BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Internal distribution code:
(A) [ ] Publication in OJ
(B) [ ] To Chairmen and Members
(C) [X] To Chairmen

D E C I S I O N
of 6 April 2000

Case Number: T 0437/97 - 3.2.3

Application Number: 88312270.7

Publication Number: 0335042

IPC: F27D 9/00, F27D 1/12, F27D 1/18, C21B 7/10

Language of the proceedings: EN

Title of invention:
Improved cooling system and method for molten material handling vessels

Patentee:
UCAR Carbon Technology Corporation

Opponent:
Fuchs Systemtechnik GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty - yes"
"Inventive step - yes"

Decisions cited:
-

Catchword:
-

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0437/97 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 6 April 2000

Appellant: (Opponent)
UCAR Carbon Technology Corporation
39 Old Ridgebury Road
Danbury
Connecticut 06817-001 (US)

Representative:
Gore, Peter Manson
W.P. THOMPSON & CO.
Coopers Building
Church Street
Liverpool LI 3AB (GB)

Respondent: (Proprietor of the patent)
Fuchs Systemtechnik GmbH
Reithallenstrasse 1
D-77731 Willstätt (DE)

Representative:
Koepe, Gerd L., Dipl.-Chem.
Blumbach, Kramer & Partner GbR
Patentanwälte
Radeckestrasse 43
D-81245 München (DE)

Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office of 22 January 1997, posted on 27 February 1997, concerning maintenance of European patent No. 0 335 042 in amended form.**

Composition of the Board:

Chairman: C. T. Wilson
Members: H. Andrä
M. K. S. Aúz Castro

Summary of Facts and Submissions

I. European patent No. 0 335 042 was granted on 15 December 1993 on the basis of European patent application No. 88 312 270.7.

II. The patent was opposed by the respondent on the grounds of lack of novelty and of inventive step of its subject-matter with respect to the prior art reflected by the following documents:

(D1) EP-B1-0 197 137

(D2) EP-A-0 044 512.

III. In its decision given at the oral proceedings on 22 January 1997 and issued in writing on 27 February 1997, the Opposition Division maintained the patent in amended form on the basis of claims 1 to 7 according to the second auxiliary request filed on 22 January 1997.

IV. An appeal was filed against this decision by the appellant (patentee) on 22 April 1997 the appeal fee being paid on the same day. The statement of grounds of appeal was filed on 24 June 1997.

V. In a communication dated 2 July 1998 the Board set out its provisional opinion that claims 1 and 7 according to both the main request received on 8 January 1996 and the auxiliary request submitted at the oral proceedings on 22 January 1997 as "first auxiliary request" appeared to comply with the requirements of Article 123(2) and (3) EPC and of Article 54 EPC.

Furthermore, it was set out in the communication that the furnace cooling system known from (D1) seemed to teach in a different direction as compared to that according to claims 1 and 7 of the main and the auxiliary requests.

VI. The appellant requested that the decision under appeal be set aside and the patent be maintained on the basis of claims 1 to 16 according to the main request submitted on 12 February 2000, subsidiarily according to the first auxiliary request, or according to the second auxiliary request both submitted on 11 January 2000.

The independent claims 1, 7, 10 and 13 according to the main request read as follows:

"1. An electric arc melt furnace for handling a heated substance, the furnace having fluid cooled containment means which comprise inner and outer walls defining a space therebetween; the walls of the containment means being substantially gas tight, inlet means for bringing pressurized liquid coolant to spray means within the space for spraying the coolant against the inner wall to maintain a desired temperature at the inner wall; outlet means for removing the spent liquid coolant; and pressure differential means comprising means for injecting a pressurised gas into the space for maintaining the space at a pressure above 101.33 kPa (one atmosphere) and below that of the pressurized liquid coolant and for maintaining a controlled pressure differential between the space and the coolant outlet sufficient to force the spent liquid coolant out of the space through the outlet means to minimize the amount of coolant standing in the space."

"7. A fluid cooled cover for an electric arc melt furnace which comprises substantially gas tight inner and outer walls defining an interior space therebetween; an inlet into the interior space for a pressurized liquid coolant; inlet means for bringing coolant to spray means within the interior space for spraying the coolant against the inner wall to cool the wall; outlet means for removing the spent coolant; and pressure differential means comprising means for injecting a gas into the space for maintaining the interior space at a pressure above 101.33 kPa (one atmosphere) and between that of the pressurized liquid coolant and of the spent coolant at the outlet means to force the spent liquid coolant out of the interior space through the outlet means."

"10. A roof for a metallurgical electric arc melt furnace which comprises inner and outer walls defining an interior space therebetween, means in the roof interior for spraying a pressurized liquid coolant against the inner wall to provide cooling and maintain the inner wall at a desired temperature; a pair of coolant outlets to permit draining of spent liquid coolant from the inner wall; means for maintaining a pressure differential between the roof interior and the coolant outlets comprising means for injecting a gas into the roof interior to force the spent liquid coolant out of the roof interior through the coolant outlets; means for sensing tilting of the roof and elevation of one of the coolant outlets relative to the other of the coolant outlets; and means for selectively closing one of the coolant outlets responsive to the tilt sensing means and the elevation of the one of the coolant outlets above the other of the coolant outlets."

"13. A method of cooling an electric arc melt furnace for handling a heated substance, the furnace including liquid cooled containment means comprising inner and outer walls defining a space therebetween and an inlet and outlet in the space for the liquid coolant, which comprises:

(a) injecting a pressurized liquid coolant through the inlet into spray means for spraying the coolant against the inner wall to maintain a desired temperature at the inner wall, and

(b) injecting a gas into the space for maintaining the space at a pressure above 101.33 kPa (one atmosphere) and below that of the pressurized coolant, and for maintaining a pressure differential intermediate the pressure of the pressurized liquid coolant and the pressure of spent coolant at the coolant outlet to force spent liquid coolant out of the space through the outlet."

VII. The appellant's arguments can be summarised as follows:

In the electric arc melt furnace known from (D2) a pump (5) is provided which draws off the majority of the saturated steam from the enclosed chamber. The cooling system operates either "at atmospheric pressure" or "slightly above atmospheric pressure". Thus coolant condensing in the chamber passes primarily under gravity through the outlet in the bottom of the chamber. Coolant in the form of saturated steam is necessarily drawn out of the chamber by the pump (5), the pressure "slightly above atmospheric" being clearly insufficient by itself to evacuate the chamber as is

required by the pressure differential means according to the patent sufficient to force out the liquid coolant.

The subject-matter of claim 1 and of claim 7, respectively, according to the main request is therefore novel over the disclosure of (D2).

(D2) relies upon cooling due to latent heat of evaporation whereas the apparatus of claim 1 and claim 7, respectively, solely sprays liquid coolant which absorbs the heat before being forced out of the chamber.

It is readily apparent that gas issuing from the nozzles (3) is purely for atomisation purposes and not for pressurisation of the chamber. This is supported by the gravity feed location of the outlet in the bottom of the chamber and the need for the evacuation pump (5).

For these reasons, in claims 1 and 7 inventive merit is also present as compared to (D2).

VIII. The respondent (opponent) requested that the appeal be dismissed. The respondent's arguments in respect of the main request were essentially as follows:

The features of the independent claim underlying the wording "...for maintaining a controlled pressure differential..." and "...to minimize the amount of coolant standing in the space" have not been disclosed in the application as originally filed.

The independent claim therefore infringes

Article 123(2) EPC.

Furthermore, the substitution of the term "an electric arc melt furnace" for the term "a vessel" constitutes an extension of the protection conferred contrary to Article 123(3) EPC since an electric arc melt furnace consists not only of a vessel and a cover but of a great number of further components such as electrodes, electrode holders and supporting beams, exhaust gas ducts, etc., containing partly also water-cooled elements.

The device known from (D2) comprises all the structural features indicated in claims 1 and 7 and is appropriate for carrying out all the process steps contained in the claims. These claims therefore lack novelty.

Furthermore, (D1) discloses an electric arc melt furnace having spray cooling means. Liquid coolant is removed from the cooling chamber by means of a pressure difference. The cooling chamber into which the coolant is sprayed is therefore maintained at a higher pressure level than the coolant outlet. It is clear for the skilled person that instead of a suction pump at the chamber outlet a pressure pump at the chamber inlet can be applied. According to (D1) also air mist nozzles, that is nozzles operating with pressurised air are proposed.

It is also known from (D2) to operate the cooling chamber with a pressure above one bar. This pressure is generated by supplying gas, in particular air, and leads to an ejection of the coolant from the bottom of the cooling chamber.

Claims 1 and 7, therefore, lack an inventive step.

Reasons for the Decision

1. The appeal is admissible.

2. *Main request*

2.1 Article 123(2) and (3) EPC

2.1.1 Claim 1 is supported essentially by original claims 1 to 4. The feature in claim 1 that the vessel is an electric arc melt furnace derives from page 3, last paragraph, of the original description. The substitution of "liquid coolant" for "fluid coolant" in claim 1 derives from the passage bridging pages 2 and 3, from page 3, paragraph 2, from page 4, paragraph 1, and from page 6, paragraph 2, of the original description.

Having regard to the wording "...maintaining a controlled pressure differential..." and "...to minimize the amount of coolant standing in the space" objected to by the respondent in view of the original disclosure, reference is made to the following wording in the passage from page 13, line 24, to page 14, line 15, of the original description:

"Spent coolant should be drained as quickly as possible so that there is a minimum of standing coolant over the lower wall 38...".

"So that the spent coolant may be quickly removed and drained from the interior 23 of roof 10, there is

provided a means for establishing and maintaining a pressure differential between the interior of the furnace roof and the coolant outlet. As used herein, this "means for maintaining a pressure differential" refers to and comprises a system wherein a gaseous medium is injected into and pressurizes the space above the sprayed coolant to force the coolant out of the roof drain."

As already outlined in the Board's communication dated 2 July 1998 the above-cited passage discloses that pressure differential means is provided comprising means for injecting a gaseous medium into the space to be cooled for establishing and maintaining a pressure differential between the space and the coolant outlet. It is self-evident that the measure of establishing and maintaining a pressure differential requires an appropriate process step and means to control this differential. On page 14, lines 7 to 15, of the cited passage the context between the maintenance of a controlled pressure differential in the space and its outlet and a quick removal of the spent coolant, that is the achievement of a minimum of coolant standing in the space is outlined.

Thus, the features relating to the maintenance of a controlled pressure differential and a minimisation of the amount of coolant in the space are - contrary to the respondent's statement - clearly supported by the original application.

The remaining independent claims 7, 10 and 13 are supported essentially by original claims 10 and 11 (claim 7), by original claims 14 and 15 (claim 10) and by original claims 19 to 21 (claim 13). Having regard

to the terms "liquid coolant" in claims 7, 10 and 13 and to the term "electric arc melt furnace" in claims 2 to 7, 10 and 13, reference is made to the observations appertaining to claim 1.

It follows that the amendments made in the claims comply with the requirement of Article 123(2) EPC.

2.1.2 All the features of claims 1, 7, 10 and 13 added to the respective independent claim as granted lead to a limitation of the scope of protection. This applies also to the issue relating to the substitution of the term "an electric arc melt furnace" for the term "a vessel".

Whilst the respondent is correct in stating that an electric arc melt furnace does not only consist of a vessel and a cover, but comprises additionally a multiplicity of the further parts such as electrodes, electrode holders and supporting beams, exhaust gas ducts, etc., containing partly also water-cooled elements, it is pointed out that the term "vessel for handling a heated substance" comprises any containment which is suitable for handling a heated substance whatever the structure of the vessel may be or whatever additional equipment the vessel may dispose of. The term "electric arc melt furnace for handling a heated substance" relates to a particular containment which besides being suitable for handling a heated substance is defined to comprise all the equipment typical of an electric arc melt furnace. Therefore, the term "electric arc melt furnace" has to be construed more limited than the term "vessel".

Thus, the amendments introduced into the claims comply

also with the requirement of Article 123(3) EPC.

2.2 Novelty

2.2.1 In the letter dated 22 October 1997 the respondent set out that the subject-matter of claim 1 and claim 7, respectively, was not novel in view of (D2).

As outlined already in the Board's communication dated 2 July 1998, claim 1 stipulates that the space between the walls of the furnace containment means is maintained at a pressure $P_{enclosed\ space}$ which is above 101.33 kPa (one atmosphere), and that this pressure is below the value of the pressurised liquid coolant $P_{pressurised\ coolant}$ and above the pressure of the spent liquid coolant $P_{coolant\ outlet.}$ Due to the difference between the pressure of the injected liquid coolant and the pressure of the enclosed space it follows that the pressurised liquid coolant and the pressurised gas are injected into the space through separate ducts which applies both to claim 1 and to claim 7.

(D2) describes an apparatus and a method of cooling containment components of a metallurgical furnace, in particular an electric arc furnace. The apparatus comprises spray means in the form of spray nozzles (3) extending into an enclosed space to be cooled for spraying the cooling liquid as droplets against an inner plate (2) of the space. Means (22, 5, 9) for evacuating the spent coolant as saturated vapour and condensed liquid, respectively, are provided, the system operating at normal pressure or at a pressure slightly above one bar. The coolant is led from coolant pressure container (18) through ducts (19) to the spray nozzles (3), no means for injecting a pressurised gas

into the space between the inner and outer containment walls being disclosed. It must therefore be concluded that in the case of system operation slightly above one bar this pressure is generated by injection of the pressurised coolant through the spray nozzles (3).

(D2) does not, therefore, disclose the injection both of pressurised liquid coolant and of pressurised gas into the space between the inner and outer containment walls, let alone the injection of coolant and gas through separate ducts and under the pressure relations indicated in claim 1. This conclusion applies also to claim 7 which likewise incorporates the above-cited features relating to the injection of pressurised liquid coolant and gas.

2.2.2 (D1) describes a method of and an apparatus for liquid phase cooling of a vessel, a furnace or a component thereof having an outer plate and an inner plate which define an enclosed space therebetween wherein a liquid coolant in the form of droplets is sprayed against the inner plate to be cooled and the coolant is removed while still substantially in its liquid form thereby preventing undesired build-up of coolant on the inner plate. The liquid coolant is removed from the enclosed space by pump means positioned downstream of the enclosed space which creates a low pressure in the enclosed space whereby the chance of coolant leaking into the furnace is reduced.

Similar to the disclosure of (D2), the furnace cooling system known from (D1) does not describe the feature that pressure differential means is provided comprising means for injecting a pressurised gas into the enclosed space for maintaining the space at a pressure above one

atmosphere and below that of the pressurized liquid coolant.

2.2.3 Claims 1 and 7, respectively, are therefore novel (Article 54 EPC).

2.3 Inventive step

2.3.1 The respondent argues that with regard to the disclosure of (D1) the subject-matter of claim 1 and claim 7, respectively, does not involve an inventive step.

As already set out in section 2.2.2 above, in the system described in (D1) liquid coolant sprayed against the plate to be cooled is removed from the enclosed space by pump means located downstream of the enclosed space creating a low pressure in the enclosed space.

As explained repeatedly in (D1)(see e.g. claim 1; column 2, line 55 to column 3, line 2, column 3, lines 19 to 26) a spray of liquid coolant in the form of droplets is directed against the plate to be cooled. Contrary to the respondent's opinion there is no hint in (D1) of injecting a pressurised gas into the enclosed space as required by claims 1 and 7, respectively, of the patent in suit.

The following is pointed out in column 10, lines 4 to 15 of (D1):

"The pump in the test facility comprises a venturi through which waste water from another area of the furnace is caused to flow, producing a low pressure in the scavenger system to evacuate the cooling fluid from

the coolant space. Operation of the pump is essential to successful operation of the invention, since in the absence of the pump the volume of water in the cooling space becomes unmanageable."

From the above passage it derives clearly that generation of a low pressure in the scavenger system of the space to be cooled is indispensable to the known system.

The suggestion of the respondent that it is clear for the skilled person that instead of a suction pump at the chamber outlet a pressure pump at the chamber inlet can be applied, cannot be followed by the Board. In a suction pump scavenger system the outlet pipe downstream of the enclosed space is an essential component, failure of which for example caused by leaks will impair the operation of the system. Furthermore, the arrangement of means for injecting a pressurised gas into the enclosed space enables an appropriate positioning of the gas injection means in the sense of achieving the sought-after pushing effect. In contrast to this concept, the operation of a suction pump in the outlet duct of the enclosed space leads to uniform pressure reduction in this space without the possibility of achieving such a locally enhanced pushing effect.

It follows that (D1) teaches in a direction which leads away from the subject-matter of claims 1 and 7, respectively.

2.3.2 The respondent states that it is known from (D2) to operate the cooling chamber with a pressure above one bar and that this pressure is generated by supplying

gas and leads to an ejection of the coolant from the bottom of the cooling chamber.

As pointed out already in section 2.2.1 above, in the system known from (D2) the coolant is led from coolant pressure container (18) to the spray nozzles (3) and - contrary to the respondent's statement - no means for injecting a pressurised gas into the space between the inner and outer containment walls for the purpose of forcing out spent liquid coolant are disclosed. Such means do also not appear to be required in this system which operates according to the principle of evaporation cooling in which mainly saturated vapour is generated and drawn off by means of the suction pump (5).

Since (D2) does not teach the injection of pressurised gas into the space to be cooled for maintaining a controlled pressure differential between the space and the coolant outlet sufficient to force the spent liquid coolant out of the space, it cannot lead - similar to the circumstances of (D1) - in an obvious manner to the subject-matter of claim 1 and claim 7, respectively.

2.3.3 To summarize, the Board considers that the solution to the technical problem underlying the invention as defined in independent claims 1 and 7, respectively, involves an inventive step and that therefore these claims as well as dependent claims 2 to 6, 8 and 9 relating to particular embodiments of the invention in accordance with Rule 29(3) EPC are to be maintained.

2.4 Independent claims 10 and 13 and claims 11, 12 and 14 to 16 dependent thereon have not been attacked by the respondent. The Board, after examination of these

claims in the light of the prior art discussed in the opposition and appeal proceedings, sees no reason to dispute patentability of these claims. Claims 10 to 16 according to the main request are therefore likewise to be maintained.

3. The grounds of opposition do not prejudice maintenance of the patent in amended form in accordance with the appellant's main request and it is therefore not necessary to consider the appellant's auxiliary requests.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form with claims 1 to 16, columns 1 to 11 of the description and Figures 1 to 5 of the drawings, all submitted on 12 February 2000.

The Registrar: The Chairman:

A. Counillon C. T. Wilson