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Datasheet for the decision of 19 December 2018

Case Number: T 2534/12 - 3.4.01

Application Number: 07005107.3

Publication Number: 1840903

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Language of the proceedings: EN

Title of invention:
Bi-alloy spacer grid and associated methods

Applicant:
Westinghouse Electric Company LLC

Headword:
Spacer grid / WESTINGHOUSE ELECTRIC COMPANY

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

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Case Number: T 2534/12 - 3.4.01

D E C I S I O N
of Technical Board of Appeal 3.4.01
of 19 December 2018

Appellant: (Applicant)	Westinghouse Electric Company LLC 4350 Northern Pike Pittsburgh PA 15146-2866 (US)
Representative:	Gallo, Wolfgang Fleuchaus & Gallo Partnerschaft mbB Patent- und Rechtsanwälte Buchenweg 17 86573 Obergriesbach (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 27 June 2012 refusing European patent application No. 07005107.3**

Composition of the Board:

Chairman	P. Scriven
Members:	F. Neumann
	D. Rogers

Summary of Facts and Submissions

I. The appeal is directed against the decision of the Examining Division to refuse European patent application number 07 005 107.3. The application was refused for lack of inventive step of the claimed subject-matter with respect to the disclosures of D1 (WO-A-02/072902) and D2 (EP-A-0 578 502), and for lack of clarity of claims 1 and 5.

II. With the statement setting out the grounds of appeal, the appellant submitted six alternative claim wordings, (a main and auxiliary requests 1 to 5), each defining the physical structure of the claimed device in different terms. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of one of these six sets of claims.

III. In a communication in preparation of oral proceedings, the Board set out its preliminary opinion with regard to clarity, added matter and inventive step. Reference was made to the documents D1 and D2.

IV. With submissions of 29 November 2018, the appellant replaced the previous requests with a new main and a new auxiliary request. At oral proceedings before the Board, the appellant confirmed these as the final form of its requests.

V. Claim 1 of the main request reads as follows:

> *A bi-alloy spacer grid (30) for a nuclear fuel assembly having a plurality of fuel elements (38), the bi-alloy spacer grid comprising:*

a plurality of grid straps (2) interlocking with respect to one another in a spaced, generally perpendicular configuration in order to form a number of compartments (36), each of the grid straps (22) comprising a plurality of dimples (8, 10) and a plurality of springs (6) coupled to the grid strap (22) proximate the dimples (8, 10), said plurality of springs (6) being provided in a strip member (24) formed as a separate component spanning the length of the grid strap (22) and attached to the grid strap (22),
characterized in that
said strip member comprises said springs (6) provided in a ribbon-like strip mechanically captured between interlocking grid straps (22), both the grid straps (22) and the strip members (24) are formed from a zirconium alloy, and the zirconium alloy of the grid straps has a lower growth rate than the zirconium alloy of the strip members when subjected to irradiation.

VI. Claim 1 of the auxiliary request has the following wording added to the end of claim 1 of the main request:

...,
each spring (6) includes a vertically elongated contact surface (14) structured to engage and secure a nuclear fuel element (38) when inserted into the spacer grid.

VII. The appellant's arguments, in so far as they are pertinent, may be derived from the reasons for the decision below.

Reasons for the Decision

The application

1. In a nuclear reactor, the fuel rods are supported and spaced from each other by spacer grids. The spacer grids are formed of interlocking grid straps which define a number of cells for accommodating the fuel rods. The grid straps are formed such that dimples extend into each cell. Spring elements are also provided on the grid straps to bias the fuel rods against the dimples to hold the fuel rods in place.

2. The application is directed to a means for ensuring that the biasing force of the springs is maintained throughout the service life of the spacer grid such that the formation of gaps between the fuel elements and the spacer grids is avoided. In this way, fretting of the fuel rod cladding, which occurs when the fuel rods are not held firmly in place by the spring and dimple supporting structure, is avoided.

Main Request

3. It is not contested that D2 discloses all features of the preamble of claim 1 of the current application.

4. In particular, D2 discloses a spacer grid made up of a plurality of grid straps which interlock to define a number of grid cells. The grid straps are formed of Zircaloy. Each grid strap comprises a plurality of dimples which are formed so as to project out of one wall of each of the grid cells (column 2, line 55 to column 3, line 3). A "ladder-like spring frame member"

10 made of Inconel is formed as a separate component and is coupled to each of the grid straps, spanning the length thereof. The spring frame is mechanically captured between interlocking grid straps (column 3, lines 30-42).

5. The spring frame member of D2 is made up of spring sections 11 and of upper and lower connecting plate sections 12. The spring sections are oriented vertically, while the connecting plate sections extend horizontally along the length of the grid straps and connect the spring sections along their top and bottom ends respectively.

6. Claim 1 of the main request defines that the springs are provided in a ribbon-like strip spanning the length of the grid strap. The appellant explained that the term "ribbon-like" was intended to make clear that the springs were oriented horizontally and were joined end-to-end, and that it was clear from the drawings that this was the intended arrangement. Effectively, the appellant considered that the chosen wording defined that the springs were attached in a series arrangement, as opposed to the parallel arrangement of D2.

7. Although the Board understands what the appellant is trying to express with the use of the term "ribbon-like", the Board does not consider that the intended end-to-end spring attachment is the only meaning which can be derived from the wording of claim 1.

8. In the Board's view, the term "ribbon-like strip" means any long, narrow, strip-like member. Since the spring frame of D2 also forms a long, narrow strip-like member, the fact that claim 1 defines the springs as being provided in a ribbon-like strip cannot serve to

distinguish the claimed subject-matter from the spacer grid of D2.

9. The appellant suggested that the difficulty in this respect was more a matter of definition rather than patentability. The appellant indicated that due to the fact that the amended claims had been drafted using the wording of the originally filed application, there was little scope to introduce a different wording which could perhaps serve to define the intended structure of horizontal springs more clearly.

10. However, irrespective of any understanding which may be derivable from the description and drawings, patentability has to be assessed based on the terms used in the claims. If they do not distinguish a feature from the prior art, patentability may well be affected.

11. The only feature distinguishing the claimed subject matter from the spacer grid of D2 is, therefore, the material of the spring. Whereas in D2 the spring frame is made of Inconel, in claim 1 the strip members are formed from a zirconium alloy having a growth rate higher than the growth rate of the zirconium alloy from which the grid straps are formed.

12. The appellant presented no arguments concerning the use of zirconium alloy. Neither a technical effect deriving from the use of a zirconium alloy nor a corresponding objective technical problem were identified.

13. The objective technical problem can, therefore, be formulated to be the provision of an alternative material for the springs.

14. D2 mentions that, whilst Zircaloy is generally a desirable material for use in reactors, it is not an ideal material for the springs (column 1, lines 27-35). Specifically, Zircaloy is prone to degradation after neutron irradiation and, as a consequence, Zircaloy springs are inferior in performance to Inconel springs (column 1, lines 30-35). For this reason, Inconel is used in D2 for the springs. In this respect, although D2 could be seen to be teaching away from the use of Zircaloy as a spring material, it nevertheless makes clear that Zircaloy has advantages in a reactor environment and is preferable to Inconel with regard to improving the neutron economy and lowering the exposure to neutron irradiation.

15. The degradation of Zircaloy spring performance is also discussed in D1. Here, it is explained that Zircaloy-4 and Zircaloy-2 both exhibit negative irradiation growth which leads to the development of gaps between the fuel rod cladding and the spacer grid. D1 proposes the use of a zirconium alloy having a different composition which is more suitable for use as a grid spring since it exhibits a high positive irradiation growth strain in the longitudinal direction even if only minimal cold working is used (page 3, lines 14-26; page 7, lines 13-19). At the same time, the alloy of D1 meets other requirements for desirable in-reactor performance. In particular, the zirconium alloy of D1 has excellent in-reactor corrosion resistance, low hydrogen uptake and good creep resistance (page 7, lines 22-25). In short, the zirconium alloy of D1 is designed for nuclear fuel assembly components, especially the grid strap spring material (page 8, lines 7-12). D1 specifically states that the alloy disclosed therein can be used in "bimetallic" grids in which the proposed high-growth alloy can be used for the cold-worked springs whilst a

different low-growth alloy can be used for the grid walls.

16. Bearing in mind that D1 was published some 8 years after D2, the skilled person would be aware that the discussion in column 1 of D2 concerning the inferior performance of Zircaloy springs, would not necessarily apply to the alloy proposed later in D1. Looking to identify an alternative material for the springs of D2, the skilled person would appreciate that the zirconium alloy of D1 has all the desired properties for use as a spacer grid spring. Indeed, as well as being more suitable in terms of neutron economy and hydrogen uptake than the Inconel of D2, it also exhibits the necessary high positive irradiation growth which makes it suitable as a spring in the reactor environment.

17. Therefore, it would be obvious to the skilled person at least to consider using the zirconium alloy of D1, ensuring that the springs are stamped with the strip rolling direction along the spring length, as specified in D1 (page 8, lines 22-25).

18. In doing so, the skilled person would arrive at the subject matter of claim 1. Hence the subject matter of claim 1 of the main request does not involve an inventive step.

Auxiliary request

19. Claim 1 of the auxiliary request adds only that each spring includes a *vertically elongated contact surface*.

20. It is not apparent how this feature serves to distinguish claim 1 from the springs of D2. In

particular, as can be seen from Figure 2 of D2, the contact surfaces of each of the springs are somewhat elongated in the vertical direction. Even if, for the sake of argument, the illustrated contact surfaces could not be described as "elongated", the appellant admitted that it would be trivial to extend them in a vertical direction in view of the vertical orientation of the springs 11 in D2.

21. Since the additional feature does not further distinguish the claimed subject-matter from the spacer grid of D2, claim 1 lacks inventive step for the same reasons as set out with respect to the main request.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

R. Schumacher P. Scriven

Decision electronically authenticated