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D E C I S I O N
of 20 January 1998

Case Number: T 0774/96 - 3.2.1

Application Number: 90117204.9

Publication Number: 0416630

IPC: F17C 7/04, F17C 9/02, B29D 30/06

Language of the proceedings: EN

Title of invention:
High pressure gas supply system

Patentee:
Praxair Technology, Inc

Opponent(s):
L'Air Liquide, S.A. pour l'étude et l'exploitation des procédés Georges Claude
Linde Aktiengesellschaft, Wiesbaden

Headword:
-

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (yes)"
"Period of more than 50 years between the publication date of the closest prior art document and the filing date of the patent in suit regarded as a further secondary indicator of inventive step"

Decisions cited:

G 0009/91, T 0301/87, T 0626/96

Catchword:
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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0774/96 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 20 January 1998

Appellant: (Opponent 02)
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Decision under appeal: **Interlocutory decision of the Opposition Division of the European Patent Office posted 25 June 1996 concerning maintenance of the European patent No. 0 416 630 in amended form.**

Composition of the Board:

Chairman: F. Gumbel
Members: M. Ceyte
V. Di Cerbo

Summary of Facts and Submissions

I. The Respondent is proprietor of European patent No. 0 416 630 (application No. 90 117 204.9).

II. The patent was opposed by the Appellant (Opponent 02) and the other party (Opponent 01) on the ground of lack of patentability (Article 100(a)).

The following state of the art, as far as it played any significant role during opposition and appeal proceedings, was opposed:

D4: US-A-4 583 372,

D8: US-A-1 930 731.

III. By an interlocutory decision posted on 25 June 1996 the Opposition Division maintained the patent in amended form.

IV. On 26 August 1996 the Appellant (Opponent 02) lodged an appeal against this decision, with the appeal fee being paid at the same time.

The Statement of Grounds of Appeal was filed on 4 November 1996.

V. Oral proceedings were held on 20 January 1998.

The Respondent requested that the patent be maintained on the basis of the following documents:

- claims 1 to 11 and description presented at the oral proceedings, and

- drawing as granted.

Amended claims 1 and 6 read as follows:

"1. A method for supplying gas to a use point (1) at a high delivery pressure, comprising:
providing a liquid supply in a liquid reservoir (10, 11) and a gas supply in a gas reservoir (6, 7, 8, 9), said liquid and gas being of the same chemical composition; and,
during a gas delivery operation:
(A) passing gas from the gas reservoir (6, 7, 8, 9) to the top of the liquid reservoir (10, 11) to raise the pressure of the liquid supply;
(B) vaporizing liquid from the liquid supply by heat exchange with ambient air to produce gas; and
(C) passing gas produced in step (B) to the use point at the delivery pressure;
characterised in that
during a stand-by operation:
(D) the liquid supply in said liquid reservoir (10, 11) is maintained at a pressure of about ambient pressure; and
(E) the gas supply is brought to a pressure at least equal to the high delivery pressure by recharging the gas reservoir (6, 7, 8, 9) with gas at a pressure at least equal to the delivery pressure by vaporizing pressurized liquid and passing the

resulting gas to said gas supply, said delivery pressure exceeding the critical pressure of the gas; and

during the gas delivery operation:

(F) the pressure of the liquid supply

(F1) is raised to at least the high delivery pressure by said passage of gas from the gas reservoir (6, 7, 8, 9) to the top of the liquid reservoir (10, 11) in step (A), and

(F2) is maintained at a pressure at least equal to the high delivery pressure by vaporising some of the pressurised liquid and passing resulting gas to the liquid reservoir (10, 11)."

"6. A gas supply system for providing gas to a use point (1) at a high delivery pressure, comprising:
a liquid reservoir (10, 11);
a gas reservoir (6, 7, 8, 9) connected by conduit means (14) to the top of the liquid reservoir, and means (14, 15, 16) for passing, at the start of a gas delivery operation, gas from the gas reservoir (6, 7, 8, 9) to the top of the liquid reservoir (10, 11) to raise the pressure of the liquid reservoir (10, 11);
an atmospheric vaporizer (26) to vaporize liquid from the liquid reservoir (10, ll); and
means (27) to pass gas from the vaporisation means (26) to the use point (1);
characterised in:
that, during a stand-by operation, said gas

reservoir (6, 7, 8, 9) has a supply of gas at a pressure at least equal to the delivery pressure, said delivery pressure exceeding the critical pressure of the gas;
that means (30, 31, 32, 33, 35) are provided for maintaining, during the stand-by operation, said gas reservoir (6, 7, 8, 9) at a pressure at least equal to the delivery pressure, and for recharging, during the stand-by operation, said gas reservoir (6, 7, 8, 9) to a pressure at least equal to the delivery pressure;
that means (17, 18, 19) are provided for maintaining, during the stand-by operation, said liquid reservoir (10, 11) at a pressure of about ambient pressure; and
that means (21, 22, 23, 24) are provided for maintaining, during the gas delivery operation, said liquid reservoir (10, 11) at the pressure at least equal to the delivery pressure, said pressure maintenance means (21, 22, 23, 24) comprising means to pass liquid from the liquid reservoir (10, 11) to a vaporizer (21, 22) and means (23, 24) to pass gas from said vaporizer to the liquid reservoir."

VI. The Appellant requested revocation of the European patent in its entirety.

In support of his request he made essentially the following submissions:

(i) In the claims it is said that during a stand-by operation, the liquid supply is maintained at a "pressure of about ambient pressure". Such a formulation does not define a clear limitation for the claimed subject-matter. Furthermore, the claimed apparatus is not only defined in terms of structural features but also in terms of a process, since the characterising part distinguishes between stand-by operation and gas delivery operation. Finally, the claims do not specify that during normal gas delivery operation the use point is supplied with high pressure gas from a main supply and that the claimed supply system is put into operation only when the main supply source can no longer deliver the requisite product due to, for example, a power outage. This essential feature should be introduced into the claims so as to define clearly the object of the invention.

(ii) The skilled person starting from document D8 considered as being the nearest prior art will with the aid of the document D4 find the way to the claimed invention according claims 1 and 6 without any inventive activity.

The essence of the disclosure in document D8 is to provide a gas supply for raising the pressure of the liquid reservoir. The supply system according to Figure 2 comprises a gas reservoir connected to the liquid reservoir. In the embodiment of Figure 1, on the other hand, the liquid reservoir

is pressurised by vaporizing some of the liquid supply and passing resulting gas to the liquid supply. It is not clearly mentioned that in the embodiment of Figure 2 the pressure of the liquid reservoir is in the stand-by operation about ambient pressure but this possibility is not excluded.

It is true that the known supply system of document D8 employs a pump to deliver the volatile material in the gas phase at the desired high pressure. However, document D4 shows a supply system which does not rely on a pump and where the liquid reservoir is supplied with gas under delivery pressure during the period when it is desired to deliver the volatile material in the gas phase to the use point. It was thus readily available to the skilled person to recognise that the supply of gas disclosed in document D8 may be accomplished without a pump.
It cannot be denied that some of the claimed features are not disclosed in documents D4 and D8. Nevertheless the alleged invention in its essential parts is to be regarded as an obvious combination of the teachings of these two citations. The remaining features of the claimed subject-matter which are not disclosed by these two citations are of mere constructional nature and are obvious in the light of common general knowledge of a skilled person.

VII. The above submissions were contested by the Respondent.

He argued in essence that in documents D4 or D8 there was no disclosure of or suggestion to the claimed features D, E, F2 of present claim 1 and the corresponding features of claim 6. Therefore even if the skilled person had considered to apply the teaching given in document D4 to the known gas supply system of document D8 he would not have arrived at the claimed subject-matter.

Reasons for the Decision

1. The appeal is admissible.

2. *Formal matters*

2.1 It is well established case law that, when amendments were made during an opposition, Article 102(3) requires them to be examined in order to ascertain that all provisions of EPC including Article 84, were complied with (see for example G 9/91, OJ EPO 1993, 408, point 19; T 301/87, OJ EPO 1990, 335).

In the judgment of the Board, the term "about ambient pressure" is sufficiently clear in its context to be understood by the skilled person as meaning that during stand-by operation the liquid supply is maintained at a pressure which cannot be exactly equal to the ambient pressure. The liquid supply is namely confined in a vessel which communicates with the surrounding atmosphere by way of an open vent valve having some pressure drop. For that reason it is correctly said that the pressure is **about** ambient pressure and Article 84 EPC is not contravened so far.

The fact that claim 6 relating to an apparatus contains indications about its two ways of operation i.e. stand-by or normal gas delivery operation does not render the claim unclear either.

It is a well accepted principle that in particular circumstances the essence of an apparatus or system cannot be well understood without the indication of the conditions under which it is operated. The claimed device is in fact an auxiliary gas supply system which is associated to a main gas supply source. During normal operation the use point is supplied with high pressure gas from the main supply source while the supply system according to the invention is on stand-by. When the main supply source can no longer deliver requisite pressure due to, for example, a plant malfunction or a power outage, the supply system of the invention comes into operation and the use point is supplied with high pressure gas therefrom. Accordingly the indication in claim 6 of the two ways of operation, i.e. stand-by and gas delivery operation, concerning essential aspects of the system of the invention and standing for respective structural features such as valves, switches, sensors etc., cannot be left out of consideration in the definition of the claimed system.

It follows that the objection raised by the Appellant as to the clarity of apparatus claim 6 is lacking in substance.

As pointed out hereinabove, the term "stand-by operation" in the claims necessarily implies the presence of a main supply source, for generating during normal operation gas under requisite pressure. Thus the Appellant's allegation that the claims are unclear because they do not refer to the main gas supply source, cannot succeed.

2.2 There are no formal objections under Article 123(2) to the amended claims either, since they are adequately supported by the original disclosure. The features of method claim 1 are in essence disclosed in original claims 1, 6, 7 and on page 7, lines 23 to 27 of the original description.

The features of apparatus claim 6 are based on original claims 10, 14, 15 and on page 7, lines 23 to 27 of the original description.

Independent claims 1 and 6 contain all the features of the granted claims 1 and 6 respectively, so that the requirements of Article 123(3) are also met.

3. *Novelty*

After examination of the cited prior art, the Board is satisfied that the subject-matter of claims 1 and 6 is novel.

Since this has no longer been disputed in the appeal proceedings, there is no need for further detailed substantiation of this matter.

4. *Inventive step (method claim 1)*

4.1 Claim 1 has been formulated so as to state in its pre-characterising portion all the features of the claimed subject-matter which are known from the Figure 2 embodiment of document D8 acknowledged as closest prior

art in the amended European patent.

According to this prior art, a liquid supply is charged into a liquid reservoir at substantially atmospheric pressure and is maintained in this reservoir at a pressure less than the delivery pressure by means of a gas supply of the same chemical composition. The gas delivery operation is accomplished by means of a pump, the pumped liquid being vaporized in a vaporizer by heat exchange with ambient air and then delivered in the gas phase to the use point.

In order to avoid flashing of the liquid into vapour and thus cavitation, the know supply system of document D8 proposes an initial pressure elevation of the stored liquid to an intermediate pressure, this initial pressure elevation being a relatively small fraction of the total pressure elevation to the delivery pressure.

Document D8 further discloses alternatives for accomplishing this initial pressure elevation.

In accordance with the alternative shown in Figure 1 a small portion of the pressurized liquid is vaporized by heat exchange with ambient air and returned to the reservoir so as to temporarily apply an increase in pressure to the pressurized liquid.

In both alternatives a pump is used for achieving the required second pressure elevation. However, the use of a pump involves various problems, particularly if the

method is to be applied in a backup system. Firstly, as pointed out in column 2, lines 25 to 44 of the patent in suit, at the moment that the backup system is needed for operation, the pump is at ambient temperature and requires a period of cooldown and priming before it can successfully operate and deliver product at high pressure. Secondly, operation of a pump during backup periods requires electrical energy. During power outages that may occur, this energy must be supplied from a backup generator. Finally, electrical switchgear controls must be employed increasing both the capital and operating costs. The requisite careful, scheduled preventive maintenance program to ensure that the pump will be operational when needed, further increases the system operating costs.

Starting from the Figure 2 embodiment of document D8, the technical problem to be solved by the present invention is to provide a method and a system for supplying gas to a use point at a supercritical pressure in a particularly reliable and efficient manner, virtually instantly, once the main gas source fails, without, at this stage, relying on electricity and or cryogenic pumps with excessive operating costs, this gas supply being maintained until the main gas source becomes fully operable again (cf. column 6, lines 45 to 51 of the European patent).

4.2 In accordance with the process aspect of the present invention this problem is in essence solved by the following steps stated in the characterising part of claim 1:

During a stand-by operation:

(D) the liquid supply in said liquid reservoir is maintained at about ambient pressure; and

(E) the gas supply is brought to a pressure at least equal to the high delivery pressure by recharging the gas reservoir with gas at a pressure at least equal to the delivery pressure by vaporizing pressurized liquid and passing the resulting gas to said gas supply, said delivery pressure exceeding the critical pressure of the gas; and

during the gas delivery operation:

(F) the pressure of the liquid supply

(F1) is raised to at least the high delivery pressure by said passage of gas from the gas reservoir to the top of the liquid reservoir in step (A), and

(F2) is maintained at a pressure at least equal to the high delivery pressure by vaporising some of the pressurized liquid and passing resulting gas to the liquid reservoir.

4.3 It should be noted that document D8 does not teach or suggest any way to deal with the problem with which the patent in suit is concerned, that is the provision of a backup system which can operate successfully without any pump during power outage. The essence of the gas supply system taught by document D8 is the use of a pump for supplying gas at a high delivery pressure from a liquid supply in a liquid reservoir. However, owing to cavitation problems, the pressurization is achieved in two stages: a first stage of pressure elevation

attained in the embodiment of Figure 2 by means of the gas reservoir, the pressure elevation being sufficient to avoid cavitation, and a second stage of pressure elevation to the required pressure which is achieved by the pump.

As stated hereinabove, the sole purpose of the gas reservoir in Figure 2 or of the alternative pressurization means in Figure 1 of document D8 is to avoid cavitation of the pump. Therefore the teaching of document D8 as a whole would detract the skilled person, on the one hand, from maintaining the gas reservoir at a pressure at least equal to the high delivery pressure, which pressure exceeds the critical pressure of the gas and, on the other hand, from passing gas from the gas reservoir to the top of the liquid reservoir to raise the pressure of the liquid reservoir to at least the delivery pressure (characterising features E and F1).

4.4 Document D4 is concerned with a method and an apparatus for storing and delivering a fluid, particularly a chemically active hazardous fluid, such as dichlorosilane. A liquid supply of the fluid is provided in a storage vessel to the top of which an inert gas, preferably helium, is passed from an inert gas reservoir to raise the pressure of the liquid supply. Liquid from the liquid supply is vaporized by an electrically heated evaporator to produce gas and the gas obtained thereby is delivered through a pressure regulator to the use point at a pressure substantially equal to the atmospheric pressure.

Figure 1 of document D4 shows a valved vent connected to the conduit leading from the gas reservoir to the liquid reservoir. This valved vent, however, merely is operative in a purging operation performed on occasion of an exchange of an empty liquid reservoir for a filled one (column 7, lines 40 to 55). At all other times, the vent is closed, and the pressure maintained in the liquid reservoir is about 40 psig (2.8 bar).

Hence there is no disclosure or suggestion in document D4 of the steps (D), (E) and (F2) stated in the characterising part of the claimed method and also step (B) of the preamble is missing.

Therefore, even if the skilled person had considered to apply the teaching given in document D4 to the known gas supply system of document D8 he would not have arrived at the claimed solution.

4.5 Furthermore, it is observed that document D4 addresses and solves a problem which is substantially different from that underlying the patent in suit. The method and apparatus proposed therein are intended to solve the problem posed by storing a chemically active fluid at a site remote from the use point, so as to minimize the risk of explosion and fire.

The pressure vessel, where the chemically active fluid is stored, may be subject to climatic temperatures variations over a range at the lower temperatures of which a vapor pressure of the fluid may be insufficient

to generate a pressure within the pressure vessel to drive the fluid towards the use point. Thus the problem to be solved by the invention disclosed in that document is to remedy this drawback without increasing the requirements for insulation, the complexity of temperature controls and the operating costs (cf. "Background of the invention" at column 1).

The relevant disclosure of document D4 is clearly confined to overcome the problem of insufficient gas pressure at lower temperatures so that the skilled person confronted with the problem underlying the patent in suit, i.e. providing a system apt to reliably supply gas especially supercritical gas, virtually instantly, once the main gas source fails, without relying on electricity and on cryogenic pumps, would not have got any suggestion from document D4.

4.6 The Appellant contended that document D8 is a very old citation published in 1933 which thus ignores the new technology available to the skilled person at the date of filing of the European patent. As a result the features which distinguish the claimed subject-matter from this old citation would have been now familiar to the skilled person, i.e. would have been obvious in the light of the common general knowledge available at the priority date of the European patent.

The Board is unable to accept this reasoning in view of the significant advantages achieved by the solution claimed in claims 1 or 6, that is particularly the ability to deliver gas to a use point even during power

outage, as well as to keep the venting losses due to vaporization to a minimum (owing to the fact that the liquid supply is maintained at ambient pressure), this solution cannot be considered as self-evident or falling within the normal skills of the skilled person.

Furthermore, it is not disputed by the Appellant that document D8 represents the closest prior art, from which the problem to be solved by the invention is established. As substantiated hereinabove, such a problem was first solved by the teaching of the European patent in suit (priority date: 1989). Thus a significant time (more than 50 year) had elapsed between the publication of the closest prior art document (1933) and the priority date of the European patent in suit. Contrary to the Appellant's submissions, the fact that the claimed solution, in spite of aforementioned advantages gained by it was not found over such a long period of time can also be considered as an indication in support of inventive step (see for example recent decision T 626/96 of 10 January 1997 of this Board).

4.7 Therefore, in the Board's judgment, the subject-matter of method claim 1 involves an inventive step, (Article 56 EPC).

Dependent claims 2 to 5 concern particular embodiments of the method claimed in claim 1 and are likewise allowable.

5. *Inventive step (apparatus claims)*

5.1 It was not disputed that apparatus claim 6 contains in essence the same features as method claim 1, the features in claim 6 being expressed, where possible, in terms of "means for". Hence, the reasons referred to in Section 4 above with respect to the inventive step of method claim 1 apply - mutatis mutandis - also to the system of claim 6.

The subject-matter of claim 6 therefore also involves an inventive step (Article 56 EPC) and is thus allowable.

5.2 Claims 7 to 11 dependent on claim 6 and defining special embodiments of the invention according to claim 6 are also allowable.

6. The description (after correction of "claim 8" in "claim 6" in line 56 of column 3) and the drawings take account of the requirements of the EPC. The opposition grounds thus do not prejudice the maintenance of the patent in amended form.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form on the

basis of claims 1 to 11 and description submitted at the oral proceedings together with drawing as granted.

The Registrar: The Chairman:

S. Fabiani F. Gumbel