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D E C I S I O N
of 14 November 2000

Case Number: T 0343/96 - 3.4.1

Application Number: 88117852.9

Publication Number: 0316631

IPC: G21C 7/08

Language of the proceedings: EN

Title of invention:
Wear-measurement of a control rod

Patentee:
WESTINGHOUSE ELECTRIC CORPORATION

Opponent:
Siemens AG

Headword:
Wear-measurement of a control rod/WESTINGHOUSE ELECTRIC CORPORATION

Relevant legal provisions:
EPC Art. 56

Keyword:
"Inventive step (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0343/96 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 14 November 2000

Appellant: (Opponent)
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Representative:
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Decision under appeal:
Decision of the Opposition Division of the European Patent Office posted 5 February 1996 rejecting the opposition filed against European patent No. 0 316 631 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: G. Davies
Members: H. K. Wolfrum
U. G. O. Himmler

Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the opposition division, dispatched on 5 February 1996, rejecting the opposition against European patent No. 0 316 631. The notice of appeal accompanied by a statement setting out the grounds of appeal was received on 3 April 1996, the prescribed fee being paid on the same day.

II. Opposition had been filed against the patent as a whole and based on Article 100(a) together with Articles 52(1), 54 (1) and (2) and 56 EPC.

III. Oral proceedings were held on 14 November 2000.

IV. The appellant requested that the decision under appeal be set aside and that the patent be revoked. Reference was made to the following documents:

E1: US-A-4 670 211 and

D3: EP-A-0 213 028.

V. The respondent requested that the appeal be dismissed and that the patent be maintained on the basis of one of the following requests:

Main request:
as granted.

First auxiliary request:
claims 1 to 8 filed on 4 August 2000, with the description and figures as for the main request.

Second auxiliary request:
claims 1 to 7 filed on 4 August 2000, with the description and figures as for the main request.

Third auxiliary request:
claims 1 to 5 filed on 4 August 2000, with the description and figures as for the main request.

Fourth auxiliary request:
claims 1 to 4 filed on 4 August 2000, with the description and figures as for the main request.

VI. **Claim 1** of the patent as granted reads as follows:

"1. An eddy current wear measuring apparatus for locating wear in a nuclear reactor control rod cladding, the apparatus comprising

- an RF-excited circumferential coil (60C) adapted to surround said control rod (30) in a plane perpendicular to its axis (A) for producing a circumferential magnetic field (MC) and producing an output corresponding to the volume of the control rod cladding within the zone thereof proximate the circumferential coil,
- at least one RF-excited radial coil (60R) adapted to be located at a point adjacent and normal to the exterior surface of said control rod (30) for producing a radial magnetic field (MR) and for producing an output corresponding to the outer radius (Do) of the control rod cladding,
- and processor means (CPU) for correlating the outputs of said circumferential coil (60C) and said at least one radial coil (60R) with calibration values and with each other to determine the condition of said control rod

cladding."

Claim 1 of the **first auxiliary request** combines the subject-matter of claims 1 and 3 of the patent, thus specifying a plurality of radial measuring coils (60R) located in the same plane at right angles to the axis of and evenly circumferentially spaced about the control rod.

Claim 1 of the **second auxiliary request** combines the subject-matter of claims 1, 3 and 4 of the patent, thus additionally specifying means for exciting the coils including an RF-oscillator for impressing an RF input on the coils.

Claim 1 of the **third auxiliary request** combines the subject-matter of claims 1 to 4 and 6 of the patent, further specifying a housing having a through-hole with a shape corresponding closely to the shape of the control rod and means adapted to be coupled to the control rod for drawing the rod along its axial length at a controlled rate.

Claim 1 of the **fourth auxiliary request** combines the subject-matter of claims 1 to 4, 6 and 7 of the patent, further defining the processing means to include means responsive to the position of the control rod as the rod is drawn past the coils.

VII. The opposition division held in its decision that the claimed subject-matter was novel and inventive because none of the cited prior art documents disclosed processor means for correlating the output from a cladding volume detector with the output from a cladding radius detector in order to distinguish

between tolerable irregularities and a harmful wear of the cladding.

VIII. The appellant essentially relied on the following submissions:

The subject-matter of claim 1 of the main request was rendered obvious by the teaching of document E1 in combination with that of document D3. E1 disclosed an eddy current wear measuring apparatus having circumferential and radial coils corresponding in arrangement and function to those specified in patent claim 1. In particular the circumferential coil 74 shown in Figure 3 of E1 was used for locally correlating measurements or defects on the control rod with respect to the start and stop of absorber material in the control rod. The localisation of measurements or defects (including wear) included the measurements made by the radial coils 72 and implied a correlation of the signals from both types of coils with each other (as well as with calibration values). In this context, correlation within the meaning of patent claim 1 was for instance a mere alignment of the outputs from the two types of coils for display on a cathode ray tube so that signals corresponding to the same location on the rod vertically overlap, as was indicated in Figure 4 of the patent. Although E1 did not mention the use of processor means for carrying out the correlation, this was an obvious option for the skilled person, at which, at any rate, document D3 would have hinted.

IX. The respondent disputed the appellant's view, relying on the following arguments:

The problem solved by the present patent was to measure

wear of the cladding of a control rod more accurately and unambiguously so as to distinguish an unacceptable degree of wear from other less harmful irregularities, as was apparent from the description of Figures 3C and 3D. Such a problem was neither recognized nor solved by the prior art according to document E1. The skilled person could learn from E1 nothing more than the proposal of making two separate measurements, one regarding the circumferential profile using an indirect measurement approach by measuring the position of fingers instead of the radial position of the cladding, and, as an (optional) additional measurement, the determination of the gross amount of cladding material as an indication of possible wear. However, there was no indication to be found in E1 as to any correlation of the signals from the two types of coils so that the skilled person could not learn from E1 any proposal or advice how to take wear measurement for locating and distinguishing wear from any kind of meaningless deformation of the cladding. Hence the appellant's interpretation of the content of E1 was mere hind-sight speculation seeking to extend the teachings of E1 by introducing meanings into the text of E1 from the teachings of the present patent.

Reasons for the Decision

1. The appeal complies with Articles 106 to 108 and Rule 64 EPC and is therefore admissible.

2. *Main request*

2.1 Subject-matter of claim 1

The claimed eddy current wear measuring apparatus requires a circumferential coil surrounding the control rod for producing an output corresponding to the volume of the control rod cladding, at least one radial coil for producing an output corresponding to the outer radius of the control rod cladding, and processor means for correlating the outputs of the two types of coils with calibration values and with each other to determine the condition of the cladding.

The claim does not specify the nature and type of correlation to be performed by the processor nor the condition of the cladding to be determined. Thus, although the claimed apparatus would be suitable for accurately determining wear of the cladding, it is not limited to such a function. Indeed, a correlation leading to the determination of localized wear is only the subject of dependent claim 5. This observation is consistent with the patent specification in column 7, lines 37 to 40 according to which defects other than intolerable wear may be detected by the inventive apparatus.

For these reasons, the Board cannot accept the respondent's submission that the invention according to patent claim 1 consisted in an apparatus determining wear of the cladding of a control rod more accurately and unambiguously by making an automated distinction between the defects shown in the example of Figures 3C and 3D of the patent.

2.2 Document **E1** (cf. Figure 3; column 1, lines 5 to 17 and 45 to 49; and column 3, line 3 to column 4, line 2) discloses a control rod testing apparatus. Its teaching starts from the knowledge that defects of control rods,

such as wear, cladding defects, swelling or ovality, were determined by eddy current examinations using differential and absolute coils surrounding the control rod (i.e. circumferential coils) as well as pancake proximity coils (i.e. radial coils) for determining the circumferential profile.

The apparatus shown in Figure 3 of E1 makes use of both types of coils.

The radial coils 72 sense any variation in the geometry of the surface of the control rod. Their sensitivity and the accuracy of their signals are improved by the provision of a plurality of resilient fingers 82 of electrically conductive material which are permanently in touch with the surface of the control rod and whose position (i.e. distance from the radial coils) is sensed by a corresponding radial coil. Notwithstanding the presence of the fingers 82, each radial coil 72 is adapted to be located at a point adjacent and normal to the exterior surface of the control rod for producing a radial magnetic field and for producing an output corresponding to the outer radius of the control rod cladding within the meaning of the corresponding feature in claim 1 under consideration.

As regards the purpose and function of the circumferential coil 74, the corresponding passage in column 3, line 42 to column 4, line 2 of E1 reads as follows:

"*Differential coil 74 is well known in the art and comprises two adjacent coils with meter 88 responding to the differential eddy current signal between the two coils. This has the substantial advantage in located*

axial changes or conditions and is particularly advantageous for determining the start and stop of internal poison within the control rod so as to locate all measurements or defects with respect to this point. The coil may also be operated using only one coil to obtain gross measurements of the amount of cladding existing, thereby determining where (sic! meaning "wear") indications, although this is a generally conventional test."

It follows from the cited passage in combination with Figure 3 that the circumferential coil is adapted to surround the control rod in a plane perpendicular to its axis for producing a circumferential magnetic field and producing an output corresponding to the volume of the control rod cladding within the zone thereof proximate the circumferential coil within the meaning of the corresponding feature of patent claim 1.

Moreover, the Board has no doubt that the indication "*so as to locate **all** measurements or defects with respect to this point*" (emphasis added) in column 3, lines 48 to 49 of E1 has to be interpreted as referring to measurements made by both types of coils. However, using a measurement by the circumferential coil 74 for the purpose of establishing a reference point for measurements made (or defects detected) by the radial coils 72, inevitably requires a correlation to be performed (in the general sense of "bringing into relation") between the two measurements, as well as the reference to "defects" implies a correlation with calibration values.

2.3 It follows from the above considerations that, contrary

to the finding of the opposition division and the respondent's submission, the eddy current measuring apparatus according to E1 operates in the same manner as the apparatus according to claim 1 and that the subject-matter of claim 1 differs from the known apparatus only in that processor means are used for carrying out the required correlation.

The objective problem associated with this difference may be seen in the desire to perform the correlation in an automated manner.

2.4 Neither this problem nor its solution would have involved an inventive step at the priority date of the patent. Even if the idea of using processor means for correlating the outputs of the various coils (or the readings of the corresponding meters) of the apparatus according to E1 had not immediately crossed the skilled person's mind, document D3 (cf. in particular Figure 4 and the description on page 8, line 8 to page 9, line 2), which is also related to an eddy current measurement apparatus in a nuclear reactor and teaches the use of a computer for evaluating and processing the signals from several eddy current coils for display, would have provided a decisive hint as to such an option.

2.5 Consequently, on the basis of the teachings of document E1, the skilled person would not have had to exercise any inventive skill in order to arrive at the subject-matter of claim 1 as granted.

The main request thus does not comply with the requirements of Articles 52(1) and 56 EPC having regard to inventive step.

2.6 Only for the sake of completeness the Board wishes to add that, in view of the fact that the circumferential coil 74 in the apparatus of E1 was known to produce an output indicative of the amount of cladding material present (so that missing material could be detected) and the fact that the plurality of radial coils evenly spaced around the circumference was known to detect variations in the radial extension of the cladding, it could indeed be argued whether it would have unduly strained a skilled practitioner's imagination to intellectually combine the two readings of meters 84 and 88 so as to be able to identify the circumferential position of missing material.

3. *Auxiliary requests*

The features added to the independent claims 1 of the auxiliary requests exclusively define conventional measures which are required for a proper functioning of the apparatus and are either explicitly known from or implicit to the prior art according to E1.

Consequently, none of the auxiliary requests complies with the requirements of Articles 52(1) and 56 EPC either.

Order

For these reasons it is decided that:

The decision of the opposition division is set aside.

The patent is revoked.

The Registrar: The Chairman:

R. Schumacher G. Davies