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D E C I S I O N
of 12 December 1995

Case Number: T 1083/93 - 3.2.3

Application Number: 88114712.8

Publication Number: 0309792

IPC: F22B 1/18

Language of the proceedings: EN

Title of invention:
Exhaust boiler

Patentee:
MITSUBISHI JUKOGYO KABUSHIKI KAISHA

Opponent:
EVT ENERGIE- UND VERFAHRENSTECHNIK GMBH
DEUTSCHE BABCOCK AKTIENGESELLSCHAFT

Headword:
-

Relevant legal provisions:
EPC Art. 56, 108

Keyword:
"Form of appeal - admissible (yes)"
"Inventive step - no"

Decisions cited:
-

Catchword:
-



Case Number: T 1083/93 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 12 December 1995

Other party:
(Opponent 01)

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Representative:

-

Appellant:
(Opponent 02)

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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:

Decision of the Opposition Division of the
European Patent Office posted 29 October 1993
rejecting the opposition filed against European
patent No. 0 309 792 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: C. T. Wilson
Members: H. Andra
L. C. Mancini

Summary of Facts and Submissions

- I. European patent application No. 88 114 712.8, filed on 8 September 1988 and published on 5 April 1989 under publication No. 0 309 792, was granted on 7 August 1991.

Claim 1 as granted reads as follows:

"1. An exhaust boiler in which a high-pressure superheater (1), a high-pressure steam generator (2), a high-pressure economizer (4), a low-pressure steam generator (5) and a low-pressure economizer (6) are disposed sequentially from the upstream side within an exhaust gas flow passageway (20), and a denitrification apparatus (3) is disposed upstream of said high-pressure economizer (4); characterized in that a bypass duct (9) is connecting said exhaust gas passageway at a position downstream of said high-pressure economizer (4) and upstream of said low-pressure steam generator (5) to the stack (8), and that dampers (11) are disposed respectively within said bypass duct (9) and at a position within said exhaust gas passageway (20) downstream of the connecting point of said bypass duct (9) and upstream of said low-pressure steam generator (5)."

- II. The patent was opposed by the Appellant (Opponent 2) and the Opponent 1 who both requested revocation of the patent on the ground of Article 100(a) EPC, in particular because of the absence of inventive step.

The oppositions were supported by the following documents:

(D1) "Power-Design and Equipment Application Section",
March 1959, p. 59-61,

(D2) DE-C-454 408,

(D3) "Kohle, Öl und Dampf in Deiner Hand", 9th Edition,
1967, Publishing house Betriebs-Ökonom GmbH, Verden
(DE), p. 58, 59,

(D4) EP-A-0 190 366,

(D5) US-A-3 314 231.

III. By decision dated 29 October 1993 the Opposition
Division rejected the oppositions.

The Opposition Division held that the documents cited in
the opposition proceedings did not suggest any solution
to the problems to be solved and how to achieve the
object as defined in the patent.

IV. On 24 December 1993 the Appellant lodged an appeal
against the decision paying the appeal fee on the same
day.

In the Statement of Grounds of Appeal filed on
24 February 1994 the Appellant referred for the first
time to the further prior art

(D6) "Taschenbuch für den Maschinenbau/Dubbel" 14th
Edition, 1981, page 575, right-hand column,
Section "Niedertemperaturkorrosion" and

(D7) CH-A-401 998.

The Appellant held that it was known from (D6) that in
the combustion of a sulphur-containing fuel a condensate
comprising SO₃ is deposited on the heat exchange
surfaces when the temperature of the combustion gases
falls below a given temperature and that this effect

leads to corrosion and pollution of the heat exchange surfaces. Further according to the Appellant, (D7) teaches that when burning different types of fuel with different contents of sulphur and making maximum use of the heat of the combustion gases one can prevent the gas temperature from falling below the borderline temperature by means of a channel bypassing part of the heat exchange surfaces and having a cross-section controllable in size. It cannot, therefore, be regarded as inventive to modify the exhaust boiler known from (D4) in the sense of Claim 1.

V. In his letter dated 15 July 1994 the Respondent (Patentee) contested the arguments of the Appellant and stated that the appeal lodged on 23 December 1993 ("with the letter dated 23 December 1993" is clearly intended) had obviously not been lodged by the firm BABCOCK but by Dipl.-Ing. Jürgen Müller.

VI. In a communication dated 20 December 1994 the Board expressed the provisional opinion that all the requirements relating to the Notice of Appeal, in particular those specified in Article 108 and Rule 64 EPC seemed to be complied with so that the appeal appeared to be admissible, but that neither the documents (D4) and (D5) nor the belatedly cited documents (D6) and (D7) seemed to establish a basis for reversing the impugned decision.

VII. The Appellant requested that the patent be revoked. He argued essentially as follows:

- With regard to the nearest prior art disclosed in (D4) the object of the invention is to provide an exhaust boiler which can always achieve maximum heat absorption regardless of whether sulphur oxides are present or not in the exhaust gas.

(D5) describes a power plant in which the hot exhaust gases of a gas turbine are utilized in conjunction with two steam generators arranged at positions upstream and downstream, respectively, in the exhaust duct. A bypass duct is provided such that the gases leaving the upstream steam generator can be vented to atmosphere.

- The object of (D7) is the same as that of the invention, namely to avoid the danger of corrosion of the heat exchange surfaces caused by a sulphur containing condensate whereby the maximum heat absorption from the exhaust gas irrespective of the sulphur content in the gas is to be obtained. The solution to this problem is achieved in accordance with the same principles as according to the invention, namely by the arrangement of a bypass duct branching off from the main gas duct downstream of the foremost heating surfaces (2) and upstream of the rear heating surfaces (9 to 12) and by the arrangement of flaps at the branching point which are provided to open, in dependence on their position, either the bypass duct or the main gas duct containing the rear heating surfaces. It did not require any inventive activity to transfer these principles to an exhaust boiler such as known from (D4).

VIII. In support of his request for maintenance of the patent as granted the Respondent argued in the written and oral proceedings essentially as follows:

- The appeal lodged on 23 December 1993 has not been submitted by the firm BABCOCK but by Mr Jürgen Müller and it is not stated at all that the appeal shall be lodged in the name of BABCOCK.

- According to the invention a bypass duct is disposed at a specified position in order to solve a problem inherent in an exhaust gas boiler having a denitrification apparatus. The inherent problem relates to corrosion or clogging of a duct which is caused by condensation of acidic ammonium sulphate. (D7) is silent on the problem related to the denitrification apparatus and also different from the invention as regards the position at which the bypass duct is located.

- The Appellant argues that acidic ammonium sulphate has the same behaviour as SO_3 . The deposit temperature of acidic ammonium sulphate, however, is remarkably higher than the dew point of H_2SO_4 . The invention resides in identifying a proper position of the bypass duct within a narrow gas temperature range in order to perform the countermeasure against acidic ammonium sulphate.

Furthermore, (D7) does not disclose a low-pressure steam generator and a low-pressure economizer to be assembled in the boiler and concerns only measures to be taken in the case of partial load operation of the boiler. This citation does not disclose a solution identical with that according to the invention which is less complicated. The skilled person when trying to solve the problem of the invention will not, therefore, look into the disclosure of (D7).

- The reference (D6) is also not relevant since it deals with liquid fuel furnaces in which denitrification is not mentioned at all.

Reasons for the Decision

1. Admissibility of the appeal.

Pursuant to Rule 64 EPC the Notice of Appeal shall contain inter alia the name and the address of the Appellant in accordance with the provisions of Rule 26, paragraph 2(c) EPC.

The single sheet of the Notice of Appeal dated 23 December 1993 and filed on 24 December 1993 contains in the letterhead the reference "Dipl.-Ing. Jürgen Müller c/o BABCOCK Deutsche Babcock Aktiengesellschaft". Since the Notice of Appeal is signed by "Müller" with the indication of the general authorization number "AV1661" and the letterhead further specifies Mr Müller as the technically competent person in charge of the case with BABCOCK there seems to be no doubt that the appeal has been lodged by the firm BABCOCK represented by the staff member Mr Jürgen Müller.

BABCOCK being a party to the Opposition proceedings adversely affected by the impugned decision may appeal against this decision pursuant to Article 107 EPC.

Since also the other requirements relating to the Notice of Appeal, in particular those of Article 108 and Rule 64 EPC, are satisfied, the appeal is admissible.

2. Novelty

Nearest prior art document is (D4) which describes the boiler as defined in the pre-characterising portion of Claim 1.

(D4) discloses an exhaust boiler (20), in which a high-pressure superheater (21), a high-pressure steam generator (22), a high-pressure economizer (23), a low-pressure steam generator (24) and a low-pressure economizer (25) are disposed sequentially from the upstream side within an exhaust gas flow passageway, and a denitrification apparatus (30, 32) is disposed upstream of the high-pressure economizer (23).

Claim 1 is distinguished from the disclosure of (D4) in that a bypass duct is connecting said exhaust gas passageway at a position downstream of said high-pressure economizer and upstream of said low-pressure steam generator to the stack, and that dampers are disposed respectively within said bypass duct and at a position within said exhaust gas passageway downstream of the connecting point of said bypass duct and upstream of said low-pressure steam generator.

It derives from the foregoing that the subject-matter of Claim 1 is novel. Since novelty was not disputed by the Appellant, this issue needs no further argument.

3. *Inventive step*

- 3.1 In the operation of the exhaust boiler known from (D4), due to the assembly of the denitrification apparatus, ammonia is added to the exhaust gas as a reducing agent. In the case where a fuel containing sulphur is burnt, acidic ammonium sulphate is formed from ammonia and sulphur oxide in the combustion gas. If the acidic ammonium sulphate is present in the exhaust gas duct in its liquid phase it acts as a binder of combustion particles or dust which causes deterioration of the heat transfer, causes draft losses and creates a serious problem of corrosion of the heat exchange surfaces. As the skilled person knows (see e.g. (D6)) the same

considerations as to the problems of corrosion, draft losses and deterioration of heat transfer apply to sulphuric acid which is formed from sulphur oxide (SO_2) and water vapour present in the combustion gas.

The features of Claim 1, in particular the arrangement of the bypass duct branching off from the exhaust gas passageway at a position between the high-pressure economizer and the low-pressure steam generator in combination with the appertaining dampers, have the effect that the exhaust gas may bypass the rear heat exchange surfaces located downstream in the gas passageway and being thus exposed to the risk of corrosive condensates forming on these surfaces, so that the gas may be guided to the stack without causing any harm to these boiler components.

The problem objectively solved by Claim 1 is, therefore, to be seen in providing an exhaust boiler of the type described in (D4) in which with sulphur compounds being contained in the exhaust gas the danger of a deterioration of the heat transfer, of an increase of draft losses of the boiler and of corrosion of the heat exchange surfaces due to the deposition of condensate is avoided.

3.2 In the present case the person skilled in the art is an expert in the field of generating steam and hot water by means of combustion processes using liquid, solid or gaseous fuel.

(D7) relates to this technical field and concerns in particular the control of the exhaust gas supply to the rear heat exchange surfaces of an exhaust gas boiler.

The technical problem underlying this citation is to provide a device for controlling the supply of exhaust gas to the heat transfer system which avoids the danger of corrosion of the rear heat exchange surfaces also in the partial load range of operation (see page 1, lines 29 to 32 of (D7)). The source of corrosion of the heat exchange surfaces referred to in the citation is a fuel containing sulphur and it is a further goal to use a broad spectrum of fuels being different in sulphur - and water - contents whilst avoiding the risk of corrosion (see page 4, lines 5 to 15 of (D7)).

Contrary to the opinion of the Respondent, the skilled person, in the search of solutions to the inherent problem of the patent in suit, would take the disclosure of (D7) into consideration since the respective technical fields and the inherent problems are essentially the same.

- 3.3 It is true that the system according to (D7) does not describe an exhaust boiler comprising a denitrification apparatus and a repartition of the heat exchange surfaces into a low-pressure and a high-pressure system. It comprises, however, a number of heat exchange surfaces arranged in line in the gas passageway where the problem of sulphur-containing condensates depositing on the heat exchange surfaces is present.

In this context, it is to be noted that the question of whether the tubing of the boiler is part of a high-pressure or of a low-pressure system is not of relevance per se to the problem of condensate deposition. In respect of this problem, only the ambient pressure in the area of heat exchange and the temperatures of the exhaust gas and of the heat exchange surfaces are significant.

According to (D7) the inherent problem is solved pursuant to the principles indicated in Claim 1 of the patent in suit, namely the provision of a bypass duct (7; Figure 1) branching off from the gas passageway at a position upstream of the rear heat exchange surfaces and the arrangement of corresponding dampers (4, 13, 13'; Figure 1) at the branch point for guiding the exhaust gas either to the rear heat exchange surfaces or to the stack.

The appropriate position of the branch point of the bypass duct is selected such that at any load including partial load in the boiler operation the exhaust gas leaves the rear heat exchange surfaces with a gas enthalpy and temperature, respectively, above the dew point, i.e. in the gaseous phase, so that no corrosion of these surfaces occurs (see page 1, lines 44 to 53 and page 3, lines 110 to page 4, line 5 of (D7)).

This concept is in agreement with the situation illustrated in Figure 5 of the patent in suit where it is shown that the limit temperature for deposition of acidic ammonium sulphate is approximately 150°C (see also column 1, lines 41 to 44 of the patent in suit specifying a limit temperature of 150°C or lower) and that any heat exchange surfaces contacted by a condensate having a temperature of 150°C and lower are subject to corrosion problems. The limit temperature for deposition of acidic ammonium sulphate is very close to that of sulphuric acid, the dew point of which is reached with a temperature of the heat exchange surfaces in the range of 130° to 140°C (see (D6)).

The skilled person is taught by (D7) that the provision of a bypass duct in the gas passageway being arranged and controlled such that the formation of condensates of sulphur compounds, in particular sulphuric acid, on the

heat exchange surfaces is avoided, solves the problem of corrosion of the rear heat exchange surfaces. He will be induced to modify the exhaust boiler known from (D4) such that the latter encompasses a bypass duct of this type. Such a modification shows promise with regard to a reduction of the negative impact of condensed sulphur compounds on the boiler components.

This does not only apply to the presence of sulphuric acid in the exhaust gas, but also to acidic ammonium sulphate originating from the ammonia added in a denitrification apparatus. These two components condensate at approximately the same temperature so that by avoiding that the heat exchange surfaces reach this temperature the negative effect caused by any of these compounds is effectively counteracted.

Moreover, the skilled person will take account of any compound containing sulphur in the exhaust gas that may in its condensed phase give rise to corrosion problems since he is aware that in order to avoid these problems the temperature of the heat exchange surfaces should be maintained above the dew point of the exhaust gas (see e.g. (D7), page 1, lines 44 to 53).

- 3.4 The Respondent argues further that the solution disclosed in (D7) is more complicated than the solution according to the invention.

In this respect, it is to be noted that providing only one bypass duct branching off at a fixed position in the gas passageway is undoubtedly a relatively simple measure. It represents, however, a crude concept in comparison with that according to (D7) since it does not take account of various factors having an effect on the

exhaust gas temperature such as the calorific value of the fuel or the point of operation of the exhaust boiler, be it starting up, partial load or full load.

As illustrated above, Claim 1 suggests essentially to omit some of the bypass ducts disclosed in (D7) and to provide instead a single bypass duct at a fixed location without taking account of the particular gas temperature distribution along the gas passageway.

Thus, contrary to the problem as formulated in the patent in suit, maximum heat absorption regardless of whether sulphur oxides are present or not in the exhaust gas cannot be achieved thereby.

Whilst the prior art discloses a solution comprising a multiplicity of bypass ducts branching off from the gas passageway at different locations, the concept of providing just one bypass duct along the gas passageway cannot be regarded as inventive if, as at present, such a measure leads to a deterioration of the utilization of the available heat.

3.5 In the absence of any convincing arguments for the existence of an inventive activity, the Board has come to the conclusion that the subject-matter of Claim 1 is not based on an inventive step (Article 56 EPC) so that this claim cannot be maintained.

4. Since the Board is bound by the single request of the Respondent, it is unnecessary to consider the merits of dependent Claims 2 and 3. These claims must therefore fall with Claim 1.

Order

For these reasons it is decided that:

1. The decision of the Opposition Division is set aside.
2. The patent is revoked.

The Registrar:



N. Maslin

The Chairman:



C. T. Wilson



