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**D E C I S I O N**  
**of 30 May 2006**

**Case Number:** T 0477/04 - 3.2.03

**Application Number:** 95303744.7

**Publication Number:** 0745817

**IPC:** F25J 3/04

**Language of the proceedings:** EN

**Title of invention:**  
Oxygen gas manufacturing apparatus

**Patentee:**  
AIR WATER INC.

**Opponent:**  
Linde Aktiengesellschaft

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 54, 56, 123(2)

**Keyword:**  
"Novelty (yes)"  
"Inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0477/04 - 3.2.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.03  
of 30 May 2006

**Appellant:** Air Water Inc.  
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**Respondent:** LINDE AKTIENGESELLSCHAFT  
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**Decision under appeal:** Decision of the Opposition Division of the  
European Patent Office posted 30 January 2004  
revoking European patent No. 0745817 pursuant  
to Article 102(1) EPC.

**Composition of the Board:**

**Chairman:** U. Krause  
**Members:** C. Donnelly  
J. Seitz

## Summary of Facts and Submissions

- I. European Patent 0 745 817 relates to an apparatus for the production of pressurised oxygen. The patent is based on European patent application 95 303 744.7 filed on 1 June 1995. The patent was revoked by a decision of the opposition division, dispatched on 30 January 2004, for lack of novelty of the independent claim 1 as granted with respect to document DE-A-3307181 (E1) and because the subject-matter of claim 1 according to the auxiliary request extended beyond that originally filed in breach of Article 123(2) EPC.
- II. The appellant (patentee) filed a notice of appeal against the decision of opposition division on 31 March 2004 and paid the appeal fee the same day. The statement of the grounds of appeal was filed on 9 June 2004.
- III. At the request of both the appellant and the respondent (opponent), oral proceedings were held on 30 May 2006. At the end of these proceedings the parties made the following requests:

*Appellant:*

That the decision of the opposition division be set aside and that the patent be maintained as granted.

*Respondent:*

For the appeal to be dismissed.

IV. The contested patent comprises one independent apparatus claim which reads as follows:

"A pressurised product oxygen gas manufacturing apparatus comprising air compression means (51) for compressing raw air, heat exchange means (55b) for cooling compressed air to an ultra-low temperature, a fractionating tower (58) for liquefying and separating the compressed air cooled to the said ultra-low temperature and holding nitrogen in a gaseous state, a liquid oxygen takeout path (72) for guiding liquid oxygen from the fractionating tower as a cooling medium to the heat exchange means (55b) in which the liquid oxygen is gasified by heat exchange to become oxygen gas, an oxygen gas takeout path (74) which extends from the liquid oxygen takeout path (72) and passes through the said heat exchange means (55b) to increase the temperature of the oxygen gas so as to obtain the said oxygen gas, means (73) in the liquid oxygen takeout path (72) for pressurising the liquid oxygen passing therethrough, the portion of the oxygen gas takeout path (74) downstream of the said heat exchange means (55b) being provided with an expansion means (75) utilizing oxygen gas passing through the (product) oxygen gas takeout path (74), and

wherein the only takeout path for said product

pressurised oxygen gas is the oxygen gas takeout path (74), extending from the liquid oxygen takeout path (72) and through the expansion means (75)."

V. **State of the art**

The respondent referred to the following documents as state of the art:

E1: DE-A-3307181  
E2: DT-2557453  
E3: US-A-4732597  
E4: US-A-5341646  
E5: US-A-5467602  
E6: US-A-5108476  
E7: US-A-4704147  
E8: US-A-5082482

VI. **Submissions of the parties**

(a) *Extension of subject-matter (Article 123(2) EPC)*

The respondent maintained that the subject-matter of claim 1 does not meet the requirements of Art. 123(2) EPC as during the pre-grant examination procedure the following feature was introduced into claim 1 as filed:

"wherein the only takeout path for said product pressurised oxygen gas is the oxygen gas takeout path (74), extending from the liquid oxygen takeout path (72) and through the expansion means (75).".

The respondent was of the view that there is no explicit disclosure in the originally filed documents for specifying that the oxygen takeout path through the expansion means is the **only** oxygen take out path. According to the respondent this cannot also be the

case on technical grounds, since the contested patent specifies a turbine as an example of the expansion means. It is well known that a turbine is always fitted with a by-pass, in order to provide the necessary control of the cooling performance independently of oxygen production. Hence, the path extending "through" the expansion means cannot be the only path as the gaseous oxygen also goes through the by-pass.

The appellant submitted that, although there is no explicit mention in the description that "the oxygen takeout path through the expansion means is the only oxygen take out path", there can be no doubt from the drawings that this is the case. The term expansion means must be taken to mean not just the element actually doing the expanding, but also all the equipment necessary for controlling that expansion. Thus, in the case of the turbine, it would include the by-pass line and all the product oxygen gas can still be said to pass through the expansion means.

(b) *Novelty (Article 54 EPC)*

The respondent argued that claim 1 as granted lacks novelty with respect to both document E1 and document E6.

(i) *Document E1*

During the written procedure the appellant disputed that E1 discloses the following features:

(a) -the apparatus is suitable for producing a pressurised product oxygen gas;

(b) -the only takeout path for said product pressurised oxygen gas is the oxygen gas takeout path, extending from the liquid oxygen takeout path and through the expansion means.

During the oral proceedings the appellant, for the first time, also asserted that E1 did not describe apparatus wherein:

(c) -the heat-exchange means used to gasify the liquid oxygen is also that through which the oxygen gas takeout path extends.

As regards feature (a), the respondent was of the view that a gas with an oxygen content of 81% cannot merely be dismissed as a by-product and that as this gas is produced at a pressure above atmospheric, and failing any other definition in the claim, it must also be seen to be pressurised.

The appellant reasoned that E1 is primarily concerned with the production of pure nitrogen as the gas mixture exiting through line 18 only has an oxygen content of 81% and is at a pressure of 1.15 bars. Hence, this gas cannot be qualified as either an oxygen product or pressurised and should rather be considered as a by-product.

As regards feature (b), the respondent proposed that line 17 of E1 must be fitted with a shut-off valve which would be closed during the start-up phase, thus, at this time E1 has only one takeout path. The respondent also proposed that feature (b) could be interpreted to mean that there is only one takeout path

from the turbine. As E1 shows such a line, i.e. that leading directly downward from the turbine, then into the heat-exchanger and exiting with the reference sign 18, the requirements of feature (b) are met anyway.

The appellant held the view that, whilst line 17 might indeed be fitted with a shut-off valve, it was not directly and unambiguously derivable that this valve alone would be closed, since it was perfectly feasible that line 15 would also be fitted with a shut-off valve which likewise would be closed during start-up. This argument appeared to be irrelevant anyway since closing the valve would not mean that line 17 disappeared and hence did not change the fact that the apparatus according to E1 is provided with two takeout paths for the product pressurised oxygen.

As concerns feature (c) the respondent argued that the heat-exchange means must be taken as being all of the heat-exchanger elements that contributed to cooling the compressed air to an ultra-low temperature.

*(ii) Document E6*

The appellant disputed that E6 discloses the feature: "the portion of the oxygen gas takeout path (74) downstream of the said heat exchange means (55b) being provided with an expansion means (75) utilizing oxygen gas passing through the (product) oxygen gas path (74)". In the appellant's view the throttling operation mentioned at column 5, line 66 concerns an oxygen-rich liquid as opposed to a gas, the liquid being partially vaporised only after it has been throttled into the side condenser 107. Hence, the throttling device is not



only positioned in a different portion of the apparatus, but also must be of a different design as it is intended for throttling liquid.

The respondent accepted that the throttling operation of E6 is in the liquid phase, but contended that the wording of the claim did not exclude this possibility. In particular, the expression "utilising oxygen gas passing through the oxygen gas takeout path" must be understood as a method step and cannot be used to define the apparatus. Further, although the claim specifies "gas" this does not exclude the possibility that it includes liquid which will eventually become the gas.

(c) *Inventive step*

The respondent presented the following lines of argument to show that the subject-matter of claim 1 does not meet the requirements of Article 56 EPC for inventive activity:

- (i) E3 in combination with the knowledge of the skilled man;
- (ii) E1 in combination with either E2 or E8.

(i) *Document E3*

In the respondent's view the apparatus described in E3 differs from that of claim 1 only in that there are expansion means utilizing oxygen gas in the portion of the oxygen gas takeout path downstream of the said heat exchange means. However, it would be obvious to the skilled person faced with the problem of ensuring a continuous and regular feed of oxygen enriched gas

through line 66 into the mixing duct 64, that it is necessary to maintain the pressure in line 66 above that of the mixing duct/line 68 at all times. As the pressure in the mixing duct is subject to fluctuations imposed by the varying demands of the user through line 68, the skilled person has no choice but to select a feed pressure in line 66 above the highest expected and use an expansion means to expand the oxygen enriched gas down to the generally lower prevailing pressure in the mixing duct 64/delivery line 68.

The appellant considered this analysis to be based purely on hindsight. E3 makes no mention of an expansion means in line 66 and it must be assumed that the mixing duct 64 is designed to ensure that the air arriving from compressor 62 is adequately blended with the oxygen enriched air under all operating conditions without recourse to an expansion means in line 66.

*(ii) E1 in combination with either E2 or E8*

The respondent proposed that the objective problem which the alleged distinguishing feature (b) solves is one of producing all of the gaseous oxygen product at a pressure higher than that of the low pressure column.

E2 describes an apparatus wherein the whole of the oxygen product from the fractionation tower is taken out in liquid form through line (15). This gives the skilled person, faced with the above problem, a direct hint that the valve in line 17 of E1 can be shut and the whole of the oxygen product delivered through line 15,18 independently of the pressure in the distillation tower.

Document E8 shows a similar process wherein the gaseous oxygen takeout path (27) is explicitly shown as being optional and is another clear hint to the skilled person that the gaseous oxygen takeout path (17) in E1 can be dispensed with.

The respondent disputed the validity of the assumptions lying behind the calculations presented in the appellant's letter of 9 June 2004, notably that all the flow would be transferred to the available line 15 without any adjustment of the volume. Calculations, presented in letter of 22 March 2006, demonstrate that it is entirely feasible to operate the installation of E1 without line 17 and without further modification, albeit with a reduced feed-air charge which might lead to some loss of efficiency. Hence, faced with the above problem the skilled person is not required to undertake any inventive activity in order to remove line 17 and thus obtain an apparatus according to claim 1 as granted.

The appellant defended the calculations presented in letter of 9 June 2004 and maintained that the apparatus according to E1 would never be operated with line 17 closed or eliminated. Although, on paper, it might be very easy to remove line 17, in reality so doing would entail a cascade of other modifications to the plant, such as resizing the heat exchanger 6, the compressor 9, the turbine 16 as well as the exhaust line 18, to cope with the increased flows. Furthermore, by removing line 17 the oxygen impurity level in the line 14 would rise to 1,700ppm such that the apparatus would no longer fulfil its primary objective of delivering high

purity nitrogen, whilst at the same time only delivering a medium purity oxygen product. The necessary structural modifications combined with the prospect of poor plant performance would thus deter the skilled person from removing line 17.

## **Reasons for the Decision**

### 1. *Extended subject-matter - Article 123(2)*

The description and claims of the application as originally filed do not explicitly disclose the contested feature, hence, it must be examined whether the application as a whole and in particular the drawings, provide a sufficient basis. Both of the embodiments depicted in figures 1 and 2 indicate that no additional gaseous oxygen takeout paths from the fractionation tower are available. The only source of oxygen gas introduced into the product oxygen gas takeout path 74 is the oxygen produced by evaporation of liquid oxygen in heat exchange means 55b. In both embodiments this oxygen is passed through an expansion means, in the form of a turbine 75, before leaving the plant as product oxygen gas. The description only details one takeout path for the product oxygen (see col. 2, lines 37, 58; col. 3, lines 6-24, and col. 6, line 46 to col. 7, line 2 of the published application) and the possibility of the coexistence of any other takeout path is not mentioned. As the apparatus under consideration is primarily destined for the production of oxygen it would be normal to expect that the presence of any other takeout paths for oxygen products would have been explicitly mentioned. Taken together

the board considers this to be a sufficient basis for accepting that the contested feature was originally disclosed.

The board is of the view that the term "expansion means" must be taken to mean not just the element actually carrying out the physical expansion of the medium, but also all the equipment immediately necessary for controlling that expansion, and which does not affect other aspects of the process. The respondent's argument that, in the case of a turbine, a by-pass line is always present in order to provide the necessary control of the gas flow and hence two takeout paths are present, is not convincing. If there is always a by-pass line present (which must be fitted with an expansion valve) as part of the turbine control, then these two elements are inextricably linked and as such form an expansion means. Given this interpretation all the product oxygen gas can still be said to pass through the expansion means even when some of it goes through the turbine by-pass.

In conclusion, the board concurs with the findings of the opposition division in this respect, and is of the opinion that the subject-matter of claim 1 as granted meets the provisions of Article 123(2) EPC.

2. *Novelty*

*(i) Document E1*

The features under dispute are:

- (a) -the apparatus is suitable for producing a pressurised product oxygen gas;
- (b) -the only takeout path for said product pressurised oxygen gas is the oxygen gas takeout path, extending from the liquid oxygen takeout path and through the expansion means; and
- (c) that the heat-exchange means used to gasify the liquid oxygen is also that through which the oxygen gas takeout path extends.

As regards feature (a), the board cannot accept the arguments of the appellant. Not only are the properties of the gas mixture exiting line 18 not a direct feature of the apparatus, but also the mixture exiting line 18 is in any case principally composed of oxygen. This type of mixture is useful for oxidation processes for example and cannot be dismissed as a by-product. Further, although admittedly the outlet pressure explicitly specified in E1 is low, there is no indication in the contested patent of how the term "pressurised" should be understood. Therefore, it must be taken to mean any pressure over one atmosphere. Hence, E1 discloses feature (a).

Concerning feature (b), the board is of the opinion that the apparatus of E1 is designed, sized and intended to function with flow of oxygen product through both of lines 15 and 17. As such line 17 is an essential element of the apparatus and is not just a cosmetic appendix. Although, it is agreed that this line may be fitted with a shut-off valve, it is not considered that the act of closing this valve would change the fact that there is still a second takeout

path available for the oxygen product which remains an immediately identifiable attribute of the apparatus.

It should also be added that even if line 17 might be fitted with a shut-off valve, so would every other inlet and outlet to the fractionation tower.

Accordingly, during the start-up phase it is to be expected that, not only line 17, but also line 15 would be shut until the necessary purity levels have been reached. There is nothing in E1 that implicitly or explicitly indicates operation at any time with just line 17 shut off or that any part of the operating cycle would inevitably lead to this configuration. Hence, it is any case not directly and unambiguously derivable from E1 that the installation would at any time be operated with only the shut-off valve in line 17 closed.

The respondent has also proposed that feature (b) could be interpreted to mean that there is only one takeout path from the turbine. However, the board cannot accept this line of reasoning since, in contrast to the contested patent, where the oxygen gas leaving the turbine is the entire pressurised product, the oxygen gas leaving the turbine in E1 makes up only a part of the oxygen product. Consequently, the pressurised oxygen gas product comes from two take out paths, one from the turbine and the other directly from the low-pressure column.

As concerns feature (c), the board is of the view that the heat-exchange means must be taken as being all of the heat-exchange means that contribute to cooling the

compressed air to an ultra-low temperature. Hence, E1 discloses this feature.

In conclusion, the apparatus according to claim 1 of the contested patent as granted is distinguished with respect to E1 by the feature (b).

*(ii) Document E6*

It is not disputed that the throttling operation mentioned at column 5, line 66 concerns an oxygen-rich liquid as opposed to a gas, the liquid being partially vaporised only after it has been throttled into the side condenser 107.

The board rejects the respondent's contention that the wording of the claim does not exclude this possibility. The expression "utilising oxygen gas passing through the oxygen gas takeout path" places limitations in apparatus terms in that the expansion means must be positioned in the oxygen gas takeout path and be suitable for expanding a gas, as opposed to a liquid. Further, the term "gas" in this part of the claim is unambiguous and cannot be taken to mean liquid that eventually becomes gas.

Hence, E6 does not disclose the feature wherein the portion of the oxygen gas takeout path downstream of the heat exchange means is provided with an expansion means utilizing oxygen gas.

In conclusion the subject-matter of claim 1 as granted is new with respect to both E1 as well as E6 and meets the requirements of Article 54 EPC.



3. *Inventive step - Article 56 EPC*

*(i) E3 in combination with the knowledge of the skilled man*

The board concurs with the respondent that the apparatus described in E3 only differs from that of granted claim 1 in that there are expansion means utilizing oxygen gas in the portion of the oxygen gas takeout path downstream of the heat exchange means.

However, the board does not accept that the skilled person, faced with the problem of ensuring a continuous and regular feed of oxygen enriched gas through line 66 into the mixing duct 64, would inevitably use an expansion means to expand the oxygen enriched gas down to the prevailing pressure in the mixing duct 64/delivery line 68. In the board's view the plant of E3 is already provided with the necessary equipment to overcome this problem. In particular, feed-air line 60 is provided with a compressor 62, whose outlet pressure would be varied to compensate for any fluctuations in user demand. It is to be expected that the mixing duct 64 is also capable of absorbing pressure fluctuations from both inlets whilst ensuring the necessary blending.

For the above reasons the skilled person would see no need to fit an expansion means to line 66 of E3 and would only contemplate such a measure with the benefit of a prior knowledge of the invention.

*(ii) E1 in combination with either E2 or E8.*

When examining the objections under novelty, the board came to the conclusion that the subject-matter of claim 1 is distinguished from that of the apparatus according to E1 by virtue of feature (b) i.e. that the only takeout path for said product pressurised oxygen gas is the oxygen gas takeout path, extending from the liquid oxygen takeout path and through the expansion means.

By removing the direct link (i.e. line 17) from the turbine outlet to the low-pressure column, this feature offers a solution to the objective technical problem of providing an apparatus which is capable of producing all of the gaseous oxygen product at a pressure higher than that of the low pressure column.

Both parties have presented calculations, lying at opposite ends of the available spectrum, to demonstrate possible scenarios for the operation of E1 without any flow through line 17. In the respondent's version the feed air input to the plant is reduced such that the quantity of oxygen product flowing through line 15 remains the same. In the appellant's version all of the oxygen output is diverted to line 15 with no compensatory reduction in feed-air supply. The board does not see any reason to decide which of the two propositions is correct as both are considered to be a deterrent to the skilled person to carry out the modification to the apparatus of E1.

In the scenario according to the appellant, the diversion of all the oxygen product through line 15

would necessitate resizing of the heat exchanger 6, the compressor 9, the turbine 16 as well as the exhaust line 18, to cope with the increased flows. Furthermore, by eliminating line 17, there would be a tendency to increase the oxygen impurity level in line 14, since all the medium purity gaseous oxygen product normally exiting through line 17 would remain in the low-pressure column thereby placing an increased burden on the available rectification capacity. As a consequence the apparatus would no longer fulfil its primary objective of delivering high purity nitrogen.

In the scenario according to the respondent the necessary reduction in feed-air input, in order to maintain the flow through line 15 constant, would result in the distillation column working at a lower charge-rate and hence, in a loss of efficiency.

In the first case the necessary structural modifications combined with the prospect of poor performance with respect to the plant's primary purpose would be deemed by the skilled person to be a poor trade-off for an increase in supply pressure of the medium purity oxygen. The skilled person would thus be deterred from disabling or removing line 17.

In the second case the loss of efficiency must also act as a deterrent to the skilled person to continue down this path. Particularly, when other alternatives, such as the addition of an oxygen compressor on the outlet line 18 which would not have knock-on effects, are available.

It is also considered that neither E2 nor E8 would prompt the skilled person to eliminate line 17. Both of these documents deal with oxygen producing installations wherein the whole of the oxygen product from the fractionation tower is removed by a single takeout path. However, both already provide a complete solution to the problem of providing an oxygen product comprising utilising cold produced by expansion of a portion of the feed-air. Given this fundamental difference compared to E1, where the cold is produced by expansion of oxygen in the turbine, the board can see no compelling reason why the skilled person would combine their teachings with that of E1.

In conclusion, the board is of the opinion that the skilled person would not modify the apparatus according to E1 by eliminating line 17.

For these reasons the subject-matter of claim 1 as granted is considered to meet the requirements of Article 56 EPC.

**Order**

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

1. The decision under appeal is set aside.
  
2. The case is remitted to the department of first instance with the order to maintain the patent as granted.

The Registrar:

The Chairman:

A. Counillon

U. Krause.