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D E C I S I O N
of 1 July 1996

Case Number: T 0839/93 - 3.4.2

Application Number: 84850239.9

Publication Number: 0138781

IPC: B01D 53/34

Language of the proceedings: EN

Title of invention:
Method and apparatus for flue-gas cleaning

Patentee:
Lindahl, Erik, et al

Opponent:
ABB Fläkt Aktiebolag

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56, 123(2)

Keyword:
"Novelty and inventive step (yes - after amendment)"
"Added subject-matter (no - after amendment)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0839/93 - 3.4.2

D E C I S I O N
of the Technical Board of Appeal 3.4.2
of 1 July 1996

Appellant: (Opponent)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 28 July 1993 concerning maintenance of European patent No. 0 138 781 in amended form.**

Composition of the Board:

Chairman: E. Turrini
Members: R. Zottmann
L. C. Mancini

Summary of Facts and Submissions

I. The Appellant (Opponent) lodged an appeal against the decision of the Opposition Division to maintain the patent No. 0 138 781 with the application No. 84 850 239.9 in amended form.

II. The cited prior art documents will be identified as follows:

R1: FR-A-2 283 719,

R2: US-A-2 598 116, and

R3: SE-A-0 130 603.

All passages of R3 cited in the following text refer to the English translation filed by the Appellant.

III. In a communication the Board expressed its preliminary opinion that and why the application did not meet the provisions of the EPC.

To meet these objections, the Respondent (Patentee) filed amended patent documents.

The Appellant did not provide arguments with respect to the amended claims.

IV. The Appellant requests reversal of the decision under appeal and revocation of the patent.

V. The Respondent requests maintenance of the patent in amended form based on the following documents:

description:
columns 1 and 2 comprising insertions 1BB and 1BC, said columns and insertions being filed with the letter dated 2 November 1995;

columns 3 to 5 of the patent specification;

claims 1 to 7 filed with the letter dated 2 November 1995;

drawings: sheet 1 of the patent specification.

VI. The independent claims read as follows:

"1. A method of flue-gas cleaning, comprising the separation of water-soluble substances from flue-gases containing water vapour, where the flue-gases are caused to directly contact atomized water in two or more separation steps, where in a subsequent one of said separation steps in the flow direction of the flue-gases, the flue-gases are cooled by atomized water to a temperature at which the water in the flue-gases is condensed out, so that the water content in the flue-gases leaving the subsequent step is less than the water content in the flue-gases entering a first of the separation steps, which water is collected and cooled, wherein said collected and cooled water is partly recirculated in said subsequent separation step and partly introduced into a prior one of said separation steps in the flow direction of the flue-gases, in which prior separation step the water is caused to be atomized and to meet uncleaned flue-gases, the water-soluble substances of which thereby are solved in the atomized water, and where the water thus impurified is collected

without recirculation and withdrawn from the prior separation step to be further treated in a separate means, and where no water is added to the separation steps in addition to the water required for initially starting the cleaning process."

4. An apparatus for flue-gas cleaning comprising the separation of water-soluble substances from flue-gases containing water vapour, where two or more separation stages (1,2) are comprised, each of which is provided with means (14,19) for injecting atomized water into a vessel and each of which is provided with an inlet and an outlet pipe (4,3,5) for passing flue-gases through the vessel, where the subsequent one of the separation stages (2) in the flow direction of the flue-gases is provided with a flow circuit for water comprising an outlet pipe (23) from said subsequent stage, a cooler (25), a pump (9) and an inlet pipe (20) to a tube system (19) comprising water atomizing means in said subsequent stage for recirculation only the water separated from the flue-gases in said subsequent separation stage (2) in order to continuously separate water from the flue-gases, wherein the water recirculated in said subsequent separation stage is cooled by a cooler, which is located in the flow direction after the vessel of the subsequent separation stage but before a connection pipe (17) connected between said flow circuit and a prior one of said separation stages (1) in the flow direction of the flue-gases to provide said prior separation stage with water thus separated, whereby water-soluble substances in the flue-gases are separated in said prior separation stage, which prior separation stage (1) is connected to a collecting means (12) for collecting the water fed to the prior step without recirculation and for further treatment of water thus impurified, and wherein the apparatus is arranged such that, in use of the apparatus, no water is added to the separation steps in

addition to the water for initially starting the cleaning process."

Claims 2, 3 and 5 to 7 are dependent on claim 1 and, respectively, 4.

VII. The arguments of the Appellant (as far as transferable to the amended claims, see III. last paragraph) can be summarized as follows:

Feature (b211) of claim 1 - see section 2. below - represents additional subject-matter over that filed.

The subject-matters of the independent claims are obvious from R1 alone or taken in combination with R2 or R3.

In R1 is a clear disclosure of an arrangement in which no water is added, since all the required water can be obtained by condensation of the water content of the flue gas. Atomizing water in tower 3 is a well-known alternative to tray separators.

Since the wording of the independent apparatus claim is not restricted to a cooler producing active cooling and pipe 3 of R2 will inevitably act as a cooler, the corresponding feature of said claim is anticipated by R2. Positioning of the cooler before or after the branch point for the recirculation line is a matter of routine choice depending on the required temperatures for the recycle liquid. If the water content of the flue gas is high enough then inherently the apparatus would operate according to the requirement that no water is added.

R3 states in particular that it is the condensed water of the flue gases that in steady state constitutes the liquid circulating through the system. Atomizing the

injected water is an obvious alternative to the use of ascending flue gases bubbling through cooler bodies of liquid according to R3. The different positioning of the cooler in the recycle circuit relative to the branch connection for the recirculation line is an obvious modification.

VIII. The arguments of the Respondent can be summarized as follows:

R1 describes a method where alkaline washing liquid can be used in a washing tower of apparently conventional type. In such washing towers the liquid is recirculated. Therefore, the liquid entered into the washing tower is recirculated. Further, there is nowhere stated that external water is not supplied.

R2 shows a method where one cleans a gas containing sulphur dioxide from SO_3 and where SO_3 is withdrawn from a prior step. Water is continuously supplied to the process. The water discharged from the subsequent step is not cooled before entered into the prior step. By a cooler is meant a cooling apparatus of some kind, not the simple pipe 3. A combination of R1 and R2 would lead to the use of external water.

R3 shows a method where substances are recovered in a prior step where the liquid is recirculated before withdrawal. A second step is a condensation step where condensate is formed. Some of the condensate is used in the prior step to compensate for the withdrawn liquid and for emitted vapour from the liquid. The rest of the condensate is withdrawn from the condensation step. A combination of R1 and R3 would inherently give that the liquid is recirculated in the separation step.

Reasons for the Decision

1. The appeal is admissible.

2. Claim 1 consists of the following features which are listed separately and numbered to facilitate reference to them:

(a) a method of flue gas cleaning;

(a1) comprising the separation of water soluble substances from flue gases containing water vapour;

(b) comprising two or more separation steps;

(b1) where the flue gases are caused to directly contact atomized water;

(b2) in a subsequent one of said steps - seen in the flow direction of the flue gases - the flue gases are cooled by direct contact with atomized water;

(b21) to a temperature at which the water in the flue gases is condensed out;

(b211) so that the water content in the flue gases leaving the subsequent step is less than the water content in the flue gases entering a first of the separation steps;

(c) the condensed water is collected;

(d) then the collected water is cooled;

(e) then said cooled water is partly recirculated in said subsequent step and partly introduced into a prior one of said steps - seen in the flow direction of the flue gases -;

(f) in said prior step the water is caused to be atomized and to meet uncleaned flue gases;

(f1) the water-soluble substances of the flue gases thereby are solved in the atomized water;

(g) the water thus impurified is collected without circulation;

(h) then the water thus impurified is withdrawn from said prior step to be further treated in a separate means;

(i) in which method no water is added in addition to the water required for initially starting the cleaning process.

3. *Allowability of the amendments*

The Board is satisfied that the present patent documents do not contain subject-matter extending beyond the content of the application as originally filed and that the present claims do not extend the protection conferred by the claims as granted.

In particular, the feature (b211) of claim 1 follows inevitably from the features in lines 10 to 12 ("no water is added ...") and lines 17 to 19 ("... water is withdrawn ...") of claim 1 as originally filed and from the corresponding passages of the description as originally filed.

Therefore, the present patent documents do not infringe Article 123(2) and (3) EPC.

4. *Prior art and novelty of claims 1 and 4*

4.1 Apparently, in pre-cooling tower 2 and intermediate cooling chamber 4 of document R1 no (liquid) water is collected and thus the flue gas is not cleaned there. Only the steps carried out in washing tower 3 and dewatering tower 6 including the circuit with cooler 7 correspond to the prior and, respectively, subsequent separation steps of claim 1.

R1 neither directly nor indirectly discloses details concerning liquid circulation, discharge or treatment in steps carried out in 2, 4 and 3 nor liquid discharge in steps carried out in 6/7 and thus neither features (g) and (h) of the last three lines of claim 1, nor a feature corresponding to feature (i) of claim 1 that no water is added to the separation steps in addition to the water required for initially starting the cleaning process.

As to the introduction of aqueous liquids into the containers 2, 3, 4 and 6, R1 suggests a lot of alternatives: Introduction of an alkaline solution into tower 3 is preferred but alternatively also water can be used (see examples and page 5 first paragraph). According to page 6 first paragraph, the water condensed out in the dewatering tower 6 not needed to cool the water in tower 6 can be used as cooling water in tower 2 or chamber 4 or washing tower 3. Moreover, it is stated there that this renders possible equalizing the consumption of water of the different elements of the

installation, suggesting that preferably all installations are connected with the cooler 7 and that the water condensed out in step 6/7 is not exclusively used for stages 6 and 3.

4.2 R2 refers to a process for cooling sulfur burner gases where the SO_3 component is reduced and the SO_2 component is kept in the gas.

It seems that the person skilled in the art does not interpret simple pipe 3 of R2 as a cooler as defined in claim 4 or as a cooling step as defined in claim 1.

Though the external water supply 15/15' to the third cooling column may be controlled by valve 19 (column 4, lines 28 to 37), the rate of delivery cannot be reduced to zero. Otherwise the third cooling column 23/7" does not receive any water; moreover, also pre-cooling column 3 would not be provided with sufficient water, since the flow rate of the external water to the third cooling column is substantially equal to the water supplied to pre-cooling column (see the last parts of all claims). R2 discloses not only that external water is continuously introduced, but moreover that it is an essential feature of the subject-matter of R2 (see, for example, column 1, lines 36 to 40, column 2, lines 6 to 11, column 5, lines 39 to 50).

4.3 Document R3 describes a process for recovering valuable substances in relatively concentrated form from flue gases from the combustion of cellulose waste liquor.

The gas is cooled by passing screens and a water bed. Each screen serves as the bottom of said water bed.

In the first step the liquid circulates between the lowermost screen 10 and a tank 21 to obtain a concentrated end product fraction. This fraction is withdrawn through a pipe 35. In addition, a comparatively diluted end product fraction is withdrawn through a pipe 39 between a cooler 8 and the last step 12 or a pipe 59 connected to a collection tank 28 arranged between the second screen 11 and the first screen 10 (see the figure and page 4 third paragraph). The cooler 8 is arranged between said tank and the third screen 12 so that the liquid supplied to the first step 10 is not cooled by cooler 8.

4.4 It follows from sections 4.1 to 4.3 that R1 describes the nearest prior art with respect to the subject-matter of the independent claims and that said claims are novel with respect to said prior art.

5. *Inventive step*

5.1 When starting from said nearest prior art of R1, it could be obvious for the skilled person to consider replacement of the trickle plates in washing tower 3 by water atomizing means. However, in view of the remaining differences of R1 and claim 1 and the alternatives of R1 - see 4.1 - , the skilled person would not arrive at the method according to claim 1 on the basis of the teachings of this document alone when trying to solve the problem underlying the subject-matter of claim 1, that is the reduction of the consumption of external substances while obtaining satisfying removal of water-soluble impurities of the method of R1. There is no teaching hinting at measure (i) nor any suggestion to withdraw water with a relatively high content of impurities or to withdraw such water only from washing tower 3.

5.2 In view of the differences of R2 and claim 1, it is rather improbable that the skilled person would at all envisage to take into account R2 to solve said problem. Even if he did, he would, due to the fact that continuous supply of external water is an essential feature of R2 and to other differences between R2 and claim 1 such as the locations of the coolers (see 4.2), not arrive at a method with all the essential features of claim 1.

5.3 Similar considerations apply to a combination of R1 and R3. Due to the missing details of waste liquid discharge and liquid transport (see 4.1 third paragraph), the corresponding features disclosed in R3 would be taken into account by the skilled person to further develop the method of R1. This would lead to a method where the liquid is recirculated in the first/prior step and where a liquid fraction, particularly of comparatively diluted liquid, is withdrawn from a subsequent step.

5.4 A similar reasoning concerning inventive step applies to claim 4, since its features correspond to those of claim 1.

6. In the result, the Board takes the view that the claims comply with the requirements of the EPC and are allowable (Article 52(1) EPC). Since this applies also to the other documents of the patent, the patent can be maintained in amended form on the basis of the documents according to section V. (Article 102(2) EPC).

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 the following version:

description:
columns 1 and 2 comprising insertions 1BB and 1BC, said columns and insertions being filed with the letter dated 2 November 1995;

columns 3 to 5 of the patent specification;

claims 1 to 7 filed with the letter dated 2 November 1995;

drawings: sheet 1 of the patent specification.

The Registrar: The Chairman:

P. Martorana E. Turrini