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Aktenzeichen / Case Number / N° du recours : T 191/87 - 3.4.1

Anmeldenummer / Filing No / N° de la demande : 80 900 657.0

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Bezeichnung der Erfindung: Method and apparatus for regulating the temperature  
Title of invention: of a heating element in a water heater  
Titre de l'invention :

Klassifikation / Classification / Classement : H 05 B 1/02, F24 H 9/20

### ENTSCHEIDUNG / DECISION

vom / of / du 13 September 1988

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /  
Titulaire du brevet :

Ferrofil A.S.

Einsprechender / Opponent / Opposant :

I Joh. Vaillant GmbH u. Co.  
II Stibel Eltron GmbH & Co. KG

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC, Rule 29(1) EPC

Schlagwort / Keyword / Mot clé :

"Inventive step (confirmed)" "No need in  
opposition procedure to insist on redrafting  
the claims for compliance with Rule 29(1)  
EPC".

Leitsatz / Headnote / Sommaire

Europäisches  
Patentamt

Beschwerdekammern

European Patent  
Office

Boards of Appeal

Office européen  
des brevets

Chambres de recours



Case Number : T 191 /87 - 3.4.1

**D E C I S I O N**  
of the Technical Board of Appeal 3.4.1  
of 13 September 1988

**Appellant :**  
(Opponent)

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**Representative :**

**Respondent :**  
(Proprietor of the patent) Ferrofil A.S.  
N-2151 Arnes (NO)

**Representative :**  
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**Decision under appeal :** Interlocutory decision of Opposition Division  
of the European Patent Office dated 24 March  
1987 maintaining European patent No. 0 027 112  
(as amended)

**Composition of the Board :**

**Chairman :** K. Lederer  
**Members :** E. Turrini  
J. Stephens-Ofner

## Summary of Facts and Submissions

I. European patent No. 0 027 112 was granted on the basis of European patent application No. 80 900 657.0.

II. The Appellants Stiebel Eltron GmbH & Co. KG and Joh. Vaillant GmbH u. Co., who will be referred to hereafter as "Stiebel Eltron" and "Vaillant", respectively, separately filed notices of opposition against the European patent, requesting revocation thereof on the ground of non-patentability because of lack of inventive step in view of the prior art disclosed, inter alia, in document:

A: US-A-2 039 641.

III. By an interlocutory decision within the meaning of Article 106(3) EPC the Opposition Division decided to maintain the patent in an amended form, as requested by the proprietor of the patent (Respondent), and accordingly notified to the parties in a communication pursuant to Rule 58(4) EPC, dated 21 November 1986.

The set of claims on which the decision was based comprises eight claims, of which Claims 1 and 5, the only independent claims, read as follows:

"1. Method of regulating the power supplied to an electric heating element of an electric water heater, the heating element being immersed in water which is to be heated to a certain temperature, the rated value, the supplied power being regulated as a function of the temperature of the water characterized in that the power which is supplied to the heating element for heating the water, is regulated not only in dependence on the temperature of the water, but also in dependence on the temperature of the heating

element, the temperature of the heating element being measured directly and/or indirectly so that

- (a) when the temperature of the element is below a certain critical value and the temperature of the water in the water heater is below the rated value, maximum power is supplied to the heating element,
- (b) when the temperature of the element has reached the critical value, but the temperature of the water in the water heater is below the rated value, less power than the maximum power is supplied to the element for further heating of the water, so that the temperature of the element is kept below the critical value, and
- (c) when the water temperature reaches the rated value, no power is supplied."

"5. Apparatus for carrying out the method as claimed in Claim 1, characterized in that the apparatus comprises a control means which regulates the power supplied to the heating element not only in dependence on the temperature of the water, but also in dependence on the temperature of the heating element, the control means measuring the temperature of the heating element directly and/or indirectly and comprising or being connected to devices for controlling the power in dependence on both the water temperature and the temperature of the heating element, so that:

- (a) when the temperature of the element is below a certain critical value and the temperature of the water in the water heater is below the rated value, there is supplied maximum power to the heating element,

(b) that when the temperature of the element has reached the critical value but the temperature of the water in the water heater is below the rated value, there is supplied less power than the maximum power to the element for further heating of the water, so that the temperature of the element is kept below the critical value, and

(c) when the water reaches the rated value, no power is supplied."

Claims 2 to 4 and 6 to 8 are appendant to Claims 1 and 5, respectively.

IV. Both Appellants lodged an appeal against the interlocutory decision.

V. Oral proceedings were held, at the end of which the Appellants both requested that the decision under appeal be set aside and that the patent be revoked.

The Respondent requested that the appeal be dismissed and that the patent be maintained in the amended form set out in the communication pursuant to Rule 58(4) of 21 November 1986 (main request).

As an auxiliary request, the Respondent requested that the patent be maintained in an amended form on the basis of Claims 1 and 5 filed on 20 August 1988, and Claims 2 to 4 and 6 to 8 as granted. Claims 1 and 5 of the set of claims in accordance with his auxiliary request are distinguished from Claims 1 and 5 of his main request essentially by a different division of the features between the preamble and characterizing portion of these claims.

VI. In support of his request, the Appellant Stiebel Eltron essentially relies upon an additional citation, namely,

D: US-A-3 456 095, which he filed on 1 June 1988.

He submits, in particular, that document D discloses, with reference to Figures 4 and 11, a regulation method as set out in the preamble of Claim 1, wherein the power supplied by thyristor 16 (Fig. 4) is a function of both the temperature of the water as measured by thermistor 64 and of the temperature of the heating element as measured by thermistor 26. In addition, Figure 5 shows a temperature curve which shows firstly, a linear portion between room temperature and a temperature at which the curve shows a point of inflexion, and which, in the absence of any limitation in this respect in present Claim 1 also represents a "critical temperature", and secondly, a portion of decreasing slope, marked 70 between said point of inflexion and an adjacent plateau, and, thirdly, a horizontal portion marked 66 and corresponding to the stabilization of the system at a "rated temperature". In the first portion, the temperature of the element is below the critical value, the temperature of the water is below the rated value, and maximum power is supplied to the heating element; in the second portion, the temperature of the element has reached the critical value but the temperature of the water is still below the rated value, and the power supplied by thyristor 16 is progressively reduced for further heating up of the water; whilst in the third portion, the water has reached the rated value and no power is supplied. Accordingly, the first, second and third portions of the curve shown in Figure 5 respectively correspond to steps (a), (b) and (c) as set out in Claim 1, which, so the Appellant contends, is fully anticipated by document D.

This, he argues, is also confirmed by the fact that the latter curve is similar in shape to the temperature curve 18 shown in Figure 5 of the patent in suit and said therein to result from the performance of the claimed method. Having regard to the similarity between the electric water heaters and the power regulating means described respectively in document D and in the patent in suit such similarity of the temperature curve can result only from the use of the same regulating methods.

The Appellant Vaillant submits that the sole distinguishing feature between the claimed method and the method disclosed by document D is that, in the claimed method, the temperature of the heating element is kept below the critical value as set out at the end of paragraph (b) of Claim 1. This feature, however, would have been obvious to the skilled addressee, who would have known, for instance from document A, that the temperature of the heating element should not exceed a certain critical value, if its burning out was to be avoided. He also argued that features directed to the critical temperature cannot positively contribute to the patentability of the claimed method, since the attacked patent does not specify the value of such critical temperature, which, furthermore, does not even need to be separately measured in the specific embodiment defined in dependent Claim 2.

Alternatively, he submits that the method disclosed by document A comprises steps (a) and (c) of the method set out in Claim 1, which is thus distinguished therefrom only by the stepped power reduction set out in step (b). Since it is clear from document A that the temperature of the heating element should not exceed a certain critical value at which burning out occurs, it would have been obvious to the skilled person starting from the method of document A to use the stepped power reduction procedure taught by

document D which is aimed precisely at avoiding such undesirable temperature overshooting.

VII. These arguments are contested by the Respondent, who stresses the fact that the present invention neither addresses the problem of avoiding overheating of the heated medium, nor that of preventing burning out of the heating element, to which documents D and A are respectively directed. On the contrary, the attacked patent is concerned with the problem of adjusting the lifetime of the heating element in an electric water heater, which is about 5 years in the prior art devices, to the usual 20 years lifetime of the remaining parts of the water heater. The invention is based on the recognition that the chemical processes which impair the durability of the heating element can be considerably slowed down, and held at an acceptable level, when the temperature of the heating element in operation is prevented from exceeding a certain critical value, which depends on the chemical quality of the water being heated up in the apparatus, and is therefore subject to geographical variations. The combination of steps (a) and (b), as set out in Claim 1, which is essential to the achievement of such temperature control, is not shown by any of the cited prior art documents, nor could it have been deduced by any combination of the technical features disclosed in documents A and D.

More specifically, whereas in the method defined in Claim 1, the reduction of the power supplied to the heating element is initiated solely by its temperature achieving a predetermined critical value and is controlled in a very specific manner, (i.e. so as to keep its temperature below said critical value),

- document A merely teaches on/off operation of a thermostatically controlled switch at a particular temperature; whilst
  
- document D discloses a temperature-regulating procedure, wherein progressive reduction of the power supply is initiated as a response also to the water temperature detected by thermistor 64, and is not conducted in such a way as to prevent further rising of the temperature of the heating element, as detected by thermistor 26.

### Reasons for the Decision

1. Both appeals are admissible.
  
2. Though not having been submitted in due time in the sense of Article 114(2) EPC, document D on which both Appellants rely was not in the Board's view to be disregarded, since it is the sole citation on the file disclosing a method for regulating the power supplied to an electric heating element immersed in water, wherein the supplied power is regulated in dependence on the temperature of both the water and the heating element, which are separately determined. The oral proceedings have been postponed to give the Respondent adequate time for consideration of the new issues raised by the Appellants on the basis of document D.
  
3. **Novelty**
  - 3.1 Document D discloses a method of regulating the power supplied to an electric heating element 74 (Figure 11) of an electric water heater, the heating element being immersed in water 72 which is to be heated to a certain

temperature, the rated value, the supplied power being regulated as a function of the temperature of the water, and of the temperature of the heating element, as defined in the first paragraph of Claim 1 in accordance with Respondent's main request. In particular, the temperature of the heating element is sensed by thermistor 26 (Figure 4), which controls the gate current of a thyristor 16 supplying power to the heating element in such a way, that an increase in the temperature of the thermistor causes a corresponding reduction of the power supplied by the thyristor 16. In order to avoid excessive temperature overshoot of the heated medium when the device is first put into use from its cold or room-temperature condition (Figure 5, curve 68), a second thermistor 64 is connected in series in the gate circuit of thyristor 16, and is so positioned as to sense the bath temperature at a distance from the heater. Accordingly, in an intermediate portion 70 of the temperature curve shown in Figure 5, whereas the rapid temperature rise of the heating element is not yet adequately compensated for by thermistor 26, since the latter cannot respond instantaneously to temperature changes, the temperature detected by thermistor 64 is still relatively low, and its impedance therefore limits the power supplied by thyristor 16 to avoid temperature overshoot. Subsequently, when the thermistor 64 becomes warm, its impedance decreases to a low and fairly stable value (column 6, line 54 to column 7, line 15).

It should further be noticed that, at least at the beginning of the heating procedure when the temperatures of both the heating element and the liquid are still near room temperature or slightly above, the former temperature is necessarily below a certain (higher) value, which may be that encompassed by the expression "critical value" in the sense of the present patent (see point 4.4 below), while the latter temperature is below the rated value and maximum

power is still supplied to the heating element as defined in step (a) of Claim 1 in accordance with Respondent's main request.

Thus, it emerges that this prior art document discloses the first paragraph of Claim 1 in accordance with Respondent's main request together with steps (a) and (c) and with the feature of step (b) according to which less power than the maximum power is supplied to the heating element when the latter reaches a certain temperature.

However, the remaining features of the claim, which specify that the temperature value at which power reduction is initiated is the critical value, and that power reduction is conducted so that the temperature of the heating element is kept below the critical value, cannot be regarded as being disclosed by document D. In particular, from the description of the function of the circuit shown in Figure 4 it is apparent that the power reduction is due to the fall of resistance of thermistor 26 as induced by an increase in the temperature of the heating element. This shows that the latter temperature keeps increasing after initiation of the reduction of power supplied to the heating element and that, consequently, the temperature of the heating element at the point of inflexion of the curve in Figure 5, which corresponds to such initiation, is lower than its final temperature when the water temperature stabilizes and cannot therefore be equated to the critical value of the temperature of the heating element in the sense of the attacked patent, which value cannot reasonably be construed as being less than its final value (see point 4.4 below). In addition, even if it were admitted for the sake of convenience, as did the Appellants, that the value of the temperature at which the power supplied by thyristor 16 starts to decrease might be designated as a "critical value", the remaining condition set out in step (b) of

Claim 1 that the power supplied to the heating element is reduced so that its temperature is kept below the critical value would still clearly not be satisfied by the regulation method disclosed in document D.

These conclusions, which follow from an objective analysis of the temperature regulation means described in document D, cannot in the Board's view be questioned by the vague and unsubstantiated statement made by Appellant Stiebel Eltron, that the similarity between the temperature curves shown in Figure 5 of document D and of the attacked patent, respectively, necessarily result from the use of the same regulation methods.

- 3.2 Document A discloses a method of regulating the power supplied to an electric heating element 28 (Figure 2) of an immersion heater, wherein the power supply is regulated through a switch 40,41 controlled by a thermostatic mechanism 27,51. The thermostatic mechanism causes the automatic opening of switch 40,41 and the deenergization of the heating element upon attainment of a predetermined temperature, which is adjustable to a rated value through screw 56, and it is located in such a way as to be responsive to the temperatures immediately adjacent the heating element. Accordingly, in case part of the heating element accidentally loses contact with the liquid, due, for instance, to liquid evaporation, overheating of the element resulting from slower heat transfer to the liquid is detected also by the thermostatic mechanism, which causes opening of the switch to avoid burning out of the element (page 1, left hand column, lines 24 to 37; page 2, left hand column, lines 47 to 51 and right hand column, lines 9 to 15). In normal circumstances however, full power is supplied to the heating element, until the temperature sensed by the thermostatic device, which is also that of the liquid immediately surrounding same, reaches the set

temperature whereupon the power supply is cut off (page 1, left hand column, lines 10 to 23) as defined also in step (c) of Claim 1 in accordance with Respondent's main request.

In addition, step (a) of Claim 1 in accordance with Respondent's main request is implicitly disclosed by document A, for the reasons already indicated with reference to the method of document D (point 3.1, 2nd paragraph).

Document A, however, neither discloses controlled reduction of the power supplied to the heating element nor does it teach to initiate such power reduction when the temperature of the heating element reaches the critical value, as set out in step (b) of the claimed method.

- 3.3 The remaining documents which were either invoked by the Appellants in their written submissions or cited in the previous stages of the proceedings, do not come any closer to the claimed subject-matter.
- 3.4 For the above reasons, the subject-matter of Claim 1 in accordance with Appellants' main request is considered to be novel within the meaning of Article 54 EPC.

#### 4. Inventive step

- 4.1 In the Board's view, the nearest prior art is disclosed in document D, which is the only one that describes a method of regulating the power supplied to a heating element of an electric water heater, wherein both the temperature of the heating element, and that of the water individually exert an influence on the level of power supplied to the heating element.

The subject-matter of Claim 1 in accordance with Respondent's main request is distinguished from the method of document D, which does not call for any provision to avoid further heating up of the heating element after initiation of the power reduction, essentially in that, when the temperature of the heating element has reached a critical value, which in the claim is defined only as the temperature up to which maximum power is supplied thereto (see step (a)), less power is supplied, so that the temperature of the temperature of the element is kept below the critical value.

4.2 According to the description of the attacked patent, the technical problem which the claimed invention solves is to improve the service life of the heating element in an electric water heater, which is about 5 years only in conventional devices, in such a way as to raise it to the average 20 years lifetime of the remaining portions of the water heater (column 1, lines 9 to 23 and column 7, lines 3 to 10), while simultaneously keeping the time required for heating up the water at a minimum value (column 2, lines 17 to 27; column 9, lines 30 to 34).

4.3 This technical problem is solved by regulating the power supplied to the heating element through the procedure defined in Claim 1 in accordance with Respondent's main request, which essentially amounts to defining a critical value of the heating element, supplying maximum power thereto as long as its temperature is below said critical value, and reducing the power supply upon attainment of the critical temperature in such a way that the temperature of the heating element thereafter is kept below the critical value. Accordingly, the ageing of the heating element, which is due to corrosion, calcerous deposits and formation of fissures (all temperature dependent processes) may be

considerably slowed down, and thus its lifetime correspondingly increased.

- 4.4 It is admitted that neither the claims, nor the specification of the attacked patent, specify an admissible range for the critical value of the temperature of the heating element, which, obviously, is dependent not only on the water quality and therefore subject to large geographical variations, but also on further requirements and parameters dictated by any planned application, such as the rated temperature at which the water is desired to stabilize, or the temperature at which burning out of the specific heating element used in the water heater will occur. In particular, and contrary to the Appellants allegation, the critical value of the temperature of the heating element obviously cannot be set at a level below the rated value, otherwise the water temperature would never reach the desired value, nor can it reasonably be set at the temperature where burning out would normally occur, if the lifetime of the heating element is to be prolonged.

The Board is, however, satisfied that the skilled person having regard to the particular circumstances of any application would be able to select optimal values for the critical and rated temperatures as set out in Claim 1 and, accordingly, to implement the method defined therein in such a way as to achieve an appreciable improvement in the lifetime of the heating element without unduly lengthening the time needed for getting hot water. The ability of the claimed method to solve the technical problem underlying the patent has not been questioned either by the Appellants.

- 4.5 The formulation of the technical problem cannot by itself provide a positive contribution to inventive step since striving to improve the durability of existing devices and

to minimize the heating time must be regarded as common concerns of any skilled person in the field of electric water heating.

- 4.6 In the Board's view, there is, however, no suggestion whatsoever to be found in the cited prior art documents that a substantial, fourfold increase of a water heater's lifetime may be achieved without significant impairment of the speed at which the water is heated up to the rated temperature, simply by controlling the temperature of the heating element in the specific manner set out in Claim 1.

In particular, document A merely addresses the technical problem of avoiding the accidental burning out of the heating element, and the solution taught therein would not prevent it from being subject to normal ageing under chemical action of water. On the other hand, the method disclosed in document D with reference to its Figures 4, 5 and 11 is specifically directed to avoiding any temperature overshoot of the heated medium above the rated temperature, which is of no relevance to the technical problem solved by the claimed method.

Moreover, it is not seen how any combination of documents A and D, none of which discloses the step of reducing the power supplied to the heating element so that its temperature is kept below a predetermined critical value, could lead to a method comprising such step. Not only did the Appellants fail to establish which specific technical features of each of these documents could, when combined, give rise to the method set out in Claim 1, but also the Board is not convinced that the skilled person would in fact have any reason to contemplate such a combination of the teachings of both these documents. In particular, the features which in the method of document A achieve the cutting-off of the power supplied to the heating element in

case of an accidental temperature rise due, for instance, to water evaporation, would a priori be of no interest or relevance to the method of document D, which inherently provides for power reduction as a result of overheating of the heating element. Conversely, progressive power reduction as achieved by the method of document D would prima facie be no better in avoiding burning out of the heating element in case of accidental overheating, than immediate power interruption as already featured by the method of document A.

- 4.7 For these reasons, the subject-matter of Claim 1 in accordance with Respondent's main request is considered to involve an inventive step within the meaning of Article 56 EPC.
  
5. Accordingly, independent Claim 1 in accordance with Respondent's main request is allowable under Article 52 EPC. So are independent Claim 5, which in essence comprises the same limitations as Claim 1, but is expressed in terms of features of an apparatus, and dependent Claims 2 to 4, and 6 to 8, by virtue of their dependence on independent Claims 1 and 5, now respectively held allowable.
  
6. The opposition ground set out in Article 100(a) EPC as put forward by the Appellants therefore does not prejudice maintenance of the patent in the amended form in accordance with Respondent's main request.
  
7. From the above analysis of the teachings from document D it emerges that Claim 1 in accordance with Respondent's main request is not correctly drafted in the two-part form as required under Rule 29(1) EPC, having regard to the nearest prior art as disclosed by said document. In particular, the features of its characterizing portion directed to the power being regulated also in dependence on

the temperature of the heating element, to the latter temperature being measured directly and/or indirectly, the features of steps (a) and (c) and part of those of step (b) are already known from document D, in combination with the features of the preamble. This deficiency is not fully remedied either in the set of claims in accordance with Respondent's auxiliary request.

The Board considers that Rule 29(1) EPC primarily concerns the examining procedure, as already expressed in its decision T 99/85 (OJ EPO, 1987, 413; point 4 of the Reasons). At that stage, compliance of the claims with Rule 29(1) EPC indeed serves the essential purpose of clearly informing third parties and potential opponents of the extent of the claimed subject-matter which is not anticipated by the nearest prior art as revealed during the examining proceedings.

The opposition procedure, however, is not designed to be, and is not to be misused as, an extension of the examining procedure, as ruled also by the Enlarged Board of Appeal in the decision Gr 01/84 (OJ EPO, 1985, 299; point 9), and, accordingly, the Board sees no need at this late stage of the present procedure to insist under Article 102(3) EPC on the independent claims being redrafted merely for compliance with Rule 29(1) EPC.

8. The Respondent's main request can therefore be accepted, and his auxiliary requests consequently need not be considered further.

**Order**

**For these reasons, it is decided that:**

**The appeals are dismissed.**

**The Registrar:**

**The Chairman:**

**F. Klein**

**K. Lederer**