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**Datasheet for the decision
of 3 February 2021**

Case Number: T 2209/18 - 3.3.05

Application Number: 10727752.7

Publication Number: 2419197

IPC: B01D53/56, F22B21/34,
F22B21/40, F23J15/00

Language of the proceedings: EN

Title of invention:

METHOD OF REDUCING NO_x-EMISSIONS USING A REACTIVE AGENT, AND
CORRESPONDING BOILER

Patent Proprietor:

Andritz Oy

Opponents:

Valmet Technologies Oy
Sumitomo SHI FW Energia Oy

Headword:

NO_x-Emissions/Andritz

Relevant legal provisions:

RPBA 2020 Art. 13(2)
EPC Art. 123(2), 54(3), 56

Keyword:

Amendment after summons - exceptional circumstances (yes)

Amendments - allowable (yes)

Novelty - (yes)

Inventive step - (yes)

Decisions cited:

Catchword:



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Case Number: T 2209/18 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 3 February 2021

Appellant 1:
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Decision under appeal:

**Interlocutory decision of the Opposition
Division of the European Patent Office posted on
13 July 2018 concerning maintenance of the
European Patent No. 2419197 in amended form.**

Composition of the Board:

Chairman G. Glod
Members: S. Besselmann
 S. Fernández de Córdoba

Summary of Facts and Submissions

- I. The appeals in this case, filed by the patent proprietor (appellant 1) and opponent 2 (appellant 2), lie from the interlocutory decision of the opposition division to maintain European patent No. EP 2 419 197 B1 in amended form, on the basis of the then pending auxiliary request 1a. The patent in suit concerns a method of reducing NOx-emissions using a reactive agent, and a corresponding boiler.
- II. The following documents are of relevance here:
- | | |
|-----|---|
| P01 | EP 2 071 239 A2 (17 June 2009) |
| P02 | M. Lundberg et al., "Effect of Ammonia Injection on Black Liquor Recovery Boiler NOx Emissions and Ash Chemistry", TAPPI Engineering, Pulping & Environmental Conference, August 24-27, 2008, ("EPE 2008"), Portland, Oregon, USA |
| D6 | US 4,115,515 (19 September 1978) |
- III. The opposition division found that the subject-matter of claim 1 of the patent as granted lacked novelty in view of document P02. It held that the then pending auxiliary request 1a met the requirements of the EPC.
- IV. Appellant 1 (patent proprietor), in its statement of grounds of appeal, defended the patent as granted and submitted the claims allowed by the opposition division as auxiliary request 1. With its reply to opponent 2's statement of grounds of appeal, it filed auxiliary requests 2-4. In reply to the board's preliminary opinion, on 12 January 2021 it replaced auxiliary

requests 3 and 4 by a new auxiliary request 3. During the oral proceedings on 3 February 2021, it maintained this auxiliary request 3 as its main and sole request and withdrew all the other requests.

V. The independent claims of this sole request read as follows:

Claim 1:

"A method of decreasing an amount of nitrogen oxides generated in the combustion of fuels and air from flue gases of a boiler, said boiler having a water circulation system comprising superheaters (8), and a furnace (1) for combusting fuel and for generating flue gases containing nitrogen oxides, which flue gases flow mainly upwards in the furnace (1) and further to the superheaters (8) and via other heat recovery surfaces of the boiler out of the boiler, and an agent for reducing nitrogen oxides is introduced into said flue gases,

wherein the boiler is provided with a bullnose (14), at the location of which the furnace (1) narrows, the bullnose (14) comprising a lower wall part (14b) that is directed diagonally from a rear wall (4) towards a front wall (2) of the boiler, an upper wall part (14a) that is directed from the front wall (2) of the boiler diagonally towards the rear wall (4), and a bullnose tip (14c) that combines these, wherein the tip (14c) of the bullnose is formed of a vertical wall part combining the inclined lower and upper wall parts (14b, 14a),

wherein the nitrogen oxides reducing agent is introduced into the upwards flowing flue gases prior to the superheaters (8), and

before the nitrogen oxides reducing agent is introduced, the temperature of the flue gases is

decreased by means of a heat exchanger (15, 15a, 15b) that is located in the elevational direction of the boiler in the area of the bullnose tip (14c) and in the flue gas flow (19) upstream of the introduction of the reducing agent, for obtaining a suitable temperature window in the flue gas flow (19) in order to reduce nitrogen oxides,

wherein the heat exchanger (15, 15a, 15b) extends from a front wall (2) to a rear wall (4) of the boiler, whereby it covers a horizontal cross-sectional surface of the furnace (1),

wherein feeding means (20) for the nitrogen oxides reducing agent are located in the elevational direction of the boiler in the area of the bullnose tip (14c), and

wherein the heat exchanger (15, 15a, 15b) is a screen."

Claim 8:

"A steam-generating boiler having a water circulation system comprising heat recovery surfaces, including superheaters (8), and a furnace (1) for combusting fuel and for generating flue gases, said flue gases flowing mainly upwards in the furnace (1) and further to the superheaters (8) and via other heat recovery surfaces of the boiler out of the boiler, and feeding means (20) for introducing a reducing agent for reducing nitrogen oxides into the flue gases,

wherein the boiler is provided with a bullnose (14), at the location of which the furnace (1) narrows, the bullnose (14) comprising a lower wall part (14b) that is directed diagonally from a rear wall (4) towards a front wall (2) of the boiler, an upper wall part (14a) that is directed from the front wall (2) of the boiler diagonally towards the rear wall (4), and a bullnose tip (14c) that combines these, wherein the tip

(14c) of the bullnose is formed of a vertical wall part combining the inclined lower and upper wall parts (14b, 14a),

wherein the feeding means (20) are arranged for introducing the nitrogen oxides reducing agent into the upwards flowing flue gases prior to the superheaters (8), and

a heat exchanger (15, 15a, 15b) is located in the furnace (1) in the flue gas flow (19) in the elevational direction of the boiler in the area of the bullnose tip (14c), for decreasing the temperature of the flue gas flow (19) in order to obtain a suitable temperature window in the flue gas flow (19) for reducing nitrogen oxides, and that the feeding means (20) for the reducing agent are located in the flue gas flow direction after said heat exchanger (15, 15a, 15b) and prior to the superheaters (8),

wherein the heat exchanger (15, 15a, 15b) extends from a front wall (2) to a rear wall (4) of the boiler, whereby it covers a horizontal cross-sectional surface of the furnace (1),

wherein the feeding means (20) for the nitrogen oxides reducing agent are located in the elevational direction of the boiler in the area of the bullnose tip (14c), and

wherein the heat exchanger (15, 15a, 15b) is a screen."

- VI. Dependent claims 2-7 and 9-13 relate to preferred embodiments.

- VII. Appellant 2 (opponent 2) presented its case concerning this request during the oral proceedings on 3 February 2021. It raised objections under Articles 123(2), 54 and 56 EPC. Only after the conclusion of discussion of these substantive matters, when the

chairman established the final requests of the parties, did it question the admissibility of this request, without providing any substantiation.

VIII. The other party (opponent 1) did not submit any comments as to the substance of the appeal and was not represented at the oral proceedings, as indicated in its letter dated 1 December 2020.

IX. Appellant 2's (opponent 2's) arguments, where relevant to the present decision, can be summarised as follows.

The claims extended beyond the content of the application as originally filed. The original application did not specify introducing the reducing agent into the upwards flowing flue gases. Nor was upwards flow implicit, because the heat exchange screen and the bullnose were known to create backflow and eddies. Furthermore, the current claims constituted an inadmissible intermediate generalisation of the specific embodiments shown in Figures 2b and 2c and the corresponding passage on page 11, lines 5 to 13 of the application as filed.

Novelty was lacking in view of document P01. The cooled beam 12b by which the additional material (namely the reducing agent) was supplied was a heat exchange screen which further lowered the flue gas temperature. This cooled beam 12b was located in the area of the bullnose, as seen in Figures 1 and 2.

Claim 1 lacked an inventive step in view of document P02 as the closest prior art, taken in combination with D6. The "injection level superheater" in P02 was in the area of the bullnose. It was irrelevant that the claim referred to the bullnose tip, because a marginal change

in height away from the bullnose tip would not make any difference. The nitrogen oxide removal additionally depended on the process conditions used, which were not specified in the claim. The claimed method was not associated with any improvement. The claimed method was obvious in view of D6, which taught various possibilities for locating the feeding means for the reducing agent. The same applied for claim 8.

- X. Appellant 1 (patent proprietor) requested that the contested decision be set aside and that the patent be maintained in amended form based on the sole request, submitted as auxiliary request 3 on 12 January 2021.

Appellant 2 (opponent 2) requested that the decision under appeal be set aside and that the patent be revoked.

Reasons for the Decision

1. Article 13(2) RPBA 2020
 - 1.1 The request maintained as the final sole request was filed after the summons to oral proceedings had been issued (summons dated 15 July 2020).
 - 1.2 Filing of the request at this stage of the proceedings has been duly justified by appellant 1 (patent proprietor) in its accompanying letter. Specifically, the request is based on previous auxiliary request 4 but addresses objections under Articles 84 and 123(2) EPC taken up again or raised for the first time in the

appeal proceedings in the preliminary opinion of the board.

1.3 Appellant 2 did not substantiate why the request should not be admitted.

1.4 The restrictions made in this request were already present in previous auxiliary request 4, which was filed in reply to appellant 2's statement of grounds of appeal. The request does not present the other parties or the board with any new issues.

1.5 This request overcomes all pending objections, for the reasons set out below. Admitting this request thus serves procedural economy.

1.6 The board therefore comes to the conclusion that these are exceptional circumstances within the meaning of Article 13(2) RPBA 2020, and admits this request into the appeal proceedings.

2. Article 123(2) EPC

2.1 Claim 1 specifies that the nitrogen oxides reducing agent is introduced into the upwards flowing flue gases prior to the superheaters. The application as originally filed does not explicitly mention upwards flow at the location where the reducing agent is introduced.

However, this feature is implicit in the embodiments now claimed.

Specifically, the feeding means (20) for the nitrogen oxides reducing agent are located in the elevational

direction of the boiler in the area of the bullnose tip (14c). The bullnose tip (14c) is formed of a vertical wall part combining the inclined lower and upper wall parts (14b, 14a) of the bullnose (14). The bullnose tip implicitly has a certain length because the heat exchanger (15, 15a, 15b) (i.e. the screen) is also located there.

As specified in the claim, the flue gases flow mainly upwards in the furnace (1) and continue to the superheaters (8). The bullnose (14) is situated where the furnace (1) narrows. The flue gases consequently flow upwards in the area of the vertical bullnose tip (14c) - prior to the superheaters - where the nitrogen oxides reducing agent is introduced.

The claim does not require a laminar flow regime. The occurrence of turbulence, possibly involving eddies and backflow, is not relevant in the present case to identifying the principal direction of flow in the area of the bullnose tip.

Referring to upwards flowing flue gases when stating that "*the nitrogen oxides reducing agent is introduced into the upwards flowing flue gases prior to the superheaters*" in the context of the claimed embodiments does not therefore cause the subject-matter to extend beyond the content of the application as originally filed.

- 2.2 Claim 1 has been amended to define the configuration of the bullnose. This definition ("*the bullnose (14) comprising a lower wall part (14b) that is directed diagonally from a rear wall (4) towards a front wall (2) of the boiler, an upper wall part (14a) that is directed from the front wall (2) of the boiler*")

diagonally towards the rear wall (4), and a bullnose tip (14c) that combines these, wherein the tip (14c) of the bullnose is formed of a vertical wall part combining the inclined lower and upper wall parts (14b, 14a)") is disclosed on page 7 (first full paragraph) and on page 10 (third paragraph) in conjunction with page 11 (second paragraph) of the application as originally filed, and is illustrated in Figures 2b and 2c.

This configuration of the bullnose is disclosed in relation to embodiments in which the heat exchanger, such as a screen, and the means for feeding the reducing agent are located in the area of the bullnose tip (page 11, second and third paragraphs and Figures 2b, 2c). These limitations are present in claim 1.

The claim also defines the relevant sequence of the heat exchanger, the feeding means, and the superheaters, in that the reducing agent is introduced prior to the superheaters, and the heat exchanger is upstream of the introduction of the reducing agent.

The claim furthermore specifies that the heat exchanger (the screen) and the feeding means are both located in the area of the bullnose tip. This implies that the bullnose tip has to be long enough to accommodate them; there is no need to explicitly recite this in the claim.

Figures 2b and 2c show further details. For instance, they depict feeding means (20) on both the rear wall and the front wall of the boiler. However, unlike the position of the feeding means in the vertical direction, these details are not particularly referenced in the application as originally filed, and

there is no reason to understand them as inextricably linked to the other features of the embodiments now claimed. Hence, there is no inadmissible intermediate generalisation.

The amendments in claim 1 do not therefore add any subject-matter extending beyond the content of the application as originally filed.

2.3 The same comments (points 2.1, 2.2) apply to claim 8, in which the same features were under debate.

2.4 In view of the above, the requirements of Article 123(2) EPC are met.

3. Article 54 EPC

3.1 Document P01 shows a boiler with a bullnose having a vertical wall part as the bullnose tip, and inclined lower and upper wall parts (Figure 1). P01 describes feeding additional material, which may be a nitrogen oxide reducing agent for decreasing nitrogen oxide emissions (paragraph [0054]). The supply means (12a, 12b) for feeding the additional material to the flue gases is in the form of a cooled case beam which is hollow. The supply means may be located in the area of the bullnose, as also illustrated in Figures 1 and 2.

3.2 Even if the supply means are considered also to constitute a heat exchange screen, there is no direct and unambiguous disclosure of an installation in which the screen and the supply means are located specifically in the area of the bullnose tip, indicated as 10 in Figure 1, and having the screen located upstream of the introduction of the reducing agent.

The subject-matter of claim 1 is therefore novel over P01 (Article 54(3) EPC).

3.3 The same considerations apply to the subject-matter of claim 8, which is therefore also novel.

4. Article 56 EPC

4.1 The patent in suit relates to a method of decreasing an amount of nitrogen oxides from flue gases of a boiler (paragraph [0001]).

4.2 It was undisputed by the parties that P02 is prior art. P02 relates to the same general purpose (title, introduction) and may be considered the closest prior art.

4.3 The boiler configuration with the "injection level superheater" (Figure 1) is the disclosure in P02 most relevant to the claims at issue. Feeding means for the reducing agent located in the area of the bullnose tip are not disclosed.

4.4 The objective technical problem is the provision of a more efficient method (paragraph [0016]).

4.5 As the solution to this problem, a method of claim 1 is proposed in which the feeding means for the nitrogen oxides reducing agent are located in the elevational direction of the boiler in the area of the bullnose tip, downstream of the heat exchange screen for obtaining a suitable temperature window in the flue gas flow in order to reduce nitrogen oxides.

- 4.6 It is concluded that the problem is successfully solved.

In appellant 2's favour, it is accepted that the nitrogen oxide removal depends on the chosen process conditions; this influence of the specific process conditions is reflected in the fact that P02 teaches different injection levels for different load levels. It is also acknowledged that the cited boiler configuration of P02 already involves injecting the reducing agent downstream of the screen.

Nevertheless, even if there is no increase in the efficiency of nitrogen oxide removal across the entire scope of the claim, i.e. irrespective for instance of the specific process conditions used, appellant 2's arguments that no improvement was obtained provide no reason to doubt that moving the feeding means from the "injection level superheater" in the relevant boiler configuration of P02 to the area of the bullnose tip provides more time for the reducing agent to react with the nitrogen oxides prior to the superheaters (paragraph [0022] of the patent in suit). The claimed location of the feeding means thus makes it possible to prevent corrosion of the superheaters. This aspect of the objective technical problem is therefore successfully solved.

5. It remains to be determined whether the solution is obvious in view of the cited prior art.

It may be self-evident that moving the feeding means to a lower part of the boiler, i.e. placing them further upstream in the boiler, increases the residence time before the superheaters are reached.

However, it has not been convincingly shown that the skilled person would have been prompted by the prior art to locate the feeding means specifically in the area of the bullnose tip after, i.e. downstream of, the screen, as required by the claim at issue, for obtaining a suitable temperature window in the flue gas flow in order to reduce nitrogen oxides.

While the "injection level superheater" in P02 is downstream of the heat exchange screen (Figure 1), this injection level was only used in screening tests for finding the best injection level, but not investigated further in the long-term test (page 2 of 7, "Experimental", first paragraph), and was consequently the least preferred. The skilled person would not have derived any motivation from this disclosure to maintain the feeding means downstream of the screen, and to use the screen for obtaining a suitable temperature window in the flue gas flow in order to reduce nitrogen oxides.

Moreover, it cannot be clearly derived from P02 that there is enough space in the area of the bullnose tip above the screen to accommodate the feeding means as well.

The teaching of P02 alone would not therefore have guided the skilled person towards the claimed method.

- 5.2 Opponent 2 relied on D6 as a secondary document, to be combined with P02 as the closest prior art. It pointed out that D6 illustrated various possibilities for locating the feeding means for the reducing agent.
- 5.3 However, while D6 shows various possibilities for locating the feeding means, it relates to a completely

different configuration of the boiler from that in P02. D6 does not disclose either a bullnose tip formed of a vertical wall part combining inclined lower and upper wall parts of the bullnose or a heat exchange screen covering a horizontal cross-sectional surface and located in the area of this bullnose tip.

The skilled person would not have derived any guidance from D6 on where to place the feeding means in relation to the bullnose tip and the screen in the boiler configuration of P02.

5.4 For these reasons, the subject-matter of claim 1 would not have been obvious to the person skilled in the art (Article 56 EPC).

5.5 Although the wording of claim 8 is slightly different ("*the feeding means (20) for the reducing agent are located in the flue gas flow direction after said heat exchanger (15, 15a, 15b) and prior to the superheaters (8)*"), it relates to the boiler corresponding to claim 1 and defines the same sequence of heat exchanger, screen and superheaters.

There were no additional specific objections to claim 8. The subject-matter of claim 8 therefore also involves an inventive step, for the same reasons as set out with regard to claim 1.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent with the claims according to the sole request submitted as auxiliary request 3 on 12 January 2021 and a description and figures to be adapted thereto.

The Registrar:

The Chairman:



C. Vodz

G. Glod

Decision electronically authenticated