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**Datasheet for the decision  
of 4 May 2023**

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**Application Number:** 12790924.0

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F16J15/34, F16J15/40

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**Title of invention:**

DRY GAS SEAL FOR SUPERCRITICAL CO2 PUMP-HIGH PRESSURE BUFFER

**Patent Proprietor:**

Nuovo Pignone S.p.A.

**Opponent:**

Siemens Aktiengesellschaft

**Headword:**

**Relevant legal provisions:**

EPC Art. 100(a), 56

**Keyword:**

Inventive step - main request, auxiliary request 1 - (no)

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

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Case Number: T 2294/19 - 3.2.06

**D E C I S I O N**  
**of Technical Board of Appeal 3.2.06**  
**of 4 May 2023**

**Appellant:** Siemens Aktiengesellschaft  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 26 July 2019  
rejecting the opposition filed against European  
patent No. 2805024 pursuant to Article 101(2)  
EPC.**

**Composition of the Board:**

**Chairman** M. Harrison  
**Members:** M. Hannam  
W. Ungler

## Summary of Facts and Submissions

- I. An appeal was filed by the appellant (opponent) against the decision of the opposition division rejecting the opposition to European patent No. 2 805 024. It requested that the decision under appeal be set aside and the patent be revoked.
- II. In its reply to the appeal, the respondent (patent proprietor) requested that the appeal be dismissed.
- III. The following documents, referred to by the appellant in its grounds of appeal, are relevant to the present decision:  
  
D1 US-A-2007/0147988
- IV. The Board issued a summons to oral proceedings and a subsequent communication containing its provisional opinion, in which it indicated *inter alia* that the subject-matter of claim 1 appeared to involve an inventive step whilst that of claim 10 appeared not to involve an inventive step.
- V. With letter of 25 January 2023 the respondent filed an auxiliary request based on the main request but with independent claim 10 deleted.
- VI. Oral proceedings were held before the Board on 4 May 2023, during which both parties withdrew their previously submitted written requests to hold the oral proceedings as a videoconference.
- VII. At the close of the oral proceedings, the requests of the parties were as follows:

The appellant requested that the decision under appeal be set aside and the patent be revoked.

The respondent requested that the appeal be dismissed (main request), or that the patent be maintained in amended form on the basis of the auxiliary request filed with letter of 25 January 2023.

VIII. Claim 1 of the main request and auxiliary request 1 reads as follows:

"A system for assuring a safe working condition of a dry gas seal, associated with a pump or compressor, during standstill operating conditions, the system comprising:

a controllable valve (412) connected to a chamber between a primary seal and a secondary seal of said dry gas seal, said valve associated with a vent to a flare-safe area;

a compressor (426) configured for boosting the pressure of an intermediate buffer gas injected into said chamber; and characterized by

a barrier fluid pressure detector for determining when barrier fluid pressure drops below a preconfigured lower limit and when said pump or compressor, at said standstill operating condition is pressurized at a settle-out pressure; and by

a control system configured for operating said controllable valve (412) and said compressor (426) based on said barrier fluid pressure."

IX. The appellant's arguments may be summarised as follows:

The subject-matter of claim 1 lacked an inventive step when starting from D1 and combining common general knowledge with this. The non-return valve 45 of D1

prohibited backflow from the flare to the chamber 11 in the event of a pressure fluctuation caused by other systems venting into a common flare system (see paragraph [0008] of D1). Based on the differentiating features of claim 1 over D1:

1. said valve (connected to the chamber) associated with a vent to a flare-safe area;
2. a compressor configured for boosting the pressure of an intermediate buffer gas injected into said chamber; and
3. the control system also controls said compressor,

the objective technical problem to be solved could in fact be formulated as two partial problems:

- a. How to provide a reliable prevention of contamination of the primary seal; and
- b. How to appropriately provide pressurised buffer gas to the chamber between the two seals.

The skilled person would reach the claimed subject-matter without exercise of an inventive step. Fig. 1 of the opposed patent, which disclosed a prior art arrangement of a dry gas seal, included a control valve 112 in the vent line allowing the pressure downstream of the first seal to be controlled for the purpose of limiting leakage from the seal and which was described as being well known. This guided the skilled person to the claimed solution to the first partial problem. Using a compressor to provide pressurised buffer gas for the seal was also an obvious way to supply pressurised gas to the system. In the case of a buffer gas compressor being dedicated to supply buffer gas to a single dry gas seal, the valve 19 of D1 could be omitted, the compressor alone being controlled. The claimed solution to the second partial problem was thus

also obvious to the skilled person.

- X. The respondent's arguments may be summarised as follows:

The subject-matter of claim 1 of the main request involved an inventive step. The three differentiating features of claim 1 over D1 had a synergistic effect such that the objective technical problem could be seen as being 'to provide a more reliable prevention of contamination of the seal with greater operational efficiency'. This was supported by col. 8, lines 22 to 25 of the patent which outlined how controlling the controllable valve and compressor together allowed seal gas usage to be reduced. The technical problem was solved through claim 1 by way of the same controller operating both the controllable valve and the compressor, thereby allowing the desired pressure in chamber 11 to be reached through balancing operation of the compressor with control of the controllable valve. Such a balance was neither disclosed nor rendered obvious to the skilled person through their common general knowledge.

The same arguments applied also to claim 1 of auxiliary request 1.

## **Reasons for the Decision**

### *Main request*

1. *Claim 1 - inventive step*
- 1.1 D1 discloses the following features of claim 1, the reference signs in parentheses referring to D1:

A system for assuring a safe working condition of a dry gas seal, associated with a pump or compressor (see paragraph [0002]), during standstill operating conditions, the system comprising:

a controllable valve (19) connected to a chamber (18) between a primary seal (9) and a secondary seal (10) of said dry gas seal (see Fig. 2),

a barrier fluid pressure detector (22) for determining when barrier fluid pressure drops below a preconfigured lower limit (see paragraphs [0027] and [0028]) and when said pump or compressor, at said standstill operating condition is pressurized at a settle-out pressure; and by

a control system (see control link between pressure detector 22 and control valve 19) configured for operating said controllable valve (19) based on said barrier fluid pressure.

At oral proceedings, both parties explicitly agreed with the Board that D1 thus failed to disclose the following features of claim 1;

1. said controllable valve is associated with a vent to a flare-safe area;
2. a compressor configured for boosting the pressure of an intermediate buffer gas injected into said chamber; and
3. the control system also controls said compressor.

1.2 Based on these differentiating features, the respondent posed a technical problem of 'to provide a more reliable prevention of contamination of the seal with greater operational efficiency'. However, the Board fails to see the 'greater operational efficiency' as being objective. Claim 1 indeed defines the control



system as being configured to operate the controllable valve and the compressor, yet fails to provide any indication of the manner in which this control is effected. In this regard, claim 1 does not define the response of the control system to either an increase or a decrease in the barrier fluid pressure which would be necessary for any conclusion regarding an increase in operational efficiency of the system as a whole to be met. For example, when the barrier fluid pressure decreases, the claim does not define the controllable valve being closed and the compressor being activated nor, on reaching the desired pressure, the compressor output being reduced. Thus no operational efficiency necessarily occurs. Hence, the synergy between the differentiating features alleged by the respondent to be present in claim 1 is, without the definition of further features relating to the manner of control, not present. However, claim 1 simply allows some undefined control to be carried out with respect to the controllable valve and the compressor which, in itself, provides no concrete efficiency benefit. The respondent pointed to col. 8, lines 22 to 25 of the patent arguing that this showed a synergy achieved between those features differentiating claim 1 over D1, yet this passage in the patent simply links closing the controllable valve and thus achieving a reduction in volume of buffer gas required to maintain a desired pressure at the seals. Such a reduction of required buffer gas is however also achieved when using, for example, a gas cylinder to supply the buffer gas, such that no unambiguous link to a more efficient operation of a buffer gas compressor can be extracted from this passage. Consequently, relative to D1, a 'greater operational efficiency' cannot be recognised in claim 1 such that this cannot appear in an appropriately

formulated objective technical problem.

1.3 As also argued by the appellant, the Board sees the objective technical problem to be solved to comprise two partial technical problems:

- a. How to provide a reliable prevention of contamination of the primary seal; and
- b. How to appropriately provide pressurised buffer gas to the chamber between the two seals.

As regards the first of these problems, contamination and icing of the primary seal is discussed in paragraphs [0005] and [0006] of the patent, the controllable valve on the line from the chamber (between the primary and secondary seals) to the vent ensuring that seal leakage from the primary seal can be reduced by increasing the pressure in the chamber between the primary and secondary seals. The provision of a reliable prevention of contamination of the primary seals is thus an objective partial technical problem based on the first differentiating feature identified in point 1.1 above.

As regards the second problem, D1 discloses the provision of a barrier fluid for the dry gas seal from an undefined source; it could typically be from a gas cylinder, a ring main or a compressor. The appropriate provision of a pressurised buffer gas thus presents an objective second partial problem based on the remaining differentiating features identified in point 1.1 above.

1.4 The claimed solutions to these partial technical problems are found not to involve an inventive step.

1.4.1 Firstly it is noted that the Board's preliminary opinion on this objection changed at oral proceedings due to the appellant's explanation of how paragraph [0031] of D1 had to be understood, in particular as regards the operation of the non-return valve 45, namely that this closed in the event of a pressure fluctuation caused by other systems venting into a common flare system (see paragraph [0008] of D1). The consequence of this understanding was that the non-return valve 45 maintained no technically significant pressure in the chamber 11. Consequently there was indeed a motivation to replace valve 45 with a controllable valve since this would allow a pressure to be maintained in chamber 11, thus aiding the reduction in contamination and icing of the primary seal. This is further explained in relation to the first partial technical problem herebelow.

1.4.2 As regards the first problem of providing a reliable prevention of contamination of the primary seal, the prior art disclosed in the opposed patent itself provides the claimed solution. Fig. 1 and paragraph [0015] discloses a prior art dry gas seal system including a valve and control element 112 for controlling the flow of buffer gas/leaked process gas to a flare-safe area. Col. 5, lines 1 to 5 discloses that the pressure established by the buffer gas is typically maintained at 4 to 7 bar which, with reference to Fig. 1, is achieved by the control valve 112 on the vent line. With this knowledge disclosed as prior art for the present patent, the skilled person is given a direct teaching as to how contamination or icing of the primary seal can be avoided, namely by increasing the pressure downstream of the primary seal with a control valve on the vent line, this reducing the differential pressure across the primary seal and

thus preventing contamination and icing of the seal.

- 1.4.3 The respondent provided no counter-argument as to why providing a controllable valve in the vent line was not obvious in the light of the prior art cited in the patent, limiting its argument to that concerning alleged synergy between the three differentiating features of claim 1 over D1. However, as already concluded in point 1.2 above, the features in claim 1 fail to justify an efficiency improvement being recognised due to no features being defined as to how the controllable valve and compressor are controlled. The existence of any synergy between the differentiating features of claim 1 over D1 is thus not accepted. The respondent's argument also fails to question the skilled person finding it obvious to modify D1 by providing a controllable valve in the vent line.
- 1.4.4 As regards the second partial technical problem of how to appropriately provide pressurised buffer gas to the chamber between the two seals, the claimed solution is also found to be obvious to the skilled person. Providing a compressor to boost the pressure of the buffer gas is found to be an obvious option for the skilled person seeking an appropriate source for pressurised buffer gas. The compressor would simply have to be provided upstream of the control valve 19 on the purge gas line 24 of D1 which would require little, if any, structural modification of the gas seal system disclosed in Fig. 2 of D1. The second differentiating feature of claim 1 over D1 would thus be reached without exercise of an inventive step.
- 1.4.5 As regards the third differentiating feature that the control system controls both the controllable valve and

the compressor based on barrier fluid pressure, this would also be obvious to the skilled person when wishing to control the barrier fluid pressure in the chamber between the primary and secondary seals. It is self-evident for a skilled person that, with a valve located in the vent line from the chamber 11 of D1 and a compressor supplying purge gas to the chamber 11, a balance of operation between these two devices is necessary in order to control the barrier fluid pressure. The immediately obvious way for the skilled person to achieve this is with a single controller being responsible for control of operation of both the controllable valve and the compressor. This was also argued by the appellant with reference to paragraph [0028] of D1 which describes purge gas pressure being controlled through operation of valve 19 dependent upon measured gas pressure, the compressor introduced into D1 being required to similarly maintain a desired purge gas pressure and thus a common controller being an immediately obvious solution.

- 1.4.6 The respondent's sole argument was again that the three differentiating features of claim 1 over D1 worked in synergy allowing the desired pressure in chamber 11 to be reached through balancing operation of the compressor with control of the controllable valve. However, this does not negate the above finding. As indicated in point 1.2 above, claim 1 lacks any further features defining how the single control system is configured to operate both the controllable valve and the compressor in a synergistic manner. It is consequently not possible to recognise any efficiency improvement achieved by claim 1 over D1 such that a single objective technical problem could not be formulated, partial objective technical problems being

appropriate (see point 1.3 above).

- 1.4.7 The Board thus concludes that the third differentiating feature of claim 1 over D1 would be reached by the skilled person without their having to exercise an inventive step.
- 1.4.8 In conclusion, when starting from D1 and wishing to solve the posed partial technical problems, the skilled person would reach the subject-matter of claim 1 without exercise of an inventive step.
- 1.4.9 The ground for opposition under Article 100(a) EPC in combination with Article 56 EPC is thus prejudicial to maintenance of the patent as granted, such that the main request is not allowable.

*Auxiliary request 1*

2. *Inventive step*

- 2.1 Claim 1 of auxiliary request 1 is identical to claim 1 of the main request. The respondent submitted no further arguments in support of this request to those presented in respect of the main request. The Board thus finds the subject-matter of claim 1 of auxiliary request 1 not to involve an inventive step (Article 56 EPC).
- 2.2 Auxiliary request 1 is consequently not allowable.

**Order**

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

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

The Registrar:

The Chairman:



D. Grundner

M. Harrison

Decision electronically authenticated