspects of the claimed process in any way indicated or envisaged its new effect, which solves the stated technical problem, i.e. the specific partial separation and the consequent reduction of solvent requirements. The subject-matter of Claim 1 and its dependent claims therefore involves an inventive step.

In view of the absence of objections from the Appellants to the suggested amendments to Claim 1 and their familiarity with the reasons of the amendment, the Board considers it unnecessary to allow time for the parties to state their observations under Rule 58(4) EPC (cf. Zeoliths/BASF/, T 219/83, 26.11.85, Headnote II, to be reported).

Order

For these reasons, it is decided that:

1. the decision under appeal is set aside;

2. the patent is maintained as amended in blue ink and presented during oral proceedings.

The Registrar

The Chairman