

Internal distribution code:

- (A) [-] Publication in OJ
- (B) [-] To Chairmen and Members
- (C) [-] To Chairmen
- (D) [X] No distribution

**Datasheet for the decision
of 28 February 2022**

Case Number: T 0208/20 - 3.2.04

Application Number: 15174721.9

Publication Number: 2955385

IPC: F04D29/12, F04D1/08, F16J15/34,
F04D29/10, F04D7/06, F04D1/06

Language of the proceedings: EN

Title of invention:
MULTI-STAGE HIGH-PRESSURE PUMP

Patent Proprietor:
Ebara Corporation

Opponent:
Sulzer Management AG

Headword:

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

Keyword:
Prior art documents - availability to the public
Inventive step - (yes)

Decisions cited:

Catchword:



Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0208/20 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 28 February 2022

Appellant: Ebara Corporation
(Patent Proprietor) 11-1 Haneda
Asahi-cho
Ohta-ku
Tokyo 144-8510 (JP)

Representative: Klang, Alexander H.
Wagner & Geyer Partnerschaft mbB
Patent- und Rechtsanwälte
Gewürzmühlstrasse 5
80538 München (DE)

Appellant: Sulzer Management AG
(Opponent) Neuwiesenstrasse 15
8401 Winterthur (CH)

Representative: IPS Irsch AG
Langfeldstrasse 88
8500 Frauenfeld (CH)

Decision under appeal: **Interlocutory decision of the Opposition
Division of the European Patent Office posted on
29 November 2019 concerning maintenance of the
European Patent No. 2955385 in amended form.**

Composition of the Board:

Chairman A. de Vries
Members: S. Hillebrand
T. Bokor

Summary of Facts and Submissions

I. Appeals were filed by the Opponent and the Proprietor against the interlocutory decision of the Opposition Division finding that the patent in suit in an amended form according to auxiliary request 2 met the requirements of the EPC.

In particular, the Opposition Division held that the subject-matter of claim 1 according to auxiliary request 2 involved an inventive step.

II. In a communication pursuant to Rule 15(1) RPBA, the Board agreed preliminarily with the findings of the Opposition Division.

III. Oral proceedings were held before the Board on 28 February 2022 in the form of a videoconference with all parties attending remotely. In the oral proceedings the Proprietor withdrew their appeal.

IV. The Appellant (Opponent) requests that the decision under appeal be set aside and the patent be revoked.

The Respondent (Proprietor) requests that the patent be maintained on the basis of auxiliary request 2, claims as upheld, i.e. the dismissal of Opponent's appeal.

V. The independent claim of auxiliary request 2, i.e. as upheld reads as follows:

*"A multistage high-pressure pump for pressurizing a fluid, comprising:
a rotational shaft (1);
impellers (3) secured to said rotational shaft (1);*

a casing (2) configured to house said impellers (3) therein;

a mechanical seal (20) constituted by a first pair (21 A, 22A) of a rotary seal member (21A) and a stationary seal member (22A), a second pair (21B, 22B) of a rotary seal member (21B) and a stationary seal member (22B), and springs (23, 23) that press said stationary seal members (22A, 22B) into sliding contact with said rotary seal members (21A, 21B), respectively;

an oil reservoir (30) configured to store oil therein;

an oil supply line (26) providing a communication between said oil reservoir (30) and said seal chamber (25);

an oil pump (31) configured to pressurize the oil from said oil reservoir (30) and supply the oil to said seal chamber (25);

an oil outlet line (27) for discharging the oil from said seal chamber (25), wherein the pressure of the oil in said seal chamber (25) is kept higher than pressure of the fluid,

a stuffing box (12A; 12B) secured to a side end of said casing (2) and forming a seal chamber (25) housing said mechanical seal (20) therein; and by a pressure retaining mechanism (32, 34, 35) configured to retain pressure of the oil in said seal chamber (25); and in that

each rotary seal member (21 A, 21B) is a seal ring rotatable in unison with said rotational shaft (1), and each stationary seal member (22A, 22B) is a seal ring secured to said stuffing box (12A; 12B), wherein said first and second pairs (21 A, 22A; 21B, 22B) of rotary seal rings (21 A, 21B) and stationary seal rings (22A, 22B) are arranged symmetrically with respect to a plane perpendicular to said rotational shaft (1), and said rotary seal rings (21 A, 21B) are secured to an outer circumferential surface of a sleeve (24), said

sleeve (24) being secured to said rotational shaft (1)."

VI. In the present decision, reference is made to the following documents:

D5: CH 572 174

D6: P. Meuter et al: "THUNDER HORSE INJECTION PUMP",,
Proceedings of the twentieth international pump
users symposium 2003

D8: EP 1 059 475 B1

D10: "SULZER KREISELPUMPEN HANDBUCH 4. Auflage", pages
173-177, ed. Sulzer Pumpen, 1997.

VII. The Appellant's arguments can be summarised as follows:
D6 discloses as closest prior art a multistage high-pressure pump with pressurized double mechanical seals in tandem arrangement and a seal support system for pressurizing the seals. The stationary seal rings are already spring biased as claimed. A symmetrical seal arrangement is a conventional and obvious alternative for the tandem arrangement, which the skilled person would choose according to the operating conditions and requirements of the pump. The remaining differences with regard to the seal support system are obvious from the common general knowledge of the skilled person.

The Respondent's arguments can be summarised as follows:

It is not proven that D6 belongs to the prior art according to Article 54(2) EPC.

The pump of D6 delivers sea water. In contrast to the patent, D6 does not therefore focus on containing by all means toxic or otherwise harmful high-pressure pump media. D6 is an individual and specific design, in which the tandem seals have been chosen for a reason, and a symmetric back-to back arrangement is explicitly

rejected. The claimed invention is therefore not obvious when starting from D6's pump.

Reasons for the Decision

1. The appeal is admissible.

2. The patent and its technical background

The patent deals with multistage high-pressure pumps, in particular with the seals sealing the pump shaft, which extends from inside the pump chamber through the pump casing to the outside.

For safety reasons, these seals usually comprise pairs of seals within a chamber surrounding the pump shaft, in which a buffer or barrier fluid circulates for cooling and/or lubricating the seal surfaces. The pairs of seals can be arranged symmetrically, i.e. in a so-called face-to-face or back-to-back configuration, or in series, both having the same orientation referred to as a "tandem" configuration.

If the pump delivers a hazardous or toxic medium, the fluid is often a barrier fluid, i.e. pressurized above the pressure prevailing in the pump chamber, in order to contain the pump medium within the pump chamber (see paragraphs [0006] and [0007] of the patent). In the multistage pump of the patent, an oil pump pressurizes oil as a barrier fluid, and a symmetrical back-to-back configuration of the seals is employed.

3. Document D6 - Public availability

3.1 In its communication, the Board gave the following preliminary opinion with regard to D6:

"D6 is part of the "Proceedings of the Twentieth International Pump Users Symposium 2003", see pages 2,

4, 6... - 18. The Opposition Division confirmed the publication of the proceedings in 2003 by checking the websites according to D6A and D6B (cf. section 2.2.1 of the impugned decision).

In contrast to the Appellant-Proprietor, the Board has therefore no doubts that D6 was made available to the public before the priority date of the patent in January 2007 and thus belongs to the prior art as defined in Article 54(2) EPC."

Since the Respondent did not further comment on this opinion in writing or during oral proceedings, the Board sees no reason to change it.

3.2 Consequently, D6 is part of the prior art according to Article 54(2) EPC.

4. **Auxiliary Request 2 - Inventive step**

4.1 D6 discloses as closest prior art a multistage high-pressure pump, which has been specifically developed and designed for pressurizing sea water at a pressure level never reached before, see page 2, left column, last paragraph, page 3, "Design concept (B)" and Fig. 3, page 5 "Concept" and figure 8. Conventional components of this pump are a rotational shaft, to which impellers are secured, and a pump casing housing the impellers. Because of previous experience with sand contained in water causing problems, double mechanical seals are chosen to withstand an external pressure of 32 bar during operation, see page 4, "Mechanical Seals" and Table 3. The pairs of seals of a double mechanical seal are housed in a seal chamber formed by a stuffing box, which is secured to a side end of the casing, figures . 8 and 11. In particular, double mechanical seals as shown in Fig. 11, each comprising two pairs of

a rotary and a stationary seal ring, respectively, are foreseen. Each stationary seal ring is secured to the stuffing box and pressed by a spring against its corresponding rotary seal ring, which is secured to the rotational shaft, as is apparent from figure 11.

Furthermore, an externally circulating barrier fluid system is provided for these double mechanical seals (page 6, "Mechanical Seals"). As mentioned above, a barrier fluid is understood by the skilled person as a fluid at a higher pressure than that of the pump medium in order to contain the pump medium in the pump chamber. As "externally circulating barrier fluid system" a separate mechanical seal support system according to API plan 53 is installed at the side of D6's pump, see page 7, "General Arrangements" and the accompanying figure 13. The skilled person knows from the reference to the API standard that the support system includes a reservoir or accumulator for storing barrier fluid. The reservoir is in fluid communication with the seal chamber via a supply line. A circulation pump supplies and discharges the barrier fluid to and from the seal chamber via the supply line and an outlet line, respectively, both being also partly visible in Fig. 11 of D6. It is implicit that the elevated pressure of the barrier fluid in the seal chamber is maintained by some pressure retaining mechanism.

- 4.2 The subject-matter of claim 1 thus differs from the multistage high-pressure pump of D6 in that
- the barrier fluid is oil
 - the oil pump is configured to pressurize the oil from the oil reservoir and supply the oil to the the seal chamber
 - the first and second pairs of rotary seal rings and stationary seal rings are arranged symmetrically with

respect to a plane perpendicular to the rotational shaft, and

- the rotary seal rings are secured to an outer circumferential surface of a sleeve, which is in turn secured the rotational shaft.

4.3 The first two of these features relate to the seal support system for the mechanical seals of D6, features that not are expressly mentioned in D6. However, it is common ground that the use of oil and an oil pump are standard features of mechanical seal support systems.

4.4 Critical for the question of inventive step are the remaining two features that define a back-to-back configuration of two pairs of seals. In D6, see figure 11, the double mechanical seal is in a tandem configuration, page 6, section "Mechanical Seals".

The multistage high-pressure pump of D6 with its double mechanical seal and barrier fluid system already solves the problem of not permitting leakage of high-pressure pump medium to the exterior mentioned in paragraph [0006] of the patent. The Board agrees with the Appellant in that the problem to be solved by means of the last two features can be considered as providing an alternative double mechanical seal design for the pump of D6.

4.5 The tandem configuration has been chosen in D6 because it is able - unlike a double mechanical seal in back-to-back configuration - to withstand full static discharge pressure in a so-called "reverse pressure situation", see "Mechanical Seals" on page 6. Such a situation could occur if one of the check valves that connects each pump of a set of pumps to a common discharge line leaked (or failed) while that pump was

on stand-by with its suction valve closed. The tandem seal arrangement is thus a specific adaptation of the pump design allowing it to be used in such a multiple pump system.

Replacing the tandem seal configuration of one of the pumps employed in the Thunder Horse application by a back-to-back seal configuration is therefore not an obvious option for solving the problem. In order to do so, a skilled person would rather consider alternative tandem seal designs.

4.6 As explained above, the D6 pump design is specifically adapted through the use of tandem seal to be employed in a multiple pump arrangement. It is debatable whether or not the skilled person might as a matter of obviousness consider using that design for a single pump application, where there is no longer a need for the double seal to be a tandem seal. However, regardless of whether or not that is obvious, equipping a stand-alone pump of the design according to D6, with a mechanical seal in back-to-back configuration would not directly result in the claimed subject-matter.

4.7 In all the combination documents D5, D8, D10 cited by the Appellant that disclose spring biased double mechanical seals in symmetrical back-to-back configuration, the springs act on the *rotary* seal members to press them against the stationary seal members (see D5, Fig. 1, D8, Fig. 1, D10, Abb. 5.17), and not on the *stationary* seal, as required by claim 1 as upheld.

The Appellant has argued that claim 1 merely requires that the spring presses the two seal members together, but does not specify on what seal member it acts.

The Board disagrees: for the skilled reader using normal comprehension skills and their understanding of syntax the only reasonable reading of "*springs that press said stationary seal members ...*" is that the springs act on the stationary seals.

- 4.8 Nor does the Board consider it straightforward, if the back-to-back configurations of D5, D8 or D10 were to be adopted in the D6 pump design, to then modify them so that the spring acts on the stationary seal. In this context the Appellant has argued that in the D6 design the springs already act on the stationary seals as can be inferred from figure 11. The skilled person therefore need only adopt the back-to-back configuration of the seals.

In the Board's view, however, the particular arrangement of the spring is an integral, inseparable feature of the entire seal design, whether that of figure 11 of D6 or that of the sole figures of D5 or D8 or figure 5.17 of D10. Thus the placement of the spring and the seal member on which it acts is specific to that design and is closely linked, structurally and functionally, to the other components and their arrangement of the seal mechanism. Consequently, if the skilled person were to consider adopting the seal designs of D5, D8 or D10, they would adopt the entire design to replace that of figure 11 of D6.

The Board thus concludes that it is by no means straightforward to have the the springs acting on the stationary seal members in D6's tandem seal and at the same time change the remaining seal parts into a back-to-back configuration.

4.9 The Board therefore agrees with the Opposition Division (see points 5.2.2 and 5.2.4 of the impugned decision) that the claimed mechanical seal design is not suggested by any of the cited prior art documents and would only be obtained by selectively isolating and recombining known individual seal features from different seal types (tandem and symmetrical) and documents (D6 and D5/D8/D10) based on hindsight knowledge of the patent.

For this reason, the subject-matter of claim 1 according to the main request (as upheld in opposition) involves an inventive step in the sense of Article 56 EPC.

5. Conclusion

With their appeal, the Opponent does not succeed in their challenge of the findings of the Opposition Division that the patent in amended form of auxiliary request 2 meets the requirements of Article 56 EPC in the light of the cited prior art.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



G. Magouliotis

A. de Vries

Decision electronically authenticated