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D E C I S I O N
of 7 February 2002

Case Number: T 1015/00 - 3.2.3

Application Number: 94201718.7

Publication Number: 0687877

IPC: F26B 25/00, F26B 23/02

Language of the proceedings: EN

Title of invention:
Method for preventing the occurrence of an explosive state in gas mixtures

Patentee:
Heidelberger Druckmaschinen Aktiengesellschaft

Opponent:
VITS-Maschinenbau GmbH

Headword:
-

Relevant legal provisions:
EPC Art. 84, 56

Keyword:
"Main request; clarity and support by description (no)"
"First and second auxiliary request: inventive step (no)"

Decisions cited:
G 0009/91, T 0301/87

Catchword:
-

Case Number: T 1015/00 - 3.2.3

D E C I S I O N
of the Technical Board of Appeal 3.2.3
of 7 February 2002

Appellant: (Proprietor of the patent)
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Decision under appeal: **Decision of the Opposition Division of the European Patent Office posted 12 July 2000 revoking European patent No. 0 687 877 pursuant to Article 102(1) EPC.**

Composition of the Board:

Chairman: C. T. Wilson
Members: U. Krause
J. P. B. Seitz

Summary of Facts and Submissions

I. The appeal contests the decision dated 26 June 2000 and posted on 12 July 2000 to revoke European patent No. 0 687 877 on the grounds of Article 100(a) EPC (lack of novelty or inventive step) in view of document

V1: EP-B-0 385 411.

II. The Appellant (Proprietor of the patent) filed the notice of appeal on 13 September 2000 and paid the appeal fee on the same day. A statement of the grounds of appeal, including a new set of claims 1 to 13, was submitted on 22 November 2000. In its response to this statement the Respondent (Opponent) made reference to the further document

V2: Sicherheitsregeln für Durchlauftrockner von Druck- und Papierverarbeitungsmaschinen, Carl-Heymanns Verlag KG, ZH 1/19, April 1990, pages 22 to 25.

In oral proceedings held on 7 February 2002 the Appellant submitted amended claims 1 to 7 of a first auxiliary request and a further set of claims 1 to 12 of a second auxiliary request.

III. The Appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims 1 to 13 submitted on 22 November 2000 (main request), of claims 1 to 7 of the first auxiliary request or claims 1 to 12 of the second auxiliary request as submitted on 7 February 2002, together with the description and figures as granted. The Respondent requested that the appeal be dismissed.

IV. The independent claims 1 and 3 of the main request read as follows:

"1. Method for preventing the occurrence of an explosive state in a gas mixture, especially of solvents in air, in an essentially confined space in form of a drying chamber (3) in a drying appliance (1) for drying a printed web (2), virtually complete oxidation of at least part of the gas mixture taking place in a combustion chamber (11,12) in the drying appliance (1), wherein the temperature difference ΔT between the temperatures of the gas mixture before and after the oxidation is determined,
characterized in that
a maximal permissible temperature increase ΔT_{max} is determined from the temperature increase during the oxidation of the gas mixture independent of the type of a flammable substance in the gas mixture and that if the temperature difference ΔT is greater than the maximal permissible temperature increase ΔT_{max} safety measures in form of switching off of the oxidation and/or a ventilation of the confined space are taken."

"3. Method for preventing the occurrence of an explosive state in a gas mixture, especially of solvents in air, in an essentially confined space in form of a drying chamber (3) in a drying appliance (1) for drying a printed web (2), virtually complete oxidation of at least part of the gas mixture taking place in a combustion chamber (11,12) in the drying appliance (1), wherein the temperature T_1 of the gas mixture before the oxidation and the temperature T_2 of the gas mixture after the oxidation are measured, and the measured temperatures T_1 and T_2 are compared with a minimum temperature T_{min} before oxidation of the gas mixture and a maximum temperature T_{max} after oxidation of the gas mixture
characterized in that

the difference between T_{max} and T_{min} being less than, or equal to a maximal permissible temperature increase ΔT_{max} which is determined from the temperature increase during the oxidation of the gas mixture independent of the type of a flammable substance in the gas mixture, and if the measured temperatures T_1 and T_2 are outside the interval determined by the maximum and minimum temperatures T_{max} and T_{min}, safety measures in form of a switching off of the oxidation and/or a ventilation of the confined space are taken."

In the corresponding independent claims 1 and 3 of the first and second auxiliary requests the passage "from the temperature increase during the oxidation of the gas mixture" was deleted. The claims of the second auxiliary request further define the maximal permissible temperature increase ΔT_{max} as being determined "according to the equation $\Delta T_{max} = k*dT*C_{LEL}$, wherein ΔT_{max} is the maximal permissible temperature increase [°C], k is a factor which depends on the safety standard, dT is the specific temperature increase [°C/(g/Nm^3)] and C_{LEL} is the concentration [g/Nm^3] of the flammable substance at the lower explosive limit".

V. The essential arguments of the Appellant can be summarized as follows:

The amendments to claims 1 and 3 of all requests, as compared with the granted claims, were based on page 2, line 36 to page 3, line 1 of the application as filed in combination with the original claim 6, and on page 4, lines 5 to 9 of the original application. The particular formula for determining ΔT_{max}, as included in original claim 6, was preferred but not essential. A skilled person reading the claims and having due regard to the description would have no problem in understanding claims 1 and 3 of the main request, in particular the determination of ΔT_{max} on the basis of a temperature increase during the oxidation of the gas mixture which need not take place when carrying out the method as defined in claims 1 and 3. The feature defining ΔT_{max} as independent of the type of a flammable substance was essential since it reflects the discovery on which the invention was based.

As to novelty and inventive step, the automatic control of the solvent concentration described in V1 was made for economic reasons and served the purpose of keeping ΔT below a maximum value. According to column 3, lines 28 and 29, this control is disabled below a certain volume flow rate. This and the delay and overshoot inherent in control systems clearly distinguished the disclosure of V1 from a safety measure as claimed inasfar as the latter was an unconditional, reliable and rapid reaction to a dangerous situation. The aspiration of fresh air into the confined space in V1, caused by increasing the flow rate of the gas mixture through the combustion chamber when approaching a maximum permissible temperature difference, was different from a rapid ventilation as a safety measure in this sense. The concept of taking such a safety measure on the sole basis of temperature measurements was based on the finding that the relationship between the maximum permitted concentration of a flammable substance and the temperature increase during oxidation thereof is independent of the type of the flammable substance, and there was no indication for this finding in V1. Whilst safety or emergency measures as such were trivial, as shown by V2, there was no indication as to how these measures could be implemented. A skilled person would consider measurements of the concentration of the flammable substance, rather than comparing the temperature difference of the gas mixture before and after oxidation with a single permissible maximum value of ΔT for various substances. The value of 1300K was given for example in claim 1 of V1 for a varying concentration, i.e. independent of the concentration of the substances, not independent of the type of the substances.

As to the second auxiliary request, neither V1 nor V2 included a pointer towards the formula for determining ΔT_{max} since V1 disclosed a value of 1300K without saying how this value was found and V2 went into a different direction by suggesting concentration measurements as a basis for the safety measures.

VI. The Respondent submits essentially the following counterarguments:

The amendments to the claims of the main and first auxiliary request were not properly based on the original application because the added feature concerning the determination of the maximal permissible temperature increase was more general than the original disclosure in claim 6 and in the text bridging original pages 3 and 4, and no other way of determining ΔT_{max} was disclosed. Further, the feature of determining the maximum value of ΔT was unclear because a measurement of the varying temperature increase during the oxidation in the process would not lead to this maximum value which is shown by the disclosure in column 4, lines 19 to 35, of the patent to be based on a calculation involving predetermined data, rather than on measurements of the temperature increase. The independence of this maximum value with respect to the type of the flammable substance concerned a discovery or allegation and could not further define the claimed method.

As to inventive activity, the feature concerning the determination of ΔT_{max} according to the main and first auxiliary request was unable to further distinguish over V1 because this document specified, for example in claim 1, a single value of 1300K for all types of organic substances which implied that this value of the temperature increase was likewise independent of the type of noxious substance. The value of 1300K would be obtained on the basis of the data of figure 1 of the patent for a realistic choice of k = 0.9...0.95 for the safety factor, and the lower values specified in column 3, lines 16 to 20 of V1 would result from a reduction of the safety factor to 0.25...0.4 in order to meet other constraints of the apparatus. The control measures of V1 were safety measures because they served the purpose of preventing an explosive concentration and overheating of the combustion chamber, and no difference in reaction time was found in practice between suitable control and safety measures. In any case, a skilled person knowing from V1 the relation between the temperature increase during the oxidation and the concentration of noxious substances would utilize this temperature increase, rather than an additional concentration measurement, for initiating the safety measures indicated in V2. Ventilation was described in V1 as one of the control or safety measures and switching off the entire process, including the oxidation, was an obvious emergency function.

The formula included in claims 1 and 3 of the second auxiliary request was based on obvious considerations because the practical limit of the temperature increase of 300 to 500K, as specified in V1, corresponded to the product of the maximum value of 1300K and a safety factor, and the maximum value of 1300K would be obtained, on the basis of the relation between the concentration and the temperature increase as known from V1, by multiplying the maximum permissible concentration, which is C_{LEL}, with a factor transforming concentration into temperature difference, i.e. having the dimension [K/(g/Nm^3)]. The method to be carried out could not be distinguished form a known method by explaining how a skilled person would calculate a known value for the maximum permissible temperature increase.

Reasons for the Decision

1. The appeal meets the requirements of Articles 106 to 108 EPC and of Rules 1(1) and 64 EPC and is, therefore, admissible.

2. *Main request*

Although an opposition cannot be based on the grounds of lack of clarity or support, any amendments made during the opposition and appeal procedure are to be fully examined as to their compatibility with the requirements of the EPC (G 9/91, OJ EPO 1993, 420, point 19 of the reasons) and, therefore, must not give rise to objections under Article 84 EPC (see also T 301/87, OJ EPO 1990, 335).

The Respondent holds that in claims 1 and 3 the feature that ΔT_{max} is determined from the temperature increase during the oxidation of the gas mixture gives rise to a clarity problem because a measurement of the varying temperature increase during the oxidation in the process would not lead to this maximum value which is shown by the disclosure in column 4, lines 19 to 35 of the patent to be based on a calculation involving predetermined data, rather than on measurements of the temperature increase. The Board concurs with this objection. In fact, this feature refers to a temperature increase during **the** (emphasis added) oxidation of the gas mixture which, due to the absence of any other oxidation of the gas mixture, will be understood to refer to the oxidation taking place during the combustion of the gas mixture in the combustion chamber as defined in the precharacterising portion of the claims. As a consequence, the method as defined in claims 1 and 3 requires a measurement of the actual temperature increase in order to determine the maximum permissible temperature increase. It is quite unclear how this could be achieved. Two different possibilities are found in the description: according to column 2, lines 11 to 15 and 38 to 48 of the patent ΔT_{max} is determined by the temperature increase during the oxidation of a gas mixture having the maximum permissible concentration, a condition which is normally not met during the actual combustion of the gas mixture, and according to column 4, lines 19 to 35, ΔT_{max} is calculated on the basis of a formula and predetermined values. Neither case corresponds to the claimed method of determining ΔT_{max} on the basis of measurements of the actual temperature increase made during the oxidation at varying concentrations of the flammable substance.

As a consequence, claims 1 and 3 of the main request are neither clear nor supported by the description as required by Article 84 EPC.

3. *First auxiliary request*

3.1 Clarity and support (Article 84 EPC)

Since in claims 1 and 3 of the first auxiliary request the method step of determining ΔT_{max} from the temperature increase during the oxidation of the gas mixture was removed, the objection of lack of clarity and support does not apply to this request. The further clarity objection of the Respondent to the feature defining the independence of ΔT_{max} of the type of the flammable substance is not shared by the Board because the question of whether this feature concerns a discovery or a further limitation of the claim cannot in principle affect the clarity of the claim.

3.2 Basis for the amendments in the original application (Article 123(2) EPC)

As compared with the application as originally filed and with the patent as granted, the independent claims 1 and 3 include the additional features (1) that the confined space is in form of a drying chamber in a drying appliance for drying a printed web, the oxidation taking place in a combustion chamber of the drying appliance, (2) that the maximal permissible temperature increase is determined independent of the flammable substance, and (3) that the safety measures are in form of a switching off of the oxidation and/or a ventilation of the confined space. It is not in dispute that features (1) and (3) are adequately supported by the application as filed, in particular page 3, lines 9 to 13, page 9, last paragraph, page 10, lines 9 to 15 and claim 13 for feature (1) and page 4, lines 5 to 9 for feature (3). Concerning feature (2) the Respondent argues that this feature was an unallowable generalisation of the specific original disclosure of determining the maximal permissible temperature increase in claim 6 and in the text bridging original pages 3 and 4, and no other way of determining ΔT_{max} was disclosed. However, this argument is not convincing because a more general information about the maximal permissible temperature increase can be derived from the text bridging pages 2 and 3 and on page 3, last paragraph, relating the temperature increase during the oxidation to the concentration of the flammable substance in the gas mixture whereby ΔT_{max} corresponds to the temperature increase during the oxidation of a gas mixture having the maximum permissible concentration of the flammable substance. This information does not rely on a particular formula for determining ΔT_{max}, as in original claim 6, and, therefore, provides a sound basis for feature (2).

The dependent claims 2 and 4 to 13 correspond to claims 2 and 5 to 14 of the original application and of the granted patent.

Hence, the amended claims of the main request meet the requirements of Article 123(2) EPC.

3.3 Scope of protection (Article 123(3) EPC)

Since the added features (1), (2) and (3) limit the scope of the patent to a specific type of confined space, a specific value of ΔT_{max} and specific safety measures, the requirements of Article 123(3) are likewise met.

3.4 Inventive step (Article 56 EPC)

3.4.1 Document V1 relates to a method of controlling a drying process so as to maintain the concentration of organic compounds in the process discharge gas, and thereby in the process itself, below an explosive limit. The organic compounds in the process discharge gas are combusted in a post-combustion chamber and the temperature of the discharge gas is measured before and after the post-combustion. If the measured temperature increase approaches a predetermined upper limit the volume flow rate of the discharge gas is increased, causing an enhanced aspiration of fresh air into the process and a reduction of the concentration of the noxious organic substances in the process (see in particular column 3, line 35 to column 4, line 1 and column 5, line 56 to column 6, line 15).

The upper limit of the temperature increase of the process discharge gas during the post-combustion is set to a value which is below 1300K, preferably 800K or most preferably to somewhere between 300 and 500K (claim 1 and column 3, lines 16 to 20). These limits may depend on the resistance of the materials (column 3, lines 20 to 22), whereas no dependence on the particular type of organic substances in the discharge gas is described. Rather, claims 1 and 2 refer to the specific temperature limits in combination with unspecified organic compounds. It can therefore be concluded that the upper limit is independent not only of the concentration, as argued by the Appellant, but also of the type of organic substance in the process discharge gas.

Since it is the purpose of the control method described in V1 to maintain the concentration of the organic compounds in the process discharge gas below an explosive limit, thereby preventing (in the language of the claims of the patent) the occurrence of an explosive state in a gas mixture, the measures of enhancing the flow rate of the discharge gas to thereby increase the aspiration of fresh air into the process can be considered as "safety measures" in the sense that, by taking these measures, a potentially dangerous situation shall be prevented. The aspiration of fresh air into the process, i.e. the drying chamber or confined space, is described as a consequence of the actual measure of enhancing the discharge gas flow rate, rather than the actual safety measure itself. In any case, it is one of the steps taken directly or indirectly in order to reduce the concentration of the noxious organic compounds, and therefore corresponds to the ventilation of the confined space as a safety measure, as defined in claim 1.

Claim 1 is therefore distinguished from the method disclosed in V1 in that the safety measures of claim 1 are taken when the maximum permissible temperature increase ΔT_{max} has been exceeded, whereas in V1 the safety measures are taken when approaching this maximum permissible temperature increase. However, this difference is a mere matter of choice of a suitable value for ΔT_{max} in the control method of V1. In fact, it makes no real difference in this control method whether the safety measures of V1 are taken when the measured temperature increase approaches a maximum value of 500K, as specified in column 3, line 20, or exceeds for example a maximum value of 450K. The skilled person will select the appropriate maximum value according to the type of control system so as to prevent the temperature increase from reaching the maximum permissible temperature increase, in this example 500K. The Board cannot see any inventive step in such a selection.

3.4.2 The Appellant argues that disabling the control method of V1 below a certain volume flow rate and the delay and overshoot inherent in such a control method distinguished the disclosure of V1 from a "hard" safety measure as claimed inasfar as the latter was an unconditional, reliable and rapid reaction to a dangerous situation. This argument is not convincing because in both cases the safety measures are taken in the case of a potentially dangerous situation, irrespective of conditions far away from this situation where the safety system may be down, and the control system of V1 responds to the same temperature conditions as in claim 1 and must be as reliable and rapid.

3.4.3 However, even in the case that the safety measures defined in claim 1 could be distinguished from the control method described in V1 as defining emergency measures to be taken if a maximum permissible temperature increase has been exceeded, despite any control of the process, no inventive step could be recognised. The requirement for safety measures, as emergency measures, for example in the case of a failure of a control system, is a typical requirement in systems such as drying appliances where the concentration of flammable substances may reach an explosive level. This is clearly shown by V2, chapter 4.2.8.3. The question arises whether, as argued by the Appellant, the skilled person implementing such an emergency system would base it on measurements of the gas concentration with special sensors. The Board cannot follow this argument. In fact, since V1 teaches (for example in column 3, lines 7 to 15 and 37 to 39) the relationship or "equivalence" between the temperature increase and the concentration of flammable substances and, based on this relationship, to utilise the temperature increase for the purpose of controlling the process so as to avoid an explosive state, the skilled person would be aware that utilising the same temperature increase, representing the concentration of the flammable gases, also as a basis for the safety or emergency measures which are necessary in the case of failure of the control would require no additional sensors and, therefore, would be much more economic than the conventional solution employing gas sensors. Switching off the oxidation, together with the entire process, would be a standard emergency measure but ventilation would also be taken into consideration because it is proposed in V1 in connection with the control for diluting the solvents, which effect is likewise desirable in the case of an emergency situation.

3.4.4 The Board therefore concludes that claim 1 of the first auxiliary request does not meet the requirement of inventive step. Since a decision can be made only on a request as a whole, no further consideration of the other independent claim 3 is required.

4. *Second auxiliary request*

4.1 Amendments

Claims 1 and 3 of the second auxiliary request include, as compared with the corresponding claims of the first auxiliary request, the further feature that ΔT_{max} is determined according to the equation $\Delta T_{max} = k*dT*C_{LEL}$, wherein ΔT_{max} is the maximal permissible temperature increase in °C, k is a factor which depends on the safety standard, dT is the specific temperature increase in °C/(g/Nm^3) and C_{LEL} ist the concentration of the flammable substance at the lower explosive limit in g/Nm^3. This equation was disclosed in original claim 6, which via claim 4 referred back to original claims 1 and 3, and likewise in the description from page 5, line 36 to page 6, line 6, as a preferred embodiment. No objection under Article 123 EPC therefore arises.

4.2 Inventive step

The added feature defines an equation for calculating, on the basis of a safety factor and material data found in handbooks, the maximum permissible temperature increase without having to rely on measurements or experiments.

In document V1 the maximum temperature increase is set to a preferred value of 300 to 500K, which is below the limit of 1300K. Thus, the maximum temperature increase can be expressed in the form of a fraction of the limit, i.e. $\Delta T_{max} = k * \Delta T_{limit}$, whereby the fraction k is is a "safety factor" which depends on the resistance of the materials (see column 3, lines 20 to 22) which is a material property found in handbooks, and ΔT_{limit} = 1300K. Considering that for the reasons set out in connection with the first auxiliary request, it would be obvious to base any required emergency measures in V1 on a measurement of the temperature increase, rather than of the concentration, a limit for the temperature increase relevant for safety or emergency measures, if at all distinguished from the control measures of V1, would be determined in the same manner as a fraction k of ΔT_{limit}, possible with a slightly higher value of k. It is true that, as argued by the Appellant, V1 does not say how the value of 1300K for ΔT_{limit} is determined. In the Board's view, however, this is a matter of obvious considerations for a skilled person. In fact, based on the relation of the temperature increase and the concentration of the flammable substances as set out in column 3, lines 7 to 9 and 37 to 39 of V1, the skilled person will determine ΔT_{limit} so that this is the temperature increase at the maximum permissible concentration. This concentration is C_{LEL}, i.e. the concentration at the lower explosive limit of the substance under consideration, because the purpose of preventing explosive concentrations, as set out in column 3, lines 10 to 12 of V1, can only be achieved when maintaining the concentration below this limit. Since the factor relating the concentration to the temperature increase is the specific temperature increase dT [°C/(g/Nm^3)], the maximum temperature increase at the lower explosive limit ΔT_{limit} is $dT*C_{LEL}$. Thus, the selection of 300 to 500K in V1 corresponds to $k*dT*C_{LEL}$ with $dT*C_{LEL} = \Delta T_{limit}$ being 1300K. The equation specified in claims 1 and 3 of the second auxiliary request therefore reflects the obvious considerations of the skilled person determining the permissible temperature increase as specified in V1.

4.3 Since the subject-matter of at least claim 1 does not meet the requirement of inventive step, the second auxiliary request is likewise not allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Counillon C. T. Wilson