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D E C I S I O N
of 25 March 1998

Case Number: T 0692/94 - 3.3.5

Application Number: 88909030.4

Publication Number: 0368936

IPC: C09C 1/50

Language of the proceedings: EN

Title of invention:

Non-cylindrical reactor for carbon black production

Patentee:

Columbian Chemicals Company

Opponent:

Degussa AG, Frankfurt

Headword:

Carbon Black Reactor/COLUMBIAN CHEMICALS

Relevant legal provisions:

EPC Art. 54(1), 56

Keyword:

"Novelty and inventive step - yes"

Decisions cited:

T 0020/81, T 0219/83

Catchword:

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Boards of Appeal

Chambres de recours

Case Number: T 0692/94 - 3.3.5

D E C I S I O N
of the Technical Board of Appeal 3.3.5
of 25 March 1998

Appellant:
(Opponent)

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Representative:

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Respondent:
(Proprietor of the patent)

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Representative:

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Decision under appeal:

Interlocutory decision of the Opposition Division
of the European Patent Office posted 27 June 1994
concerning maintenance of European patent
No. 0 368 936 in amended form.

Composition of the Board:

Chairman: R. K. Spangenberg
Members: G. Dischinger-Höppler
J. H. van Moer

Summary of Facts and Submissions

I. This appeal is against the decision of the Opposition Division to maintain European patent No. 0 368 936 in amended form on the basis of amended Claims 1 and 5 submitted on 10 January 1994 and Claims 2 to 4 and 6 to 9 as granted.

Claim 1 reads as follows:

"1. Apparatus for the production of carbon black comprising:

means (12) for producing a flow of hot gas; a reaction chamber (14) having an inlet opening receiving the flow of hot gas and having an outlet opening so that the hot gas can flow through the reaction chamber, the reaction chamber having a cross section defining a cross-sectional flow area;

means (20) positioned between the inlet opening and the outlet opening of the reaction chamber (14) for introducing a plurality of feedstock hydrocarbon sprays into the reaction chamber substantially transversely to the hot gas flow to form a non-circular feedstock hydrocarbon spray pattern (46) at the cross-section of the reaction chamber; and characterized in that:

said reaction chamber (14) is of non-circular cross-section and is shaped, and said spray means (20) are positioned within the reaction chamber, such that the feedstock hydrocarbon spray pattern (46) formed extends substantially across the entire cross-sectional flow area of the reaction chamber and is not circular in cross-section so as to maximize coverage of the cross-sectional area of the hot gas flow by the feedstock hydrocarbon spray."

II. In view of the only relevant state of the art cited during the opposition proceedings, EP-A-0 136 629 (D1), the Opposition Division held that the subject-matter of Claim 1 was novel and was based on an inventive step. They considered that, by using the claimed reaction chamber, an improved admixture of hydrocarbon feedstock and hot gas was achieved which reduced the detrimental effects of insufficient admixture where void hot gas is present. D1 did not impart a corresponding teaching.

III. The Appellant's (Opponent's) arguments can be summarized as follows:

The term "generally cylindrical" used in D1 included non-circular cross-sections of the various zones in the reactor of D1. This also applied to the "frustoconical sidewall" of the mixing zone in D1, so that D1 covered conical mixing zones having non-circular cross-sections. Moreover, the above term included those well-known reactors which were lined with plain-cut fire-proof bricks and, hence, had a polygonal cross-section. In order to create novelty, the claimed reactor had, therefore, to be limited to the only specified embodiment with eight flat sides.

Concerning inventive step, the Appellant submitted that - during the opposition proceedings - he had provided good reasons to assume that, on the balance of probabilities, in an eight-sided reactor more impingement coke and refractory grit would be formed than in an essentially circular reactor. The main reason for this assumption was that due to the claimed maximum coverage of the cross-sectional area of the reactor by hydrocarbon spray the probability of contact between the feedstock hydrocarbon and the reactor walls was increased. Therefore, the alleged advantages of the

claimed apparatus were not credible. The onus of proof that these advantages were effectively achieved rested on the Patentee, who had failed to provide evidence such as comparative tests in view of the closest prior art. Reference was made to T 20/81.

- IV. The Respondent (Proprietor) pointed out that the Appellant had not presented a reasoned statement regarding novelty of the remaining features of Claim 1 of the main and auxiliary request. Hence, the Appellant had not set out full and reasoned arguments as to why the appeal should be allowed, so that the appeal was inadmissible. Anyway, D1 did not disclose a reaction chamber having a non-circular cross-section or comprising a plurality of flat sides. The term "cylinder" in its natural sense had the meaning of an elongate body with a constant circular cross-section. This was indubitably shown in the drawing of D1 and it was nowhere in the text or drawing of D1 even remotely suggested that the cross-section of the reactor may be anything other than generally circular.

Concerning inventive step, the Appellant had entirely failed to address the problem existing in a cylindrical reactor where portions of the hot gas flow remain void of feedstock hydrocarbon which is detrimental to the quality of the resulting carbon black, and the solution proposed by the patent in suit which was nowhere even remotely suggested in D1. With reference to T 219/83 (OJ, EPO, 1986, 211; reasons no. 12) the Respondent further concurred with the Opposition division's statement that in the present case the burden of proof lay with the Opponent.

- V. The Appellant requested that the decision under appeal be set aside and that the claims be restricted to the octagonal embodiment of the figures.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.

The Board is unable to agree with the Respondent's submission that, in order to be admissible, the Appellant must present a statement regarding all aspects of patentability. In respect of admissibility it is sufficient for the Appellant to submit a statement which supports, in his view, his request. In the Board's judgement, the statement of grounds does so at least in respect of the alleged lack of inventive step.

2. The Board concurs with the finding in the decision under appeal that the claims as amended are not open to objection under Article 123(2) and (3) EPC. This finding was not in dispute during the appeal and opposition proceedings.

3. *Novelty*

In the Board's judgement, D1 does not disclose the characterizing portion of Claim 1 with the result that the requirement of Article 54 EPC is met. The claimed apparatus is characterized by the following two features:

- (1) that the reaction chamber is of non-circular cross-section and

(2) that the shaping of the reaction chamber and the arrangement of the spray means are such that coverage of the cross-sectional area of the gas flow by hydrocarbon is maximised.

3.1 Concerning the first feature, the Board agrees with the Respondent in that in the English language (as well as in the German language used by the Appellant) the term "cylinder", when used in a technical, not purely mathematical, context, usually denotes a circular cylinder. Any other cross-section of the cylinder would have to be specifically mentioned. More important is, however, that the only figure of D1 is drawn in a manner to show all parts of the reactor with a circular cross-section and that in the description these parts are disclosed to be "annular", "generally annular" or "generally circular" (see e.g. page 4, lines 11, 27 and 35 and page 8, lines 17/18). The Board considers, in the Appellant's favour, that it is well-known in the art to line the reaction chamber with fire-proof material such as shaped bricks as asserted by the Appellant, castable refractories or insulating cement. This may, therefore, also be true for the reactor of D1 wherein the sidewalls of all zones (combustion zone, mixing zone and pyrolysis zone) are formed from refractory material (see page 4, lines 9 to 14, page 5, lines 18/19 and page 7, lines 34/35). However, the Appellant failed to show that any such lining would necessarily lead to a non-circular or even polygonal cross-section, or that D1 suggests that the geometric form of the cross-section of any zone of the reactor might be anything other than circular. Moreover, the assertion that conventional brick-lined reactors were of non-circular cross-section has not been supported by evidence. The term "generally" as used in the context of D1 must, therefore, be taken to denote merely those deviations from the precise circular form which are due to the constructional imperfections usually obtained in

the respective technical field. By contrast, the Board is satisfied that the term "non-circular" as used in the claims and description and as represented in the figures of the patent in suit, clearly denotes a cross-section which is not "generally" circular in the above sense.

- 3.2 The second characterizing feature mentioned in point 3 above is nowhere explicitly or implicitly disclosed in D1, nor is the Board aware of any reason why such a feature should be necessarily present in the prior art reactor design. This was not disputed by the Appellant, who did not provide any arguments in this respect.

4. *Inventive step*

- 4.1 The patent in suit relates to an apparatus for producing carbon black wherein means for introducing feedstock hydrocarbon sprays are positioned between the inlet and the outlet of a reaction chamber so as to form a non-circular spray pattern transversely to a hot gas flow which flows through said reaction chamber from said inlet to said outlet (first part of Claim 1).

According to column 1, lines 52/53 and column 3, lines 8/9 of the patent in suit, prior art carbon black reactors usually had cylindrical reaction chambers with a circular cross-section. Two main problems are said to exist in such prior art reactors:

- (a) The feedstock hydrocarbon which is introduced through the walls of the reaction chamber tends to impinge on the inner surface of the cylindrical reaction chamber around the point of introduction of the hydrocarbon feed with the undesirable effect of formation of refractory grit and impingement coke (see column 2, lines 13 to 58);

(b) Void hot gas (ie hot gas which remains void of feedstock hydrocarbon) is present in the reactor and increases the flame length with the detrimental effect of over-pyrolysing some of the feedstock and thereby broadening the particle size distribution of the carbon black product (see column 3, lines 1 to 31).

4.2 The patent in suit seeks to overcome said problems and proposes as a solution a reactor wherein the cross-section of the reaction chamber is non-circular such that the flow of hot gas has a cross-section which conforms substantially to the non-circular cross-section of the spray pattern formed by accordingly arranged spray means, so as to maximise coverage of the cross-sectional area of the hot gas flow by the hydrocarbon spray (see column 3, lines 41 to 54).

4.3 The patent in suit does not contain any examples to show whether the above effects have actually been obtained, but as a support there exist various indications of plausibility in the specification (column 2, line 13 to column 3, line 31 and column 4, lines 9 to 44). By contrast, the Appellant's allegation that the claimed subject-matter did not solve the problem of impingement since the claimed maximum coverage of the cross-section of the reaction chamber by hydrocarbon feed would increase the contact with the walls of the chamber, is in the Board's judgement not convincing, because it does not take into consideration further possible influences, such as e.g. differences in the flow patterns and turbulence in the differently designed reactors.

Decision T 20/81 (OJ EPO 1982, 217) cited by the Appellant is not relevant since, in the present case, the Board is satisfied that in view of the indications of plausibility mentioned above, there is no reason to believe that the stated problem is not solved by the claimed reactor and no reason to demand further proof, e.g. experiments, from the Respondent.

4.4 The cited prior art is totally silent about the coverage of the cross-sectional area of the gas flow by hydrocarbon spray and its advantages. On the contrary, D1 which is primarily concerned with reactors of greater economy and flexibility of operation, suggests a variety of methods for introducing the feedstock hydrocarbon, inter alia by injection ports, spray nozzles or as a coherent stream (see page 5, line 18 to page 6, line 29), but without realizing that there could be a relationship between void hot gas and the flame length or, respectively, the particle size distribution. As a consequence, it is not obvious in the light of D1 to avoid the presence of void hot gas by adapting the geometry of the cross-section to that of the spray pattern.

5. Claim 1 therefore meets the requirements of the EPC.

Claims 2 to 9 relate to specific embodiments of Claim 1. Their subject-matter derives its patentability from that of Claim 1.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:



S. Hue

The Chairman:



R. Spangenberg

