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D E C I S I O N
of 3 June 1997

Case Number: T 0420/93 - 3.4.1

Application Number: 87106066.1

Publication Number: 0243917

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Language of the proceedings: EN

Title of invention:
Nuclear fuel assembly

Patentee:
AB ASEA-ATOM

Opponent:
Siemens AG

Headword:
-

Relevant legal provisions:
EPC Art. 56, 104(1), 111, 112, 114(1)

Keyword:
"Inventive step (denied)"
"Reference of questions to the Enlarged Board of Appeal (no)"
"Inventive step (no)"
"Apportionment of costs (no)"
"Remittal to the first instance (no)"
"Admissibility of late filed documents (yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0420/93 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 3 June 1997

Appellant: (Proprietor of the patent)
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Representative:
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Respondent: (Opponent)
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Decision under appeal: Decision of the Opposition Division of the European Patent Office posted 24 February 1993 rejecting the opposition filed against European patent No. 0 243 917 pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: G. D. Paterson
Members: Y. J. F. Van Henden
H. J. Reich

Summary of Facts and Submissions

I. European patent No. 0 243 917 was granted to the Respondent.

This patent comprises six claims, those numbered 2 to 6 being dependent claims appended to Claim 1, which reads:

"a nuclear fuel assembly for a nuclear boiling water reactor comprising a fuel channel of substantially square cross-section, a plurality of vertical fuel rods arranged in sub-bundles with substantially square cross-section, a vertical channel-formed support member with a center (7a) for the passage of water, said center being connected to wing parts (8) said sub-bundles of fuel rods being surrounded by said fuel channel and spaced apart by the channel-formed support member (7, 8) fixedly connected to the fuel channel (1), the cruciform center (7a) of said support member being limited by the central parts of the channel-formed support member, which conforms to the corner portions of said sub-bundles, in the region between the corner portions of the sub-bundles directed towards the center, characterized in that in each sub-bundle (6) of fuel rods (10) at least one fuel rod position has been removed from the corner portion of the sub-bundle (6) positioned nearest to the center (7a) of the fuel assembly, and that an enlarged cruciform center (7a) is formed by the channel-formed support member (7, 8), shaped in accordance to the non occupied corner portions of the sub-bundles".

II. An opposition was filed against the European patent on the ground mentioned in Article 100(a) EPC. The Opponent took the view that, having regard to the disclosure in documents:

D1: EP-A-0 099 322 and

D2: US-A-4 683 113,

the latter one corresponding to the JP-A-60/242392 (D2a) published before the date of priority of the European patent, the subject-matter of said patent lacked novelty or at least inventiveness. Later, during oral proceedings held on 13 January 1993 before the Opposition Division, the Opponent also referred to the patent specification

D3: US-A-4 585 614,

mentioned in the preamble to the description of the European patent and corresponding to the document SE-B-423 760, already cited in the ESR (European Search Report) and published before said date of priority.

III. The Opposition Division rejected the opposition, grounding its decision substantially as follows:

Document (D1) discloses many nuclear fuel assemblies in which the arrangement of the fuel elements is irregular. However, Claim 1 does not mention any such arrangement. Therefore, said claim is to be regarded as related to a "normal" fuel assembly comprising fuel rods arranged in a quadratic lattice, and its subject-matter is new. Furthermore, (D1) does not mention any assembly from which fuel rods have been removed at the corners of sub-bundles located nearest to the centre in order to achieve an enlarged cruciform centre: in the assembly of Figure 9, the cruciform centre results from the provision of non-quadratic sub-bundles, but (D1) is silent about measures suitable for enlarging said centre. As a matter of fact, it is by combining different designs envisaged in (D1) that the Opponent grounds its assertion that (D1) would disclose an

assembly with an enlarged cruciform centre. Such a conclusion, however, is based on hindsight. Furthermore, (D1) does not suggest to shape the support member in such a way as to achieve an enlarged cruciform centre. Comparable arguments apply to the disclosure in (D3), so that the subject-matter of Claim 1 is new and inventive with respect to the teachings of the latter document and (D1).

Document (D2) discloses an assembly in which additional water channels are provided in a central portion of the sub-bundles. According to the Opponent, it would be obvious to connect such channels with side walls to build a water cross. However, this would require an inventive step, for whole rows of fuel rods should be removed, whereby the fuel capacity would be significantly reduced.

As further evidence of inventiveness, it should finally be noticed that the sacrifice of fuel capacity in an assembly embodying the invention presents several advantages. For instance, owing to the moderation caused by the water in the enlarged centre, a longer running is possible when the fuel is getting exhausted. Besides, shutdown is more stable and there is less material liable to capture thermal neutrons.

IV. The Opponent lodged an appeal against the decision of the Opposition Division, requesting

(A) that the following questions be referred to the Enlarged Board of Appeal:

(i) does the principle laid down in Section C.IV.7.4 of the Guidelines, namely that a specific disclosure takes away the novelty of a generic claim, remain valid in the proceedings of opposition?

(ii) when an allowed claim can be read by the skilled person from the state of the art, is it admissible or even compulsory in the proceedings of opposition or in subsequent proceedings of appeal to achieve, by means of a change in the formulation such as a disclaimer, a clarification which renders novel the subject-matter of the claim?

(iii) are EPO instances entitled to allow or to maintain unchanged a claim which does not need a clarification but of which the wording, for it to be considered as defining patentable subject-matter, shall be interpreted as mentioning a distinguishing feature only disclosed in relation with the embodiments of the invention?

(B) that the decision under appeal be set aside;

(C) that the case be remitted to the opposition Division and

(D) that the appeal fee be refunded.

Subsidiarily, the Appellant requested that oral proceedings be held.

In support of these requests, the Appellant also referred in its Statement of grounds of appeal to the further documents

D3a: DE-A-3 142 300,

D3b: DE-A-3 022 687,

D4: US-A-4 578 241,

D5: EP-A-0 036 142,

D6: EP-A-0 099 323 and

D7: US-A-3 764 471.

Documents (D3a) and (D3b) together contain the matter disclosed in document (D3) and were cited because the latter document had been made available to the public at the date of priority of the European patent, whereas documents (D4, D5 and D6) respectively correspond to the citations SE-B-426 428, SE-B- 421 969 and SE-B-431 691 of the ESR.

V. The Respondent requested that the appeal be rejected as unfounded and, subsidiarily, that oral proceedings be scheduled. Its comments on the grounds of appeal were filed on 11 January 1994.

VI. The Board issued a communication pursuant to article 110(2) EPC taking the preliminary view that, having regard to the state of the art disclosed in the documents (D1, D2 & D2a, D3a, D3b, D4, D5 and D6), no claim of the European patent seemed to cover subject-matter involving an inventive step. The communication also stated that it did not appear to be appropriate or necessary to refer any questions of law to the Enlarged Board, and that refund of the appeal fee was not envisaged.

Though having requested two extensions of the period for filing its observations, the Respondent failed to comment on the Board's communication and, therefore, a summons to attend oral proceedings was sent to the parties.

VII. In a letter dated 29 April 1997, the Respondent further submitted that the documents (D3) to (D7) should not be introduced into the proceedings because of belated file and requested subsidiarily that the European patent be maintained in amended form on the basis of a set of six claims annexed to that letter. This subsidiary request was not maintained in the oral proceedings before the Board.

In said letter, the respondent also referred to the document:

D8: O. Nylund et al.: "SVEA - new generation of BWR fuel assemblies", in Asea journal 3/84, pages 4 to 7.

VIII. The oral proceedings were held on 3 June 1997.

During the hearings, the Appellant's representative handed over two bundles or respectively four and five pages with text and drawings explaining the Appellant's views.

On its part, the Board drew the attention of the parties to Figure 4 of the European patent representing an embodiment of the claimed nuclear fuel assembly where the wing parts (8) of the channel-formed support member consists of thin plates and do not comprise vertical channels.

Before deliberation by the Board, the Respondent's representative submitted two sets of claims forming the respective bases of a first and a second auxiliary request. Disregarding their division into a plurality of numbered clauses, the related versions of Claim 1 are distinguished over Claim 1 of the European patent as granted in that,

- according to the **first auxiliary request**, the adjective "regular" is inserted between "at least one" and "fuel rod position" in the characterising part and,

- according to the **second auxiliary request**, a further clause reading "the fuel rods of each sub-bundle being arranged in an essentially regular quadratic lattice, "is inserted after "sub-bundles with substantially square cross-section," in the pre-characterising part.

According to both auxiliary requests, dependent Claims 2 to 6 identical to those of the European patent are appended to Claim 1.

IX. The Appellant maintained its requests and, in support thereof, argued in substance as follows:

Nuclear fuel assemblies according to the pre-characterising part of Claim 1 are already known from documents (D1) and (D3). In particular, Figures 4 and 8 of document (D1) show sub-bundles with 25 fuel rods having the same diameter and arranged in arrays of five lines and five columns. From Figure 9, the reader furthermore learns that a broader central channel can be obtained by removing one central fuel rod. Therefore, it is not inventive to remove the rods from the central corners of the sub-bundles to realise a still broader central channel, even if it is borne in mind that the inventions disclosed in (D1) and (D3) aim at increasing the number of fuel rods. Likewise, the phrase "vier im wesentlichen quadratische Teilbündel" i.e. "four substantially quadratic sub-bundles" in Claim 1 of document (D3a) obviously refers to the presence of corners not provided with fuel rods. Bearing in mind that document (D3a) starts from the

teachings of document (D3b) where thinner fuel rods are placed at the corners of the sub-bundles, the lack of novelty of Claim 1 becomes apparent. Besides, another arrangement without fuel rods at the central corners, whereby the possibility of chamfering said corners is obviously offered, is disclosed in document (D7).

The Opposition Division took the view that novelty would not be at issue because documents (D1) and (D2) do not show any fuel assembly from which a "normal fuel rod" has been removed. Nevertheless, stating in Claim 1 that "at least one fuel rod position has been removed" does not reveal anything as regards the type of the fuel rod. Furthermore, from the patent in suit, the skilled person learns no restriction concerning the diameter and arrangement of the fuel rods. As a matter of fact, the adjective "normal" is much too vague for an assessment of novelty and inventiveness. For instance, in the particular case of an arrangement according to Figure 10 of document (D7), where the meshes of the gitter have the same cross-section, it cannot be decided which ones contain "normal fuel rods".

The Opposition Division also took the view that, albeit entailing a reduction of the fuel capacity, the removal of fuel rods would provide advantages. The latter, however, have been known for a long time, as evidenced by the statement in document (D2) that such removal results in improved fuel economy, and by the presence of water rods (14) in the arrangements according to the Figures 4, 12 and 15 of that document.

Headnote III of Decision T 16/87 (OJ EPO 1992, 212), on which the Opposition Division might have relied, is admittedly in contradiction with paragraph C.IV.7.4 of the Guidelines. Nevertheless, is it acceptable that the fate of a claim shall depend on whether the relevant

state of the art has been considered during the proceedings up to grant or only during the proceedings of opposition? Hence the first question to be submitted to the Enlarged Board of Appeal. This question is relevant to decide whether the Opposition Division made a substantial procedural violation justifying a refund of the appeal fee.

In the present case, the lack of clarity resulting from the distinction between "normal" and other fuel rods has a consequence from the standpoint of Articles 54 and 56 EPC. In this respect, attention should be paid to headnotes I and II of decision T 170/87 (OJ EPO 1989, 441) stating that an explanatory figure does not clearly exclude a feature which is not represented, and that the use of disclaimers does not render inventive an obvious teaching. Hence the second question of law.

In cases where no reference to the description and drawings is needed in a claim, decision T 16/87 seemingly allows this in order to arrive at a patentable subject-matter without having to define in detail the decisive feature. This applies to the present case. Nevertheless, if a claim clearly defines an object, no restrictive interpretation of its wording should be allowed and, conversely, if inventiveness depends on the provision of a further feature, then the latter should be mentioned in the claim. Decision T 175/85 (OJ EPO 1989, 71) states indeed that, when examining a claim for inventive step in such cases, it should be assumed that it is directed solely to the simultaneous application of all its features. Pursuant thereto, the Opposition Division should have been aware that Claim 1 lacks novelty, since it also covers any irregular arrangements of the fuel rods and any type of rods. Decision T 416/87 (OJ EPO 1990, 415), however, states that, if the description specifies a feature to be an overriding requirement of the invention, the

claims may be interpreted as requiring this feature, even though not stating this. A similar case arises in decision T 406/86 (OJ EPO 1989, 302) taking into consideration, for the purpose of assessing novelty, features mentioned in the description of a patent, but not in the claims. Hence the third question of law.

X. The Respondent requested that the appeal be dismissed and that the patent be maintained as granted or, subsidiarily, on the basis of the first or second auxiliary request filed during the oral proceedings dated 3 June 1997. Its argumentation may be summarized as follows:

The Appellant's pleading that Claim 1 would not be formally correct does not even have the quality to enter opposition proceedings. Therefore, under the presumption that Claim 1 covers sub-bundles with irregular lattices, it shall be investigated whether novelty or inventive step are lacking.

Figure 1 of document (D1) does not destroy novelty for there is no cruciform centre shaped in accordance with non-occupied corner portions of the sub-bundles. The Appellant's argumentation based on Figure 1 of document (D1) starts from the wrong assumption that said figure discloses the removal of irregular fuel rods from corners of a sub-bundle. According to (D1), however, it is sought to increase from 16 to 20 the number of fuel rods in a conventional sub-bundle without increasing the outer dimensions. This is achieved by using two quadratic lattices, each occupying the space on a respective side of a diagonal, said lattices being displaced with respect to one another. Furthermore, document (D1) points to three openings (9) within the spacer, in which openings water tubes or thinner fuel rods may be arranged. Such teachings may not be interpreted as an incentive to remove fuel rods.

Besides, the skilled person would not use the free corner spaces nearest to the centre for enlarging the central part of the cruciform channel. It is indeed stated in (D1) that these locations are reserved to spacing members or holders. Likewise, the seemingly enlarged centre in Figure 9 is the unavoidable result of using rectangular sub-bundles. It may actually not be considered as "enlarged", since no possibility of decreasing its size is offered and, at the utmost, it corresponds to the removal of only one fuel rod, whereas the invention teaches to remove the four innermost fuel rods.

Document (D3a) too discloses measures for increasing the number of rods in a sub-bundle, and this without changing the dimensions of the fuel rods. This purpose is achieved by means of irregular lattices but, from Figure 2, it is obvious that the free spaces of such lattices are far too small to accommodate a further fuel rod. Document (D3a) suggests to use the free spaces of the lattice to reduce the width of the sidewalls to no more than 65% of the width of a sub-bundle. However, it is not for increasing the amount of non boiling water in the centre of the fuel assembly that it is proposed there to cut off the rounded edges of each fuel channel surrounding a sub-bundle, but for stiffening the fuel channels against the inner pressure. The formation of an enlarged centre of the cruciform water channel is thus merely incidental and, again, this centre has a cross-section much smaller than is contemplated in accordance with the invention. Furthermore, there being no common fuel channel surrounding the groups of four sub-bundles, no need for stiffening such a common channel by means of a cruciform support member can be felt.

Document (D2a) is essentially concerned with the problem of flattening the power distribution in the axial direction of a fuel assembly and, as a solution thereto, proposes the provision of first fuel rods containing a burnable poison and fuel pellets having a higher enrichment in the upper part of these rods and that of second fuel rods containing fuel pellets of uniform enrichment, exclusively. The purpose of the water rods (14, 51) is nowhere disclosed, and neither is it mentioned in document (D2a) that the walls of the fuel channels would bulge. It shall therefore be assumed that said walls are strong enough and, since the fuel assembly is presented as performing perfectly, why should the skilled person have subdivided it into four sub-bundles? Furthermore, the arrangement of a cruciform support member carrying non-boiling water in the fuel assembly of document (D2a) would require narrowing the distance between the fuel rods in order to provide the needed space. Considering that the distribution of boiling and non-boiling water is of decisive importance to the distribution of neutron flux, as appears from document (D8), this would involve tremendous risks, whereas increasing the wall thickness is a safe, simple and efficient measure. Moreover, the arrangement of a central water rod as shown in Figure 19 of document (D2a) and that of a cruciform water channel according to any of the documents (D4) and (D8) are equivalent solutions. Combining them involves the presence of a huge quantity of non-boiling water in the fuel assembly, so that the skilled person would have feared the creation of an unwanted neutron trap. Consequently, he would rather have provided additional water channels at or close to the centres of the individual sub-bundles, as shown in Figure 3 of document (D3b).

The fuel assembly known from document (D3b) is not provided with a channel shaped support-member. To increase the mechanical stability of the channels, fuel rods having a smaller diameter are provided at the four corners of the sub-bundle, thereby making it possible to enlarge the rounded portions of the channel wall at these places. Again, this document does not suggest to remove fuel rods from any place in the sub-bundle. Figure 10 of document (D7) is still less relevant, since it does not disclose any place from which a fuel rod has been removed for whichever reason. Besides, the free spaces at the outer four corners cannot be provided with spacer cells and, therefore, cannot accommodate fuel rods. Finally, nothing in documents (D5) and (D6) is related in any relevant way to the present invention.

XI. At the conclusion of the oral proceedings, it was announced that no questions are referred to the Enlarged Board of Appeal, that the appeal is allowed, that the European patent is revoked and that no apportionment of costs is awarded.

Reasons for the Decision

1. Admissibility of the late filed documents (D3) to (D7).

The Board observes that, in relation to the European patent application No. 87 106 066.1 on which the patent in suit was granted, the ESR only mentions patent litterature belonging to the Respondent. The Respondent is thus deemed to know not only the teachings disclosed in the citations SE-B-421 969, SE-B-423 760, SE-B-426 428 and SE-B-431 691 of the ESR, but also those disclosed in the parent patent applications or patents it respectively filed or obtained in other

countries. Therefore, it may not be contended that taking into consideration the documents (D5, D3 & D3a, D4 and D6), which correspond in the same order to said citations of the ESR and, contrary to the latter documents, are drafted in official languages of the EPO, would impose an additional burden, either in terms of work or of costs, on the Respondent. Besides, the Board stated in its earlier decision T 387/89 (OJ EPO 1992, 583) that an Opposition Division or a Board of Appeal may introduce into opposition proceedings documents cited in the European Search Report even if not so relied upon by the opponent if they have strong reasons to consider that such documents do in fact provide evidence in support of a ground of opposition that is of such relevance that it could affect the outcome of the opposition proceedings - see point 2.2 of the Reasons, last paragraph. This jurisprudence applies to the documents (D3, D3a, D4, D5 and D6), which were found to be relevant to the case in suit in the Board's communication issued before the oral proceedings and, therefore, the Board rejects the Respondent's request not to introduce them into the proceedings - Article 114(1) EPC.

In its decision T 156/84 (OJ EPO 1988, 372), the Board furthermore stated that the EPO has to examine the relevance of citations introduced late into the proceedings of opposition ... and that no final decision on the opposition can be taken until such an examination has been performed - see point 3.8 of the Reasons. Document (D3b) having been found of relevance in the Board's communication, the Respondent's request not to introduce it into the proceedings is also rejected - Article 114(1) EPC.

2. *State of the art*

2.1 Document (D5) pertains to a nuclear fuel assembly for a boiling water reactor comprising a fuel channel of substantially square cross-section surrounding a plurality of vertical fuel rods - see the first five lines of Claim 1.

Said fuel rods are arranged in four sub-bundles of equal size - see from page 13, line 35 to the line 4 of page 14. With regard to the arrangement of fuel rods represented in the Figures 1, 3, 4, 13 and 14, therefore, it may be accepted that, in a fuel assembly according to Figure 16 of document (D5), the fuel rods are also "arranged in sub-bundles with substantially square cross-section, the fuel rods of each sub-bundle being arranged in an essentially regular quadratic lattice" - see also the statement, on page 9, lines 29 and 30, that each sub-bundle comprises sixteen fuel rods; see also page 1 of document (D1), lines 3 to 12, where it is acknowledged that such is indeed the case according to the Swedish patent application No. 8 002 080, of which the priority is claimed in document (D5) and which, just as (D5), belongs to the Respondent.

The fuel assembly according to Figure 16 of document (D5) further comprises a vertical channel formed support member with a cruciform centre (74") for the passage of water, said centre being connected to wing parts (73) - see from the last line of page 11 to the line 11 of page 12. The sub-bundles of fuel rods are surrounded by the fuel channel (70) of the assembly, since, as already pointed out, said fuel channel surrounds the fuel rods. Besides, it may not be denied that said sub-bundles are spaced apart by the channel-formed support member, which support member is fixedly connected to the fuel channel (70) - concerning

this latter point, see from page 12, line 27, to the line 11 of page 13. Finally, document (D5) teaches that, in the embodiment according to Figure 16, the support member is formed of four L-shaped metallic sheets (75, 75', 75" and 75'"), each plane portion of such a sheet facing a parallel portion of another one - see page 12, lines 11 to 16. Therefore, it follows from the above that in the nuclear fuel assembly disclosed in document (D5), "the cruciform centre (74") of the support member is limited by the central parts of the channel-formed support member, which conforms to the corner portions of the sub-bundles, in the region between the corner portions of the sub-bundles directed towards the centre".

Therefore, a nuclear fuel assembly such as defined in the pre-characterising part of Claim 1 according to any of the Respondent's requests had been made available to the public by document (D5) before the priority date of the European patent.

2.2 With regard to the preceding, the subject-matter of Claim 1 according to the Respondent's **main and second auxiliary request** is novel in that:

- "in each sub-bundle (6) of fuel rods (10), at least one fuel rod position has been removed from the corner portion of the sub-bundle positioned nearest to the centre (7a) of the fuel assembly", and in that

- "an enlarged cruciform centre (7a) is formed by the channel-formed support member (7, 8), shaped in accordance to the non-occupied corner portions of the sub-bundles".

Claim 1 according to the Respondent's **first auxiliary request** mentions the same novel features and furthermore states that the fuel rod position removed from the corner portion of the sub-bundle is a "regular fuel rod position".

3. Inventive step (Respondent's main request and second auxiliary request).

3.1 Document (D2a) was made available to the public before the filing date of the Swedish patent application No. 8 601 982, of which the patent in suit claims the priority. The Board is of course conscious that any statement in document (D2) has not necessarily an equivalent in that Japanese patent application. Nevertheless, in the Board's view a skilled person clearly derives from document (D2a) that it pertains to nuclear fuel assemblies and that in Figures 1, 9, 15, 19 to 21, 23, 24, 26, and 28 thereof, the circles surrounding capital letters W represent the cross-sections of "water rods" analogous to line 28 of column 6 in document (D2).

Figures 1, 9, 15, 20, 21, 23, 24, 26 and 28 of document (D2a) disclose the cross-sections of nuclear fuel assemblies comprising each sixty-four elements such as fuel rods, control rods and water rods (14) arranged in matrix configuration along eight rows and eight columns. According to the Figures 15, 24, 26 and 28 or document (D2a), four water rods (14) are provided, which rods are disposed in the central portion of the fuel assembly, i.e. at the locations where the fourth and fifth rows of the matrix cross the latter's fourth and fifth columns. Figure 19 of the Japanese patent application however, shows an embodiment in which the four central water rods (14) are replaced by a single large water rod (51).

3.2 The Respondent pointed out that document (D2a) is essentially concerned with the problem of flattering the power distribution in the axial direction of a fuel assembly and, as a solution to that problem, proposes the provision of first fuel rods containing a burnable poison and fuel pellets having a higher enrichment in the upper part of said first rods, and that of second fuel rods containing fuel pellets of uniform enrichment, exclusively. The purpose of the water rods (14, 51) and the possibility of bulging being nowhere disclosed in document (D2a), the skilled person would thus not take this document into consideration - see letter of 29 April 1997, third and fourth paragraph of page 3.

Nevertheless, if may not be denied that the design of nuclear fuel assemblies sets a plurality of problems which cannot be solved by a single person, but rather by a team comprising, **inter alia**, specialists of neutronics. Furthermore, neither may it be also denied that a specialist of neutronics could ignore the purpose of the water tubes (14, 51). therefore, and considering that document (D2a) relates to a nuclear fuel assembly for a boiling water reactor, the Board shares the Appellant's view that a skilled person having to design such assemblies would take said document (D2a) into consideration. As a matter of fact, this appears to be the less disputable as Claim 3 of the patent in suit extends the notion of "cruciform centre" to the case of a water channel with circular cross-section.

3.3 In its letter of 29 April 1997, the Respondent pointed out that providing a central water rod, as shown in Figure 19 of document (D2a), or providing a water-carrying cruciform support member according to

document (D4) or (D8) are equivalent solutions to improve the neutron flux distribution, and that the skilled person has to decide which one of these two solutions he wants to use - see the last but one paragraph of page 5.

In relation with the prior art referred to there, however, document (D5) reveals that it was already known before its own date of priority to stiffen the walls of a vertical fuel channel by means of four plates made of metallic sheets, which plates subdivide the bundle of fuel rods into four sub-bundles and are provided with holes - see the paragraph bridging pages 1 and 2. Such holes obviously allow the passage of water between the spaces for the sub-bundles in the fuel assembly and, since the stiffening plates are located in vertical planes, it may also be accepted that said holes are "horizontal".

To a skilled person starting from the teachings of document (D5) given in relation with Figure 16, where a water-carrying cruciform support member substantially identical to that of figure 2 in document (D4) is represented, it was consequently obvious to replace the cross-shaped water channel by an enlarged central water rod having the same size as that of Figure 19 in document (D2a), wherein the place for enlarged central water rod 51 was made available by removing from each sub-bundle the fuel rod positioned nearest to the centre of the fuel assembly, and to fixedly connect said enlarged water rod to the walls of the fuel channel (70) in Figure 16 of the document (D5) by means of four wing parts made of thin metallic plates having horizontal holes for the passage of water between the spaces for the sub-bundles in the fuel assembly. Doing

so, however, leads to the subject-matter of Claim 5 of the European patent as appended to Claim 3, i.e. to an object covered by Claim 1, without any exercise of inventive ingenuity being required from the skilled person.

3.4 The Board furthermore observes that, starting from the state of the art disclosed in document (D2a), alternative considerations could have lead the skilled person to the subject-matter of Claim 5 as appended to Claim 3 of the patent in suit without him being involved in the exercise of inventive ingenuity.

It is known in the art that fuel channels of nuclear fuel assemblies are usually made of zirconium alloy suitable for reactor purpose, typically Zircaloy - see: document D4, lines 51 to 53 of column 2; document (D5), lines 25 and 26 of page 4; document (D8), page 4, left-hand column, stating moreover that Zircaloy has a low neutron absorption. Zircaloy, however, is not a material of widespread use as, for instance, stainless steel and is comparatively more expensive. Therefore, an incentive to reduce the quantity of Zircaloy needed for making a fuel assembly is given to the skilled person.

From document (D5), said skilled person learns that, in fuel assemblies without support member - i.e. in fuel assemblies of the type described in document (D2a) -, the risk of bulging exists - see the lines 11 to 18 of page 1. From document (D3b), he learns that, in order to keep bulging within acceptable limits, the fuel channel must be made of a thick metal sheet, the thickness being about 3 mm in the case of an assembly comprising 64 fuel rods - see page 4, lines 10 to 13 of the second paragraph. From document (D4), he furthermore learns that a fuel channel provided with a stiffening device can be made with considerably smaller

wall thickness than what would otherwise be needed - see the lines 49 to 52 of column 1 - and, finally, he learns from document (D8) that, in a fuel channel surrounding 8 x 8 rods, the total amount of Zircaloy is reduced when a stiffening cross is provided - see the central column of page 5.

Bearing in mind the preceding, the Board cannot follow the Respondent when, in relation with the fuel assembly disclosed in document (D2a), said Respondent submits that the walls of the fuel channel would be strong enough to resist bulging and that the skilled person had no reason to subdivide it into four sub-bundles, since said fuel assembly would perform perfectly - see page 3 of the letter dated 29 April 1997, first and second paragraph. Likewise, neither can the Board follow the Opposition Division when the latter takes the view that, in order to provide place for a water cross, whole rows of fuel rods should be removed from the assembly disclosed in document (D2a), and that the fuel capacity would significantly be reduced - see point 6 of the reasons for the decision under appeal. A first reason therefor is that, just as document (D2a), documents (D1) and (D3) to (D6) all pertain to fuel assemblies comprising 8 x 8 fuel rods, and a second reason is that the provision of the comparatively thick water cross is only an optional feature of the claimed subject-matter - see also the left hand column on page 6 of document (D8), stating that "SVEA fuel assemblies have almost the same outer dimensions as the 8 x 8 assemblies and can be used directly together with them", what means that no prohibitive reduction of the distance between fuel rods is needed, and that no risk is involved, as the Respondent nonetheless submitted in point 4 of its letter dated 29 April 1997.

At this stage, it appears that, as announced at the beginning of the present point of the decision, envisaging to stiffen a fuel assembly according to Figure 19 of document (D2a) by means of thin metallic wings with horizontal holes for the passage of water and adopting the measures required to that effect - in particular, slightly reducing the distances between the rows of fuel rods in each sub-bundle to provide the needed place - would not have involved the skilled person in the exercise of inventive ingenuity.

3.5 To invalidate the above findings, the Respondent objected that, since the cited documents had been published, nobody thought of combining their teachings to arrive at the invention.

In the Board's view, however, replacing a known solution of a problem by an equivalent one is not liable to interest the skilled person, whose normal task is rather to eliminate deficiencies and to achieve improvements - see the Board's earlier decision T 15/81 (OJ EPO 1982, page 2), point 3 of the reasons, third paragraph. At the utmost, an incentive to seek for an equivalent solution could be given to him by commercial considerations, for instance if he is willing to preclude a risk of infringement. Nevertheless, the Respondent has not supplied evidence that it had been attempted to make fuel assemblies equivalent to any of those disclosed in the documents (D1) and (D3) to (D6), but not falling within the protection conferred by these documents.

In the Board's judgment, therefore, according to any of the Respondent's main and second auxiliary request, the subject-matter of Claim 5 as appended to Claim 3 lacks an inventive step.

3.6 Furthermore, the Board does not share the Respondent's opinion that the idea of providing an enlarged central water channel and channel shaped wing parts would have scared the skilled person. From documents (D5) and (D3b), said person knows indeed that a support with channel shaped wings provides a more uniform distribution of neutron flux, whereby the reactivity of the sub-bundles is enhanced, concurrently with the achievement of more uniform fuel burnup and power density of the fuel rods - in document (D5), see from the line 31 of page 2 to the line 3 of page 3 and, in document (D3b), the third paragraph of page 8. Nevertheless, the density of moving neutrons in the central zone of an assembly may be expected to be higher than in the external zones, whereby the need for a higher absorption of neutrons near the centre can be felt, or at least established from the observation of irradiated assemblies.

In the present case, the relevant skilled person is, as already pointed out, a team comprising specialists of neutronics, i.e. people knowing the complexity of the laws governing emission, transmission and absorption of neutrons in a structure as heterogene as a fuel assembly for a boiling water reactor. Such people may not ignore that, in their field of professional activity, the potential interest of any modification whatsoever can only be determined by carrying out appropriate calculation programs with computers, and this for a plurality of sets of numerical values of the relevant parameters. Despite the high level of technicality required for this purpose, however, such activities remain a question of routine and, in the present case, no inventive step is perceived in the provision of a support member comprising four channel shaped wing parts and an enlarged central channel shaped in accordance to non occupied corner portions of the sub-bundles of a nuclear fuel assembly. As a matter

of fact, this appears to be the less disputable as, in the groups of four sub-bundles (2a to 2d) represented in Figure 1 of document (D3b), the use of sub-bundles such as represented in Figure 3 also leads to a considerably increased volume of non-boiling water.

3.7 In the Board's judgment, therefore, if follows that Claim 1 according to either of the Respondent's main and second auxiliary requests does not cover matter involving an inventive step.

The Respondent's second auxiliary request was filed at a very late stage during the oral proceedings before the Board, and for the above reasons is clearly not allowable. From the formal point of view, therefore, there is no basis for admitting this request into the proceedings (see e.g. Decision T 153/85 OJ EPO 1988, 1).

4. Inventive step (Respondent's first auxiliary request).

The patent in suit teaches that, in a sub-bundle, fuel rods with different degrees of enrichment may be asymmetrically arranged. There being no other indication as regards the differences between fuel rods, the Board is unable to determine whether the removed fuel rods of the sub-bundles are regular or not. Nevertheless, comparing the Figures 19 and 20 of document (D2a) shows that the rods replaced by the tubes (14, 51) are of the type identified by the references (34, 44). Rods (34, 44) can reasonably be expected not to contain a burnable poison as follows from document (D2), lines 42 and 43 of column 6 and lines 33 to 38 of column 8. Rods having a uniform enrichment may be considered as "regular" and, consequently, the insertion of this adjective in the characterising part of Claim 1 does not confer inventiveness to its subject-matter.

In the Board's judgment, therefore, Claim 1 according to the Respondent's first auxiliary request also lacks an inventive step.

5. As set out in detail above, Claim 1 according to any of the Respondent's request lacks an inventive step and is consequently not admissible - Article 52(1) EPC in conjunction with Article 56.

6. Therefore, the Respondent's requests have to be rejected, and the European patent is revoked.

7. Having regard to the above reasoning, the Board considers that the questions of law put forward by the Appellant for referral to the Enlarged Board are not relevant to the decision in this case, and that referral in accordance with Article 112 EPC is therefore inappropriate. Furthermore, the Board sees no basis for refund of the appeal fee pursuant to Rule 67 EPC.

Order

For these reasons it is decided that:

1. No questions are referred to the Enlarged Board of Appeal.

2. The Decision of the Opposition Division is set aside.

3. The European patent is revoked.

The Registrar: The Chairman:

M. Beer G. D. Paterson