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D E C I S I O N
of 20 February 2004

Case Number: T 0385/00 - 3.4.1

Application Number: 95102091.6

Publication Number: 0678876

IPC: G21C 17/06

Language of the proceedings: EN

Title of invention:

Soundness inspection apparatus and method for nuclear reactor
fuel assembly

Patentee:

KABUSHIKI KAISHA TOSHIBA

Opponent:

FRAGEMA - G.I.E.

Headword:

-

Relevant legal provisions:

EPC Art. 52, 56

Keyword:

"Inventive step - no (main request and auxiliary request)"

Decisions cited:

-

Catchword:

-



Case Number: T 0385/00 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 20 February 2004

Appellant: FRAGEMA - G.I.E.
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office posted 8 February 2000
rejecting the opposition filed against European
patent No. 0678876 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: G. Davies
Members: M. G. L. Rognoni
H. K. Wolfrum

Summary of Facts and Submissions

- I. The appellant (opponent) lodged an appeal, received on 6 April 2000, against the decision of the opposition division, despatched on 8 February 2000, rejecting the opposition against the European patent No. 0 678 876. The appeal fee was paid on 6 April 2000 and the statement setting out the grounds of appeal was received on 7 June 2000.
- II. The opposition had been filed against the patent as a whole, based on Article 100(a) EPC, and concerned, in particular, objections under Articles 52(1), 54 and 56 EPC.
- III. In the contested decision, the opposition division held, *inter alia*, that the following late- filed document:

D4: DE-A-41 14 293

was not to be admitted into the proceedings, since it was not *prima facie* relevant.

As to the following prior art:

D1: EP-A-0 235 534

D3: FR-A-2 661 765

the opposition division considered that it did not prejudice the maintenance of the patent as granted.

- IV. In response to a communication from the Board summoning the parties to oral proceedings, the representative of the appellant announced, by letter dated 19 September

2003, that the appellant would neither be present and nor be represented at the oral proceedings. Thus, the Board was asked to take a decision concerning the revocation of the patent on the basis of the appellant's written submissions.

- V. Oral proceedings were held on 20 February 2004 in the absence of the appellant.
- VI. The appellant requested that the decision under appeal be set aside and the patent be revoked.
- VII. The respondent (patentee) requested that the appeal be dismissed (**main request**), or that the patent be maintained on the basis of claims 1 to 11, filed in the oral proceedings, and claim 12 as granted (**auxiliary request**).
- VIII. The wording of claim 1 of the patent specification (**main request**) reads as follows:

"1. *An inspection apparatus (42) for inspecting soundness of a nuclear fuel assembly (19) against acceleration developed when the nuclear fuel assembly (19) for a nuclear reactor is transported in a transportation container (1) from a nuclear fabrication facility to a nuclear power plant, said inspection apparatus comprising*

sensing means (43) being mounted at the transportation container (1), for continuously sensing the acceleration and a waveform thereof taking place at the transportation container in transit and

outputting signal of acceleration data detected,
recording means (44) for continuously recording a peak value and waveform data of the acceleration applied to the transportation container in response to the signal outputted from the sensing means (43), and
determining means (48) for analyzing the data from the recording means (44) and determining the soundness of the nuclear fuel assembly (19) on the basis of the result of analysis of the recorded data
wherein said determining means (48) discriminates whether the acceleration is a temporary one or a continuous one, and includes a visual display panel for displaying the result of analysis of the recorded data and an allowable limit for the result of analysis of the recorded data of the acceleration as a display image, the display image showing time -series accelerations applied onto the transportation container, or showing a frequency distribution of occurrence of the accelerations applied onto the transportation container, or showing a relationship between the acceleration applied onto the container and frequency of the acceleration."

The wording of claim 1 according to the auxiliary request differs from claim 1 as granted essentially in that one of the OR-clauses in the last paragraph of the

claim has been replaced by an AND-clause, as follows (emphasis added):

"... wherein said determining means (48) discriminates whether the acceleration is a temporary one or a continuous one, and includes a visual display panel for displaying the result of analysis of the recorded data and an allowable limit for the result of analysis of the recorded data of the acceleration as a display image, the result of the analysis displayed as a display image being a relationship between the acceleration applied onto the container and frequency of the acceleration and either time -series accelerations applied onto the transportation container, or a frequency distribution of occurrence of the accelerations applied onto the transportation container."

IX. The appellant argued essentially as follows:

The subject-matter of claim 1 of the contested patent (**main request**) related essentially to an apparatus for controlling the state of fuel rods after they had been submitted to accelerations during transportation. The reference to fuel rods in the claim merely indicated that the items to be transported were particularly sensitive and required special precautions, whereas the fact that they were conveyed between a nuclear fabrication facility and a power plant had no bearing on the actual structure of the claimed apparatus.

D4 related to a process for monitoring temperature, air humidity and accelerations (ie shocks and vibrations). Though this document did not specify the kind of goods to be transported, it was clearly indicated that they were sensitive to shocks.

The apparatus shown in D4 comprised a sensor mounted on a container for continuously sensing the acceleration forces sustained by the container and for **continuously** recording their peak values and their waveforms. As specified in claim 4 of D4, the registered data were transmitted to a PC to be analysed with a view to determining whether the goods had been damaged. The data displayed in Figures 4 and 5 of D4 represented time - series accelerations applied to the container, as specified in the contested patent. Since the particular nature of the goods to be transported could not establish the novelty of an apparatus used to monitor their accelerations and since at least one of the three alternative display images specified in claim 1 of the contested patent was known from D4, the claimed subject-matter lacked novelty (Article 54 EPC).

Even if it were assumed that D4 did not show all the features of the alleged invention, this document provided the skilled person with the teaching required to build an apparatus comprising all the features recited in claim 1 of the patent in suit. Hence, the subject-matter of claim 1 did not involve an inventive step within the meaning of Article 56 EPC.

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

The inspection apparatus according to claim 1 of the **main request** determined the soundness of a fuel assembly on the basis of continuous sensing and recording of peak values and of waveform data of the acceleration experienced by the fuel assembly during transportation. The analysis of the recorded data allowed to discriminate between temporary and continuous accelerations, whereas the display of the results of such analysis and of predetermined limits made it possible to establish the soundness of a fuel assembly.

D4 related to an apparatus for determining peak values or average values of accelerations applied to sensitive items during transportation. This document, however, did not teach continuous recording of waveform data of the acceleration. The waveform was sampled at predetermined intervals (eg 2 seconds) only for the purpose of deriving a peak value and the samples were not continuously recorded in order to be subsequently analysed. Though the scanning rate was selectable, the values referred to in D4 were much too low to provide information about the actual acceleration waveform and thus were not "waveform data" as specified in claim 1. The sampled data were not "continuously recorded" but simply stored long enough to derive peak values or average values. Finally the apparatus of D4 did not display time-series accelerations together with an allowable limit.

As there was no indication that a person skilled in the art, starting from D4, would have had any incentive to arrive at the claimed apparatus, the subject-matter of claim 1 of the main request was both new and inventive with respect to D4.

Claim 1 according to the **auxiliary request** specified that the results of the analysis of the recorded acceleration data were displayed both as a relationship between the acceleration applied onto the fuel assembly and its frequency and as time-series accelerations. The display of the former necessarily implied that acceleration waveforms were sampled at a rate sufficiently high to retain all frequency information, that such waveform data were continuously recorded and stored throughout transport and that a frequency analysis was performed.

As pointed out above, D4 did not teach to sample waveform data at a rate which would be suitable for a frequency analysis, or to record continuously sampled acceleration values.

In D1 only accelerations exceeding a predetermined amplitude were sampled and thus this document did not show continuous recording of waveform data. The passing remark in D1 that the processor of the apparatus was free to carry out limited data analysis and that it could be programmed to execute some instructions between acceleration samples, for instance, in order to measure the frequency contents of accelerations exceeding a predetermined threshold could not be interpreted as a teaching to perform a waveform analysis.

Thus, even a combination of the teachings of D4 and D1 would not lead the skilled person to an apparatus as specified in claim 1 of the auxiliary request.

Reasons for the Decision

1. The appeal is admissible.

2. The contested patent addresses the problem of assessing the "soundness" (ie the integrity) of a fuel assembly which has been transported between a nuclear fabrication facility and a nuclear power plant. The proposed solution consists essentially in monitoring the acceleration experienced by the fuel assembly during transportation, analysing the recorded data, displaying the results of such analysis and determining the soundness of the fuel assembly on the basis of the displayed data and of predetermined allowable limits.

Admissibility of D4

- 3.1 D4 had been submitted to the opposition division's attention during the oral proceedings held on 17 January 2000. The first instance's refusal to introduce this document into the proceedings was based on the opinion that it did not disclose essential features of the claimed subject-matter and did not provide more information than the prior art already on file.

- 3.2 D4 relates, *inter alia*, to an apparatus for monitoring the transport conditions of items sensitive to shocks and vibrations (cf D4, column 1, lines 32 to 43). Data indicative of the accelerations affecting the transported items are sensed and recorded so as to determine, on arrival, whether acceleration values have exceeded the limits imposed by the nature of the goods and, thus, whether damage is likely to have occurred (cf. D4, column 4, line 67 to column 5, line 15).
- 3.3 D4 is silent about the nature of the goods to be monitored during transport and simply defines them as being sensitive to shocks and vibrations. It can therefore be assumed that such an apparatus would, in principle, be suitable for monitoring the accelerations experienced by fuel assemblies, as they are conveyed between a nuclear fabrication facility and a nuclear power plant, and for determining their "soundness" on arrival. The data collected by the apparatus of D4 are samples of the acceleration applied to the transportation container and the data displayed as a function of the transportation time are peak or average acceleration values (see Figures 4 and 5). None of the other documents cited in the course of the opposition proceedings shows this particular feature of claim 1.
- 3.4 As D4 was concerned with a possible solution to the problem addressed in the contested patent, it is relevant for the assessment of the patentability of the claimed invention and, consequently, has to be admitted into the proceedings.

Respondent's main request

4.1 The apparatus known from D4 comprises sensing means for continuously monitoring accelerations due to the shocks and vibrations experienced by the transport container to which it is mounted (column 3, lines 35 to 49). According to a first mode of operation, sampled acceleration values are recorded over a predetermined time interval and stored until they are replaced by a more significant event. In a second mode of operation, the samples recorded during a time interval (eg 60 seconds) are processed in order to obtain the peak value or the average value for that time interval (cf. column 7, lines 15 to 32).

4.2 It is uncontested that the apparatus shown in D4 comprises the following features recited in claim 1 of the main request:

- **sensing means** (G, Figure 2) being mounted at the transportation container, for **continuously sensing the acceleration** and a **waveform thereof** taking place at the transportation container in transit and outputting signal of acceleration data detected (cf Figure 3);

- **recording means** (24, Figure 2; column 4, lines 2 to 13) for continuously recording a **peak value** of the acceleration applied to the transportation container in response to the signal outputted from the sensing means;

- **determining means** (34) for analysing data from the **recording means** (24) (cf. Figures, 1 and 2; column 4, lines 27 to 35);

wherein said **determining means**

- includes a **visual display panel** (36) for displaying the result of analysis of the recorded data,
- the display image showing **time-series accelerations** applied onto the transportation container (Figures 4 and 5).

4.3 According to the respondent, an essential difference between the apparatus of D4 and the claimed invention was that the latter comprised recording means for "continuously" recording "waveform data" of the acceleration, whereas the former recorded only peak values at predetermined time intervals. Furthermore, the claimed apparatus comprised "determining means" for determining the soundness of the nuclear fuel assembly and for discriminating between "temporary" and "continuous" accelerations.

4.4 In the opinion of the Board, the expression "recording means for continuously recording ... waveform data of the acceleration" used in claim 1 can be understood, in view of the **digital** recording and processing of acceleration data foreseen according to the patent description (see column 10, lines 3 to 9), as implying that the sensed acceleration is sampled at an appropriate rate and that the acceleration samples are recorded. In other words, "continuously recording" does

not refer to a continuous **analog** recording of the sensed acceleration. Moreover, the continuous recording of sampled data referred to in claim 1 does not necessarily imply that such data are **permanently** stored. In fact, they may be stored only as long as they are needed for the processing involved in extracting the data which are actually going to be displayed (eg "*time-series accelerations*").

4.5 The apparatus of D4 continuously samples acceleration waveforms and records the sampled data during a predetermined time interval in order to derive the peak value, or the average value, for such time interval, whereby both the sampling rate and the time interval during which data are sampled and recorded can be selected according to the requirements of a particular application and the limitation imposed by the data storage capacity of the system (column 6, lines 39 to 48 and column 9, lines 13 to 25).

4.6 As to the "*determining means*" for determining the soundness of the nuclear fuel assembly and discriminating between temporary and continuous accelerations referred to in claim 1, it appears from the whole disclosure that this expression does not involve any particular functionality of the claimed apparatus but merely relates to the **presentation** of the final results obtained from the recorded data. In fact, as pointed out in the description (column 7, lines 15 to 19), "*...the determining means analyzes the data and presents or displays them graphically on the visual display panel, and soundness verification is thus performed based on these data displayed on the panel as a display image.*" Furthermore, the display image in one

of the three alternative embodiments specified in claim 1 shows "*time-series accelerations*" similar to those exemplified in Figures 4 and 5 of D4. It is therefore fair to assume that also the data displayed by the apparatus according to D4 would allow the viewer to discriminate between temporary and continuous accelerations.

4.7 In summary, the subject-matter of claim 1 according to the main request differs from the apparatus shown in D4 only in that, the "*visual display panel*" displays "*an allowable limit for the result of analysis of the recorded data*" together with the result of the analysis of the recorded data.

5.1 D4 specifies that the records of peak or average values of the acceleration applied to the transport container are examined on arrival in order to determine whether the transported items have been exposed to unallowed shocks and vibrations (column 4, line 67 to column 5, line 9). As a condition for determining the "soundness" of such items is that prescribed limits for peak values of the acceleration are not exceeded, it would be obvious to a person skilled in the art to facilitate the visual assessment of the recorded data by adding corresponding allowable limits to the display.

5.2 Hence, the subject-matter of claim 1 does not involve an inventive step within the meaning of Article 56 EPC.

Respondent's auxiliary request

6.1 Claim 1 of the auxiliary request differs from claim 1 of the main request essentially in that the visual display panel shows "*a relationship between the acceleration applied onto the container and frequency of the acceleration and either time-series accelerations applied on to the transportation container, or a frequency distribution of occurrence of the accelerations applied on to the transportation container*". Examples of such a relationship are given in Figures 12 and 13 of the contested patent, which show diagrams of the power spectrum density and of the magnitude of accelerations as a function of frequency.

6.2 The Board agrees with the respondent that the addition of this feature implies the "*continuous*" recording **and** storing of data indicative of the waveform of the acceleration throughout the transportation period because such data are required to obtain a relationship between acceleration and frequency.

On the other hand, the apparatus of D4 stores samples of the acceleration waveform corresponding to a predetermined time interval only as long as it is required to derive the peak value or the average value of the acceleration within such interval (column 7, lines 26 to 32). Moreover, there is no indication in D4 that such data might also be used to analyse the frequency content of the acceleration or to provide any relationship between acceleration and frequency.

6.3 Hence, a first question to be addressed is whether the person skilled in the art, wishing to improve the assessment of the integrity of transported items afforded by the apparatus known from D4, would consider the possibility of acquiring data to be used for obtaining a relationship between acceleration and frequency.

6.4 In the opinion of the Board, it is fair to assume that the person skilled in the art facing the problem of monitoring shocks and vibrations likely to damage sensitive items would be aware that not only the average intensity or peak intensity of accelerations measured within predetermined time intervals but also their frequency contents could be indicative of possible mechanical damage suffered by the transported items. In fact, it is the energy absorbed through shocks and vibrations which may cause structural damage and, as generally known, such energy is both a function of the acceleration's magnitude and frequency and may unexpectedly increase at some frequencies due, for instance, to mechanical resonance. Thus, it can be regarded as an obvious wish of the skilled person to monitor both the amplitude and the frequency of accelerations to which sensitive items are exposed.

6.5 Evidence of this desire can, in effect, be found in D1, which relates to an apparatus for measuring and recording accelerations affecting easily damaged items. According to this document, waveforms of accelerations above a predetermined threshold level are sampled, recorded and processed by a processor unit which performs "*limited data analysis*", such as the determination of the "*frequency contents*" of

accelerations exceeding a predetermined level (page 7, lines 25 to 29). Though, as pointed out by the respondent, D1 is silent about the purpose such frequency contents might serve and about a possible link between acceleration frequency and soundness of the transported goods, this document clearly implies that a frequency analysis of the sensed accelerations could contribute to the determination of the impact of accelerations on sensitive goods. The relevance of the relationship between acceleration and frequency is furthermore confirmed by D3 (see Figure 6 and the corresponding description) which teaches to monitor accelerations in three separate frequency bands by means of three parallel channels.

6.6 It should also be noted that, apart from increasing both the sampling rate of the amplitude waveform and data storage capacity and from providing a microprocessor capable of performing waveform analysis on the basis of known algorithms, no substantial modifications of the apparatus of D4 would be required for gathering waveform data which could provide a relationship between acceleration and frequency and for establishing such a relationship.

6.7 Therefore, in the light of the teaching of D1 or D3 and of general knowledge common in the art, it would have been obvious to the skilled person, wishing to improve the apparatus known from D4 for the inspection of the soundness of a nuclear fuel assembly against acceleration developed during transport, to consider the possibility of monitoring not only peak values of shocks and vibrations but also their magnitude as a function of frequency. In doing so the skilled person

would have arrived at the claimed subject-matter without requiring any inventive skills.

Consequently, the subject-matter of claim 1 does not involve any inventive step within the meaning of Article 56 EPC.

7. As none of the respondent's requests meet the requirements of the EPC, the patent has to be revoked.

Order

For these reasons it is decided that:

1. The decision of the opposition division is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

R. Schumacher

G. Davies