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Bezeichnung der Erfindung: Coal gasification plant

Title of invention:

Titre de l'invention :

**ENTSCHEIDUNG / DECISION**

vom / of / du 12 June 1984

Anmelder/Patentinhaber:

Applicant/Proprietor of the patent:

British Gas Corporation

Demandeur/Titulaire du brevet :

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Art.52(1),56

"Inventive Step"

Leitsatz / Headnote / Sommaire

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Case Number: T 109 / 83

**DECISION**  
of the Technical Board of Appeal 3.3.1  
of 12 June 1984

**Appellant:**  
(Proprietor of the patent)

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**Representative:**

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(Opponent)

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**Decision under appeal:**

Decision of the Opposition Division of the European Patent  
Office dated 5 July 1983 revoking European patent  
N° 8847 pursuant to Article 102(1) EPC

**Composition of the Board:**

Chairman: D. Cadman

Member: G. Szabo

Member: L. Gotti Porcinari

Summary of Facts and Submissions

- I. European Patent No. 8847 (Application No. 79 301 103.2) was revoked by the decision of the Opposition Division of the European Patent Office dated 5 July 1983. The decision was based on claims 1 to 3 of which the main claim was worded as follows:

"1. A coal slagging gasifier comprising: a gasifying vessel, means for introducing coal into said vessel for gasification thereof in said vessel, means for introducing oxygen and steam into said vessel to effect gasification of coal therein and a hearth located at the bottom of said vessel and including a liquid cooled slag tap member having a slag removal orifice located centrally within said hearth for removing slag from the vessel; characterised in that said hearth further includes a removable liquid cooled annular hearth member located above said slag tap member with the openings of said slag tap member and said annular hearth member in vertical alignment for discharge of slag therethrough."

- II. The reason for the revocation was that the subject-matter of the claims was lacking an inventive step. The problem was to improve the resistance of the slag tap and hearth of the gasifier against aggressive corrosion and thermal attack by the molten slag. The solution of the problem involved a removable liquid cooled annular hearth member located above the slag tap member of the gasifier in a vertical alignment therewith. The most relevant prior art was known from DE-C-1 207 350 (1). The cited document described a furnace comprising also a removable liquid cooled annular hearth member located above the melt tap

member. Since the process which is carried out in the apparatus described in (1) is not only applicable to general melting furnaces but also to coal slagging gasifiers the transfer of the additional liquid cooled annular hearth member to a coal slagging gasifier must have been obvious to the skilled practitioner.

III. The patentee entered an appeal against the decision on the 11 July 1983 with a payment of the fee and filed a Statement of Grounds within the prescribed time limit. The respondent, i.e. the opponent, filed his reply within the time provided. At the oral proceedings on 17 April 1984 before the Board, the appellants submitted a new main claim. This was subsequently amended by corrections of editorial character in a letter dated the 26th April 1984, and now reads as follows:

"1. A coal slagging gasifier comprising: a gasifying vessel (10), means (12) for introducing coal into said vessel for gasification thereof in said vessel, means (16) for introducing oxygen and steam into said vessel to effect gasification of coal therein, and a hearth (18) which slopes downwardly at the bottom of said vessel towards a liquid cooled slag tap member (20) having a slag removal orifice located centrally within said hearth for removing slag from the vessel, capable of maintaining a pool of molten slag and iron in the hearth by directing hot combustion products from a burner (60) located beneath the slag tap orifice up the tap orifice to retain the pool of slag and iron in the hearth, the tapping of the molten slag and iron being initiated and controlled by stopping or reducing the burner output and reducing the pressure in a quenching chamber (24) by controlled venting through its venting system so as to produce a differential

pressure between the quenching chamber and the gasifier vessel, characterised in that the said hearth (18) further includes a removable liquid cooled annular dish-shaped hearth member (40) located above said slag tap member (20) with the openings (71) (72) of said slag tap member and said annular hearth member in vertical alignment for discharge of slag therethrough, both the slag tap member (20) and the annular hearth member (40) being formed of copper or copper and alloyed metal and having interally coiled passageways (51), (67) for the flow of a liquid-coolant there-through from associated inlet pipes (52), (68) to associated outlet pipes (54), (69) in order that the exposed surfaces are cooled efficiently to maintain acceptable surface temperatures."

IV. The appellants argued in their submissions and during the oral proceedings substantially as follows:

- (a) The teaching represented by the cited art is unrelated to the objectives of the invention claimed in the patent under appeal. The skilled person could not possibly arrive at the specific design of the claimed slagging gasifier from citation (1) for overcoming the particular problems associated therewith. The upward pointing overflow in the document is intended to maintain a steady pool of liquid melt. The essentially continuous removal of this melt is aided by a jet or stream of liquid or gas in order to produce a suction effect and to granulate the material. The pool of molten slag and iron is, on the other hand, maintained in the gasifier by hot combustion products

from a burner underneath and by control of pressure, and the periodical discharge is initiated by reducing the burner output and pressure.

- (b) No modification of the cited art (1) in the direction of the invention could have been envisaged, since both furnaces and gasifiers would have become functionally inoperative without the upward pointing overflow and stream of fluid to provide the drag for the removal of material. The suggested additional cooled member above the slag tap is not exposed to aggressive corrosion, and is rather surrounded by solidified melt according to Figure 1 of the cited document.
- (c) The problems associated with a modern slagging pressure gasifier are illustrated by the publication submitted by the appellant (Research Communication GC 112 by The Gas Council) and also by GB-B-977 122. Essentially such gasifiers include a burner which provides a jet of flame directed upwardly into the slag outlet pressure to maintain the slag in a sufficiently fluid condition. The walls of the hearth located at the lower end of the operator were normally formed of refractory material, carbon tiles and alumina. In spite of the fact that the bottom arrangement was made funnel shaped in order to facilitate the removal of molten iron, the slag tap suffered extensive corrosion although it had been cooled. The replacement of refractory parts in the immediate area around the slag tap with an annular hearth member, constructed of high conductivity material such as copper, with proper cooling to achieve an appropriate surface temperature in this area made

all the difference to the result, which was a substantially improved resistance to the corrosive and erosive effects experienced beforehand. The main claim is now limited by all features which are necessary for the purpose.

V. The respondent submitted substantially the following arguments:

- (a) The person skilled in the art would be aware of the consequences of molten slag in a gasifier. Whether or not the removal of this is achieved through the manipulation of pressure from the quenching chamber or by the sucking action of a fluid stream, is irrelevant. Both methods were well known. The cited document (1) makes it clear that the suggested process is suitable for the removal of all kinds of molten materials and its teachings are applicable to gas producing equipment (see also Prospectus "Über den Schlackenbad-generator", 1958, submitted in the opposition proceedings).
- (b) The patentee has overlooked that in the furnace described in document (1) there is provided a second water-cooled component in a vertical alignment, in addition and above the other water-cooled ring in the tap channel. This is equivalent to the hearth member in the patent under attack. The cited process aims also at the control of a corrosive slag. The decision of the Opposition Division made it clear that no patent would have been granted, had the newly cited art been taken into consideration.

- VI. The appellant requested that the decision of the Opposition Division be set aside and the patent be reinstated. The respondents requested the unconditional confirmation of the decision of the lower instance and that an intermediate communication should be issued in the case. At the oral hearings the respondents were unrepresented.

#### The Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is, therefore, admissible.
2. The present version of the claims cannot be objected to on formal grounds. The features of the preamble of the main claim takes due account of the relevant parts of the coal slagging gasifier to be improved and the characterising statement now includes all the necessary features of the modification thereof. All integers have support in the disclosure or drawings, and none of the amendments extends the protection conferred by the granted patent.
3. The problem with which the invention was concerned was to reduce the severe effect of molten slag and iron in consequence of aggressive erosion, corrosion and thermal attack to the slag tap area in a coal slagging gasifier. The solution of the problem involves the disposition of a removable dish shaped annular hearth member made of copper or copper alloy, which provides efficient cooling and is also vertically aligned with the slag tap orifice.

4. The claimed arrangement distinguishes the gasifier from those closest in the cited art (cf. GB-977 122(2) or Report (3) (see Figs. 5(c) and (d)) in as much as the component being above and around the slag tap member is selected to be of a highly conductive material such as "copper or copper and alloyed metal", whilst refractory material, e.g. ceramic tiles, were employed beforehand. In addition, the annular hearth member to be constructed is dish-shaped in the tap and its central opening leading to the slag tap shows a substantially vertical alignment. Contrary to this, the arrangements in the state of the art show a preference for a funnel shaped gradual slope towards the central orifice. It is assumed that the above characteristics of shape and arrangement also contribute to the result achieved, which is the substantial reduction of undesirable damage to the area caused by the action of the molten slag and iron between and during the intermittent discharges of the material through the tap orifice. No citation recommended the use of metal to protect the area, let alone the incorporation of copper which is neither the hardest of metals nor one with a very high melting point. No particular advantage with regard to corrosion resistance under the conditions prevailing in the gasifier could therefore be expected.
5. The teaching of DE-B-1 207 350 (1) relates to the removal and the granulation of the continuously overflowing molten iron by using a jet or stream of fluid which is introduced in the tap orifice to drag the material downwardly. The fluid may also serve to cool the nozzle member. According to the same document there can also be provided an additional overflow member which is cooled and disposed above and around the

nozzle member. This member is, however, protruding upwards in order to maintain permanently a pool of metal around it. It is, apparently, normally lined on the outside with a solidified melt which has gradually accumulated around it from the pool (s. Fig. 1).

6. Although the above plant and process is also suggested to be suitable for gas production, a similar equipment with permanent overflow would in the first place be envisaged, in accordance with the teaching of the document. Any further modification to convert the equipment into a coal slagging gasifier which is controlled at the orifice with a burner and by pressure from the quenching chamber, would necessarily change the shape and function of the overflow member. The protruding shape would have to be abandoned and the member would be exposed to intermittent discharge of the slag and iron without allowing the formation of a layer of deposited material on its surface.
7. There are no reasons on the basis of the prior art, or implied by the problem to be solved, which would have pointed towards the particular shape and arrangement represented by the annular hearth member as it is now defined in the claim. Whilst refractory tiles in this area were cooled to prevent overheating, the efficient cooling of components made of high conductivity metals requires additional capabilities in this respect and the substantially increased removal of heat from the slag and metal in the gasifier must have created new conditions on the surfaces in contact with the erosive material. Thus the beneficial effect of using an additional component made of cupric material and shaped in

a way defined in the claim, must have been unexpected and the combination therefore unobvious in the light of the state of the art.

8. The respondents requested that the Board should issue a preliminary or intermediate communication before deciding the case. Although the procedure before the Boards of Appeal is intended to be a written procedure, the Board itself would only issue communications if its views differed from those held by any of the participating parties, i.e. it comprised new aspects and another interpretation of the situation. In addition, the Board is bound to grant the opportunity to have an oral hearing, if requested by any of the parties which would be adversely effected if a decision were to be taken before such hearing. Both parties were invited to the oral hearing requested by the appellants and had thereby the opportunity to influence the proceedings and the views of the Board. Neither was the Board in a position to commit itself to the views of either party before the hearing, nor did it intend to introduce new aspects in the dispute on its own initiative. There was therefore no good reason to issue a communication beforehand. The non-appearance on the part of the respondents cannot be allowed to hinder or delay the proceedings or prevent the reinstatement of the revoked patent with appropriately amended claims.

#### Order

It is decided that

1. The decision of the Opposition Division dated 5 July 1983 is set aside.
2. The case is remitted to the first instance to reissue the European Patent in an amended form on the basis of the following documents:

(1) Description:

column 1, lines 44 to 60 being replaced by corresponding new texts submitted on 17 April 1984 in the oral proceedings and distributed to the parties on 19 April 1984, with minor editorial corrections suggested in the attachment to the letter of 26 April 1984 by the appellant, and by appropriate translations;

column 2, lines 33 to 35 being deleted.

(2) Claims:

Nos. 1 to 3 being replaced by those submitted on 17 April 1984 in the oral proceedings, and distributed to the parties on 19 April 1984, with minor editorial corrections suggested in attachment to the letter of 26 April 1984 by the appellant, and by appropriate translations.

Registrar:

Chairman:

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