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D E C I S I O N
of 24 August 1994

Case Number: T 0957/90 - 3.2.2
Application Number: 85107588.7
Publication Number: 0169374
IPC: C23F 13/02
Language of the proceedings: EN

Title of invention:

Method of preventing stress corrosion cracking in machines or
machine parts made of austenitic cast iron

Patentee:

EBARA CORPORATION

Opponent:

KSB Aktiengesellschaft

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step - no"

Decisions cited:

-

Catchword:

-



Case Number: T 0957/90 - 3.2.2

D E C I S I O N
of the Technical Board of Appeal 3.2.2
of 24 August 1994

Appellant: EBARA CORPORATION
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Representative: Nöth, Heinz, Dipl.-Phys.
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Mozartstrasse 17
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Respondent: KSB Aktiengesellschaft
(Opponent) Johann-Klein-Strasse 9
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Representative: -

Decision under appeal: Decision of the Opposition Division of the
European Patent Office dated 24 October 1990
revoking European patent No. 0 69 374 pursuant to
Article 102(1) EPC.

Composition of the Board:

Chairman: H. Seidenschwarz
Members: R. Lunzer
M. Aúz Castro

Summary of Facts and Submissions

I. European patent No. 169 374 was granted on 5 April 1989 on the basis of application No. 85 107 588.7 filed on 19 June 1985, claiming a priority date of 22 June 1984 derived from Japanese Application No. 127631/84. Claim 1 of the patent in suit took the following form:

"1. A method of preventing the occurrence of stress corrosion cracking in a machine or machine part made of austenitic cast iron designed for handling salt water, said method being characterized by subjecting said machine or machine part to cathodic polarization."

II. An opposition was lodged by the Respondent on the ground of Article 100(a) EPC, alleging lack of any inventive step of the subject-matter of Claim 1 (Article 56 EPC) relying in particular on the following documents:

- (1) Baeckmann/Schwenk "Handbuch des kathodischen Korrosionsschutzes" (1980) pages 52 - 55, and
- (2) "Austenitisches Gußeisen, by Von O. Nickel published in "Konstruieren + Gießen" (1984) and reprinted by Zentrale für Gußverwendung, Düsseldorf (1985).

Although the Respondent had not shown that document (2) was published before the priority date of the patent in suit, the Appellant did not object to its being treated as reflecting the state of expert knowledge at around the priority date (Statement of Grounds of Appeal, page 4 second paragraph).

III. By its decision given on 24 October 1990, the Opposition Division revoked the patent. It found with respect to the disclosures of documents (1) and (2), and also of document (3) DE-A-2 144 834 which had been referred to in the examining procedure, that the alleged invention, relating to making use of cathodic protection to overcome the problem of stress corrosion cracking found in austenitic cast iron components in contact with sea water, was lacking in any inventive step. As document (3) (page 3 lines 3 to 5) showed that stress corrosion cracking had been shown to occur in austenitic steels, this form of corrosion would be expected to occur in austenitic cast iron, and to be the cause of the problems of the cracking encountered. Given that knowledge, it would have been obvious to the skilled person in the art to have used cathodic protection as a remedy, as proposed in document (3) in connection with austenitic steels.

IV. An appeal against that decision was filed on 13 December 1990, the appeal fee was paid on the same day, and the Statement of Grounds of Appeal was filed on 20 February 1991.

The Appellant argued in its written submissions, and at the oral proceedings held on 24 August 1994, that it had made an epoch making discovery in appreciating that stress corrosion cracking could occur in austenitic cast iron when in contact with sea water. This was something which had never before been suspected. There was no prior proposal to use cathodic protection on austenitic cast iron components. In that connection, document (2) stressed the corrosion resistance of austenitic cast iron, and mentioned that when present in sea water and in contact with other metals, care had to be taken to avoid **increased** corrosion resulting from galvanic action due to the presence of, and possible contact with, other

metals. In contrast there was no hint that it could be possible to take advantage of galvanic action, with a view to increasing the corrosion resistance of austenitic cast iron.

The decision under appeal was wrong in extending the teaching of document (3), relating solely to austenitic steels, to austenitic cast iron. The respective corrosion characteristics of these alloys were quite different. Even if the skilled worker had concluded that cracking was due to stress corrosion, it still had to be decided whether it was caused by anodic reaction, or by cathodic reaction which resulted in atomic hydrogen entering the structure of the material and causing embrittlement. Although document (1) discussed stress corrosion cracking, in fact all of its examples (a) to (j) at pages 53 to 54 related exclusively to steels.

Photographs (produced with its letter of 22 January 1992) showed the nature of the cracks in the austenitic iron castings in which the problem had arisen. With the same letter there was included a translation of a list of materials known to be susceptible to stress corrosion cracking. That list, taken from a Japanese book with the title "Iron and Steel Corrosion Science" published by Asakura Shoten, 1976, did not include austenitic cast iron.

At the oral proceedings one of the inventors, Mr Matsuho Miyasaka, explained the invention against the background of the prior art. He drew attention to six factors which were investigated as possible causes of cracking, before the possibility of stress corrosion cracking was considered. He also compared the alleged invention with a further document introduced for the first time at the oral proceedings:

- (4) "Engineering properties and Applications of the Ni-Resists and Ductile Ni-Resists", published by INCO

(mentioned in the description of the patent in suit at page 2 line 28) which at page 10 right hand column stressed the rarity of stress corrosion cracking in cast materials, and at page 11 left hand column suggested that if it occurred, the problem could be overcome by stress relief annealing.

Furthermore, the invention had been the subject of a paper accepted for publication at the conference on corrosion, the International Corrosion Forum (17-21 March 1986), held by the National Association of Corrosion Engineers (NACE) in Houston, Texas. A copy of a paper based on that conference published in Corrosion, Vol. 43, No. 10 pp. 582-588 was introduced during the oral proceedings.

- V. The Respondent argued in its counterstatement, its subsequently filed statements, and at the oral proceedings, that even if the Appellant had, as it alleged, discovered that austenitic cast iron is susceptible to stress corrosion cracking, contrary to what had been believed in the past, that was no more than an unpatentable discovery. Document (2) did not suggest that there was any kind of technical prejudice against the adoption of cathodic protection for improving the corrosion resistance of austenitic cast iron. As soon as it was appreciated that the cause of the cracking was stress corrosion, the solution to that problem was obvious to every skilled worker, as was confirmed by reference to document (3). Regarding the inventor's six possible causes for the observed cracking mentioned by him in the oral proceedings, having found that none of those six was the cause of the cracking, it

would have been a matter of routine investigation to have tested for the possible occurrence of a seventh, i.e. stress corrosion cracking.

As to the argument based on document (4), it was accepted that it proposed stress relief annealing as a cure for stress corrosion cracking. However, if that cure did not work, the skilled worker would look to other possible causes.

- VI. The Appellant requested that the decision under appeal be set aside, and the patent maintained as granted. The Respondent requested that the appeal should be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Novelty*

Novelty was not disputed. Having reviewed all the available documents, the Board is satisfied that the subject-matter of Claim 1 is to be considered novel.

3. *The alleged invention*

The patent in suit states (page 2 lines 18 to 23) that problems had been encountered due to cracks developing in machine parts made of autenitic cast iron handling enriched sea water (7% NaCl) at ca. 33°C, and that although the cause of the cracks had been sought in various directions, it could not be identified. At page 2 line 29 it is then indicated that stress corrosion cracking was not to be expected in austenitic

cast iron in a chloride environment. Nonetheless, the inventors investigated the possibility of stress corrosion cracking being the cause. Their tests, reported at page 2 line 53 to page 5 line 27, proved to be positive, and consequently methods of preventing stress corrosion cracking were investigated (page 5 line 28 to page 6 line 58) and cathodic protection was shown to be effective.

4. *Inventiveness*

4.1 In the light of the facts and arguments stated above, the issues which divided the parties to the present appeal were: (a) whether in the present case finding the cause of cracking could be inventive; (b) whether it could be inventive to adopt cathodic protection to overcome cracking in austenitic iron castings once its cause was known to be stress corrosion; and (c) whether in principle the finding of the cause of cracking was an unpatentable discovery.

4.2 Identifying the cause of cracking

4.2.1 The Appellant stressed that as the occurrence of stress corrosion cracking was wholly unknown in austenitic cast irons, it was surprising that it had been found to occur at ordinary temperatures, under relatively low stress, and where the corrosive medium was not particularly aggressive. The Board is prepared to accept that the conditions were not severe, and that the occurrence of stress corrosion cracking in austenitic cast iron had not hitherto been encountered.

4.2.2 However, the present case turns on whether a skilled person, confronted with an austenitic cast iron pump casing which had cracked after working in a corrosive medium, and seeking to find the cause of cracking, was

doing any more than routine investigation in deciding to test for stress corrosion cracking as a possible source of the problem. The Board answers that question in the negative. It is accepted by the parties, and confirmed in the description of the patent in suit (page 5 line 46) and in documents (1) and (3), as well as by the list of alloys and environments in which stress corrosion cracking is to be expected filed by the Appellant and mentioned in paragraph IV above, that this kind of cracking is a well known phenomenon. Thus, once other tests had failed to establish the cause of cracking, it was in the Board's view no more than a matter of routine testing to investigate whether it was possible that alloys, hitherto thought not to be subject to stress corrosion cracking, were in fact so susceptible. Accordingly, the Board does not consider that it was inventive in the circumstances of the present case to test for the occurrence of stress corrosion cracking, or that the recognition of the cause of cracking residing in stress corrosion cracking involved any inventive step.

4.3 The remedy chosen to prevent cracking

4.3.1 The Appellant also sought to support the alleged invention on the basis of the distinction, made in the patent in suit (page 5 lines 43 to 50) and also in its written statement of 21 January 1992 (pages 5 to 7), that even after it had been found that stress corrosion was the cause of cracking, inventive selection was still needed to establish whether it was caused anodically or cathodically. However, in the Board's view, once cracking is known to be due to stress corrosion, the skilled worker would at once contemplate the use of galvanic protection, being one of the well known ways of overcoming corrosion, and would readily ascertain the voltage which provides the greatest degree of

protection, i.e. whether anodic or cathodic protection is required.

4.3.2 In fact it is acknowledged in the patent in suit (page 5 lines 28 to 38), that when cracking is **known** to be due to stress corrosion, the skilled worker would be aware that it can be overcome by reducing the stress, and/or reducing the corrosion. Stress can be reduced by using increased wall thickness in the vulnerable areas, while corrosion can be reduced, either by surface protection, such as by painting, coating, or plating, or by substituting alloys having higher nickel content. In the Board's view, the further option, of using cathodic protection, which is a well known method of overcoming corrosion, particularly for structures immersed in aggressive liquids, is no less one which would readily have occurred to the skilled worker, and its adoption in the present circumstances cannot be regarded as inventive. In fact at the oral proceedings it was accepted by the inventor that cathodic protection is a well known method of preventing corrosion.

4.4 Accordingly the Board reaches the conclusion that it was obvious to look for stress corrosion cracking as a possible cause of the cracks observed, and that, having ascertained the cause, it was no less obvious to prevent the cracking by the use of cathodic protection. Thus, the subject matter of Claim 1 lacks any inventive step, and fails to satisfy the essential requirement of Article 56 EPC.

5. Having reached the above conclusion, the Board sees no need to deal with the discovery issue argued by the Respondent.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:



S. Fabiani

The Chairman:



H. Seidenschwarz