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Datasheet for the decision of 7 February 2023

Case Number: T 1405/18 - 3.2.06

Application Number: 11182752.3

Publication Number: 2436880

IPC: F01D5/14, F01D3/00

Language of the proceedings: EN

Title of invention:
Method of modifying a steam turbine

Patent Proprietor:
General Electric Technology GmbH

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 1405/18 - 3.2.06

D E C I S I O N
of Technical Board of Appeal 3.2.06
of 7 February 2023

Appellant: (Patent Proprietor)	General Electric Technology GmbH Brown Boveri Strasse 7 5400 Baden (CH)
Representative:	Rüger Abel Patentanwälte PartGmbB Patentanwälte Webergasse 3 73728 Esslingen a. N. (DE)
Respondent: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Paul & Albrecht Patentanwälte PartG mbB Stresemannallee 4b 41460 Neuss (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 27 March 2018 revoking European patent No. 2436880 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	M. Harrison
Members:	M. Hannam
	K. Kerber-Zubrzycka

Summary of Facts and Submissions

I. An appeal was filed by the appellant (patent proprietor) against the decision of the opposition division revoking European Patent No. 2 436 880. The appellant requested that the decision under appeal be set aside and the patent be maintained according to its main request.

II. In its reply to the appeal, the respondent (opponent) requested that the appeal be dismissed.

III. The following document, referred to by the appellant in its grounds of appeal, is relevant to the present decision:

D5 US-A-3 263 963

IV. The Board issued a summons to oral proceedings and a subsequent communication containing its provisional opinion, in which it indicated *inter alia* that those features of claim 1 known from D5 and the objective technical problem to be solved may require discussion at oral proceedings.

V. Oral proceedings were held before the Board on 7 February 2023. At the close of the proceedings, the requests of the parties were:

The appellant (patent proprietor) requested that the decision under appeal be set aside and the patent be maintained based on the main request filed with the statement of grounds of appeal.

The respondent (opponent) requested that the appeal be dismissed.

VI. Claim 1 of the main request reads as follows:

M1 Method of modifying a steam turbine (1),

M2 steam being generated by a steam generator,

M3 the method enabling the turbine (1) to be adapted to the change from a first maximum thermal power of the steam generator to a second maximum thermal power of the steam generator,

M4 the method comprising, providing a turbine (1) with a high-pressure module (2) having;

M5 at least one set (2A) of fixed blades sized for the first maximum thermal power;

M6 at least one set of moving blades (2B) sized to operate at the first and second maximum thermal powers; and

M7 a rotor (4),

M8 replacing the at least one set (2A) of fixed blades sized for the first maximum thermal power with at least one set (2A) of fixed blades sized for the second maximum thermal power,

M9 while the rotor (4) and the moving blades (2B) of the high pressure module (2) remain unchanged on changing from the first maximum thermal power to the second maximum thermal power.

VII. The appellant's arguments relevant to the present decision may be summarised as follows:

The subject-matter of claim 1 involved an inventive step.

Regarding feature M8, D5 failed to unambiguously disclose replacing the at least one set of fixed blades

with another set of fixed blades. D5 concerned a power recovery turbine such as, for example, an aircraft-type gas turbine which thus had hot, pressurised gases rather than steam as a process fluid. A gas turbine was operated with variable speed whereas a steam turbine typically had a constant speed over extended periods of time such that the demands placed upon the respective turbines were not comparable. Therefore D4 taught away from changing a set of fixed blades with an alternative set since the primary disclosure concerned simply adjusting the angular positions of the nozzle blades (see col. 4, lines 4 to 14). When read in context, col. 5, lines 14 to 18 would thus not suggest changing a full set of nozzle blades.

D5 also failed to disclose sizing the nozzle blades for a first and second maximum thermal power. In fact, as indicated in col. 4, lines 72 to 75, simple replacement of a damaged set with another set was a typical reason for the replacement.

As regards the technical problem to be solved, this was seen as 'how to adapt a turbine to change from a first maximum thermal power to a second maximum thermal power of the steam generator in a short period of time. Carrying out the change 'in a short time period' should have been included in the problem since avoiding changing the rotating blades significantly reduced modification work required and avoided excessive down-time of the turbine. Carrying out the change with 'few part changes' should not appear in the technical problem since this gave a hint towards claim 1.

D5 itself would not guide the skilled person to the claimed solution. Nozzle blades were usually changed paired with the neighbouring rotary blades and D5 did

not indicate that the rotary blades were left unchanged when the nozzle blades were replaced. D5 also related to an exhaust flow from a gas turbine which would be at low pressure, rather than in a high pressure module as claimed; the skilled person would thus not consider D5 as providing a relevant teaching. The disclosure in col. 1, lines 22 to 24 of D5 indicating a desire to avoid extensive disassembly of the turbine when adjusting the nozzle blades did not unambiguously relate to not disassembling the rotating blades; it could relate to other stages of nozzle blades being kept unmodified.

VIII. The respondent's arguments relevant to the present decision may be summarised as follows:

The subject-matter of claim 1 lacked an inventive step starting from D5 and combining with common general knowledge.

Feature M8 was known from D5. When col. 4, lines 4 to 14 was read in conjunction with col. 5, lines 14 to 18 of D5, replacing a complete set of nozzle blades with a different set, each being sized to different maximum thermal powers of the steam generator, was known. The claimed first and second maximum thermal powers were not defined in the patent and were thus to be interpreted as broadly as technically reasonable. D5 was also not limited to just gas turbines but related to turbines in general, as was evident from col. 1, lines 11 to 25.

The technical problem to be solved was 'how to adapt a turbine to the change from a first maximum thermal power of the steam generator to a second maximum thermal power of the steam generator with few changes

of parts'. Time and efficiency did not belong in the objective technical problem as these features were not reflected in claim 1.

D5 taught changing the stator blades alone, all other parts of the turbine remaining unchanged (see col. 1, lines 13 to 25). The specific embodiment of D5 also clearly did not change the rotor when the complete set of stator blades were changed. The claimed subject-matter would thus be reached by the skilled person wishing to solve the posed problem without exercise of an inventive step.

Reasons for the Decision

1. *Inventive step*

D5 in combination with the general knowledge of the skilled person

1.1 The Board finds, and both the appellant and the respondent accepted, that D5 explicitly discloses features M1 to M7 of claim 1.

1.2 D5 also discloses (see col. 5, lines 14 to 18) the part of feature M8 relating to replacing the at least one set of fixed blades with an alternative set of fixed blades.

1.2.1 The appellant's argument that D4 failed to disclose this feature because it taught away from changing a set of fixed blades with an alternative set, is not accepted. Col. 4, lines 4 to 14 of D4 indeed discloses the variation of the angular positions of existing nozzle blades in order to adjust to variations in

operating conditions. However, an alternative is disclosed in col. 5, lines 14 to 18 whereby replacement of all of the nozzle blades is effected, which nozzle blades display 'improved design and operational characteristics'. D5 thus, additionally to features M1 to M7, also discloses that part of feature M8 relating to replacing a set of fixed blades with an alternative set of fixed blades.

1.2.2 The appellant's contention, with reference to col. 4, lines 72 onwards, that damage to 'one or more' of the nozzle blades was the disclosed cause for replacement and this thus excluded replacement of a whole set of nozzle blades is also not accepted. Replacement of 'one or more' nozzle blades included a disclosure of replacing all nozzle blades which, in view of col. 5, lines 14 to 18 (as referred to in 1.2.1 above), was also a clearly intended option in D5.

1.2.3 The appellant's further argument that col. 5, lines 14 to 18 was not a 'teaching' to change all blades but rather that such a change would be convenient, does not change the Board's finding. The cited passage states that 'replacement of all of the nozzle blades ... could of course be effected in the same convenient manner'. This is a clear disclosure of it being possible to change all of the nozzle blades; whether this can be done conveniently ('in the same convenient manner') or not does not negate the explicit disclosure of all nozzle blades being changed.

2. The appellant's further contention that D5 concerned a power recovery turbine such as, for example, an aircraft-type gas turbine which thus had hot, pressurised gases rather than steam as a process fluid, is not accepted. Leaving aside the issue of whether

this constituted an amendment to the party's appeal case under Article 13 RPBA 2020 due to it not being mentioned in the appeal grounds, the broadest disclosure in D5 is anyway not limited to a gas turbine as the appellant argues. Col. 1, lines 11 to 12 indicates the invention to relate to nozzle blade assemblies 'for use in turbines', lines 13 to 25 further specifying how the nozzle blade assembly can be configured in 'the turbine' without any limitation as to what kind of turbine this might be. Therefore the skilled person would understand that the nozzle blade assemblies disclosed in D5 are suited to turbines in general and that the power recovery turbine is simply a particular embodiment. Why it would not be suited to a steam turbine was not argued by the appellant.

2.1.1 D5 thus fails to disclose the following features of claim 1:

M8 (part) [the replacement set of fixed blades] is sized for the second maximum thermal power; and
M9 while the rotor and the moving blades of the high pressure module remain unchanged on changing from the first maximum thermal power to the second maximum thermal power.

2.2 Based on these differentiating features over D5, the objective technical problem to be solved is seen as 'how to adapt a turbine to the change from a first maximum thermal power of the steam generator to a second maximum thermal power of the steam generator with few changes of parts'.

2.2.1 The appellant argued that the problem should not include 'with few changes of parts' since this gave a hint to the solution in claim 1. The Board disagrees.

The inclusion of 'with few changes of parts' in the objective problem is seen to be suitably general so as not to include a pointer to the claimed solution. Any number of solutions to achieving 'few changes of parts' can be envisaged e.g. not changing the bearings despite a change in turbine power, the claimed solution however specifically defining that the rotor and the moving blades remain unchanged.

2.2.2 The appellant's argument that the posed problem should additionally include that the adaptation can be carried out 'in a short time period' is not accepted. No feature included in claim 1 is directed to suitably modifying the turbine in a short period of time. Whilst it can be accepted that replacement of the blades of the stator only might be relatively simple when compared to changing the blades of the rotor, this is not a difference with respect to D5 which discloses the nozzle blade changes being performed 'without extensive disassembly of the turbine' (see col. 1, lines 15 to 17 and 22 to 25 of D5). The skilled person would understand this as being without disassembly of the rotor and rotary blades. Even if, to optimise the efficiency of a turbine, changes to nozzle blades were usually paired with changes to neighbouring rotary blades, D5 teaches nozzle blade changes alone, with the neighbouring rotary blades being left unchanged. Relative to D5, therefore, no shortening of the time period for modification would necessarily be achieved.

2.2.3 The appellant's arguments regarding a shutdown of a power plant being time critical such that speeding up any modification would be beneficial is also not seen to be an objective consideration, not least when starting from D5 as the closest prior art which, as indicated in point 2.2.2 above, also discloses leaving

the rotor unchanged. The same conclusion is also reached with respect to claim 1 avoiding the complex replacement of blades in the rotor and avoiding possible damage of the rotor ensuing from its removal; these factors are of no advantage with respect to D5 which also leaves the moving blades unchanged (see, for example, col. 1, lines 15 to 17 and 22 to 25 of D5).

2.2.4 The objective technical problem to be solved is thus as indicated in point 2.2 above. This also matches what was stated in the Board's provisional opinion (see point 2.1.3)

2.3 The Board finds that D5 itself already provides guidance to the skilled person, starting from D5 and in the light of the objective technical problem, to size the replacement set of stator blades for the second maximum thermal power whilst not changing the rotor and the moving blades.

2.3.1 Whilst col. 4, lines 4 to 14 discusses an embodiment in which, rather than replacing a set of fixed blades, the angular positioning of the nozzle blades are adjusted, this adjustment is nonetheless carried out to account for 'variation in the energy characteristics of the hot pressurized gases and/or the operational requirements' of the turbine, in order to achieve 'maximum operational efficiency [of the turbine] under a variety of operational conditions'. The Board cannot see the disclosed adjustment as anything other than tailoring the nozzle blades to the new thermal power of the process fluid. Such a thermal power of the process fluid is also seen to correspond to the claimed 'second maximum thermal power' since this feature is not further defined in claim 1 and so is interpreted in its broadest technically reasonable manner to simply be an

alternative operating point of the process fluid, different to the first maximum thermal power. The appellant also did not argue that maximum thermal power had any other particular meaning.

2.3.2 Col. 5, lines 14 to 18 of D5 discloses an option of replacing all of the nozzle blades with those of 'improved design and operational characteristics', which directly links this disclosure to that in col. 4, lines 4 to 14, discussed above, in which the nozzle blade change is sized to the new maximum thermal power. This guides the skilled person in the light of the problem to be solved to feature M8 without their exercising an inventive step.

2.3.3 As regards feature M9, D5 also discloses the nozzle blade changes being performed without extensive disassembly of the turbine (see col. 1, lines 13 to 17 and 18 to 25). With removal and modification of a rotor and its rotating blades being a significant task in a turbine overhaul, such a disclosure of 'without extensive disassembly of the turbine' would directly guide the skilled person to avoid changes to the rotor and the moving blades when carrying out the modification of the nozzle blades, thus satisfying feature M9 of claim 1.

2.3.4 The appellant's argument that D5 related to exhaust flow from a gas turbine which was at low pressure and thus could not provide a hint as to how to modify the claimed high pressure steam turbine is not accepted. As mentioned above, D5 is directed to nozzle blade assemblies for use in turbines in general (see col. 1, lines 11 to 12) and is directed to power recovery gas turbines (i.e. low pressure turbines) only in preferred disclosures (see e.g. col. 1, lines 31 to 34). The

skilled person would thus not limit their understanding of the disclosure solely to low pressure turbines since broader applicability to turbines in general is disclosed. Also, no reason has been given why the teaching of D5, albeit including a gas turbine embodiment, would be unsuitable for a steam turbine.

2.3.5 The appellant's argument that nozzle blades were usually changed together with the rotary blades because they are paired with one another, and this would be how the skilled person would interpret D5, is also not accepted. As indicated in points 2.2.2 and 2.3.3 above, D5 discloses the nozzle blade changes being performed 'without extensive disassembly of the turbine' which the skilled person would understand as being without disassembly of the rotor and rotary blades. Even if, to optimise the efficiency of a turbine, changes to nozzle blades were usually paired with changes to neighbouring rotary blades, D5 teaches nozzle blade changes alone, with the neighbouring rotary blades being left unchanged.

2.3.6 The appellant's further contention in this regard, that the stated 'without extensive disassembly' in D5 related to modifying just one stage of nozzle blades, the other stages being kept unmodified, is unpersuasive. As was also accepted by the appellant (or at least not contested), the more onerous disassembly of a turbine related to replacement of the blades in the rotor rather than replacement of nozzle blades. Consequently avoiding disassembly of the rotor and its blades is that which would provide the greatest advantage when modifying a turbine. Beyond this, the detailed embodiment disclosed in D5 also makes no mention of performing any disassembly of the rotor, thus providing further corroboration that the intention

in D5 is for the nozzle blades alone to be modified, the rotor and the moving blades remaining unchanged.

2.3.7 In summary therefore, starting from D5 and wishing to solve the objective technical problem, the skilled person would be guided by D5 itself to reach the claimed subject-matter without exercising an inventive step. The subject-matter of claim 1 thus lacks inventive step (Article 56 EPC).

2.3.8 The main request (also the appellant's sole request) is thus not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

D. Grundner M. Harrison

Decision electronically authenticated