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**Datasheet for the decision
of 1 October 2012**

Case Number: T 0594/10 - 3.2.03
Application Number: 01934637.8
Publication Number: 1283974
IPC: F24D 3/00, F24D 3/18,
F24D 12/02, F02G 1/043,
F02G 1/055, F24H 1/00
Language of the proceedings: EN

Title of invention:

Apparatus and method for combined generation of heat and electricity

Patentee:

Enatec Micro-Cogen B.V.

Opponent:

Microgen Energy Limited

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 84, 123(2)

Keyword:

"Novelty (yes)"
"Inventive step (no)"

Decisions cited:

-

Catchword:

-



Case Number: T 0594/10 - 3.2.03

D E C I S I O N
of the Technical Board of Appeal 3.2.03
of 1 October 2012

Appellant: Microgen Energy Limited
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
13 January 2010 concerning maintenance of
European patent No. 1283974 in amended form.

Composition of the Board:

Chairman: U. Krause
Members: C. Donnelly
K. Garnett
Y. Jest
I. Beckedorf

Summary of Facts and Submissions

- I. The appeal lies from the decision of the opposition division, posted on 13 January 2010, maintaining European patent no. 1283974 in amended form.
- II. The opponent (hereinafter "the appellant") filed a notice of appeal on 22 March 2010 and paid the fee on the same day. By letter of 23 March 2010 the appellant filed a correction to the name of the patent proprietor referred to in the notice of appeal. The grounds of appeal were filed on 24 May 2010.
- III. The following documents were cited by the appellant in the grounds:
- D1: US-A-5419284;
 - D2: "Microgen- Cogeneration for the home", R.G. Dann, J.A. Parsons and A.R. Richardson, 1998 International Gas Research Conference, 8-11 November 1998, San Diego, California USA, pages 12 to 22;
 - D3: WO 99/40310
 - D4: Stirling cycle machines, G. Walker, Clarendon Press Oxford 1973, pages 121 to 127;
 - D5: EP-A-1083 393 (prior art under Article 54(3));
 - D6: Central Heating, undated brochure, pages 90 to 95
 - D7: Collins English Dictionary, sixth edition 2003, page 187, Harper Collins Publishers, Glasgow;
 - D8: EP-A-582109 and translation;
 - D8A: EP-B-582109 and partial translation;
 - D9: Standard EN483: 1999 Comité de Normalisation (CEN).

IV. The patent proprietor (hereinafter "the respondent") replied to the appellant's case by letter of 4 October 2010.

V. In a communication dated 25 May 2012 pursuant to Article 15(1) RPBA, annexed to the summons to oral proceedings the Board informed the parties of its provisional opinion. In particular, the Board indicated that the subject-matter of claim 1 as maintained by the opposition division appeared to be new with respect to D5, but that inventive step would need to be assessed with respect to both D2 and D8.

VI. By letter of 25 June 2012 the proprietor-respondent withdrew its request for oral proceedings.

VII. The party's requests are as follows:

The appellant requests that the impugned decision be set aside and the patent revoked in its entirety.

The respondent requests:

as a main request, to reject the appeal or, alternatively, to maintain the patent in amended form on the basis of one of the first to fourth auxiliary requests filed with letter of 4 October 2010.

VIII. Independent apparatus **claim 1** as maintained by the opposition division reads:

"Apparatus for heating fluid in a pipe system comprising:

- a fluid circuit comprising pipes (4);

- a first burner (3) for heating the pipes (4) of the fluid circuit;
- a feed (12) for air and fuel for causing combustion of this mixture by the first burner;
- a generator (20) comprising a Stirling engine with a head (21) for generating electrical energy;
- a second burner (11) for heating the head of the generator (20) for generating electrical energy; and
- an outlet pipe (26) for discharging flue gases from the second burner into the space where the first burner is situated."

Independent method claim 9 as maintained by the opposition division reads:

"A method for heating fluid, wherein:

air and fuel are fed to a first burner (3), through a feed for causing combustion of this mixture;

- pipes (4) of a fluid circuit are heated by the first burner;

- a head (21) of a Stirling engine of a generator which generates electrical energy is heated by a second burner (11), and

- flue gases from the second burner are discharged through an outlet pipe (26) into the space where the first burner is situated."

IX. Auxiliary requests

First auxiliary request

Claim 1 has been amended to read:

"Apparatus for heating fluid in a pipe system comprising:

- a fluid circuit comprising pipes (4);
- a first burner (3) for heating the pipes (4) of the fluid circuit such that the flue gases coming from the first burner flow along the pipes (4) in downward direction and are deflected into an outlet pipe (6);
- a feed (12) for air and fuel for causing combustion of this mixture by the first burner;
- a generator (20) comprising a Stirling engine with a head (21) for generating electrical energy;
- a second burner (11) for heating the head of the generator (20) for generating electrical energy; and
- an outlet pipe (26) for discharging flue gases from the second burner into the space where the first burner is situated, such that the flue gases coming from the second burner (11) heat the fluid in the pipes (4)."

Second auxiliary request

Claim 1 reads:

"Installation for combined generating heat and electricity, comprising a cooling circuit (35) comprising a pump (36), a three-way valve (37), radiators (38) and a heat exchanger (39) for a boiler such as are connected in practice for heating of houses and on commercial premises, the cooling circuit (35) being connected to an apparatus (1), the apparatus comprising:

a fluid circuit comprising pipes (4);

- a first burner (3) for heating the pipes (4) of the fluid circuit such that the flue gases coming from the first burner flow along the pipes (4) in downward direction and are deflected into an outlet pipe (6);

- a feed (12) for air and fuel for causing combustion of this mixture by the first burner;

- a generator (20) comprising a Stirling engine with a head (21) for generating electrical energy;

- a second burner (11) for heating the head of the generator (20) for generating electrical energy; and

- an outlet pipe (26) for discharging flue gases from the second burner into the space where the first burner is situated, such that the flue gases coming from the second burner (11) heat the fluid in the pipes (4)."

Third auxiliary request

Claim 1 is as the second auxiliary request but additionally comprising the feature wherein:

"the generator is provided with a cooling circuit (31) which is connected in series behind the fluid circuit of the first burner."

Fourth auxiliary request

Claim 1 is as the third auxiliary request but comprising the feature wherein:

"the apparatus further comprises a fan (7) for discharging the flue gases, which fan is located downstream of the pipes relative to the flow of flue gases."

Method claims

Corresponding amendments have also been made to the independent method claim of each request.

X. The relevant arguments of the parties can be summarised as follows

Respondent's Main request, Novelty

Appellant

Claim 1 lacks novelty over D5.

In particular, D5 discloses "an outlet pipe for discharging flue gases from the second burner into the space where the first burner is situated".

This feature is disclosed in figure 1 and described on page 4, lines 13 to 14 where it is stated that "a part of the thermal-cell housing 11 partly decouples the two burners 15 and 16". It is apparent from figure 1 that this part is a wall of an outlet pipe which conveys the exhaust gas (shown by arrow 18) from the engine into the space where the burner 16 is located.

Respondent

The only structural features of the passage disclosed in D5 are those shown in the cross-section of the device in figure 1. This illustrates a passage having a closed upper boundary and an open lower boundary, but provides no other details. It is impossible to conclude from this that the passage has the structure of a pipe in that it defines a conduit.

XI. Inventive step

Appellant

The subject-matter of claim 1 as maintained does not involve an inventive in view of:

(i) D2 and common general knowledge or in view of the teaching of D1 or D8; or

(ii) D8 and common general knowledge.

The only difference between D2 and the subject-matter of claim 1 as maintained is that the outlet pipe discharges the flue gas "into the space where the first burner is situated". However, this distinction is trivial since there is no prejudice against combining the heat exchangers in D2 and this would be an obvious modification falling within the realm of routine design in view of the fact that in both cases the hot gases give up their heat to a water stream.

However, even if it is not accepted that such a modification is obvious from D2 alone then D1 and D8 teach exactly this configuration.

Alternatively, starting out from the device disclosed in D8 as the nearest prior art, the subject-matter of claim 1 as maintained differs only in that the generator is specifically designated as being a Stirling engine. Since there is no difference between the exhaust gas from a Stirling engine and the exhaust gas from any other type of engine, it would seem an obvious choice for the skilled person to use a Stirling engine in the apparatus of D8.

Respondent

Starting out from device known from D2 it is not obvious to replace the two separate heat-exchangers with one large one. The resulting over-dimensioned heat exchanger means there is a decrease in flow speed of the flue gases which leads to a more efficient exchange. Also using a single heat-exchanger means only one fan is necessary.

D8 was cited in the initial European search report as a document describing the general state of the art which was not considered to be of any particular relevance and is mentioned as such in the contested patent. The appellant's arguments regarding D8 are based on hindsight.

XII. Auxiliary requests

Appellant

In the application documents as filed the flue gases are deflected into the outlet pipe (6) by the fan (7); no other way is disclosed. Hence, there is no basis for the generalisation now specified in claim 1 of the first auxiliary request and the requirements of Article 123(2) are not met. Such a feature anyway lacks an inventive step.

The term "cooling circuit" used in the second auxiliary request is unclear. Moreover, there is no basis in the application documents as filed for the broad generalisation to all the types of connection between a cooling circuit and a fluid circuit now claimed rather than the one specific connection disclosed. Thus, the claim does not meet the requirements of either Article 84 or 123(2).

The third auxiliary request introduces a further cooling circuit which adds to the lack of clarity already present in the second auxiliary request.

The fan is only originally disclosed as being within the heat-exchanger casing. Claim 1 of the fourth

auxiliary request covers the possibility that it could be in the outlet pipe; Article 123(2) is therefore infringed.

Respondent

The skilled person would realise that a fan is not strictly necessary for deflecting the flue gases through the outlet pipe. By flowing the flue gases downwardly along the pipes an optimal heat exchange is achieved. Thus, the subject-matter of claim 1 according to the first auxiliary request is originally disclosed and inventive.

It is clear that the term "cooling circuit" used in the second auxiliary request refers to that part of the circuit where the fluid gives up its heat. The wording used to define the various components of the circuit is taken directly from the description.

It is clear from the reference signs used in claim 1 of the third auxiliary request that the "cooling circuit (31)" is a separate from the "cooling circuit (35)" and is connected in series behind the fluid circuit of the first burner (3). This provides the advantage of reducing temperature differences whilst ensuring the efficiency of the Stirling engine.

The positioning of the fan downstream of the pipes is not limited to a specific location within the heat exchanger casing. Further, this feature is not obvious since there is increased corrosion of components from exposure to flue gases and condensation as well as the need to control the fan as a function of both burners.

In order to overcome these problems a lot of engineering is required.

Reasons for the decision

1. The appeal is admissible.
2. State of the art
 - 2.1 D8 was filed for the first time with the grounds of appeal, partly in response to some of the comments made in the decision concerning D1. It is immediately apparent that D8 is very relevant since it shows a microgeneration plant in which the exhaust gases from a heat-engine driving a generator are used to pre-heat a hot-water supply. Thus, D8 is admitted into the proceedings.
3. Novelty
 - 3.1 D5 relates to a heating apparatus comprising two burners disposed in a housing and discharging their flue gases 18,19 into separate parts of a common combustion chamber upstream of a heat exchanger 12. Figure 1 of D5, referred to by the appellant, illustrates a passage between the two parts of the common combustion chamber having a closed upper boundary and an open lower boundary.
 - 3.2 D5, column 2, lines 54 to 57 states that "a part of the thermal-cell housing 11 partly decouples the two burners 15 and 16" (also see page 4, lines 13 to 14 of the English translation of D5 provided by the

appellant). From figure 1 it can be seen that the part in question extends from the upper portion of the housing and lies between the outlet for the exhaust gases 18 emanating from the burner used to heat the Stirling engine head and the outlet for the exhaust gases 19 coming from burner 16. However, since figure 1 only shows a cross-section of the thermal-cell housing, it is impossible to tell exactly what form this part has. Further, it is apparent, both from the passage cited by the appellant and the figure, that the principal function of this part is separation of the exhaust gas flows, as illustrated by the arrows 18 and 19 both going vertically downwards to the heat exchanger rather than deliberate conveyance of the exhaust stream 18 into the space occupied by burner 16.

- 3.3 In conclusion, D5 does not directly and unambiguously disclose the feature of an outlet pipe for discharging flue gases from the second burner into the space where the first burner is situated.

Thus, the subject-matter of claim 1 is new.

4. Inventive Step

- 4.1 The appellant has argued that the subject-matter of claim 1 as maintained lacks an inventive step starting out from either D2 or D8.

- 4.2 D2, in particular figure 5 and the text on page 19, shows a Stirling engine used in a microcogeneration apparatus. The only difference between the apparatus of D2 and the subject-matter of claim 1 is that the exhaust gas from the Stirling engine burner gives up

its heat to the domestic radiator circuit in an exchanger which is separate from the supplementary heater.

- 4.3 The Board agrees with the appellant that this difference does not justify the recognition of an inventive step. Faced with the problem of recovering heat from the engine burner gases the skilled person has only two options: (i) to provide a dedicated exchanger or (ii) to use the same exchanger as the supplementary heater.
- 4.4 The decision as to which of these alternatives to apply is a question of economics in weighing initial capital costs against increased efficiency (as discussed for example in D2 from the last paragraph on page 15 to the first paragraph page 16) based on routine design considerations taking into account the relative load cycles of the Stirling engine (electricity production) and the supplementary burner (heating demand). D2 also studies whether supplementary heating is needed at all if appropriate storage is available (see page 16, second and third paragraphs, figure 3). In relation to a demonstration apparatus this would mean that a separate supplementary heater would need to be provided in order to make the comparisons. Once the decision has been made to incorporate the supplementary heater, an optimisation in terms of reducing capital costs and space by using one heat-exchanger, as shown for example in D8, is obvious.
- 4.5 The respondent has made reference to the advantages of using a single heat-exchanger such as increased heat exchange efficiency and the need for only one fan.

However, even if present, these must be considered as bonus effects resulting from the obvious choice to use a single heat-exchanger.

4.6 Alternatively taking D8 as the nearest prior art, this document describes an:

apparatus for heating fluid in a pipe system comprising:

- a fluid circuit comprising pipes (6,8,22);
- a first burner (5) for heating the pipes (6,8,22) of the fluid circuit;
- a feed (see column 2, lines 12 to 13) for air and fuel for causing combustion of this mixture by the first burner;
- a generator (28) comprising a diesel engine (27) for generating electrical energy;
- an outlet pipe (30,33) for discharging exhaust gases from the engine into the space where the first burner (5) is situated.

4.7 The subject-matter of claim 1 differs therefrom in that the diesel engine is replaced by a Stirling engine with a second burner for heating the head of the generator.

Thus, the only difference between D8 and the subject-matter of claim 1 lies in the type of heat-engine employed.

- 4.8 However, the choice of engine type is a matter of routine design which would be made according to circumstances. The advantages of the Stirling engine, such as low maintenance (see for example D2, page 18) as well as multi-fuel capability and silent operation, are well known. It would be obvious for the skilled person to choose such an engine where such factors are of prime importance (e.g. for operation in areas lacking modern infrastructure or domestic use, as discussed in D2).
- 4.9 Thus, the subject-matter of claim 1 as maintained lacks an inventive step taking either D2 or D8 as the nearest prior art.
5. First auxiliary request
- 5.1 The passage at page 3, lines 1 to 4 of the published application documents implies that the flue gases need not necessarily be deflected into the outlet pipe by a fan since the fan (7) is mentioned with respect to a particular embodiment in a separate sentence after the general statement to the effect that "flow is deflected as according to arrows A into an outlet pipe 6". Thus, the amendment introduced into claim 1 of the first auxiliary request specifying that that "the flue gases coming from the first burner flow along the pipes (4) in downward direction and are deflected into an outlet pipe (6)" meets the requirements of Article 123(2) EPC.
- 5.2 However, such a flow pattern is shown in D8 where the exhaust gases from the burner 5 flow in the direction of arrow "a" downwards along the pipes of the exchangers 7 and 10 in an S-shaped path until being

eventually deflected into an outlet pipe 17 (see column 2, lines 19 to 26).

5.3 Thus, the subject-matter of claim 1 according to first auxiliary request does not involve an inventive step over the disclosure of D8.

6. Second auxiliary request

6.1 In claim 1 of the second auxiliary request it is not clear whether the terms "cooling circuit" and "fluid circuit" define the same or different circuits. Originally, the term "cooling circuit" was used to refer to that cooling the Stirling engine. Lines 11 and 12, page 4 of the published application indicate that the cooling circuit as defined in this request would only be such when in combination with the engine cooling heat exchanger 31.

6.2 Notwithstanding the above objection, the connection of such circuits comprising standard elements to apparatus for combined generating heat and electricity is well known in the art since providing household heat is one of the principal system requirements. For example, D8 discloses a circuit comprising a pump (P), a 4-way distributor valve (24), radiators and a heat exchanger for a boiler such as are connected in practice for heating of houses ("Hausanlage 21") connected to an apparatus for combined generation of heat and electricity.

6.3 Thus, even if the unclear designation of the "cooling" circuit were accepted, the requirements of Article 56 would not be met since the claim merely defines the

connection of a conventional domestic hot water supply circuit using standard elements.

6.4 The second auxiliary request is therefore not allowable.

7. Third auxiliary request

7.1 The further cooling circuit cannot be distinguished from the first cooling circuit by reference signs which do not form part of the claim. The "cooling circuit 31" in fact appears to be a heat-exchanger which cools the Stirling engine. Thus, the requirements of Article 84 EPC are not met.

7.2 Providing a heat-engine with a cooling circuit is a conventional measure. In the case of a heat-engine used in an apparatus for combined generation of heat and electricity it would be an obvious measure to connect the cooling circuit with the domestic heating circuit in order to maximise efficiency. Such thermodynamic coupling is shown for example in D8 where water enters the engine at 31 and leaves at 32 to return to the distributor valve 24 where it can be returned to the domestic hot water supply which is heated by the burner 5 in exchanger 6 and circulated by the pump 25.

7.3 Thus, for both these reasons, the third auxiliary request is not allowable.

8. Fourth auxiliary request

8.1 The appellant is correct in arguing that the fan is only explicitly originally disclosed as being within the heat-exchanger casing.

- 8.2 Furthermore, the apparatus of D8 comprises a fan 16 (Gebläse 16) for discharging the flue gases, which fan is located downstream of the pipes relative to the flow of flue gases (see column 2, lines 29 to 32 and figure).
- 8.3 Thus, even if an implicit disclosure of a fan arrangement outside the heat-exchanger casing were to be accepted, the subject-matter of claim 1 would still lack an inventive step with respect to D8.
- 8.4 The fourth auxiliary request is therefore not allowable.
9. Since the respondent-patentee has withdrawn its request for oral proceedings and has had the opportunity to present its comments concerning all the objections brought above, the Board can issue its decision on the basis of the written submissions.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

Registrar:

Chairman:

D. Hampe

U. Krause