

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 18 March 2025**

Case Number: T 1192/23 - 3.2.03

Application Number: 18397514.3

Publication Number: 3415816

IPC: F22G1/16, F22G5/18, F22G5/02,
F22G5/00

Language of the proceedings: EN

Title of invention:

A METHOD AND A SYSTEM FOR EXTENDING THE LOAD RANGE OF A POWER
PLANT COMPRISING A BOILER SUPPLYING STEAM TO A STEAM TURBINE

Patent Proprietor:

Valmet Technologies Oy

Opponent:

Sumitomo SHI FW Energia Oy

Headword:

Relevant legal provisions:

EPC Art. 56
RPBA 2020 Art. 12(4), 12(6)

Keyword:

Inventive step - (yes)

Amendment to case - amendment within meaning of Art. 12(4) RPBA
2020 (yes) - suitability of amendment to address issues (no)

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0

Case Number: T 1192/23 - 3.2.03

D E C I S I O N
of Technical Board of Appeal 3.2.03
of 18 March 2025

Appellant: Sumitomo SHI FW Energia Oy
(Opponent) Metsänneidonkuja 10
02130 Espoo (FI)

Representative: Genip Oy
Heikinkatu 7
48100 Kotka (FI)

Respondent: Valmet Technologies Oy
(Patent Proprietor) Keilasatama 5
02150 Espoo (FI)

Representative: Berggren Oy
P.O. Box 16
Eteläinen Rautatiekatu 10A
00101 Helsinki (FI)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
10 May 2023 concerning maintenance of the
European Patent No. 3415816 in amended form.**

Composition of the Board:

Chairman C. Herberhold
Members: B. Goers
J. Hoppe

Summary of Facts and Submissions

I. European patent No. 3 415 816 relates to a method of extending the load range for viable operating of a steam turbine power plant having a boiler with a superheater and an auxiliary superheater as well as to a system with a control unit adapted for such a method.

II. In the opposition proceedings the opposition division decided to maintain the patent as amended according to auxiliary request 1.

III. This decision was appealed by the opponent ("appellant").

IV. At the oral proceedings before the Board the final requests were as follows:

The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The patent proprietor ("respondent") requested that the appeal be dismissed.

V. Documents relevant to this decision

D2: JPH 05256428 A

D2T: English translation of D2

D10: US 2,606,103 A

D12: US 5,239,946 A

VI. Claim wording relevant to this decision

(a) Independent method claim 1 reads as follows
(feature numbering added in "[]"):

"[1] A method of extending the load range for viable operating W_V of a steam turbine power plant

[2] comprising a boiler (10)

[2.1] with a superheater (11) for supplying superheated steam to

[2.2] a steam turbine (3), the steam turbine having a required minimum viable temperature T_V of steam entering the steam turbine,

[3] the load range for viable operating W_V of the steam turbine power plant being extended by means of controllably using

[3.1] an auxiliary superheating chamber (1) comprising

[3.1.1] an auxiliary superheater (2) to further superheat steam;

[4] the method comprising:

determining the temperature T of the steam entering the steam turbine;

[4.1] when the temperature T of the steam entering the steam turbine is above an alert temperature T_A , which alert temperature T_A is higher than the required minimum viable temperature T_V ;

[4.1.1] burning fuel in the boiler to generate thermal energy to be transferred into steam in the superheater (11) to generate superheated steam satisfying the required minimum viable temperature T_V of the steam entering the steam turbine;

[4.1.2] conveying the superheated steam from the superheater (11) to the auxiliary superheater (2) of the auxiliary superheating chamber (1);

[4.1.3] burning fuel with a burner (24) in the auxiliary superheating chamber (1)

[4.1.3.1] to keep the auxiliary superheating chamber in a hot standby temperature, which temperature is higher than ambient temperature and not higher than the temperature of the

superheated steam entering the auxiliary superheater (2);

[4.1.4] conveying the superheated steam from the auxiliary superheater (2) to the steam turbine; and

[4.2] when the temperature T of the steam entering the steam turbine is at or below the alert temperature T_A ,

[4.2.1] burning fuel in the boiler to generate thermal energy to be transferred into steam in the superheater (11) to generate superheated steam;

[4.2.2] conveying the superheated steam from the superheater to the auxiliary superheater (2) of the auxiliary superheating chamber (1);

[4.2.3] further superheating the superheated steam by burning fuel with a burner (24) in the auxiliary superheating chamber (1) to generate thermal energy to be transferred into the superheated steam in the auxiliary superheater (2) such that the required minimum viable temperature T_V of steam entering the steam turbine is satisfied;

[4.2.4] conveying the superheated steam from the auxiliary superheater (2) to the steam turbine."

(b) Independent system claim 6 reads as follows:

"A system comprising

a boiler (10) with a superheater (11) for supplying superheated steam to a steam turbine (3), the steam turbine having a required minimum viable temperature T_V of steam entering the steam turbine; a controllably usable auxiliary superheating chamber (1) comprising an auxiliary superheater (2) and a burner (24), the auxiliary superheater

installed in a steam forward conveyance pathway (30, 31) between the superheater (11) and the steam turbine;

a control unit (23) adapted to:

determine the temperature T of the steam entering the steam turbine;

when the temperature T of the steam entering the steam turbine is above an alert temperature T_A , which alert temperature T_A is higher than the required minimum viable temperature T_V ,

control the burning of fuel in the burner such that the auxiliary superheating chamber (1) is kept in a hot standby temperature, which temperature is higher than ambient temperature and not higher than the temperature of the superheated steam entering the auxiliary superheater (2);

when the temperature T of the steam entering the steam turbine at or below the alert temperature T_A ,

control the burning of fuel in the burner (24) such that thermal energy is transferred into the superheated steam in the auxiliary superheater (2) such that the required minimum viable temperature T_V of steam entering the steam turbine is satisfied."

VII. The appellant's arguments, where relevant to the present decision, can be summarised as follows.

(a) Main request - admittance of the inventive-step objection starting from D12

The objections of lack of inventive step starting from D12 in combination with either common general knowledge or D10 were to be admitted into the appeal proceedings as being *prima facie* relevant. D12 disclosed a boiler with a fluidised bed as in accordance with the patent with a first superheater and an auxiliary superheater, wherein a burner was used to control the temperature of the steam in the auxiliary superheater to be subjected to a turbine and for which a hot standby mode was obvious from common general knowledge alone. In addition, D10 disclosed a two-step steam-heating system for which a hot standby mode was obvious when the steam was at the desired temperature.

(b) Main request - inventive-step objection starting from D2

The subject-matter of claims 1 and 6 was not inventive starting from D2 in combination with common general knowledge. While D2 did not explicitly disclose features [4.1] to [4.1.4], the operation state defined in this document was obvious from common general knowledge. States in which the temperature after the first superheater was above the minimum viable temperature with subsequent operation of the secondary superheater burner at a hot stand-by temperature would have occurred in any of the following cases:

- due to dynamic changes in the heat load, making operation of the second superheater superfluous,
- for a viable temperature of the turbine at temperatures below the high-temperature fouling range, or
- when operating the power plant with non-corrosive fuels.

For any of these cases it was obvious that the controller put the burner in a hot standby temperature

mode as in accordance with the distinguishing features. Since D2 did not mention switching off the burner in the hot standby mode, it was implicit that the burner was still burning fuel in this mode.

VIII. The respondent's arguments, where relevant to the present decision, can be summarised as follows.

(a) Main request - admittance of the inventive-step objection starting from D12

The objections of lack of inventive step starting from D12 and in combination with either common general knowledge or D10 were not to be admitted into the appeal proceedings since they were not *prima facie* relevant. The burner in D12 was only provided to control the bed temperature, and only at start-up or in low-load operation.

D10 disclosed a process and a system that were fundamentally different from the fluidised-bed reactor in D12, and the skilled person had no reason to combine the teaching. In any case, D10 did not teach a hot standby temperature mode in accordance with features [4.1] to [4.1.4], either.

(b) Main request - inventive-step objection starting from D2

The subject-matter of claims 1 and 6 involved an inventive step starting from D2 when considered in combination with common general knowledge. The skilled person would not have deviated from the teaching in D2 even for variable loads because, in any case, hot-temperature fouling had to be avoided and the final steam temperature of around 400°C had to be achieved

since the turbine was designed for this temperature. The skilled person instead controlled the load of fuel to the boiler. For a hypothetical case in which the boiler used a fuel of which the flue gases were not prone to hot-temperature fouling, of which there was no indication in D2, the skilled person would not have operated the auxiliary superheater at all and instead would have considered a conventional process without an auxiliary superheater.

Reasons for the Decision

1. Non-admittance of the inventive-step objections based on D12 as the starting point

1.1 With the statement setting out the grounds of appeal the appellant raised the following objections of lack of inventive step for the first time:

- D12 in combination with common general knowledge
- D12 in combination with the teaching of D10

In the opposition proceedings, D12 was only used for a novelty attack against the current main request. Therefore, the inventive-step objections starting from D12 and in combination with common general knowledge or with the teaching of D10 are amendments under Article 12(4) RPBA.

No circumstances of the appeal case are apparent which explain why the objections had not already been submitted in the opposition proceedings leading to the decision under appeal (see Article 12(6), second sentence, RPBA) and no such circumstances were provided by the appellant either. The appellant merely argued that the objections should be admitted into the appeal proceedings due to their relevance to an alleged lack of inventive step.

In exercising its discretion the Board did not admit these objections into the appeal proceedings because the objections could and should have been raised in the opposition proceedings and because these amendments are, *prima facie*, not suitable for coming to a

different conclusion with respect to the issue of compliance of the main request with the requirements of Article 56 EPC. This is explained in the following paragraphs.

- 1.2 Objection starting from D12 in combination with common general knowledge
- 1.2.1 D12 discloses a fluidised-bed incineration process in which tube walls of the reactor (12) connected in series with the heat-exchanger tubes 64 (downstream of an economiser and a reheater) are provided to superheat the cooling fluid in order to generate steam of a viable temperature for the turbine (see column 5, lines 10 to 14 and 58 to 67: tube bundles 64 generate the "**final** exit temperature [...] to better match the turbine requirements"; emphasis added). The purpose of these series of heat exchangers is the same as in the patent: "substantial regulation of the final exit temperature of the cooling fluid passing through the heat exchanger tube bundles 64 [...] to better match the turbine requirements", i.e. "during start-up and low load operation [of the reactor]" (column 6, lines 6 to 11). The "regulation of the final exit temperature" implies the definition of a setpoint or target value which corresponds to a viable steam temperature for the turbine. A hot standby mode in accordance with features [4.1] to [4.1.4] is not disclosed in D12, and this is not contested.
- 1.2.2 It is true that the patent encompasses boilers of the fluidised-bed type (see paragraph [0044]); however, contrary to the patent, the energy for the auxiliary superheating step in D12 is provided by the recycled bed material (see column 5, lines 47 to 53: "to extract heat from the beds of particulate material"). Although

there are also burners arranged in the auxiliary superheating chambers 38, these are only provided to "provide substantial heat to the cooling fluid during start-up and low load operation" (see column 5, lines 53 to 57 and column 6, lines 6 to 11). The appellant's argument that the burners in D12 would serve the same purpose as the auxiliary superheater burner in the patent is thus not convincing. Instead, the burners in D12 serve two different purposes.

First, they provide additional (super-) heat to the cooling fluid, but only in start-up or low-load states in which sufficient heat is not provided by the particulate material to superheat the steam, i.e. conditions different to those defined by features [4.1] to [4.1.4].

Second, the burners apply heat to the recycled particulate material provided to be fed to the fluidised-bed reactor. The purpose is to control the bed temperature (see column 5, lines 53 to 57 and claim 13). Therefore, under normal load conditions, a modification to the control of superheating the cooling fluid also affects the temperature control of the bed particulates, and vice versa. In a situation in which the steam temperature entering the heat exchanger 36 is already at an alert temperature (for example due to high loads in the reactor), the skilled person would not consider operating the burner in a hot standby mode since:

- (a) no additional heat for the steam is needed and
- (b) this would interact with the bed temperature control by heating the particulate material, which is the main control target of the burner in D12 during normal operation.

For these reasons D12 is not suitable for calling into question inventive step when considering common general knowledge alone.

1.3 Objection starting from D12 in combination with the teaching of D10

The skilled person would not consider the teaching of D10 in order to modify the burner and superheater control in D12, either. D10 does not disclose a fluidised bed reactor but a chemical-recovery boiler, in which fuel particles are formed by incineration of black liquor sprayed into the reactor. Contrary to the fluidised bed reactor in D12 the particles in D10 "gravitate" in counterflow to the gases to accumulate on the ground (see column 3, lines 23 to 47 and "bed 3" in Figure 1). Therefore, the teaching of D10 is not compatible with the bed temperature control by means of a burner in the particle recycle path according to D12.

2. Main request - inventive step

The appellant raised the following further objection of lack of inventive step against the independent claims 1 and 6 of the main request:

- D2 as the starting point in combination with common general knowledge.

This objection is not persuasive, and therefore cannot successfully invalidate the presence of an inventive step. The reasons are explained in the following paragraphs.

2.1 Common and distinguishing features

Figure 1 of D2 discloses a system and method of producing steam in a turbine power plant. Fuel is burned in a boiler ("incinerator 1") and heat is extracted from the flue gas using a first superheater ("primary superheater 14") to produce superheated steam. The steam is further heated in an auxiliary ("secondary") superheater (15) arranged in an auxiliary superheating chamber ("combustion chamber 18") which is external to the flue gas conduit. In this chamber additional heat is supplied by a fuel burner 20 (see also D2T, paragraphs [0019] to [0021]). The burner is controlled such that the steam temperature T (of the secondary superheated steam 13b) is "held at a set temperature" (D2T, paragraphs [0020] and [0027]). The controlled temperature and the corresponding pressure (e.g. 400°C and approx. 40 bar; see D2T, paragraph [0021]) correspond to a viable temperature T_V within a feasible load range of the turbine.

D2 does not explicitly or implicitly disclose a state in which T is above an alert temperature T_A . It was thus undisputed that the features relating to the control state for T being above an alert temperature T_A in which the burner is controlled to a hot standby temperature are not disclosed in D2, i.e. the whole control mode defined by features [4.1] to [4.1.4].

2.2 Effect and objective technical problem

A hot standby temperature according to feature [4.1.3.1] is defined in the patent as a temperature at which "the superheated steam travelling through the auxiliary superheater is not further superheated" (paragraph [0063]). The effect linked to a

hot standby mode is mentioned in paragraph [0062] of the patent: "the boiler 10 and the superheating chamber 1 and the steam turbine 3 are kept at an elevated temperature, i.e. above ambient temperature, in order to reduce the time required to heat the said system components to a production temperature". This measure is provided for example for boiler-steam turbine systems operating under dynamic load changes (see patent, for example paragraphs [0027], [0030] and [0062] as well as Figures 4b to 4c).

The technical problem mentioned in the decision under appeal and referred to by the parties of "how to modify the operation with two-stage superheating" (this is understood as how to provide an alternative process) is not convincing since, due to its unspecific formulation, it does not take into account the technical effect discussed above.

Instead, the objective technical problem is to allow for flexible adjustment to changing electricity demands and/or changing heat loads of the power plant.

2.3 Obviousness

2.3.1 According to D2, for prior art waste incineration systems, corrosive flue gases impose limits on the operating temperature of the superheater 14' (see D2, Figure 3 and D2T, paragraph [0007]).

In order to overcome these limitations, D2 proposes a process (see Figure 1) which allows for a viable (high) steam temperature for the turbine while still avoiding high-temperature corrosion of the superheater. In this document, in a first step the (now "first") superheater (15) in the flue gas channel is operated at wall

temperatures no higher than 300°C (see D2T, paragraph [0021]). In a second step the steam temperature is then raised to 400°C by an auxiliary superheater in an auxiliary superheater chamber that is separate from the flue gas channel, i.e. in the absence of corrosive gases. The skilled person understands that, according to the teaching of D2, the power plant has to be operated such that the following two conditions are fulfilled:

- the lower temperature in the first superheater is maintained to avoid high-temperature corrosion and
- the steam temperature is further increased in the auxiliary superheater to achieve the steam temperature for which the turbine is designed.

Due to this, the temperature of the steam from the first superheater is always below a minimum viable temperature necessary for the turbine. Operation states in which, at "full load" of the power plant, the minimum viable temperature is already achieved in the first superheater (see patent, Figure 2b and paragraph [0067]: operation in the "load range W_N for normal operation") are not provided in D2. The conclusion in the decision under appeal that, in view of this, the skilled person "has absolutely [sic] no motivation to modify the system" in accordance with features [4.1] to [4.1.4] is therefore persuasive.

As argued by the respondent, in view of the teaching of D2, the skilled person would adapt the load rate of feedstock to the boiler, for example, rather than to deviate from any of the two conditions, even for variable load conditions.

This is particularly true since D2 teaches that, for operating the first superheater under high-temperature corrosion conditions, special "superheated tube materials" would be necessary (D2T, paragraph [0010]); i.e. the systems according to Figures 1 and 2 are not suitable for such an operation.

- 2.3.2 But even if, for the sake of argument, the temperature of the steam from the first superheater were to rise above the minimum viable temperature of the turbine and above an alert temperature (i.e. the first superheater being in a hot-temperature fouling state although this is to be avoided according to D2), this would not lead to the claimed invention.

Due to the intended two-step steam heating operation regime (as explained above), there is no indication in D2 that the burner, in an operation state in which extra heat from the auxiliary superheater is not required, is to be maintained in a hot standby mode in which fuel is still burned (as in accordance with features [4.1.3] and [4.1.3.1]). No evidence for corresponding common general knowledge was put forward by the appellant, either.

Instead, in this hypothetical situation in which the required steam temperature would already be met downstream of the first superheater, a straightforward solution would be to shut down the burner (accordingly, see the appellant's own argument in the statement setting out the grounds of appeal, page 19, first paragraph: "the additional superheater is not employed"). As far as the appellant has argued that D2 did not mention switching off the burner, this is not relevant as D2 does not reflect a situation in which the burner is not needed, and therefore a response to

this either by a hot standby mode or by switching off the burner is not needed either.

In addition, the appellant argued that, in such a situation, a hot standby mode was considered by the controller anyway to avoid the steam being cooled in the auxiliary superheater; however, this is not necessarily the case, but only occurs if the temperature falls below the control target temperature for the steam. The auxiliary superheater chamber in D2 is in thermal contact with the flue gas pathway via the water-cooled peripheral wall 21 (see D2T, paragraph [0020] and Figures 1 and 2). There is thus no support for the appellant's allegation that the auxiliary superheating chamber and thus also the steam passing through it were substantially cooled (i.e. below the control target of D2) if the burner is not operating. In any case, this also does not anticipate the definition of an alert temperature and its comparison with a minimum viable temperature as a criterion for triggering the hot stand-by mode as required by feature [4.1].

- 2.3.3 In a further line of argument, the appellant held that, even at low temperatures such as those disclosed for the conventional process (see D2T, paragraph [0009]: steam temperature of 260°C), a viable temperature for operating a turbine was achieved. In such a case no auxiliary superheating was necessary and the process was operated in accordance with the method in claim 1.

This is not persuasive. The turbine of the system in Figure 1 of D2 is designed for a particular higher operating temperature (in paragraph [0021] of D2T, a temperature of 400°C is mentioned). Such a turbine cannot effectively operate at a considerably lower

temperature of e.g. 260°C (see design temperature for the turbine in a conventional device of Figure 3 as disclosed in paragraph [0009]). Operating the turbine at such low temperatures would also be contradictory to the teaching of D2 (see paragraph [0021] of D2T).

Moreover, even if the lower temperature was considered feasible as the turbine operating temperature, there would be no need to operate the burner in the second superheater at all (see also point 2.3.1 above), not even at a hot standby temperature (see also point 2.3.2 above).

2.3.4 In yet another line of argument, the appellant held that the skilled person would have considered the plant disclosed in D2 for incineration processes with unproblematic non-corrosive feedstock. In such a case, it was already possible to operate the first superheater at the viable steam temperature without the need for further superheating, thereby operating the plant disclosed in D2 in accordance with the method in claim 1.

However, apart from the fact that operating the plant with a different fuel is driven by hindsight (D2 is directed to waste combustion in an incinerator and the effective use of waste heat from it, see D2T, paragraph [0001]), for such a case D2 already presents the solution in terms of the prior art considered: in the absence of a fouling problem, an auxiliary superheater external to the flue gas pathway is not necessary. The skilled person would thus consider that the conventional solution disclosed in Figure 3 of D2 (i.e. without an auxiliary superheater) is sufficient and thus would not arrive at the invention.

Even if the skilled person were to use the process according to Figures 1 and 2 for such feedstock, operation of the additional superheater would not be necessary, in particular not hot standby temperature operation, since any consumption of additional fuel in the burner without any need would lower the efficiency of the system. The appellant's further argument that the two-step superheating process would nevertheless be applied in this case since it has improved controllability is merely based on hindsight. An improvement to controllability due to two temperature steps is not discussed in D2 nor is it made evident from the documents presented.

3. As the appellant's objections to the main request either are not convincing or have not been admitted, the appeal is not successful.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



D. Grundner

C. Herberhold

Decision electronically authenticated