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Bezeichnung der Erfindung: Reconstitutable fuel assembly for a nuclear reactor
Title of invention:
Titre de l'invention :

Klassifikation / Classification / Classement : G21C 3/32

ENTSCHEIDUNG / DECISION
vom / of / du 24 August 1989

Anmelder / Applicant / Demandeur :

Patentinhaber / Proprietor of the patent /
Titulaire du brevet : Westinghouse Electric Corporation

Einsprechender / Opponent / Opposant : Framatome

Stichwort / Headword / Référence :

EPÜ / EPC / CBE Article 56 EPC

Schlagwort / Keyword / Mot clé : "Inventive step (no)"

Leitsatz / Headnote / Sommaire

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Case Number : T 166/88 - 3-4-1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 24 August 1989

Appellant : (Proprietor of the patent)
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Decision under appeal : Decision of Opposition Division of the European Patent Office dated 21 March 1988 revoking European patent No. 0 048 343 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : K. Lederer
Members : E. Turrini
P. Ford

Summary of Facts and Submissions

I. European patent No. 0 048 343 was granted on the basis of European patent application No. 81 106 498.9.

The patent comprises two claims, of which Claim 1, the only independent claim, reads as follows:

"1. A reconstitutable fuel assembly comprising an array of fuel rods (12) held in radially spaced relationship by grids (14) spaced along the fuel rod length, control rod guide tubes (16) strategically interspersed among the fuel rods (12), and secured to the grids (14), top and bottom nozzles (18,26) attached to the ends of said guide tubes (16), end plugs (36) secured in the bottom of each of said guide tubes (16), each having a threaded central opening and a fastener (30) interconnecting the bottom nozzle (26) with each of the joined guide tube end plugs (36), said fastener (30) including a head (50) and an integral shank which extends into said end plug (36), said shank being externally threaded (at 40) along a major portion of its length and designed to mate with the threaded opening (38) in the end plug (36) for joining the bottom nozzle (26) and guide tubes (16) into a firm rigid assembly, characterized in the combination of the following features:

(a) Said fastener (30) has sections (46,44,42) of reduced diameter projecting from the threaded shank to facilitate the entry of the fastener (30) into a position for threading into the end plug (36),

(b) said fastener head (50) has a cavity (60) adapted to accept a tool for effecting threaded engagement of

the parts, and said fastener head (50) has a portion (56) engageable with the bottom nozzle (26) for locking the fastener (30) to the nozzle (26) to thereby preclude its accidental withdrawal from the guide tube (16) during reactor operation,

(c) said portion on the fastener engageable with the bottom nozzle (26) includes a section (56) capable of being moved outwardly into engagement with slots (58) in the bottom nozzle (26) to lock the fastener (30) in the nozzle (26),

(d) said section (56) is a rim on the fastener head (50) capable of being swaged into said slots (58) in the nozzle (56), and

(e) said fastener head (50) has a peripheral groove (63) adapted to be engaged by a tool for grasping and retaining the fastener (30) during insertion or removal of the fastener (30) from the nozzle (26)."

II. The patent was revoked by a decision of the Opposition Division on opposition by the Respondent, on the ground that its subject-matter did not involve an inventive step in view in particular of the content of the following documents:

FR-A-2 368 785 (Document B); and

"Hütte" - Des Ingenieurs Taschenbuch, Vol. II, page 18, Berlin 1931, Verlag von Wilhelm Ernst & Sohn (Document H).

III. The Appellant (Patentee) lodged an appeal against this decision.

IV. Oral proceedings were held before the Board, at the end of which the Appellant requested that the decision under appeal be set aside and that the patent be maintained as granted. The Respondent (Opponent) requested that the appeal be dismissed.

V. In support of his request, the Appellant essentially submitted the following arguments.

The invention relates to a reconstitutable fuel assembly allowing remotely controlled disassembling and reassembling and, more particularly, it provides specific means for achieving proper alignment of the control rod guide tubes with the corresponding openings in the adjacent nozzle, as is required by the reassembling operation.

To this effect, the claimed arrangement essentially comprises a fastener having sections of reduced diameter projecting from the threaded shank as defined in feature (a) of the characterising portion of Claim 1. Accordingly, when introducing the first fasteners into the openings of the nozzle and the adjacent ends of the guide tubes, the fastener sections of reduced diameter automatically perform relative alignment of both elements, so that separate alignment operations can be dispensed with.

In contrast, the assembly of document B comprises guide tubes having enlarged ends, which have first to be aligned with and inserted into the corresponding holes of the adjacent nozzle, before the fasteners are inserted. This arrangement is not therefore well suited for remotely controlled reassembly.

The remaining cited documents do not disclose the use of sections of reduced diameter projecting from the threaded

shank of a fastener as a means for aligning the elements to be joined with the fastener either, nor do they show fasteners comprising more than one such section as is required by the wording of feature (a).

For these reasons, and whilst the remaining features of the claim are admittedly either known from document B or not inventive by themselves but, as concerns feature (e) which relates to the provision of a peripheral groove on the fastener head to be engaged by a tool for grasping and retaining the fastener during remote insertion or removal, are nevertheless necessary to make proper use of the essential feature (a), the claimed subject-matter cannot be considered to derive in an obvious manner from the prior art.

VI. These arguments were contested by the Respondent who essentially submitted that, due in particular to the fragility of the guiding tubes, it was not conceivable to align their ends with the corresponding openings of the adjacent nozzle only by means of the fasteners. On the contrary, such alignment was commonly achieved by means of auxiliary fixtures for receiving the guided tube ends and the adjacent nozzle, respectively, and for properly positioning them with respect to each other before introduction of the fasteners into the nozzle openings. Accordingly, the only purpose of the sections of reduced diameter at the end of the threaded shank of the fastener was to facilitate its entry in that opening, which was also the sole function recited in feature (a) of Claim 1.

However, in order to facilitate entry of a fastener into a threaded hole it was current practice to provide it with an end portion of, for instance, conical shape, which can be considered as being constituted by a "plurality" (namely an infinity) of sections of reduced diameter as set out in Claim 1.

The remaining features of Claim 1 were well-known per se, and since they did not collaborate with feature (a) to give rise to any synergetic effect, the claimed arrangement was a non-patentable collocation of either known or obvious features.

Reasons for the decision

1. The appeal is admissible.

2. Novelty

2.1 Document B discloses a reconstitutable fuel assembly (page 1, lines 1 to 30) comprising an array of fuel rods (barreaux combustibles parallèles 1) held in radially spaced relationship by grids (entretoises transversales 2) spaced along the fuel rod length (Figure 1 and page 2, lines 37 to 40), control rod guide tubes (tubes de soutien 5; the description specifies on page 5, lines 33 to 37 that these support tubes may allow passage of control elements), strategically interspersed among the fuel rods (Figure 2), and secured to the grids (page 2, line 37 to page 3, line 6), top and bottom nozzles (plaques d'extrémité 3) attached to the ends of said guide tubes (Figure 1; page 3, lines 6 to 11), each having a threaded central opening (extrémité filetée 9) and a fastener (douille 16) interconnecting the bottom nozzle (the description indicates e.g. on page 2, lines 12 to 26 that the fasteners are positioned at both ends of the guide tubes and thus also at the bottom; moreover Figure 3 is indicated on page 2 as representing a fastener connecting a tube with generically a nozzle) with each of

the joined guide tubes, said fastener including a head (19) and an integral shank (11), said shank being externally threaded (filetage 18) along a portion of its length and designed to mate with the threaded opening in the tube for joining the bottom nozzle and guide tubes into a firm rigid assembly (Figure 3; page 4, lines 12 to 23).

The fastener head (19) has a cavity (Figure 3) adapted to accept a tool (tournevis) for effecting threaded engagement of the parts (page 4, lines 12 to 17), and said fastener head (19) has a portion engageable with the bottom nozzle (3) for locking the fastener to the nozzle to thereby preclude its accidental withdrawal from the guide tube (5) during reactor operation (page 4, lines 6 to 23).

The portion on the fastener engageable with the bottom nozzle includes a section (23) capable of being moved outwardly into engagement with slots (15) in the bottom nozzle to lock the fastener in the nozzle, said section (23) being a rim on the fastener head capable of being swaged into said slots in the nozzle (Figure 3, rim (23), left side in the Figure; page 4, lines 18 to 21).

In this known assembly, there is no portion of reduced diameter projecting from the threaded shank of the fastener, and the fastener head does not comprise any peripheral groove either. In addition, the threaded shank of the fastener is directly engaged into enlarged end portions of the corresponding guide tube.

Thus, the subject-matter of Claim 1 differs from the fuel assembly according to document B in that

- the fastener has sections of reduced diameter projecting from the threaded shank to facilitate the entry of the fastener into a position for threading into the end plug (feature (a) of the characterising portion of Claim 1);

- the fastener head has a peripheral groove adapted to be engaged by a tool for grasping and retaining the fastener during insertion or removal of the fastener from the nozzle (feature (e) of the characterising portion of Claim 1);

- end plugs, each having a threaded central opening mating with a major threaded shank portion of the fasteners, are secured in the bottom of each guide tube, as set out in the preamble of Claim 1 (column 6, lines 27 to 29 of the published patent specification).

2.2 Document US-A-3 791 466 (document G), which is referred to in the introductory portion of the patent specification (column 1, lines 15 to 20) discloses a reconstitutable fuel assembly as defined in the preamble of Claim 1 (Figures 1 and 3, description column 2, lines 51 to 63 and column 3, lines 61 to 67; fuel rods (16), grids (22,24,26), control rod guide tubes (18), top and bottom nozzles (15,14), end plugs (40) and fastener (38) with externally threaded shank). In addition, the fastener head of this known device clearly has a cavity (a groove as shown if Figure 3) adapted to accept a tool for effecting further engagement of the parts, as set out in the first portion of feature (b) of the characterising portion of Claim 1.

In this known assembly however, the fastener neither comprises any section of reduced diameter beyond its threaded shank, nor does its head comprise any section for locking the fastener in the bottom nozzle, nor any

peripheral groove adapted to be engaged by a tool for grasping and retaining the fastener during insertion removal, as is defined in features (a), (c), (d) and (e) and in the last portion of feature (b) of the characterising portion of Claim 1.

2.3 Document H shows several fasteners, in which a cylindrical or conical section of reduced diameter projects from the threaded shank portion and is specified to serve the purposes of facilitating introduction of a nut and of protecting the threads (page 18, point 3, first paragraph and the four drawings a to d at the top of Figure 44).

This document however does not relate to the mounting of reconstitutable fuel assemblies of the type defined in the preamble of Claim 1, neither does it disclose any detail of the fastener head as defined in features (b) to (e) of the characterising portion of the claim.

2.4 The remaining documents on the file do not come closer to this claimed subject-matter.

2.5 For the above reasons, the subject-matter of Claim 1 is considered to be novel in the sense of Article 54 EPC.

3. Inventive step

3.1 The nearest prior art is in the Board's view constituted by the assembly disclosed in document B, from which the subject-matter of Claim 1 is distinguished by the sections of reduced diameter which project from the threaded shank (feature (a)), by the peripheral groove on the fastener head (feature (e)) and by the provision of end plugs secured in the bottom of each guide tube and mating with a major threaded shank portion of the fasteners (see point 2.1).

3.2 With regard to feature (a), assessment of the technical problem which it seeks to solve has given rise to considerable discussion during the proceedings.

The function of the sections of reduced diameter as explicitly set out in the claim itself is "to facilitate the entry of the fastener (30) into a position for threading into the end plug (36)". Various passages of the description confirm in a very consistent manner that the end of the fastener is shaped in such a way as to facilitate initial engagement of the latter in the openings of the nozzle and of the guide tube end plugs, and accordingly to avoid cross-threading or galling during thread engagement (column 1, line 55 to column 2, line 3; column 4, lines 6 to 33).

In contrast, there is no support at all in the description or claims for the Appellant's submission that the fastener end sections are designed in such a way as to permit direct alignment of the guide tube ends with the adjacent nozzle. Quite on the contrary, the last portion of the description (column 6, lines 4 to 16) unequivocally discloses that the fasteners are inserted into the respective holes only after proper alignment between the nozzle and the adjacent guide tube ends has been achieved using auxiliary fixtures, as was submitted also by the Respondent.

Thus, the only technical problem to which feature (a) can reasonably be considered to achieve a solution is that of facilitating introduction of the fastener into the threaded holes of the nozzle and guide tube end plugs while simultaneously protecting the threads from cross-threading and galling. This is however a most common concern in the mechanical art, and the thus defined

technical problem does not therefore by itself contribute to inventive step of the claimed solution.

The skilled person faced with the above problem finds in page 18 of document H which is dedicated to threaded fasteners, examples of fastener ends comprising a first, cylindrical, section of reduced diameter and a second, conical, section of reduced diameter located between the first section and the threaded shank (Figure 44, examples c and d). Having regard to the fact that these end configurations are explicitly said in the document to facilitate introduction of a nut and to protect the threads, he would immediately recognise that applying the same end configuration to the fastener known from document B, which is all what is required by the wording of feature (a), would lead to solving his technical problem as well.

When arguing that document H would not disclose fastener ends comprising more than one section of reduced diameter, the Appellant suggests that the expression "sections of reduced diameter" as used in feature (a) would not encompass conical sections, but only define end configurations comprising more than one cylindrical section of reduced diameter. However, were this limited interpretation of the wording of feature (a) accepted, or had feature (a) been amended in such a way as to comprise an explicit limitation in this sense, the Board could not see in the replacement of an end section of continuously varying diameter by a number of adjacent cylindrical sections of step-wise varying diameters anything more than a mere working option which is readily available to the skilled person.

For these reasons, feature (a) is not considered to provide any positive contribution to inventive step of the subject-matter of Claim 1.

3.3 The remaining distinguishing features of Claim 1 cannot by themselves justify patentability of its subject-matter either, as was admitted also by the Appellant.

Indeed, it is a common procedure to use a tool engaging the head of a fastener such as a screw or a bolt for grasping and retaining it during insertion in or removal from a threaded hole. Providing an additional groove on the fastener head for co-operating with a corresponding mechanism on the tool is a straightforward measure for improving engagement between both elements, which does not require any inventive ingenuity.

The use of end plugs which are secured in the end of each guide tube and have a threaded central opening for mating with the major threaded shank portion of the fastener is known from document G (end plug (40); Figure 3).

3.4 The three distinguishing features of the claimed assembly as defined in paragraph 3.1 above do not appear to co-operate in such a way as to achieve a common result going beyond the sum of their individual contributions, which was not denied by the Appellant either.

For these reasons, Claim 1 is considered to define a mere collocation of features which are either known in the art or obvious to the skilled person, and its subject-matter cannot therefore be considered to involve an inventive step within the meaning of Article 56 EPC.

4. Accordingly, the ground for opposition mentioned in Article 100(a) EPC prejudices the maintenance of the European patent.

Order

For these reasons, it is decided that:

The appeal is dismissed.

The Registrar: **The Chairman:**

M. Beer K. Lederer